EFFECTIVENESS OF ONLINE INSTRUCTION:
DIFFERENCES IN MEASURED STUDENT OUTCOMES
ONLINE VERSUS FACE-TO-FACE INSTRUCTION
AT THE HIGH SCHOOL LEVEL

A thesis presented
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ABSTRACT OF DISSERTATION

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ABSTRACT

There has been an exponential growth in online courses offered at the high school level but little evidence as to whether they are as effective as face-to-face courses. It has become critical to understand and evaluate the effectiveness of online education in order to reap the benefits and reduce the drawbacks of contrasting learning modes. The purpose of this study was to explore how online education at the high school level is more, less, or equally as effective as face-to-face instruction. These issues were examined within the lens of online learning theory by evaluating the same high school course taught in either a traditional face-to-face classroom or online. The mode of instructional delivery formed the independent grouping variable. Grades based on the categories of discussion, assignments, projects, and tests formed the dependent variables. A sequential explanatory design was used to triangulate the data. This included a prospective causal-comparative, quantitative component. Student focus groups and a teacher interview provided the qualitative component. The quantitative findings revealed no significant differences in any of the grade categories which included discussion, assignment, project, tests, and a mid-term exam. The qualitative findings supported the quantitative findings. It was found that teacher interaction, design of learning activities, and written discussions were important for both online and face-to-face students. The development of independent learning skills was important for success by online students. These findings were presented and discussed and categorized by the dependent variables. The significance of these findings as they relate to practice, policy, and research are also discussed.

Keywords: online, face-to-face, high school, student learning, measured student outcomes, sequential explanatory design, mixed method.
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Chapter 1: Introduction

Stating the Educational Problem

Online courses are being offered at the high school level with little evidence that they are at least as effective as traditional face-to-face courses. There has been exponential growth in online classes both at the secondary and higher education level (Adkins, 2010; Online Learning, 2009). Online education at the higher education level has been shown to be at least as effective as traditional face-to-face courses, however, there has not been enough comparative research at the high school level to show similar results (Means, Toyama, Murphy, Bakia, & Jones, 2009).

The problem this study addresses is that online instruction at the high school level must be shown to be at least as effective as face-to-face education in order to hold equal value in education. Achieving and maintaining quality instruction in an online environment is important (Schrum, 1998). If online education is not as effective, a second-class educational system is being offered to students. This inequity in education could potentially create a two-tiered educational system creating a new group of “have” and “have-nots” in regard to education. If online education is as effective, many potential benefits could be realized.

Problem Significance

Significance for research. This report directly benefits the research community as it helps to address the gap in research that deals with online education and adolescents, particularly in the area of overall educational effectiveness. High school students learn differently than higher education students. Anthropologists and developmental psychologists have shown clear distinctions in psychological and social behavioral patterns between adolescents and adult learners (Viner & Christie, 2005). Adolescents generally take more risks, spend more time with peers, and are highly susceptible to peer pressure (Viner & Christie). This research provides
insights into how adolescents learn. Adolescent behavior factors such as the desire to interact with peers may be leveraged in an online environment. In addition, adolescents’ propensity toward risk-taking behavior may be incorporated into a safe and secure online learning environment.

This report also offers benefits such as how to use online tools matched to instructional methods (Means et al., 2009). This research provides insight into the teaching role and course design that works best for students. In addition, research regarding how online tools are used at the high school level, provides help in motivating students to learn and in structuring content in order to support higher order thinking.

**Significance for practice.** In the United States, K-12 schools are looking for new approaches that increase capacity in order to prepare students to compete in the global marketplace. Policymakers have proposed expanding learning time in school as a way of improving student achievement by utilizing online courses which can be taken anytime and anywhere (Cavanaugh, 2009).

Equity of educational resources remains a problem today in the United States K-12 systems, resulting from unequal access to a quality curriculum, availability of skilled and effective teachers, and the ability to meet the needs of students outside the mainstream (Darling-Hammond, 2007). Online courses offer potential help to rural and inner-city schools which often struggle to obtain highly qualified teachers in all curriculum subjects. The lack of flexible scheduling has negatively affected teacher retention. Furthermore, Archambeaut and Crippen (2009) have found that teachers who otherwise might have left teaching are teaching online. Online courses offer full and part-time teachers options that are not available in traditional school settings. This has the potential to increase the teaching pool.
Online courses offer small and medium-sized high schools many potential benefits. Smaller schools have the greatest challenge in offering a wide variety of courses to meet the needs of students. Through the use of online courses, smaller schools could expand the range of courses that would otherwise be unavailable to students due to low enrollment or scarcity of staff. Online offerings could include recovery credits for those who have fallen behind classmates or dropped out (Cavanaugh, Barbour & Clark, 2009). Advanced Placement courses could be offered to individuals or small groups of students when they otherwise wouldn’t be feasible. The flexible schedule offered by online courses may appeal to non-traditional students such as students who are home schooled, pregnant, incarcerated, or homebound due to illness or injury (Wicks, 2010). Hybrid class offerings may help to resolve course scheduling issues. In addition, online instructional methods may, in many cases, transfer to the traditional face-to-face classroom particularly as computer access in high schools becomes ubiquitous.

Significance for policy. Educational costs are a constant political issue affecting policy. Studies have shown that the cost to educate online students is generally less than that for face-to-face students (Anderson, Augenblick, DeCescre & Conrad, 2006; Picciano & Seaman, 2009; U.S. Census Bureau, 2008). Economic pressures may push more schools to offer online courses. Also, the Massachusetts Department of Elementary and Secondary Education (1995) currently requires 990 hours of supervised instruction time per student each year. If online instruction is shown to be effective, this could change the hourly requirement impacting schools across the Commonwealth.

Running courses for small groups of students is often very expensive, but if online courses are shown to be as effective as small group face-to-face instruction, school systems may work together and combine courses to run them in an economic fashion. This could potentially
lead to regionalization of school systems as teachers and administrators share responsibilities for cooperative online ventures.

Schools traditionally have only permitted classes taught face-to-face to meet graduation requirements. Evaluation of the effectiveness of online courses at the high school level may cause this policy to be reexamined. This will have a significant impact on what a high school education looks like in the near future.

**Research Question**

There is an expectation today that students can learn online. The Partnership for 21st Century Skills espoused learning that includes information and communication skills, thinking and problem solving skills, and interpersonal and self-directional skills (Salpeter, 2003). These are skills that are needed and can be developed in online courses. This partnership is also advocating for new school and curriculum designs. It is becoming more important in our “flat-world” that our citizens take the initiative and continue to adapt to a dynamic work environment (Salpeter). Americans must be able to learn effectively online or risk falling behind the international community.

Watson, Murin, Vashaw, Germin, and Rapp (2010) reported at the beginning of the 2011 school year that 48 of 50 states provided online learning opportunities to at least some of its K-12 students, including 39 states that provided courses through state sponsored virtual schools. Supplemental courses have comprised the majority of the online schools’ focus, but 27 states have at least one full-time online school operating state-wide. The estimate is that 200,000 students attended full-time online schools during the 2010-2011 school year. The fastest growing segment of K-12 online learning is individual school districts operating their own online programs, with many creating blended learning options. The estimate is that 50% of all districts
are operating or planning online learning programs (Watson, et. al.). The International Association of K-12 Online Learning estimates that approximately one and a half million students are taking one or more online courses (Wicks, 2010).

To leverage the benefits and reduce the drawbacks of both online and face-to-face learning modes, it is important to know if high school online learning is as effective as traditional face-to-face learning. A key question is how online and face-to-face instructional methods at the high school level differ in effectiveness. To make this determination, the following overriding research question has been developed:

“In what ways is online education at the high school level more, less or equally as effective as face-to-face instruction?”

**Summary of introduction.** Millions of high school students are taking online courses. It is important to study the ways in which high school online instruction is effective in order to address issues of practice, policy and research. This study compared measured student outcomes of online sections with face-to-face sections of a required course for students at one high school. The same instructors taught both the online and face-to-face sections and all students were full-time students at the same school. Students chose the learning mode. The available data were measured student outcomes in the form of grades. The course content combined business topics with technology skills. Face-to-face students took the course in a computer lab. Online students had access to similar computers during a scheduled study hall period but resources varied when these students worked at home. This study was significant because it sheds new light on day-to-day instructional practices as well as the impact on school, district and state policies. Building on the body of knowledge of adult online learning, this study adds to the limited but growing body of literature regarding educating adolescents online.
Theoretical Framework

Online theory was used as the central learning theory to understand the overarching construct, the comparison of effectiveness of the online and face-to-face modes of instructional delivery. Online learning is a subset of all distance education which has in common with it flexibility of time and space when compared to face-to-face education. Reported as a developing theory and a subset of learning in general, online learning theory shares overlapping ideas with many long established educational theories (Anderson, 2008). Ally (2008), for example, details how aspects of behaviorism, cognitivism and constructivism overlap with online learning theory. However there are important characteristics of online learning that distinguish it from other theories such as time and space considerations (Anderson, 2008; Siemens, 2005).

Bransford, Brown and Cocking (1999) used four overlapping lenses to group the cognitive study of thinking and learning. They defined effective learning into learner-centered, community-centered, knowledge-centered, and assessment-centered learning. These groupings, along with guidelines pertaining to the constructs, served as the organizing topics for the characteristics of this study using an online learning framework.

Learner-centered learning. The learner-centered lens looks at the unique needs of each individual learner. Learning online limits the use of non-verbal cues when communicating. While there are drawbacks to these limits, there are potential gains as well (Short, Williams & Christie, 1976). Richardson (2000) points out that by combining real-time and recorded voice, as well as text and video, communication can be enhanced. Experienced online educators build in methods at the beginning of activities to get to know students’ areas of strengths and weaknesses. Common approaches in regard to these efforts are posting of pictures, biographies and
questionnaires. These approaches also support efforts to build a community of learners (Ally, 2008).

Slavin (1995) addressed the importance of self-initiation and motivation in education. Being self-directed and having the ability to avoid distractions have been identified as prerequisite skills for adult online learners (Guglielimino & Guglielimino, 2002). Today, all students come to an online learning experience with varying degrees of technical abilities and comfort. Understanding students’ beliefs about their abilities helps determine how well they will adapt to learning online (Kirby & Boak, 1987). Understanding a student’s prior knowledge and abilities is important in all educational settings.

Students’ learning preferences are changing today. Increasingly, relationships are built online and learning preferences are more technological (Dede, 2007). Online tools and resources continue to develop. Learners are creating and adding more publicly available content. Appropriate content is made available based on individual and group learning needs (Anderson, 2008). Students’ online interactions with peers, instructors, and resources occur within situations that are personally meaningful (Ally, 2008; Dede 2007; Mayes, 2006).

Language and the ability to express thoughts in written form take on a more important role in an online educational setting than in a traditional setting (Anderson, 2008). Bender (2003) provides many examples of online pedagogy involving written discussions and emphasizes the importance of written communication in the online setting.

The use of computers to assist with learning and the use of artificial intelligence have been discussed for many years. Michalski, Carbonell and Mitchell (1986) report that technological advances, along with advances in understanding how we learn, have made these discussions more relevant today. Christensen, Horn and Johnson (2008) believe that software
designed to focus on the individual needs of the students is the most promising avenue for learner-centered education. Dede (2007) describes the use of multi-user virtual environments to engage students as they manipulate avatars. Combining virtual reality with artificial intelligence will likely have dramatic effects on online learning theory.

**Community-centered learning.** The community-centered lens examines the social component of learning with a group of students. As participants get to know each other, appropriate supports can be targeted to the unique needs of the individual. Vygotsky’s social constructivist approach is strongly evident in this aspect of online learning theory. Online interactions mirror Vygotsky’s child-in-activity approach using the available cultural tools within a social context (Miller, 2002). Today’s tools include thousands of online collaborative sites which form the new generation of online services called Web 2.0.

The communal aspect of learning has been examined by Lipman’s (1991) communities of inquiry and Wenger, McDermott, and Snyder’s (2002) communities of practice. Cooperative learning activities most often lead to conflict, struggle, and learning concepts with peers. The basic premise is that by developing a shared sense of belonging, commitment, and trust, students challenge each other to learn (Anderson, 2008; Mayes 2006).

Online communities of learning have different characteristics than face-to-face communities, the most obvious being the method of meeting. In face-to-face courses synchronous meetings dominate. Wang and Newlin (2001) advocated for both synchronous and asynchronous communication in an online course, calling asynchronous communication the “backbone and muscle” and synchronous communication the “heart and hustle” (p.1).

Debates about the drawbacks or benefits of real-time online meetings include topics such as the absence of body language, social pressure in online environments, added capacity, lack of
participation, and resistant faculty (Bryne, Flood & Willis, 1999; Cutler, 1995; Morris & Organ, 1996). Working effectively with the affective domain of students can be a challenge without many visual or verbal cues in an online environment. Today’s online communities are in a rapid state of flux. There are many new types of communities being formed online including friendships on Facebook, avatar groups in Secondlife, and communities that include educational simulation requiring large scale role play (Dede, 2007).

Online instructors face many challenges in designing a plan to create and sustain an online community. Among these is the wide variation in the expectation of learners which includes preconceived concepts of online learning and technology in general. Both teachers and students come to online learning with expectations. These expectations dramatically affect learning outcomes (Kanuka, 2008). A shift toward more synchronous communication in online learning has negatively affected some students who value the freedom and independence from time and place restrictions. This freedom is one of the more traditional attractions of online learning.

One of the structures of online learning is that students are typically alone in front of a computer at a time of their choosing (Ally, 2008). “The major motivation for enrollment in distance education is not physical access but the temporal freedom that allows students to move through a course of studies at a time and pace of their choice” (Anderson, 2008, p. 52). Being part of a community of learners places limits on that freedom. Community-centered learning is a challenge in both online and face-to-face learning modes when trying to accommodate diverse needs of students and teachers.

Knowledge-centered learning. Mayer and Fowler’s first stage of the learning cycle requires understanding of concepts as someone else explains them (Mayes, 2006). Siemens
(2005) “connectivism” learning theory addresses knowledge as something that exists in the world at large, not just with individuals. In order for students to make decisions, core knowledge must be acquired. McPeck (1990) points out that teaching thinking skills first requires the acquisition of content knowledge. Lower order thinking skills including knowledge and comprehension are prerequisite to the development of higher order skills (Bloom, Englehart, Furst, Hill, & Krathwohl, 1956).

In today’s world, and in particular in an online environment, there is easy access to information; however, access does not equate to knowledge or comprehension of the content. This ease of access does provide students with expanded opportunities to explore the content in greater depth and create their own learning paths (Dede, 2007). The capacity for students to create their own learning paths through content formatted with hypertext links is congruent with constructivist instructional design theory which stresses individual discovery and construction of knowledge (Shank, 1993).

Perhaps the most revolutionary change in recent years is who makes information available. Attaching key words to reference materials has been a long-standing practice in libraries. Today, a similar process of tagging user-created content allows almost anyone to add information in an efficient matter. Content is augmented by adding reference materials through the use of hyperlinks. Learning and reasoning distributed among many people, tools, and media, as well as across time and space, have led to a significant shift in the co-creation of knowledge (Dede, 2007). This challenges education to incorporate the strengths and minimize the weaknesses of this new reality.

The volume of information and resources can easily be ignored by students because the information is either irrelevant or overwhelming. As a result, selection of instructional methods
is an important consideration in online learning. Piaget’s Cognitive Development Theory points out that new information must connect to prior knowledge to be relevant. New knowledge is learned when connected to a framework of existing knowledge. This framework requires interaction with new information, prioritization, and organization of knowledge to fit existing understandings (Piaget, 1990). Making connections among the ideas, facts, and subjects becomes the focal point (Siemens, 2005). Ally (2008) includes guidelines for content acquisition which are as follows: identification and prioritization of information and problems; gathering information from multiple sources; evaluating information for veracity; and struggling to find new meaning. New meaning is obtained if students engage with the content.

An online learning environment provides unique opportunities to motivate students through challenge, curiosity, and imagination; however, excitement for excitement’s sake does not lead to effective learning. It is important to select content and instructional methods that motivate and are meaningful for the learner. A wealth of online learning objects can be applied dynamically to allow for exceptional support at just the right time for the learner (Ally, 2008; Dede, 2007; Mayes, 2006).

Information must be grouped or chunked into logical learning units. Vygotsky describes the need for this buildup when describing the Zone of Proximal Development emphasizing incremental knowledge growth, based on prior knowledge and experiences (Miller, 2002). The metaphor of a scaffold is often used when describing how an instructor provides a structure to build from lower order to higher order thinking (Ally, 2008; Dede, 2007). Providing a clear structure helps students build a cognitive context from which to build their own knowledge and enhance thinking skills. Cognitive supports such as advanced organizers and concept maps are examples of such supports (Novak & Wandersee, 1990; Willerman, 1991).
Dede (2007) describes a shift in the type of skills needed today with the decline of routine tasks in favor of expert decision making and complex communication skills. Ability to function at the highest order of thinking skills has become paramount. Exploration through reflection enhances a student’s ability to transfer knowledge to unfamiliar contexts and develop new knowledge structures. Self-direction is important in learning as is the ability to “learn how to learn” in a structured metacognitive approach (Phelps, Hase & Ellis, 2005). The online learning environment is uniquely structured to support these required skills (Ally, 2008).

Lave and Wegner (1991) describe the importance of learning within meaningful situations as situated learning. Collaborative, authentic, project-based learning that includes assessments by the instructor, peers, and self, fit the online classroom well (Ally, 2008; Anderson, 2008; Dede, 2007).

Assessment-centered learning. Formative or process assessment is feedback provided during instruction. Summative assessment is provided after instruction. Both forms of feedback are a critical component of learning (Ally, 2008).

Face-to-face learning provides teachers ample opportunities to observe students in their learning and provide formative feedback in a timely manner. Online feedback takes a different form and is spread out over many more hours. Online instructors have fewer opportunities to provide real-time feedback. Feedback provided during synchronous online discussions and meetings is more similar to feedback in face-to-face environments. Instant question and answer online sessions are often limited to synchronous sessions such as online office hours. Instant chat and cell phone technologies have expanded availability of all educators to provide feedback (Ally, 2008).
One of the major challenges of assessment-centered learning is the increased workload of online teachers. There exist a multitude of real-time and time-delayed communication tools. As a result, students expect prompt responses and this can overwhelm teachers who maintain an expository approach (Anderson, 2008).

Online theorists espouse the use of both self-assessment and peer feedback (Anderson, 2008; Siemens, 2005). By providing reflective feedback, students both support their own learning and that of their peers (Ally, 2008; Dede, 2007). In addition, the public nature of online reflection may have implications promoting efficacy. Online peer feedback has unique advantages such as providing assessments using the colloquial vocabulary of the peer group. Peer tutors have been used in both online and face-to-face learning modes but are more readily accessible in an online social networking environment. Roberts (2004) states that online collaborative learning is an idea whose time has come. Group collaborative learning environments allow students to assess their own learning while also supporting group members’ learning.

Students should be able to communicate issues, solve problems, test solutions, and adapt to results (Baxter, Elder & Glaser, 1996). As technology continues to advance, complex algorithms with online assessments help differentiate instructional supports based on the results of tests (Anderson, 2008; Mayes, 2006). In addition, computerized assessments through simulations are becoming more common for assessment needs (Dede, 2007).

**Constructs.** Online and face-to-face delivery modes of instruction, formed the two independent grouping variables of this study. The four types of learning as grouped by Bransford, Brown, and Cocking (1999), serve to conceptually frame the five dependent variables used in this study. Measured student outcomes formed the dependent variables. These variables
Conceptual Framework: Overview

**Figure 1.** The independent grouping variables include the modes of instruction, online and face-to-face, and the dependent variables include instructor defined discussion, assignment, project, test and mid-term grades. The constructs include the types of learning as defined by Bransford, Brown and Cocking (1999).
included discussion, assignment, project, test, and mid-term grades. In particular, discussion grades corresponded with learner and community-centered learning; assignment and project grades corresponded with knowledge-centered learning; and tests and mid-term grades corresponded with assessment-centered learning. The mode of delivery was the presumed causal variable and the grades were the presumed effect variable (Kerlinger, 1986). As demonstrated in Figure 1, the effectiveness of the mode of instructional delivery was reflected in student grades in the various categories defined above (Hoy, 2010). These particular constructs, variables, and inter-relationships provided a sound conceptual framework from which to explore the effectiveness of online education at the high school level.

Theoretical framework summary. Online learning theory postulates that early education efforts were defined by the techniques and tools that took advantage of the availability of current media. Early universities were built around rare, handwritten books and manuscripts stored in medieval libraries. Early distance education was constructed around written text and slow, mail-based communication. Face-to-face education was built around physical sites where teachers and students could meet. Today online education is constructed around 1) access to content which is orders of magnitude greater than ever before, 2) availability of, and access to, many forms of rapid communication, and 3) ever increasing accessibility which allows teachers and students to meet from just about any location. The one limitation of online education cited most often is the unique and often rich face-to-face interaction available in a traditional classroom and this is being challenged today with immersive environments such as realistic avatar-based classrooms at sites such as Secondlife (Anderson, 2008).
Chapter 2: Review of Literature

The literature was systematically reviewed and then examined relative to the dependent variables of discussion, assignment, project, test, and mid-term grades in order to better inform the development of the research hypotheses presented in this section. The intent of the overall review was to examine the body of knowledge regarding ways in which online instruction has been shown to differ in effectiveness from face-to-face instruction.

Definitions

For the purpose of this study, the following definitions were established to add clarity and understanding. Each of the grade definitions were defined by the instructors taking part in the study.

1. **Online education**: There are many definitions of online education. These definitions show the varied instructional practices and constantly changing available technologies. For the purposes of this study, online education is defined by Ally (2008):

   *The use of the Internet to access learning materials; to interact with the content, instructor, and other learners; and to obtain support during the learning process, in order to acquire knowledge, to construct personal meaning, and to grow from the learning experience.* (p.17)

2. **Face-to-face education**: Traditionally, education has occurred in a classroom comprised of a teacher and students. Face-to-face education is a synonym for this type of instruction. Oxford Dictionary (1996) defines “face to face” as “with the people involved being close together and looking directly at each other.”

   Furthermore, it defines education as “the process of receiving or giving systematic instruction.”
3. *Discussion grades*: Grades scored were advanced (numerical value four), proficient (numerical value three), needs improvement (numerical value two), and failing (numerical value one). Standard rubrics were used for all classes. The discussion board and chat text tools on a learning management system were used for all discussion grades.

4. *Assignment grades*: Assignments were formative work focused at the knowledge and comprehension levels. Many assignments were taken directly out of a common textbook. Assignments were typically completed within a one-hour time period. Grades scored were advanced (numerical value four), proficient (numerical value three), needs improvement (numerical value two), and failing (numerical value one). Standard rubrics were used for all classes. Partial credit for assignments was awarded for work not fully or optimally completed.

5. *Project grades*: Projects were normative work focused at the application level or above. Chunks of knowledge involving sequential steps were required to complete a project in a cumulative manner. Projects were intended to be authentic to the students with consideration given to the efficiency of the lessons. They were typically completed within a three- to four-hour time period and were a combination of individual and group work. Extensive project-specific rubrics were used to score the projects. Project points were multiples of four points that varied between four and twenty-four points. Standard rubrics were used with multiple rubric rows for complex projects with each row having a maximum score of four.

6. *Test grades*: Test grades were based on unit testing. A unit ran approximately six weeks. Tests included knowledge, recall, and application components. Knowledge
and skills tested were those learned through readings, lecture/presentations, assignments, and projects. Four tests were given including two 50 point quizzes and two 100 point tests.

7. *Mid-term examination*: The mid-term exam was a comprehensive measure of learning after eighteen weeks of the class. The mid-term was comprised of an objective component and an application component. The mid-term examination was scored on a 100 point scale.

**Discussion Grades**

There are advantages and disadvantages to using online discussions instead of face-to-face discussions. A review of the literature shows that online discussions support a shift toward learner-centered education, tend to be more reflective, lead to more equitable contributions, and support social learning. However, online discussions can lead to high volume and low quality communication and misunderstood and fragmented discussions. Traditional instruction normally involves face-to-face discussion within a whole class or group setting. Online instruction commonly involves discussions that are asynchronous, such as discussion boards, or synchronous, such as text chats.

**Reflection.** Asynchronous discussion forums or boards were derived from newsgroups which allowed people to post messages and comment on other messages. Discussion boards with bulletin board systems first started in the late 1970s. Web-based discussion boards date back to 1995 (Boyd & Ellison, 2008). Discussion boards support students in constructing their own meaning and help to provide a shift to a more learner-centered methodology (Althaus, 1997; Lapadat, 2002; Olaniran, Savage & Sorenson, 1996). Students engage in more personal and meaningful dialogue. There is no need to wait for permission to read and respond to another’s
contribution as students can contribute at their own pace (McComb, 1993). Unlike face-to-face discussions, there is typically no requirement to take turns. Individuals respond based on their interest in the subject (Murphy, 2001). Discussion boards can help provide a personalized approach allowing for varied pace when dealing with a variety of issues.

The nature of asynchronous learning allows the learner time to digest the content at their own pace and provides more of an opportunity for critical thinking (Menchaca & Bekele, 2008). Schon (1987) advocates using reflective practice which supports planning, acting, evaluating and rethinking the situation based on student experience. This reflective practice also supports Bloom’s range of thinking skills (Bloom et al., 1956). As reported by Anderson and Krathwohl (2000), students are shown to be more reflective when using the discussion board as they are able to obtain the highest order thinking skill, metacognition. Face-to-face discussions require students to speak out and process information quickly. Conversely, online discussions with forums typically are multi-day events allowing for more processing time for those who need it. Discussion responses are more carefully constructed because postings are publicly displayed for an audience with similar interests (Biesenbach-Lucas, 2003; Lapadat, 2002). Oravec (2002) notes that online posts may further develop critical thinking skills because students must carefully evaluate what they read and write, as their words are now available to a larger audience. Proclaimed benefits of online discussions have also been examined from a negative point of view. It has been shown, for example, that it takes more time for both teachers and students to participate in online discussions with discussion forums. One of the trades-offs of more carefully constructed responses is the additional time needed to read and reply to well-formed discussion items (Wiesenber & Hutton, 1996).
Blogs are designed to be easy-to-use public, individual diaries which have as their core function the ability to communicate with others. Due to their commenting ability, most blogs can be used as discussion forums. Ferdig and Trammell (2004) explain how students are blogging about topics that are important to them, directing their own learning, and receiving input and feedback from others. Research on blogs has shown findings similar to discussion boards since the two tools share similar features, including the ability for students to provide thoughtful posts (Flatley, 2005).

Online reflection with most asynchronous tools requires writing, which makes the reflection explicit. Through the writing process, more time for reflection is generated. Reflection allows students to correct distortions in their beliefs, and critique the presuppositions on which their beliefs have been built (Mezirow, 1990). Discussion boards have also been shown to support higher levels of abstract thought than traditional face-to-face discussions; this has promoted critical thinking processes (Aviv, Erlich, Ravid, & Geva, 2003). When questions and readings are provided in advance of discussion, studies also have shown that online access allows students to prepare at a higher level than in the past (Menchaca & Bekele, 2008).

**Relationship building.** Synchronous tools such as text chats, audio and video conferencing, virtual classrooms, and virtual worlds provide interaction that is more similar to a face-to-face environment. Text chats have been used for students to interact with their instructor and other students. For example, groups of students are assigned chat groups and topics. Students take turns leading a chat session on the topic, including providing reading materials and discussion questions prior to the real-time sessions. Instructional methods such as these provide many of the same characteristics as discussion boards but without the time delay. Instructors may also hold office hours using text chats to answer students’ questions at scheduled times. The
benefits include the ability to socialize and communicate feelings with others in the course, to get
to know the instructor and other participants better, and to get timely feedback on coursework
(Chatti, Jarke, & Frosch-Wilke, 2007). Rapport building has been shown to be an important
element in developing an effective classroom.

Erikson (1970) describes the adolescent stage of development as the time when a child is
most likely to experience an identity crisis, a time of intensive self-analysis and exploration.
These explorations are often played out with peers. Peers become the most important social
group at this age (Marcia, 1980). Online discussion tools are unique in their ability to address
and support peer interaction. There has been a dramatic increase in the use of peer-to-peer
software on the Internet both within learning management systems and with stand-alone
software. The increase in peer-to-peer software’s availability and use in the last few years raises
many questions about its use in online instruction. New tools may assist online students in
working together in the development of collaborative thoughts and knowledge and in the
production of collaborative projects. The online nature of these tools allows for large-scale
participation. Prior to 2006, there were few examples of the use of these technologies in the
classroom (Kop, 2006).

Equity. Equity was found to be supported by the use of online written discussions
especially for a person shy in a face-to-face setting (Ortega, 1997). Warschauer (1997) reported
that there was more focus on learning with online written discussions than in face-to-face verbal
discussions, and there were fewer social games being played relating to issues such as race,
gender, and group status. It has been shown that students who would not otherwise participate in
face-to-face courses will participate in online courses for a variety of equity issues.
Low quality. The research also shows that, as in face-to-face discussions, not all additions to the conversation are of high quality, which leads to digressions. Procrastination has been identified by some as an issue leading to low rates of responses and reduced interaction and dialogue (Beaudin, 1999; Miller, Rainer, & Corley, 2003). Both procrastination and digressions lead to fragmented discussions (Hew & Cheung, 2003). Many instructors require student responses to connect to prior statements. In response, some students feel conversations are forced, unnatural and lack spontaneity (Biesenback-Lucas, 2003). Additionally, text-based online discussion makes miscommunication easier than in a face-to-face setting. Challenges of communicating with text can lead to misinterpretations, although students reported missing the visual cues less over time (Burge, 1994; Tiene, 2000; Wiesenberg, & Hutton, 1996).

A common instructor requirement is to require a set number of posts during an online discussion. Oliver and Shaw (2003) reported that this has led to students posting simply to meet the minimum requirements of the instructor. Without a qualitative assessment component, posts were often of low quality and high quantity (Murphy & Coleman, 2004). Conrad (2007) reports that student evaluations noted that some students were overwhelmed by the number of messages, postings that included personally meaningful items that did not get a response, and tension that resulted from misunderstandings.

Shared meaning. Lava and Wenger (2002) found that structured online written conversations help develop communities of practice for both sociability and learning. Knowledge held by members was provided, and shared meaning developed. Greener and Perriton (2005) expressed reservations regarding online learning communities, stating the belief that students experience a fragmented community based, not on learning, but on an inflexible set of learning objectives. A more pervasive view is that online tools allow users to create the opposite scenario;
namely, greater flexibility within an environment where students share experiences and encourage discussion of ideas and collaborative development of thought (Kop, 2006; Lamb, 2004).

There have been a number of models proposed for evaluating collaborative online learning. Rourke, Anderson, Garrison, and Archer’s (1999) model evaluates group interaction that supports members’ social, cognitive, and affective needs examining how the group builds and maintains a common commitment. Another model focuses on a hierarchical approach which first encourages providing access and motivation, and then builds a sense of belonging. This is followed by sharing knowledge and developing shared understanding of content (Salmon, 2000).

**Discussion grades summary.** Traditional distance education used one or more tools such as written materials sent through the mail and cable television in order to facilitate learning and teaching (Groff, 1996). Distance education has been transformed by using interactive, communication-based tools in support of learning which is social, problem-based, and collaborative (Dede, 2004). Collaborative discussion, reflection, and the building of learning communities are supported by the use of multiple online tools. Pituch and Lee (2006) found that multiple technologies used in different contexts were crucial for success. Access to a variety of asynchronous and synchronous tools is important. The availability of multiple online tools adds flexibility to the learning environment and appeals to multiple learning styles (Menchaca & Bekele, 2008).

Online written discussions pose a variety of challenges including difficulty in communicating through writing, the timing of communication, and the need to encourage high quality communication over high quantity of contributions. Yet online discussions offer unique rewards as well. It has been shown that online written discussion in various forms supports a
shift toward effective learner-centered education. Students involved in online discussions have more time to reflect and more flexibility during online written discussions, which may meet their individual needs better than verbal discussions. Today’s adolescents prefer communicating with peers online. The emphasis on peer relations at this age can be leveraged in creative ways through the use of various asynchronous and synchronous online tools that have been effective for older individuals. For example, a modified sense of anonymity in a typically faceless online environment has been shown to contribute toward a more equitable contribution in online discussions. Finally, combinations of factors have been shown to support social learning at the higher education level and would likely also apply to adolescent online learning. Based on the previous research, the following hypothesis was proposed:

**Hypothesis 1.** The discussion grades in the online class will be higher than in the face-to-face class.

**Assignment Grades**

As defined, assignments involve lower order thinking, are short in duration, and are used to provide some of the prerequisite knowledge and skills needed for discussions, projects and tests. A review of the literature shows that classroom interaction whether online or face-to-face is a critical success factor for student work. The research also shows that regular support from the instructor within a clear course structure and working closely with peers are important. Additionally, the research shows that adolescents are still developing their sense of responsibility and must be highly motivated by meaningful and engaging tasks in order to complete work on their own.

**Interaction.** Process-oriented and social learning have been found to be crucial for success in online learning (Ostlund, 2008). Teacher-student interaction has long been established
as an important component of adult learning online (Rovai, 2002; Wegerif, 1998). Some instructors have reported that their interactions with students through online courses are more focused on teaching and learning than in the traditional setting (Muirhead, 2000).

Online teacher-student interaction must be pervasive if an online course is to be effective (O’Leary & Quinlan, 2007). Interaction has been called the most important characteristic in online courses and one of the primary differences between online and face-to-face instruction. Students in online courses seek frequent and timely interactions as well as deep and strong relationships with participants (Weiner, 2003). Because of increased communications, some online teachers report closer, positive student-teacher relationships that correlate to positive student outcomes, including motivation and critical thinking (Cornelius-White, 2008).

Pauls (2003) reported that in many cases when there was very little instructor or pupil interaction, online courses became only slightly better than mail-based correspondence courses. Keefe (2003) found the expectations of the online student regarding instructor-student interaction exceeded those of the face-to-face student. Students were found to be less satisfied with their online instructor even though similar levels of interaction and feedback were provided by the face-to-face and online instructors.

Support. Mason and Weller (2000) explain both the need for a high level of support and the difficulty to obtain this support in an online course. Teacher presence was still an expectation of the students in online courses (Anderson, Rourke, Archer, & Garrison, 2001). Online tutor models have had mixed success. When tutors adapted to students’ needs, a high level of student satisfaction was reported. Salmon’s (2000) peer tutoring model had non-subject matter experts serve as tutors. This model proved challenging but successful for some students if a supportive learning environment was established.
Peer supported learning has shown significant promise. Knowledge is socio-culturally situated and mediated by language and, therefore, communication is critical in the formation of knowledge (Rorty, 1979). The shift away from a teacher-centric model is supported by this line of thinking. Today’s students are very comfortable communicating online which allows for more peer-assisted learning. It has been shown that learning is enhanced when teachers facilitate peer review (Coomey & Stephenson, 2001). Thomas (2005) argues that there is value in children learning in an online environment without an expert present, through the use of trial and error, discussion, and various role playing techniques.

Online peer groups have been shown to have higher levels of interaction than face-to-face groups. There is little peer-to-peer interaction during lecture in a face-to-face course. Informal review and online chats showed significantly more interaction. Some of the differences may have been attributed to the formality of the setting. The online settings are shown to be more informal than lecture settings (Schoenfeld-Tacher, McConnell & Graham, 2001).

Course organization. Faculty plays an important role in organizing learning, providing feedback, and monitoring online progress. Instructors must help students to access, process and understand the content required for the course. Menchaca and Bekele (2008) explained the importance of “supporting student motivation; optimally utilizing appropriate technologies; choosing relevant learning approaches; and designing, offering and monitoring online courses” (p. 248). Problems reported with online courses include poor course organization, lack of clarity of material, issues of group dynamics, and a limited amount of feedback. Reeves (2003) summarized that there is almost no evidence to support the claim that instructors who adopt new and emerging technologies also adopt new pedagogy. Without new approaches in building base knowledge and skills, assignments may not get the attention needed by the online student. Online
classes are more structured than face-to-face classes. They require the agenda to be out in front with clear expectations about what is expected by the student (Abel, 2005).

**Regular supervision.** There are benefits of face-to-face instruction that are not typically present in an online setting. During daily face-to-face instructions, instructors can provide regular supervision and require completion of daily work by providing fully developed messages about the importance of meeting prescribed deadlines. Face-to-face instructors have the ability to read body language and the opportunity to ask questions and clarify information in person (Twomey, 2004). In online education there is a different sense of identity and place. Most online communications are very different from face-to-face communications. Messages are sent without the benefit of most non-verbal cues. The intent of the message is be derived from the text alone.

Erikson (1970) describes the adolescent stages of development as a time when students are challenging authority and still developing a sense of responsibility. The lowest order thinking skills needed for assignments may not directly connect to students’ lives and, therefore, students may view this type of work as less meaningful (Bloom et al, 1956). A result is that students may not become fully engaged in completing this work and may not seek appropriate supports for their class assignments. Adolescents face a high learning curve in regard to meeting deadlines for what they perceive as less meaningful assignments. Online students must be more self-motivated than a face-to-face student (McGivney, 2004). Without the teacher’s physical presence, students must become active, self-directed learners in an online environment (Weimer, 2002).

**Assignment grades summary.** Adolescents need to understand the value of the work in order to fully engage with assignments. The nature of assignments makes them less meaningful to students who may provide less effort than on more important and engaging material and activities. Students in a face-to-face class are provided regular supervision and consistent daily
reminders that this work must be done, which is more difficult to communicate consistently online. Additionally, adolescents are at a stage of developing personal responsibility, which could be a challenge to develop without regular interaction. Based on the previous research, the following hypothesis was proposed:

**Hypothesis 2.** The assignment grades in the online class will be lower than in the face-to-face class.

**Project Grades**

As defined, projects are authentic in nature, requiring students to apply knowledge and skills in meaningful ways. Instructors group needed knowledge and skills into sequential steps to create products. Projects are formative in nature, taking multiple class periods to complete and carry more weight than assignments. Projects are presented to students in a structured manner often with checklists. A review of the literature shows that with the use of learning management systems, coursework can be more easily designed and redesigned online to support a collaborative, learner-center approach with engaging media. The research shows that engaged online students increase their time spent on learning and are more likely to learn when it is best for them.

**Learning management systems.** In the past, commercial course management systems restricted instructors to the delivery of information rather than the provision of engaging, authentic, learning experiences (Herrington, Reeves & Oliver, 2005). Learning management systems provide clear methods for organizing information, activities, communication, and resources, allowing knowledge to be connected to prior learning. These systems allow for neat organization of materials which support structured learning from a cognitive standpoint. The students’ own experiences can be linked to coursework and the experience of others can lead to a
collaborative approach to understanding (Kop, 2006). Advances in course management systems
allow for better instruction but there is no guarantee that this will occur (Barbour & Reeves,
2009).

**Course design.** Many online courses are designed by curriculum specialists, content
experts, and instructional designers, allowing teachers to be learning specialists concentrating on
the students (Kennedy & Cavanaugh, 2009). Recently there has been a push for evaluation of
online course design. Programs such as Marylandonline’s Quality Matters have produced
recommendations and a rubric for the evaluation of an online course design, based on scholarly
research. The rubric includes course overview and introduction, learning competencies,
assessment and measurement, learning resources and materials, learner interaction, course
technology, learner support, and accessibility (Quality Matters, 2009). Similarly, the National
Education Association has produced guides to online high school courses (NEA, 2002). There is
evidence that properly designed and structured online higher education courses are as effective,
if not more effective, given equal student maturity and motivation (Johnson, Argon, Shaik &
Palma-rivas, 2000).

Projects are designed and redesigned regularly to fit the current interests of the students.
Projects presented online can leverage many of the benefits offered by learning management
systems. Constant refinement of the course structure through a learning management system has
led to increased efficiencies. For example, an online course taught once can be exported and used
as a basic template from which to improve upon for the next course. Providing an efficient
structure becomes increasingly important with the expansion of digital learning resources
(McGreal, 2008).
Learner-centered learning. Current views of knowledge embrace a curriculum where students collaborate with fellow learners, building upon prior learning and experiences to control their own learning with authentic projects (Cobb, 1999; Lave & Wenger, 2002). Online instruction is an appropriate learner-centered approach when the learner is provided with appropriate tools and resources (Brown, 2005). Online courses that are interactive are strongly aligned to the principles of learner-centered education (McCombs & Vakili, 2005). In an online environment, there are age appropriate social forces at work allowing the learner to interact with an online class in an engaging way (Mayes, 2006). High percentages of online teachers use teaching practices associated with high student achievement such as student-centered approaches, collaborative learning, independent inquiry and research, and student discussion (Rice, Dawley, Gasell, & Florez, 2007). In a learner-centered online approach, instructors focus attention on specific performances of individual students and guide them as needed to achieve success (Cavanaugh, 2001).

When students are motivated with engaging projects, the flexible nature of online learning may provide a means to allow students to learn when it is best for them (Wegerif, 1998). In addition, this offers an approach to expand time-on-learning that allows for more flexible and individualized learning. Expanded learning time has shown success in raising student achievement (Cavanaugh, 2009). Students decide how much time and when to spend time on learning. Online learning has a number of student-centered structural benefits including reducing the issue of student absences since much of the learning is asynchronous and real-time learning is often recorded (Fowler, 2005).

Engaging media, such as podcasts, have been built into online courses, thus enhancing projects even more. A podcast is an audio or video file distributed to an appropriate media player.
over the Internet (Frydenberg, 2008). Instructors can create customized on-demand electronic course materials supporting high levels of engagement. These highly engaging, on-demand resources may be particularly useful for younger, sometimes impatient learners.

**Project grades summary.** Always available online, structured projects presented within a learning management system provide unique advantages to online instructors and students. Online instruction has been shown to support the shift from a teacher-directed to a learner-centered approach particularly when relating to authentic project-based learning. In addition, online learning helps motivate students because of its innate time flexibility regarding when and how much time can be devoted to learning. Engaging media have been combined with projects, and as a result students have responded by spending more time on learning. Based on the previous research, the following hypothesis was proposed:

**Hypothesis 3.** The project grades in the online class will be higher than in the face-to-face class.

**Tests and Mid-Term Grades.**

Tests are designed to be a comprehensive measure of what has been learned through discussions, assignments, and projects and should reflect overall learning in a course. Relatively little research is available dealing with overall success by adolescents in the online environment. Barbour and Reeves (2009) point out that there is a limited amount of published research on K-12 online learning programs in general. There is very little evidence-based research available to guide educational leaders in high school online learning (Cavanaugh, Barbour & Clark, 2009; Means et al., 2009; O’Dwyer, Carey & Kleiman, 2007).

**Effectiveness research K-12.** Literature on the first uses of online learning for K-12 education began appearing in 1997. The advantages of online learning at this level have been
mixed (Barbour & Reeves, 2009). A meta-analysis of nineteen research studies examining K-12 online programs showed just two of the studies employed an experimental or quasi-experimental approach (Cavanaugh, 2001). In another meta-analysis of 232 studies that focused on online learning at the K-12 level, only two of those used experimental or quasi-experimental approaches, had appropriate data analysis, and made appropriate conclusions based on the methodologies employed (Ungerleider & Burns, 2002).

A large scale study was done with Algebra I high school students in Louisiana comparing face-to-face and online instruction by comprehensive measures. Louisiana has a shortage of qualified math instructors so the model for both modes of instruction involved master math certified teachers delivering content and non-math certified support personnel assisting with interaction. It was found that the online classes were a viable model with students pointing out the use of technology, working with other students, and experiencing learning online as a motivator. In contrast, students reported they felt they had too little interaction with the online instructors (O’Dwyer, Carey & Kleiman, 2007). Another study of an algebra course taught in Florida, by state-certified teachers, using the state curriculum in public traditional and virtual schools, showed that students in both schools achieved at equivalent levels on a nationally normed exam (Cavanaugh, Gillan, Bosnick & Hess, 2008).

Leading commercial online schools have reported higher test taking and passing rates than state and national averages on Advanced Placement exams, but little independent research is available in this area (Cavanaugh, 2009). The amount of research evidence in refereed journals in the area of K-12 online education is limited (DiPietro, Ferdig, Black & Preston, 2008). Each of the large scale reviews of literature on K-12 online learning have been limited to just dozens of
studies and reports, compared to recent reviews of literature on adult online learning which includes hundreds of studies (Cavanaugh, Barbour & Clark, 2009).

**Effectiveness research in higher education.** The availability of research at the higher education level does provide important information as to how high school online learning may be different from face-to-face instruction. Findings for older learners have shown that students taking online courses have performed equal to or better on average than students taking the same face-to-face courses (Mean et al., 2009). Just as there are differences between face-to-face courses, there are differences in online courses. Distinguishing characteristics in online courses include the amount and types of peer-to-peer and student-teacher interactions that take place and the degree to which a class is well structured. (Bernard et al., 2004; Paloff & Pratt, 2001).

Menchaca and Bekele (2008) noted that overall success factors in online education at the higher education level have been inconclusive. Some of the variables associated with success or failure in online courses have been isolated at the higher education level. These include students’ attitudes and beliefs about the efficacy of online classes (Allen, Mourhis, Burrell, & Mabry, 2002; Muilenburg & Berge, 2001; Cooper, 2001; Sherry, Fulford & Zhang, 1998). Additionally, it was found at the higher education level that students who struggle to pick up the necessary basic technical skills tend not to succeed (Dawson, Cavanaugh, & Ritzhaupt, 2008; Oslund, 2008). The more experience students have with online education, the better their success (Pituch & Lee, 2006; Yan, 2006). The level of student motivation was one of the major success factors (Abel, 2005; Romero, du Boulay, Cox, Lutz, & Bryant, 2007). Kop (2006) discusses the challenges of intrinsically motivating learners rather than using assessment requirements to force compliance. It was found that participants who embrace change and develop a favorable attitude toward technology were successful (Menchaca & Bekele, 2008).
Kellogg and Politoski (2002) found higher levels of motivation of elementary and secondary students for online education correlates with certain learning styles. Barbour and Reeves (2009) report some studies have shown that secondary students who are typically successful in online learning have independent orientations toward learning, are highly motivated by intrinsic sources, and have strong time management, literacy, and technology skills. These characteristics are consistent with traits that are typically associated with adult learners.

**Testing grades summary.** There has been little evidence-based research on testing grades conducted at the high school level. Studies conducted do lean toward similar findings between the high school and higher education levels; namely, that online education is at least as equivalent as face-to-face instruction. The success factors identified at the higher education level show that those who have the necessary prerequisite technical skills and proper attitude about their own ability to learn, as well as time management skills and motivation, tend to be successful in online courses. Test grades are likely a reflection of the net effect of discussions, assignments, and project work. Based on the previous research, the following hypothesis was proposed:

**Hypothesis 4.** The testing grades in the online class will not be significantly different than in the face-to-face class.

**Conclusion of Literature Review**

The literature has been reviewed through the lens of online learning theory. It is clear that there is a gap in effectiveness research at the high school level. Instructional methods using some online tools have clearly been shown to support the learner-centered approaches at the higher education level. The research shows how various characteristics of online learning lead to both benefits and challenges to the online learning instructional mode when compared with face-to-
face instruction. This mix of benefits and challenges of online learning led to the four hypotheses presented.

**Chapter 3: Research Design**

This chapter presents the mixed method methodology used in this study to address the research question, "*In what ways is online education at the high school level more, less or equally as effective as face-to-face instruction?*" This is followed by a discussion of issues surrounding validity and credibility of the data. It concludes with an explanation of the timeline of the study, and addresses the issues associated with the protection of human subjects.

**Methodology**

The practice-based research approach used in this study was a mixed method approach. Descriptive characteristics of the site and participants are presented as are the sample equivalence test results. Finally, the data collection for both the quantitative and qualitative components is discussed.

**Mixed method.** Educational researchers have been described as “eclectic” and draw on methods from different traditions which combine quantitative and qualitative approaches within the same research project (Wilson, 1997). A mixed-method model associating both quantitative and qualitative data was used. “The mixed method approach involves the use of both approaches in tandem so that the overall strength of a study is greater than either qualitative or quantitative research” (Creswell, 2009, p. 4). This method uses different but complementary data on the same topic. The triangulation of data in a mixed method approach provides a means to demonstrate increased validity (Morgan & Spanish, 1984). The combination of methodologies adds reliability to a study by revealing the extent to which student perceptions matched their scores (Webb,
Campell, Schwatz, & Sechrest, 1966). Calderon, Baker and Wolf (2000) point out that qualitative and quantitative research can be highly complementary.

The study used a sequential mixed-method approach, first using quantitative data and then qualitative data in a supportive role to better understand the findings from the primary quantitative analysis. The qualitative data is embedded within the larger study providing a supportive role (Creswell & Plano Clark, 2007). This approach is sometimes called a sequential explanatory design and is typically used to explain and interpret quantitative results by collecting and analyzing follow-up qualitative data (Morse, 1991). A major strength of this design is that the steps fall into clear and separate stages; therefore, it is easier to analyze, describe and report the findings. The main weakness of this design is the collection of data can be a lengthy process (Creswell, 2009).

**Quantitative method.** The quantitative method used was a non-experimental, after the fact method (“ex post facto”). Specifically, the design was prospective causal-comparative which starts with the causes and then examines the effects (Gray, 1992). This approach was the most appropriate and practical research method to explore the relationship between the mode of instruction and the numeric grades. A prospective causal-comparative design is appropriate when the following conditions are present as was the case in this study:

1. The groups were already formed and the study conducted after the treatment condition had occurred thereby eliminating the possibility of using an experimental design (Ary, Jacobs, & Razavich, 2002; Inam & Caso, 2002).
2. The independent variable (mode of instruction) cannot be manipulated by the researcher since the event is already underway or completed (Gray, 1992).
3. The participants are in the event now or the event is complete; therefore, there is no control over the selection of participants (Tabachinick & Fidell, 2001).

4. The groups are not presumed to be similar (Patten, 2000).

5. The approach protects the participants in the study from any psychological harm or discomfort that may arise during the study and is therefore the most ethical approach (Fraenkel & Wallen, 2006).

It is important to note that causal comparative study findings cannot determine the nature of causality as is the case using the experimental method, but does allow the researcher to attempt to identify cause-effect relationships or argue causation. This type of method does not prove cause and effect.

**Qualitative method.** After the quantitative approach was completed, student focus groups and a teacher interview were conducted in order to add any potential insights, affirmations, or discrepancies of the quantitative findings. Focus groups and a group teacher interview used in conjunction with quantitative projects have been shown to broaden and deepen a researcher’s understanding of the issues (Krueger, 1994; Morgan & Spanish, 1984). Focus groups have their origins in the social sciences and have been used extensively for educational purposes (Morgan, 1988; Ottewell & Brown, 1999).

A focus group is a small group of people (4-12) who meet with the researcher for 1-2 hours and discuss selected topics in a non-threatening environment in order to explore participants’ perceptions, attitudes and ideas (Bers, 1989; Krueger, 1994; Secker, Wimbush, Watson, & Milburn, 1995). The groups experience conversation, with a research purpose, in an informal, flexible environment. Group members take on the role of consultants to their peers by listening, mirroring back what has been said, and generally facilitating understanding of the
issues (Wilson, 1997). The setting leads to the building of trust and respect where the participants feel important to the process of building knowledge (Ottewill & Brown, 1999).

Focus groups and a group teacher interview were the most appropriate qualitative research methods for this study for the following reasons:

1. Groups include planned discussions designed to obtain perceptions, beliefs and values on a defined area of interest in a permissive non-threatening environment (Calderon, Baker & Wolf, 2000; Krueger, 1994).

2. Focus groups are viewed as a valid research method, especially when a researcher is interested in “filling in between the lines,” by gaining a deeper understanding of issues (Breen, 2006; Whitney, 2005).

3. Group research questions require participants to share and compare experiences with each other, develop and generate ideas from a social context, and explore issues of shared importance (Breen, 2006).

4. Focus group settings allow for probing and clarification of identified important concepts (Grusin & Stone, 1992; Wilson, 1997).

5. Focus group members validate and check other members’ responses while consensus building reduces extremes (Morgan, 1998).

Focus groups must be treated with a degree of caution (Ottewill & Brown, 1999). It is important that the group thoroughly discusses issues prior to seeking consensus (Grusin & Stone, 1992). And it is important that all voices are heard, being sure that one or two members do not dominate the discussion (Breen, 2006; Morgan, 1998).

Site and participants. Statistical theory will not predict what will happen with each occurrence, but can predict what will tend to happen over the long run given a particular sample
size. If the sample is of sufficient size, the variances from the prediction are likely to be relatively insignificant and incidental. Generally speaking, the higher the sample size, the more predictable or the more statistical power a prediction has; however, large samples can be costly in terms of time, energy, and money. There are few guidelines pertaining to the minimum number of subjects needed. Fraenkel and Wallen (2006) recommend a sample size of at least 30 individuals per group for causal-comparative studies in order to have a statistical power that is reasonably high and to detect reasonable departures from a null hypothesis.

The population studied consisted of students in grades 10-12 at a mid-sized high school in the northeastern portion of the United States. Students ranged in age from fifteen to eighteen years of age. The available sample was students taking a Computer Business Applications course, one of two offered courses that meet the district’s computer education graduation requirement. Students choosing the Computer Business Applications course were offered the choice of taking the course in a traditional face-to-face manner within a high school computer lab or taking the course online; therefore, convenience sampling was used (Fraenkel & Wallen, 2006).

The sample consisted of students in four sections of the Computer Business Applications course which had a total enrollment of 82 students. This course was offered at the College Placement I level (Appendix A). Two teachers each taught one section in a face-to-face environment and one section in an online environment. All students were full-time students, scheduled for seven courses, at the high school. Students enrolled in the online course each were required to schedule a study hall period in lieu of an extra class. Some, but not all students, shared a common study hall period. These students were permitted to use the library media center computer labs during their study hall period in order to complete online assignments.
The two veteran teachers assigned to the online courses had each taught the same course multiple times in a face-to-face format, but never in an online mode. Both teachers had personally taken online courses at a graduate level, and hold multiple, advanced degrees.

**Sample equivalence.** The researcher collected demographic data on the available sample that included gender, grade level, socioeconomic status, ethnicity, and grade point average (Tables 1 and 2). To determine whether or not the face-to-face and online groups were equivalent, the researcher used chi-square tests to investigate differences in gender, grade level, socio-economic status, and ethnicity and completed a t-test to explore differences in grade point average.

### Table 1

**Gender, Grade Level, Socioeconomic Status, and Ethnicity Combined Contingency Table**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Face-to-Face</th>
<th></th>
<th>Online</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>21</td>
<td>51</td>
<td>21</td>
<td>51</td>
</tr>
<tr>
<td>Male</td>
<td>20</td>
<td>49</td>
<td>20</td>
<td>49</td>
</tr>
<tr>
<td><strong>Grade Level</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade 10</td>
<td>14</td>
<td>34</td>
<td>9</td>
<td>22</td>
</tr>
<tr>
<td>Grade 11</td>
<td>12</td>
<td>29</td>
<td>11</td>
<td>27</td>
</tr>
<tr>
<td>Grade 12</td>
<td>15</td>
<td>37</td>
<td>21</td>
<td>51</td>
</tr>
<tr>
<td><strong>Socio Economic Status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not-Low Income</td>
<td>34</td>
<td>83</td>
<td>28</td>
<td>68</td>
</tr>
<tr>
<td>Low Income</td>
<td>7</td>
<td>17</td>
<td>13</td>
<td>32</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>2</td>
<td>5</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Black</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Multi-Race</td>
<td>2</td>
<td>5</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>White</td>
<td>34</td>
<td>83</td>
<td>28</td>
<td>69</td>
</tr>
</tbody>
</table>

### Table 2

**Face-to-Face and Online Group Differences for Grade Point Average**

<table>
<thead>
<tr>
<th></th>
<th>Face-to-Face</th>
<th></th>
<th>Online</th>
<th></th>
<th>d.f.</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade Point Average</td>
<td>2.95</td>
<td>0.693</td>
<td>2.82</td>
<td>0.778</td>
<td>80</td>
<td>.807</td>
</tr>
</tbody>
</table>

**Note:** p = .211, p > .05.
average. The alpha for these analyses was set at .05 (Fraenkel & Wallen, 2006). A one-tailed t-Test for Independent Means was conducted on the grade point average of the two groups to determine if groups differ on this numeric value. As demonstrated in Table 2, a Levene’s Test for Equality of Differences showed the difference between groups was not significant (t= .807, df = 80, p = .211, one-tailed). No significant difference between variances of the group were shown, F(1,80) = .402, p > .05. The grade point averages of the face-to-face group (M = 2.95, SD = 0.693) were similar to the grade point averages of the online group (M=2.82, SD = 0.778). There were no significant differences between the two groups’ grade point average.

Using chi-square the researcher determined there were no significant differences between groups based on the characteristics of gender, grade level, socioeconomic status. And ethnicity. Chi-square tests are used to compare expected and obtained frequencies from the dichotomous variables (Fraenkel & Wallen, 2006). As shown in Table 3, a 2 X 2 chi-square indicated no significant difference for frequency of gender between the groups, \( \chi^2 (1, N = 82) = 0.000, p > .05 \). A 2 x 3 chi-square indicated no significant difference for frequency of grade level between the groups, \( \chi^2 (2, N = 82) = 2.130, p > .05 \). A 2 x 2 chi-square indicated no significant difference for frequency of socio economic status between the groups, \( \chi^2 (1, N = 82) = 2.381, p > .05 \). A 2 x 5 chi-square indicated no significant difference for frequency of ethnicity between the groups, \( \chi^2 (4, N = 82) = 3.866, p > .05 \).

Table 3

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>df</th>
<th>( \chi^2 )</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>1</td>
<td>0.000</td>
<td>1.000</td>
</tr>
<tr>
<td>Grade Level</td>
<td>2</td>
<td>2.130</td>
<td>0.345</td>
</tr>
<tr>
<td>Socio Economic Status</td>
<td>1</td>
<td>2.381</td>
<td>0.123</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>4</td>
<td>3.866</td>
<td>0.424</td>
</tr>
</tbody>
</table>

Note: p=1.000 for gender; exactly 21 females and 20 males participated for each group.
On October 1, 2010, the enrollment total in the four sections was reported as 90 students. When the study was conducted, the enrollment was 82; of the eight students that dropped the course, two students were enrolled in a face-to-face section, and six were enrolled in the online section. In summary, there were no significant differences between the face-to-face and online groups for frequencies of gender, grade level, socioeconomic status, and ethnicity. Additionally, there was no significant difference between the two groups when comparing grade point averages. These tests suggest homogeneity of groups.

**Quantitative data collection.** As suggested by Fraenkel and Wallen (2006) in this type of study, descriptive parameters and statistics were collected for the groups from the electronic student information system maintained in the school system. In particular, the statistics included gender, grade level, socioeconomic status, ethnicity, and grade point average. The grade data was exported from the electronic grade book that records all students’ grades. Grades were categorized for this course into discussion, assignment, project, test, and mid-term exam grades by the teachers. The grades from the beginning of the year until mid-way through the third quarter of the courses were used.

Permission to access the data, conduct the focus groups, and interview the teachers was obtained from the high school principal. Permission from students and parents was obtained prior to conducting the focus groups (Appendix B). Permission from the teachers was obtained prior to conducting the teacher interview (Appendix D). Table 4 provides a graphic overview of the data table matching the independent variables with the dependent variables. The scores are equivalent to the grade values described in the definitions for each of the dependent variables.

**Qualitative data collection.** Focus groups and a teacher interview were used for the qualitative aspect of this study. Most researchers use more than one focus group per study, often
Table 4

<table>
<thead>
<tr>
<th>Mode</th>
<th>Discussions Scores</th>
<th>Assignments Scores</th>
<th>Projects Scores</th>
<th>Tests Scores</th>
<th>Mid-term Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Face to Face</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

up to three to five groups. Four focus groups were conducted with a total of 24 student participants in this study. Group sizes ranged from 4-8.

Breen (2006) points out the importance of careful selection of participants in a focus group. Participants often experience a rewarding learning experience on their own. Through the activity of generating and sharing ideas, participants establish personal relevance to new policies, ideas or issues. If the topic is irrelevant to a participant’s work or personal goals, a disservice is done to the research as well as the participants. Ottewill and Brown (1999) state the makeup of the groups does not need to be entirely representative but should not rely solely on volunteers. Students from a cross section of the population were asked to participate based on equality in gender, grade level, socioeconomic status, ethnicity and grade point average. Focus group meetings were held during periods adjacent to lunch periods and lunch was provided. Each group ran for approximately 90 minutes. Both instructors were interviewed simultaneously for a period of approximately 120 minutes.

It is important to carefully plan discussions with focus groups in order to obtain perceptions, values and beliefs of the group (Krueger, 1994; Simon, 1999). Ottewill and Brown (1999) also point out the importance of advanced planning tempered with a degree of flexibility to accommodate developments. A comfortable conference room was the setting for the focus groups which helped to build respect and feeling of importance for successful focus groups and the teacher interview (Ottewill & Brown, 1999). The presence of food makes for a comfortable atmosphere and encourages lively discussion (Whitney, 2005). The focus groups and the teacher
interview were scheduled so as not to coincide with major school events such as exams, extracurricular activities, or vacations. The researcher served as the moderator and posed questions which were based on the objectives of the study (Morgan, 1998).

Students and teachers received instruction as to the purpose and flow of the focus group and the teacher interview, including the importance of listening to each member and trying to understand issues from each member of the group (Wilson, 1997). Comprehensive written focus group and teacher interview plans were used (Appendix C and E) (Breen, 2006). The welcome statements provided an explanation as to the plan for the session. During the discussion of each quantitative finding, the researcher prompted the group first to discuss the topic in general and did not interrupt except when asking for clarification on statements (Grusin & Stone, 1992). Each member was encouraged to contribute at the general level before moving to the more detailed level in order to ensure that quieter members contributed (Ottewell & Brown, 1999).

After the general discussion, the researcher directed the discussion with probing questions focused on student and teacher experiences and perceptions regarding how they learned and the extent to which they agree or disagree with statements. Finally, the researcher summarized main points that arose during the discussion and obtained participants’ agreement with the summation (Breen, 2006; Kaase & Harashbarger, 1993).

Analysis and reporting from the focus groups and the teacher interview included the important themes, most noteworthy quotes, and unexpected findings. The level of importance was based on the groups’ input including such indicators as the extent participants agreed or disagreed on issues, and the frequency in which participants’ opinions shifted. Caution was taken with opinions that changed frequently. Reporting included the extensiveness, intensity and specificity of comments (Breen, 2006).
Methodological conclusion. In summary, a mixed-method approach was used to inform the research question using a sequential explanatory design and to triangulate the data. This design included a prospective causal-comparative, quantitative component. Student focus groups and the teacher interview provided the qualitative component. The availability of the sample was convenient. Combinations of descriptive and inferential statistics were employed including sample equivalence testing using chi-square and t-tests. A one-way multivariate analysis of variance to examine significant differences between the two groups based on the five dependent variables was employed. To better inform the quantitative findings, both student focus groups and a teacher interview were conducted. Discussion questions for the focus group were derived from the quantitative results, the characteristics of online learning theory, and the major themes identified through the review of literature. Following the student focus groups, a teacher interview was conducted utilizing discussion questions from the student focus groups and the major topics reported by students during their focus groups.

Validity and credibility. In any study there are threats to internal validity. Attempts were made to control for these. The specific factors were identified including the likelihood as to whether or not they made a difference in the findings determined (Fraenkel & Wallen, 2006).

The major threats to a causal comparative study are subject characteristics: mortality, location, instrumentation, history, and maturation (Fraenkel & Wallen, 2006; Szabla, 2006). Subject characteristics are a major threat. As mentioned, population sample equivalence tests were conducted and reported. These included chi-squared tests for the categorical variables of gender, grade level, socioeconomic status, and race. A t-test for the continuous variable grade point average was conducted and reported. Mortality or losses of respondents can also be a threat. As reported, just eight of the 90 students dropped the course during the study. All the
students attended the same high school which eliminated the location threat. Instrumentation in this case dealt with grading. The same rubrics for grades were used for each group. The teachers met to discuss and review inter-rater reliability using the Looking At Student Work assessment protocol (Little & Curry, 2008). In addition, each teacher evaluated one section of the face-to-face course and one section of the online course, which reduced teacher evaluation bias and, therefore, did not affect the overall comparison. All students matured at relatively the same pace and all fit within a relatively small age range (ages 15-18) which reduced the effect of the maturity variable. There were no significant historical considerations that occurred during this study.

Validity threats related to the qualitative component are not well-suited for the research effort in trying to describe a specific situation (Fraenkel & Wallen, 2006). The emphasis is on the integrity and expertise of the researcher. All inferences drawn were obtained from data gathered through the use of appropriate procedures which have been clearly defined in this study. For example, the researcher summarized and checked for consensus within the focus groups and the teacher interview. This procedure reduced extreme positions held by participants (Morgan, 1998). It also confirmed or refuted the perception of the discussion between the researcher and the participants (Breen, 2006). Exact student quotes were recorded, tallied and reported for each of the identified major themes in an effort to provide maximum transparency into qualitative findings.

External validity is based on many situation-dependent factors, so drawing conclusions from one study is not possible (Light, Singer & Willett, 1990). External validity directly correlates to how much the findings can be generalized to participants and settings that have similar characteristics (Creswell, 2009). The researcher has provided detail about the
population’s gender, grade level, socioeconomic status, and race, and provided significant detail about the setting. These details include that all student chose their learning mode; face-to-face students took the course in a computer lab, and online students each had a regularly scheduled study hall period and access to computers during this time. In addition, while the instructors were experienced teachers, including having taught the course many times in a face-to-face setting, it was the first time the teachers had taught a course online. Generalizations beyond this population and setting must be cautiously considered. It is the researcher’s belief that this study adds to the body of knowledge from which conclusions can be drawn. Replication of this study is encouraged.

**Timeline**

The numerical data was available as of the end of February 2011. During the following month student and parent permissions were obtained, data collection and analysis was completed, and the focus groups were conducted. Shortly thereafter, a teacher interview was held. Data analysis and reporting was concluded by the end of April 2011.

**Protection of Human Subjects**

In accordance with the policy of Northeastern University, an application was submitted to Northeastern University’s Institutional Review Board (IRB) and approved. The primary study was a confidential quantitative analysis of after-the-fact data. Some students were selected to participate in the 90-minute focus groups. Participants were treated with dignity and respect as required by both the protocol and requirements outlined by the IRB, including ensuring participants are kept safe and out of harm’s way physically, socially, emotionally, and academically. Following the student focus groups, a modified application request seeking permission to interview the teachers was submitted to Northeastern University’s IRB and
approved. Teachers were asked to participate in a 90-minute interview. Teachers who taught the course, and students enrolled in the course, were valued participants in the study. The students’ and teachers’ identities remain confidential and are not identified in any reporting.

**Chapter 4: Report of Research Findings**

The quantitative data is first presented including an explanation of the one-way multivariate analysis of variance (MANOVA), the MANOVA assumptions, and the results of the test of significance; from these results the proposed hypotheses were rejected or accepted. This is followed by the presentation of qualitative results which include the summarized results of the focus groups and the teacher interview, grouped by categories of discussion, assignments, projects, and tests with sub groupings of these categories by the major themes that emerged.

**Quantitative Results**

The level of error in experimental measures is like noise that can bury a signal. Anything that can enhance accuracy and consistency of measurement can increase statistical power (Fraenkel & Wallen, 2006). Some statistical tests are inherently more powerful than others. A one-way multivariate analysis of variance (MANOVA) was used to test the hypothesis. An analysis of variance is appropriate as the researcher is trying to determine significant differences between the means of two groups and five dependent grading variables. This allows for the use of the MANOVA which is a powerful test of differences among means (Fraenkel & Wallen, 2006). If the dependent variables are all equal, then the linear combinations are also equal. The Wilks’ lambda measure was used because it is frequently reported in social science literature (Green & Salkind, 2011). If the one-way MANOVA were significant, then one-way analysis of variance (ANOVA) tests would have been conducted on each dependent variable to determine which of the dependent variables were significantly different. ANOVA tests are widely used in
psychological research and are a popular follow up approach (Brace, Kemp & Snelgar, 2006). The software package Statistical Package for Social Sciences was used to analyze the data.

The p-value is the probability level that indicates the level of significance, that is, the probability that the results are a function of chance. By convention, most researchers accept a relationship as statistically significant if the p-value is equal to or less than .05 (Hoy, 2010); this measure of statistical significance was used in this study.

**MANOVA assumptions.** The MANOVA is an inferential procedure that has assumptions which must be assessed. The three assumptions are: 1) independence of observations, 2) multivariate normality, and 3) homogeneity of the covariant matrices (Weifurt, 1995).

The first assumption that must be assessed prior to running a MANOVA is that observations are independent of each other (Stevens, 2002). In this case, this means that each recorded score for a single student is not influenced by another student’s score. There were no group scores recorded for discussions, assignments, projects, or tests. Instructors scored each grade with standard rubrics applied to individual student work.

The second assumption is that scores on the dependent variables be normally distributed within the two groups. One method to test for normality is to divide skewness and kurtosis by their standard errors. Skewness and kurtosis should be within the +2 to -2 range when the data are normally distributed (Stevens, 2002). The researcher found that dependent variables for each group were not within the desired range. The researcher performed histograms on each dependent grade variable which showed data was skewed to the right. Giles (2002) states there are two ways normality can be violated which include: 1) platy kurtosis which is evident when the distribution curve looks like a low plateau and: 2) presence of outliers. Normal distribution
cannot be expected with student grades (Rumrill, Cook & Wiley, 2011). Histograms on each dependent variable were performed to ensure the absence of a low plateau curve and data was examined to ensure outliers were not included. The general consensus is that the MANOVA is a robust procedure and tends to be performed regardless of whether or not the data violate this assumption (Weifurt, 1995).

The third assumption is that variances of all the dependent variables must be equal across groups and the covariance for all unique pairs of dependent measures are equal across all groups (Weifurt, 1995). Stevens (2002) summarized studies from when this assumption was not shown to be met, stating that when the number of subjects in each group is approximately equal, a slight reduction in statistical power will occur. In this study, the number of subjects in each group was identical. Brace, Kemp & Snelger (2006) state that if you have equal sample sizes and a reasonable number of participants in each group and you’ve check for outliers before conducting your analysis, then MANOVA will still be a valid test even with modest violations of these assumptions.

**MANOVA test of significance.** The researcher conducted a MANOVA to determine differences between the independent grouping variable (face-to-face and online) on the five dependent variables (discussion grades, assignment grades, project grades, test grades, and the mid-term grade). The researcher used the standard significance level for social science research; the alpha was set to .05 for the overall MANOVA. The researcher reported the Wilks’ lambda statistic since it is frequently reported in social science literature.

The researcher conducted a correlation test between each of the dependent variables. These tests match each of the dependent variables individually to the others. In each pairing, a significant relationship was shown (Table 5). The design of the course helps explain this finding.
Some of the topics from the discussions were from content in assignments. Both the discussions and the assignments were building blocks for completion of the projects. The primary focus of tests was designed to examine what students had learned and could apply from projects; therefore test grades would also logically correlate to discussion and assignment grades. The mid-term examination was a cumulative test again drawing content from items learned during discussions, assignments, and projects. The mid-term test examined learning which was also tested on the individual tests. In summary, the course was designed so that the topics and skills from each dependent variable overlapped, which explains this finding.

Table 5

<table>
<thead>
<tr>
<th>Measure</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Discussion Grades</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Assignment Grades</td>
<td>.566*</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Project Grades</td>
<td>.517*</td>
<td>.644*</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Test Grades</td>
<td>.317*</td>
<td>.450*</td>
<td>.525*</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>5. Mid-term Grades</td>
<td>.468*</td>
<td>.486*</td>
<td>.548*</td>
<td>.404*</td>
<td>--</td>
</tr>
</tbody>
</table>

Note: * p < .01.

As shown in Table 6 no significant differences were found among the groups and the dependent measures, Wilks’ lambda = .874, F (5, 76) = 2.2, p > .05. The analysis reflected a modest association between the groups and the combined grade variables – multivariate partial \( \eta^2 \) based on Wilks’ lambda was .13. In addition as shown in Table 5 and described above, there was a strong correlation among all of the dependent variables. This correlation provides further evidence that the lack of significant differences would be similar for each dependent variable between the online and face-to-face groups. As discussed in Chapter 3, the MANOVA is a powerful test of differences among means and because no significant difference was shown
between groups with all dependent variables, there was no need to conduct follow up individual analysis of variance for each dependent variable (Fraenkel & Wallen, 2006).

Table 6

<table>
<thead>
<tr>
<th></th>
<th>MANOVA F(5,76)</th>
<th>Discussion Grades F(1, 80)</th>
<th>Assignment Grades F(1, 80)</th>
<th>Project Grades F(1, 80)</th>
<th>Test Grades F(1, 80)</th>
<th>Mid-term Grades F(1, 80)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructional Mode</td>
<td>2.2</td>
<td>0.19</td>
<td>0.05</td>
<td>1.72</td>
<td>2.17</td>
<td>0.34</td>
</tr>
</tbody>
</table>

Note: p >.05

Table 7 contains the means and standard deviations of the dependent variables (discussion grades, assignment grades, project grades, test grades, and mid-term grades) for the two groups (face-to-face and online) from the MANOVA analysis. The face-to-face group had a higher mean score on discussions (M = 84.67, SD = 16.06) than the online group (M = 83.14, SD = 18.17). The face-to-face students also scored a higher mean score on the projects (M = 84.68, SD = 16.79) than the online students (M = 80.28, SD = 13.36). The online group had a higher mean on assignment grades (M = 81.29, SD = 14.53) than the face-to-face group (M = 80.47, SD = 18.11). Online students had higher test averages as well (M = 79.97, SD = 14.14) when compared to the face-to-face students (M = 75.45, SD = 13.48). Finally, the average of the mid-term examinations for the online group was higher (M = 81.59, SD = 9.28) than the face-to-face group (M = 80.51, SD = 7.34).

Rejection or acceptance of hypotheses. The following section focuses on the results of the findings for the hypotheses based on the quantitative findings. Overall, there was an even split of participants in each group (n = 41). A review of the mean scores of the two groups suggests a very small difference between the groups and those differences were mixed between the dependent variables; namely higher mean scores for online with assignments, tests and mid-
Table 7
Means and Standard Deviations by Dependent Variables for the Two Groups for MANOVA Analysis

<table>
<thead>
<tr>
<th>Group</th>
<th>Discussion Grades</th>
<th>Assignment Grades</th>
<th>Project Grades</th>
<th>Test Grades</th>
<th>Mid-term Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Face-to-Face</td>
<td>84.67</td>
<td>16.06</td>
<td>80.47</td>
<td>18.11</td>
<td>84.68</td>
</tr>
<tr>
<td>Online</td>
<td>83.14</td>
<td>18.17</td>
<td>81.29</td>
<td>14.53</td>
<td>80.28</td>
</tr>
</tbody>
</table>

*Note.* Dissertation Sample: n=82, 41 in each group.
term grades and higher mean scores for face-to-face with discussion and project grades. To explore significant differences between online and face-to-face groups based on the dependent variables, the researcher employed a multivariate analysis of variance (MANOVA). The alpha was set at .05, as this is a standard significance level for social science research. If there were a significant difference between the groups based on any of the dependent variables, the MANOVA test would show a p < .05. This was not the case. The difference between the two groups was not significant, F (5, 76) = 2.2, p > .05, for the MANOVA. This result shows there were no significant differences between the groups for each of the dependent variables.

**Hypothesis 1:** *There will be higher discussion grades obtained by online students than face-to-face students at the high school level.*

The first hypothesis focused on comparing discussion grades between the two groups. Hypothesis 1 predicted that the discussion grades of the online group would be higher when compared to the face-to-face group. In fact, the mean scores for the face-to-face group were slightly higher (M = 84.67, SD = 16.06) when compared to the online group (M = 83.14, SD = 18.17). As stated above, this difference was not significant when examining the variance, F (5, 76) = 2.2, p > .05. No significant difference was found between the online students and the face-to-face students based on discussion grades; therefore, the researcher rejects Hypothesis 1.

**Hypothesis 2:** *There will be lower assignment grades obtained by online students versus face-to-face students at the high school level.*

The second hypothesis focused on comparing assignment grades between the two groups. Hypothesis 2 predicted that the discussion grades of the online group would be lower when compared to the face-to-face group. In fact, the mean scores for the online group were slightly higher (M = 81.29, SD = 14.53) when compared to the face-to-face group (M = 80.47, SD
18.11). This difference was not significant when examining the variance, $F (5, 76) = 2.2, p > .05$.

No significant difference was found between the online students and the face-to-face students based on assignment grades; therefore, the researcher rejects Hypothesis 2.

**Hypothesis 3:** There will be higher project grades obtained by online students versus face-to-face students at the high school level.

The third hypothesis focused on comparing project grades between the two groups. Hypothesis 3 predicted that the project grades of the online group would be higher when compared to the face-to-face group. In fact, the mean scores for the face-to-face group were slightly higher ($M = 84.68, SD = 16.79$) when compared to the online group ($M = 80.28, SD = 13.36$). This difference was not significant when examining the variance, $F (5, 76) = 2.2, p > .05$.

No significant difference was found between the online students and the face-to-face students based on assignment grades; therefore, the researcher rejects Hypothesis 3.

**Hypothesis 4:** There will be no significant difference in testing grades obtained by online students versus face-to-face students at the high school level.

The fourth hypothesis focused on comparing test grades between the two groups. Hypothesis 4 predicted that the test grades would show no significant difference between the online group when compared to the face-to-face group.

The mean test scores for the online group ($M = 79.95, SD = 14.14$) were slightly higher than the face-to-face group ($M = 75.45, SD = 13.48$). The mean mid-term scores for the online group ($M = 81.59, SD = 9.28$) were slightly higher than the face-to-face group ($M = 80.51, SD = 7.34$). Once again, as shown above this difference was not significant when examining the variance, $F (5, 76) = 2.2, p > .05$. No significant difference was found between the online
students and face-to-face students based on testing grades including the mid-term grade; therefore, the researcher finds the quantitative results are in keeping with this hypothesis.

**Summary of quantitative results.** It was shown that there was a correlation between each of the grading categories relating to the overlapping concepts and course design. No significant differences between the online and face-to-face groups for any of the five dependent variables (discussion grades, assignment grades, project grades, test grades, and mid-term grades) were found using a MANOVA. While these alone are important findings, it was helpful to examine these findings in more detail to identify how online and face-to-face education differs. The sequential explanatory design that was used helped explain and interpret the quantitative results and assisted in addressing the research question (Morse, 1991). Qualitative data was collected and analyzed to provide additional insight into the quantitative findings.

**Qualitative Results**

The purpose of the qualitative aspect of this project was to explore the quantitative findings which showed no significant difference within each of the grade categories and to further address the research question, “**In what ways is online education at the high school level more, less or equally as effective as face-to-face instruction?**” First, an explanation of the focus groups and teacher interview processes are presented. Second, qualitative results from the focus groups and the teacher interview are presented, grouped by each of the four hypotheses. Each theme presented is shown to support the quantitative findings.

**Focus group process.** Discussion questions derived from the results of the quantitative results of no significant differences for each of the quantitative findings for the four hypotheses, led each section of the discussion. The format of these questions were “Why do you believe there was no significant difference between the online students and face-to-face students
EFFECTIVENESS OF ONLINE INSTRUCTION: HIGH SCHOOL

<dependent variable> grades?” and “What experiences have you had that could explain this finding?” Each section concluded with an opportunity for students to add additional thoughts during the discussion of the topic. The concluding discussion question for each section was in the form, “Is there anything else connected to this finding that you feel strongly about and would like to bring up now?”

Additional discussion questions were formed based on the characteristics of online learning theory and from major themes identified through the review of literature. For example, research has shown that written online discussions allow for increased reflection. From this, the following discussion questions were formed, “Did it take longer to participate in an online discussion than a face-to-face discussion?” and “Did you find it a challenge to express your thoughts in writing?” Table 8 through Table 11 provides the matching of the characteristics and themes to the discussion questions in order to add insight into the quantitative findings.

Four student focus groups were conducted with participants from online and face-to-face classes. The size of the focus groups ranged from 4 to 8 with a total of 24 student participants. Participants met in the informal conference room where pizza, drinks, and cookies were made available. The research followed the detailed focus group plan that was approved by the Internal Review Board (Appendix C). Each of the four focus groups lasted approximately 90 minutes. Each session was recorded with a digital recorder for analysis of data.

During the focus group sessions students shared and compared experiences and explored issues of shared importance (Breen, 2006). The researcher posed discussion questions and allowed the topic to run its course. If needed, the researcher asked students to elaborate to ensure each topic was thoroughly discussed. The researcher summarized the responses and sought consensus of the summaries. During the focus group process the researcher recorded reflective
Table 8

Focus Group Discussion Questions: Hypothesis 1 Online Discussions

<table>
<thead>
<tr>
<th>Online Theory and Literature Review</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online discussions support shift toward learner-centered education.</td>
<td>Were the discussion topics interesting to you?</td>
</tr>
<tr>
<td></td>
<td>How motivated were you to “get into” the discussion?</td>
</tr>
<tr>
<td></td>
<td>Did you feel you were helping steer the conversation?</td>
</tr>
<tr>
<td></td>
<td>Did you feel you were an important contributor to the discussion?</td>
</tr>
<tr>
<td>Online discussions allow for participation when it is best for the student.</td>
<td>When did you contribute to the discussions and was that a time that you were prepared and focused on the topic at hand?</td>
</tr>
<tr>
<td>Online discussions allow more time reflection time, especially written online discussions.</td>
<td>Does it take longer to participate in an online discussion than a face-to-face discussion?</td>
</tr>
<tr>
<td></td>
<td>Did you find it a challenge to express your thoughts in writing?</td>
</tr>
<tr>
<td>Peer communication is very important to adolescents.</td>
<td>How do you prefer to communicate with peers?</td>
</tr>
<tr>
<td>Online communications provide a sense of modified anonymity leading to more equitable contributions.</td>
<td>Did you feel more comfortable when contributing using online discussion tools (discussion boards and chats) rather than offering items in class?</td>
</tr>
<tr>
<td></td>
<td>How important are non-verbal cues in understanding a classmate?</td>
</tr>
<tr>
<td>Online communication can be misunderstood.</td>
<td>How well did you get to know your classmates during the chats or discussions?</td>
</tr>
<tr>
<td>Online communication can be of low quality.</td>
<td>Did your discussions lead toward developing a shared understanding between the groups discussing the items?</td>
</tr>
</tbody>
</table>
Table 9

Focus Group Discussion Questions: Hypothesis 2 Assignment Grades

<table>
<thead>
<tr>
<th>Online Theory and Literature Review</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructor interaction and support is critical for success.</td>
<td>How effective was teacher support and prompting in getting you to complete your assignments, including submitting them in a timely fashion?</td>
</tr>
<tr>
<td>There is more direct supervision in a face-to-face classroom.</td>
<td>Did you feel assignments were meaningful? How important were the assignments?</td>
</tr>
<tr>
<td>Work needs to be meaningful and engaging for students to put in full effort.</td>
<td>Did you receive any assistance on assignments from the instructor, classmates or others?</td>
</tr>
<tr>
<td>There is regular communication built in to a face-to-face classroom that is more of a challenge in an online setting.</td>
<td></td>
</tr>
<tr>
<td>Peer interaction has been shown to improve learning.</td>
<td></td>
</tr>
<tr>
<td>Developing personal responsibility needs regular teacher interaction.</td>
<td>What happened when you didn’t turn in your assignment?</td>
</tr>
<tr>
<td></td>
<td>How did you get feedback on your assignment?</td>
</tr>
<tr>
<td></td>
<td>What distractions did you have when working on assignments?</td>
</tr>
<tr>
<td>The structure of an online course is critical.</td>
<td>Was it clear how to go about completing the assignments and when items were due?</td>
</tr>
<tr>
<td></td>
<td>What kinds of resources were used in helping you complete the assignments?</td>
</tr>
<tr>
<td></td>
<td>Were there too many, too few, or just about the right amount of resources available to help complete the assignments?</td>
</tr>
<tr>
<td>Online Theory and Literature Review</td>
<td>Questions</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Work needs to be meaningful and engaging for students to put in full effort.</td>
<td>Did the projects challenge your thinking or were they mostly just following instructions?</td>
</tr>
<tr>
<td>Supports shift from teacher-director to learner-centered approach.</td>
<td>Did you feel projects were meaningful?</td>
</tr>
<tr>
<td></td>
<td>How important were the projects?</td>
</tr>
<tr>
<td></td>
<td>How motivated were you to make the project meaningful?</td>
</tr>
<tr>
<td>Online provides structure with learning management systems.</td>
<td>Was it clear how to go about completing the projects and when items were due?</td>
</tr>
<tr>
<td>Online can use engaging media.</td>
<td>What kinds of resources were used in helping you complete the projects?</td>
</tr>
<tr>
<td></td>
<td>Were there too many, too few, or just about the right amount of resources available to help complete the projects?</td>
</tr>
<tr>
<td>Developing personal responsibility needs regular teacher interaction.</td>
<td>How effective was teacher support and prompting in getting you to complete your projects, including submitting them in a timely fashion?</td>
</tr>
<tr>
<td>Online learning provides flexibility for more time on learning and a better time to learn</td>
<td>Did you receive any assistance on projects from the instructor, classmates, or others?</td>
</tr>
<tr>
<td></td>
<td>How did you get feedback on your projects?</td>
</tr>
<tr>
<td></td>
<td>What distractions did you have when working on projects?</td>
</tr>
</tbody>
</table>
Table 11

Focus Group Discussion Questions: Hypothesis 4 Test Grades

<table>
<thead>
<tr>
<th>Online Theory and Literature Review</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online students should have prerequisite computer skills.</td>
<td>How would you rate your computer skills prior to starting the course?</td>
</tr>
<tr>
<td></td>
<td>Did you feel that you had the necessary technical skills to be successful</td>
</tr>
<tr>
<td></td>
<td>in an online course?</td>
</tr>
<tr>
<td>Attitude and motivation are important for success.</td>
<td>Do you consider yourself a self-directed learner?</td>
</tr>
<tr>
<td></td>
<td>What did you like or not like about the tests?</td>
</tr>
<tr>
<td></td>
<td>How did you study for the tests? About how much time did you study for</td>
</tr>
<tr>
<td></td>
<td>the tests?</td>
</tr>
<tr>
<td></td>
<td>How motivated were you to study for the tests?</td>
</tr>
<tr>
<td>Tests reflect overall learning.</td>
<td>Did you feel the tests were a good measure of your achievement in the</td>
</tr>
<tr>
<td></td>
<td>course?</td>
</tr>
</tbody>
</table>

comments that were used during the coding process. A modified qualitative coding system was used based on Hahn’s (2008) multidisciplinary coding approach. The coding moves from unsorted data to the development of refined topics and themes. The following steps were used to identify major themes of the focus groups.

1. The researcher drafted themes by listening to the recorded focus groups sessions.
   Particular attention was given to summarization statements that reached consensus. The researcher merged these themes with the handwritten reflective comments.

2. The researcher categorized these themes by the characteristics of online learning theory and topics identified by the literature review, and then grouped these under one or more of the hypotheses.
3. The researcher then transcribed each student’s comments noting whether the comment was from an online student or a face-to-face student.

4. The researcher then grouped each comment under the identified topics and adjusted the topics when necessary to reflect best both the online and face-to-face students’ comments and the summary statements that had received consensus. The total number of student comments for each learning mode per theme was computed. For further details on the identified topics, see Appendix F.

5. Finally, the researcher examined each topic for individual issues and identified emergent themes. Appendix G details the flow from identified topics into emergent themes.

**Teacher interview process.** After the researcher had drafted the major themes from the student focus groups, a Teacher Interview Guide (Appendix E) was developed, submitted and approved by the IRB as a modification to the original application. This included the questions used in the student focus group and some additional clarifying questions. The clarifying questions were developed from topics mentioned by students in the focus group sessions and these questions were designed to provide the researcher a clearer understanding of the course expectations and educational environment.

As in the student focus groups, the opening and closing questions for each of the four sections of the discussion were open-ended questions derived from the results of the four quantitative results of no significant differences for each of the hypotheses (Appendix E). The instructors were interviewed simultaneously in a private office. The Teacher Interview Guide protocol was followed.

The interview was digitally recorded; the interviewer took notes during the session, inclusive of when the teachers were in agreement and when they were not. Following the
interview, the researcher transcribed the interview, compared the written transcript with the researcher’s written notes, and matched the results to the major themes identified through the student focus group process. The following qualitative findings are grouped by the four hypotheses.

**Hypothesis 1 - discussion grades.** As shown above, there were no significant differences between the discussion grades of the online students and the face-to-face students. A brief, detailed explanation of the composition of discussions begins this section. Teacher monitoring and feedback, design of discussion sessions, and participation level help explain why no significant differences were found. In addition, two complicating factors are presented. A sampling of statements from the online and face-to-face students gathered during the focus groups are presented in Table 12. The sample statements are organized by the three themes that help to explain the finding for the first hypothesis.

The discussion grades were developed from text-based student discussions in both the face-to-face and online classes including small group, real-time live text chats, and large group asynchronous discussion boards. All text chats were recorded for later review. Students in the face-to-face classes participated in the text chat during one class period. Student groups for online classes scheduled text chats in the afternoons and evenings. The themes that contributed to the finding of no significant differences in discussion grades are teacher monitoring and feedback, design of discussion sessions, and participation level.

**Teacher monitoring and feedback.** One factor that supports the finding of no significant difference in discussion grades was that teacher monitoring and feedback were equally robust. It was reported in the focus groups that teachers in both learning modes provided excellent monitoring and feedback. For example, one online student stated, “The teacher would make you
<table>
<thead>
<tr>
<th>Themes</th>
<th>Online</th>
<th>Face-to-Face</th>
<th>Researcher’s Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher monitoring and feedback</td>
<td>“The teacher would make you contribute. She’d call you out.”</td>
<td>“When the teacher would come into the chat then, we’d get back on topic.”</td>
<td>Active teacher monitoring was equally robust.</td>
</tr>
<tr>
<td></td>
<td>“I personally contribute more to the chats because you have the teacher right there live, with the teacher telling you to contribute.”</td>
<td>“The first time we did it no one stayed on topic and we didn’t really discuss the topic. The teacher got mad.”</td>
<td>Timely teacher monitoring and feedback impacted student contributions from both groups of students.</td>
</tr>
<tr>
<td></td>
<td>“You couldn’t answer in one word. You had to answer in a complete sentence with our opinion.”</td>
<td>“The teacher would come around and grade you on the rubric. If you messed something up, you’d have a chance to correct it.”</td>
<td>Teacher interaction led to improved quality of posts from both groups of students.</td>
</tr>
<tr>
<td></td>
<td>“The teacher recorded the chat and would go over it later. You had to contribute.”</td>
<td>“The first time the teacher gave a three out of four because we didn’t answer the questions. He saw this after he reviewed the recording.”</td>
<td>Review of recorded sessions added pressure to contribute to all students.</td>
</tr>
<tr>
<td>Design of discussion sessions</td>
<td>“It is normally easier to talk to someone who you wouldn’t normally talk to online.”</td>
<td>“Chats were awkward with students sitting only a few feet away.”</td>
<td>Some anonymity can contribute to academic discussions.</td>
</tr>
<tr>
<td></td>
<td>“Even though I didn’t know some of the people in the chat, I still learned from them.”</td>
<td>“I really don’t need to know them well to have a good chat.”</td>
<td>Both groups reported strong personal relationships were not important for academic discussion.</td>
</tr>
<tr>
<td>Themes</td>
<td>Online</td>
<td>Face-to-Face</td>
<td>Researcher’s Comments</td>
</tr>
<tr>
<td>-------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Design of discussion</td>
<td>“I like talking to people face-to-face, but I can actually type more</td>
<td>“I can write the words I want to say so I can get more in-depth that</td>
<td>Keying entries allowed for increased quantity and depth of students posts.</td>
</tr>
<tr>
<td>sessions</td>
<td>than I can actually say.”</td>
<td>way.”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>“The people in my chat are people that would normally talk a lot, and</td>
<td>“At first, I would just say “I agree” and “yes.” By the third or fourth</td>
<td>Text discussions helped to equalize contributions for all students.</td>
</tr>
<tr>
<td>(continued)</td>
<td>it’s kind of surprising that in a chat they didn’t.”</td>
<td>chat, I started putting stuff in and contributing more.”</td>
<td></td>
</tr>
<tr>
<td>Participation levels</td>
<td>“Finding a time to meet was a challenge.”</td>
<td>“We participated in the chats during class.”</td>
<td>Online students met challenges in scheduling and attending chats which were not</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>necessary for face-to-face students.</td>
</tr>
<tr>
<td></td>
<td>“I tried to (do other things) but then I realized that I’d miss things.”</td>
<td>There were no comments from face-to-face students about distractions during</td>
<td>Distractions were either minimal or students learned to control them in both the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>text chats.</td>
<td>online and face-to-face environment.</td>
</tr>
</tbody>
</table>
contribute. She’d call you out.” A face-to-face student stated, “When the teacher would come into the chat, then we’d get back on topic.” Through their online or physical presence and review of archived sessions, teachers were able to provide both real-time and after-the-fact feedback which helped all students improve their discussion contributions. Research has shown the importance of teacher feedback in improving the quality of posts (Murphy & Coleman, 2004). This high level of teacher monitoring and feedback for both learning modes helps to explain why no significant differences were found in discussion grades.

Feedback from teacher monitoring provided pressure for all students to stay focused during discussions. The teachers’ active participation in chat sessions pressured students to contribute, which kept the discussion properly focused in both learning modes. Online chats occurred one at a time which allowed for the teacher to be actively present in each chat. “I personally contribute more to the chats because you have the teacher right there live with the teacher telling you to contribute.” Students reported that teacher presence was an important factor related to staying on topic and to the amount they contributed. Face-to-face chats occurred simultaneously which meant the teacher’s attention was divided by the number of chat groups. Periodic visits into the chats during the face-to-face sessions would often focus on steering the students back to the topic of the chat. Face-to-face students reported receiving whole class feedback as the teacher spot checked text chats and roamed the room during text chats. “The first time we did it no one stayed on topic and we didn’t really discuss the topic. The teacher got mad.” Teacher feedback has been shown to keep online discussions focused and to encourage participation (Hew & Cheung, 2003). Feedback from the teacher helps explain why no significant differences in the discussion grades were found.
Equally effective feedback that improved the quality of the posts contributed toward the finding that discussion grades were similar. A lack of depth in many of the early text chat discussions was reported by teachers and students in both learning modes. All stated there were far too many, “I agree” and “Me, too” replies. Online students reported getting feedback from teachers about the quality of the chat posts during the chat and would make corrections at that time. “You couldn’t answer in one word. You had to answer in a complete sentence with our opinion.” Face-to-face students reported a similar experience with discussion board posts. “The teacher would come around and grade you on the rubric. If you messed something up you’d have a chance to correct it.” Both groups reported learning quickly how to improve the quality of their contributions when they received this feedback. Qualitative feedback has been shown to be important in improving the quality of contributions to online discussions (Oliver & Shaw, 2003). Feedback from teachers during both text chats and discussion boards contributed to better student contributions and better discussion grades for students in both learning modes, supporting the finding of no significant differences in discussion grades.

The recording of text chats, archived reviews by teachers, and teacher feedback improved student participation in both groups. Face-to-face and online students reported they felt pressure to contribute to a recorded text chat. “The teacher recorded the chat and would go over it later. You had to contribute.” All students reported that they had to respond in the text chats or they wouldn’t get credit for participating. Some face-to-face students reported that many learned this the hard way by receiving fewer points during an initial text chat, but that they did learn to contribute more moving forward. “The first time the teacher gave three out of four because we didn’t answer the questions. He saw this after he reviewed the recording.” For students in both
learning modes recording and teacher review of the chat resulted in better participation by all students which further explains why no significant differences in discussion grades were found.

**Design of discussion sessions.** Another reason why there were no significant differences in grades is because the design of the discussion sessions was very similar. All discussions were text-based discussions. Students in both groups reported that the combination of removing non-verbal cues and not having strong personal relationships with peers led to a more focused and reflective academic conversation. Discussion using text helped to equalize contributions from all students. In addition, online and face-to-face students reported that they could contribute more using text chats. This supports the discovery that there were no significant differences in discussion grades.

Use of typed text helped students keep the discussion focused on academic subjects. Students reported that a personal connection with other students was not necessarily helpful for an academic discussion. For example, an online student stated, “Even though I didn’t know the people in the chat, I still learned from them.” A face-to-face student reported, “I really don’t need to know them well to have a good chat.” Students reported that the removal of non-verbal cues allowed them to focus more on the topic. One teacher reported “social games” occurred with text chats during face-to-face classes because students participated while physically in the same area. The teacher reported roaming the room to keep students from distracting others. This teacher reported that it was the presence of non-verbal cues that caused a distraction to some, and the lack of anonymity proved to detract from the learning activity; however the teacher reported this distraction was easily controlled by active monitoring. A face-to-face student stated, “Chats were awkward with students sitting only a few feet away” and an online student stated, “It is normally easier to talk to someone you wouldn’t normally talk to online.” In summary, the use of
typed text kept discussion focused on academic subjects for both online and face-to-face students, further supporting the quantitative finding.

Both groups reported that using written text responses provided for more reflection time than would occur in a typical verbal discussion. Students stated that writing out their thoughts provided them time to reflect and censor initial reactions. Many students felt it was easier to explain their thoughts by writing them out. An online student stated, “I like talking to people face-to-face, but I can actually type more than I can actually say.” A face-to-face student reported, “I can write the words I want to say so I can get more in-depth that way.” Research has shown that the added time to think about content allows students to correct distortions and clarify their understanding of online discussion topics (Menchaca & Bekele, 2008). Students in both the online and face-to-face sessions filtered contributions and provided more meaningful insights into the text-based discussions which supports why no significant differences in the discussion grades were found.

Text chats were an equalizing factor between quieter students and very social students in both learning modes. Most students felt that a quieter student contributed more in a text chat than in a verbal discussion. They stated this was particularly true of classmates they didn’t know very well. One of the quietest members of the face-to-face focus groups reported that it took a couple of chats but eventually he started to contribute more. “At first, I would just say, “I agree” and “yes.” By the third and fourth chat, I started putting stuff in and contributing more.” The students and teachers agreed that there was an advantage for the quieter students because they felt more comfortable contributing online. However, one online student pointed out, “There were people in my chat that would normally talk a lot and it’s kind of surprising that in a chat they didn’t.” The impact of using the text chat produced a more equitable distribution of the discussion to all
students in both learning modes supporting the similar discussion grade finding. Warschauer (1997) points out some of the benefits of some anonymity with online discussions include the reduction of social games that often take place in face-to-face verbal settings. The design of discussion sessions was similar for both online and face-to-face sessions. Characteristics of these text based discussion sessions included removal of non-verbal cues and the lack of personal relationships which led to more equitable, focused, and reflective academic discussions for all students, contributing to the equality of discussion grades.

**Participation levels.** Almost all students participated in discussions regularly and were focused on the chat which supports the finding that discussion grades were similar. Online students faced greater hurdles in attending discussion sessions and faced more distractions, but they learned to take responsibility for attending and remaining focused during the sessions. This led to a high participation rate by all students which further supports the finding of no significant difference in discussion grades.

Early in the course, some online students struggled to attend chat discussions. “Finding a time to meet was a challenge.” Students in the face-to-face sections participated when they were present in class and were not challenged in the same way. “We participated in the chats during class.” Online students learned to accept responsibility for scheduling and attending chats. Teachers reported significant improvement in attendance in text chats by online students as the course progressed. Online students participated in discussions at a rate similar to the face-to-face students further supporting the finding of no significant difference.

Particularly with early chats, some online students struggled to be fully attentive during the discussions. One student reported, “I do other things during the chat and I can still concentrate.” A number of online students reported the opposite belief. “I tried to but then I
realized that I’d missed things.” Importantly, most of the online students reported they learned to control their distractions during chats which they attributed in part to an active teacher presence. Research has shown that unconstrained online discussions result in many more distractions for participants (Ulrich, Borau, Luo, Tan, Shen & Shen, 2008). Students in the face-to-face class did not report significant multitasking during chats. Face-to-face students stated that there were few distractions available in the classroom because of Internet filtering and teacher monitoring. In summary, online students learned to control distractions while face-to-face students had minimal distractions leading to a similar focus maintained by all students during the chats.

**Teachers’ interview - discussion grades.** The teachers’ interview supported the three themes identified through the student focus group process. A sampling of statements from the interview are presented in Table 13. Teachers provided feedback to students both during active monitoring and after review of the sessions. In regard to an online chat, a teacher stated, “I was devoted to that particular group for that particular hour.” Another reported that during the face-to-face text chat, both computer monitoring and walking around were used as monitoring techniques. “I monitored from my computer, but I also got up and walked around the room.”

Teachers reported a different feel to discussions when students chatted remotely. “There was a different atmosphere when you could also see your peers during a text chat.” The lack of anonymity was a distraction for some. “I had some students that were distracting others and they needed direct supervision.” Anonymity in general supported the quieter students. “There was definitely an advantage for the quieter students in the chats.” Teachers reported that the text chat sessions where helpful in building rapport with students. “I think I learned a lot about them. I think they learned a lot about me. It made it a more personable situation when I’d see them in the hall.”
Table 13

<table>
<thead>
<tr>
<th>Themes</th>
<th>Online</th>
<th>Face-to-Face</th>
<th>Researcher’s Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher monitoring and feedback</td>
<td>“I was devoted to that particular group for that particular hour.”</td>
<td>“I monitored from my computer, but I also got up and walked around the room.”</td>
<td>Teachers actively monitored during text chats.</td>
</tr>
<tr>
<td></td>
<td>“I generally got the gist of it. There weren’t any surprises.”</td>
<td>“I reviewed more for the face-to-face because I was concerned with the quality of the contributions.”</td>
<td>Teacher reviewed the recorded sessions.</td>
</tr>
<tr>
<td>Design of discussion sessions</td>
<td>“There was definitely an advantage for the quieter students in the chats.”</td>
<td>“I had some students that were distracting others and they needed direct supervision.”</td>
<td>Anonymity contributed to academic discussions.</td>
</tr>
<tr>
<td></td>
<td>“I think I learned a lot about them. I think they learned a lot about me. It made it a more personable situation when I’d see them in the hall.”</td>
<td>“There was a different atmosphere when you could also see your peers during a text chat.”</td>
<td>Chats helped teacher and student rapport for the online sessions.</td>
</tr>
<tr>
<td>Participation levels</td>
<td>“I think we were more involved with getting the kids to participate in the chat.”</td>
<td>“If the student was absent, they’d have to read the recorded chat and answer the discussion questions.”</td>
<td>Teachers supported students to successfully participate in discussions.</td>
</tr>
</tbody>
</table>

Teachers reported that they spent a significant amount of time trying to get online students to participate regularly in the chat. “I think we were more involved with getting the kids to participate in the chat.” Additionally, teachers worked with absent face-to-face students to
ensure they earned credit for chat participation. “If the student was absent, they’d have to read the recorded chat and answer the discussion questions.”

**Summary of hypothesis 1 – discussion grades.** Equal participation levels and similar design of discussion sessions coupled with regular teacher monitoring and feedback help explain why no significant differences in discussion grades were found. Teacher interaction was integral to successful discussions. When a teacher was actively present, students contributed equally. Teacher feedback led to improved quality of posts for students in both learning modes. A similar design of text discussions provided a level of anonymity that promoted reflection, self-filtering of comments, and equalized discussion contributions of all students. Development of independent learning skills was evident for online students as compared to face-to-face students. Online students learned to take responsibility for attending chats and maintaining focus through distractions. Face-to-face students did not need to develop these skills since the activities took place within a structured classroom environment. Active monitoring and feedback by the teachers, similar design of discussion sessions, and development of independent learning skills by online students, help explain why no significant differences in discussion grades were found.

**Hypothesis 2 – assignment grades.** This section provides insight into why there were no significant differences between the assignment grades of online students and the face-to-face students. Teacher flexibility and targeted support led to a similar assignment completion rate for both groups. Some online students struggled without immediate teacher support, but others benefited by gaining independent learning skills. Similar findings between the two groups related to student focus and available supports are discussed below. A sampling of statements from the online and face-to-face students gathered during the focus groups are presented in Table 14. The sample statements for each theme help to explain the finding for the second hypothesis.
Assignments were designed to build core knowledge and comprehension. There were frequent assignments short in duration, typically lasting the equivalent of one class period. All assignments were available through the assignments link on a learning management system for both face-to-face and online courses. Many assignments came directly out of a textbook designed to teach application skills within a project environment.

**Completion rate.** Teachers were flexible as to when assignments were due and targeted their support to students who most needed it, which led to a similar completion rate for both groups. This supports the finding of no significant difference between the assignment grades. This flexibility and support was clearly evident during the early part of the course for online students and consistently evident for face-to-face students. Early in the course, teachers worked with online students to develop habits to promote timely submission of work because many students were not turning in assignments. “There was a point when the teacher said the term is ending, get in as many missing assignments as you can by a due date.” Online students and the teachers reported that an important rhythm was established two months into the course; work was assigned at the end of the prior week and then due on Monday, Wednesday and Friday. Menchaca and Bekele (2008) state the importance in motivating students by “optimally utilizing appropriate technologies; choosing relevant learning approaches; and designing, offering and monitoring online courses” (p. 248). Teachers stated that online students dramatically improved their organizational skills including their ability to manage their own time. One teacher stated, “They got it.” The result of teachers working with online students was that more assignments were submitted on time.

Face-to-face students felt they needed more time to complete the work they were given. They reported debating between turning an assignment in incomplete and turning an assignment
Table 14

Focus Groups Assignment Grades Themes and Responses

<table>
<thead>
<tr>
<th>Themes</th>
<th>Online</th>
<th>Face-to-face</th>
<th>Researcher’s Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completion rate</td>
<td>“There was a point when the teacher said the term is ending, get in as many missing assignments as you can by a due date.”</td>
<td>“The teacher would sometimes push off the assignments a bit if the class was getting behind.”</td>
<td>Flexibility was evident early in course for online students and consistently for face-to-face students.</td>
</tr>
<tr>
<td></td>
<td>“Sometimes he’d see me in the library and come over and remind me to complete an assignment.”</td>
<td>“He had an agenda up on the Smartboard and in class he’d remind us.”</td>
<td>Both groups of students received targeted prompting to complete work.</td>
</tr>
<tr>
<td>Independent learning</td>
<td>“When I worked through the problems I had on my own, I learned so much more. I knew that program like the back of my hand.”</td>
<td>“During class you always had access to the teacher.”</td>
<td>Online students struggled with material more when the instructor was not available.</td>
</tr>
<tr>
<td></td>
<td>“I’d end up spending so much more time at home than if I had someone available for help. I know it definitely takes more time at home.”</td>
<td>“Usually I’d call the teacher over and he’d come right over”</td>
<td>Access to instructional support affects time spent on problem solving.</td>
</tr>
<tr>
<td>Student focus</td>
<td>“The distractions were not a huge problem with the simple items.”</td>
<td>“I think the distractions are just like in any other class.”</td>
<td>All students reported losing some time to distractions.</td>
</tr>
</tbody>
</table>
Table 13 (continued)

Focus Groups Assignment Grades Themes and Responses

<table>
<thead>
<tr>
<th>Themes</th>
<th>Online</th>
<th>Face-to-face</th>
<th>Researcher’s Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student focus</td>
<td>“When it is the easy stuff, just following things step-by-step, I don’t get distracted, but when I get stuck it’s a problem.”</td>
<td>“Facebook is blocked at school.”</td>
<td>Generally both groups of students maintained sufficient focus when working on assignments.</td>
</tr>
<tr>
<td>(continued)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supports</td>
<td>“It was helpful to have students in my study who were in the same situation.”</td>
<td>“I’d just ask the people around me for help if I couldn’t figure it out.”</td>
<td>All students reported using peer support when they struggled.</td>
</tr>
<tr>
<td></td>
<td>“I’d keep the book at home and used books available in the labs when at school.”</td>
<td>“It was helpful when the teacher demonstrated what we needed to do before we did it.”</td>
<td>In most cases, students had access to the same resources. There were two exceptions.</td>
</tr>
</tbody>
</table>
in late with the possibility of losing credit. These students felt pressure not to miss a day of class. They reported the class moved on without them, and the only way to catch up was to come in after school. However, face-to-face students also reported that teachers would often alter a due date when they estimated most of the class would not be able to complete an assignment. “The teacher would sometimes push off the assignments a bit if the class was getting behind.” Most online students stated they had enough time to do the work. Many of the online students reported that time to complete assignments wasn’t a big issue since they knew well ahead of time when assignments were due and had time to schedule their work. One exception was a student who stated, “I didn’t feel I had enough time to do my assignments because I had to do them all at school. I didn’t have the programs at home.” In summary, teachers worked closely with students to ensure online students developed a habit of submitting work in a timely way and were flexible enough to ensure that all groups had enough time to submit their work leading to similar completion rates.

Targeted teacher prompting of select students was successful for both groups supporting the finding of no significant differences between assignment grades. Face-to-face students received daily prompts through posted agendas reminding them to submit assignments. “He had an agenda up on the Smartboard and in class he’d remind us.” Some face-to-face students also received personal reminders when they fell behind. Similarly, select online students were periodically prompted by their instructors in the library or in the hallway regarding missing items. However, most online students did not receive regular prompting. Online students, especially seniors, reported that in the past they felt they needed “constant nagging” to complete items. The online course did not provide this and they needed to get the work done anyway. Instructors reported seeking out select online students at the beginning of the year because these
students were not participating regularly. The instructors felt this “chasing of students” wasn’t needed later in the course. Cavanaugh (2001) points out the importance of a learner-centered online approach where instructors focus on specific student performance and guide individual students as needed in order to be successful. The result of targeted prompting early on was that online students learned to complete assignments without prompting. Daily prompting was maintained in the face-to-face course throughout the year. Teacher flexibility and targeted prompting help explain the finding of the second hypothesis.

**Independent learning.** Less access to the instructor caused some online students to struggle which was actually a benefit to some students but not to others. On average, assignment grades from online students matched those of face-to-face students who had regular access to teachers and struggled less, which further supports the no significant difference finding.

Face-to-face students had regular access to the instructor during class periods. The instructor was also available before and after school and during a 30-minute activity block twice a week. While the online students had a regularly scheduled study hall period, they did not have a regular scheduled time with the instructor. Many online students and teachers did report that teachers were often, but not always, available during the students’ study hall period. Online students also had access to the teacher before and after school and during the activity block.

In many but not all cases, online students successfully worked through struggles without teacher support and reported a high level of learning as a result. “When I worked through the problems I had on my own, I learned so much more. I knew that program like the back of my hand.” Instructors reported that this struggle seemed to benefit some students but not others. Students who didn’t solve their own problems reported the lowest level of learning. “If I couldn’t figure it out, I’d give up.” McGivney (2004) points out that an adolescent online student must be
online students must be active, self-directed learners without the physical presence of the teacher. Many of the face-to-face students reported calling the teacher over frequently as the teacher moved throughout the classroom. “During class you always had access to the teacher.” Face-to-face students reported no hesitation in asking for help from the teacher. Online students reported that assignments would often take much longer to complete because they were working independently. “I’d end up spending so much more time at home than if I had someone available for help. I know it definitely takes more time at home.” While face-to-face students did report the need for more time, it was not related to independently working through problems. Most face-to-face students reported guidance was nearly always available when working through problems. “Usually, I’d call the teacher over and he’d come right over.”

Online students struggled more than face-to-face students. Those who persevered through these difficulties without timely teacher interaction learned more and further developed the ability to learn independently. Those that failed to persevere learned less. On average, the online students did as well as the face-to-face students in this area, further supporting the findings from the second hypothesis.

**Student focus.** All students reported losing some time due to distractions. Both groups perceived they were faced with more distractions than the other group. Online students reported they faced more obstacles to learning at home, but they reported that most of their work was completed during the study hall period at school where they had fewer distractions. Students in both groups reported that they learned to deal with distractions or learned to avoid distractions further explaining why no significant differences in grades were found.
Face-to-face students reported that the teacher was often explaining items in class and that this was a distraction when they wanted to work on their assignments. They also dealt with other typical classroom distractions including classroom visitors, announcements, and distracting students. “I think the distractions are just like in any other class.” Online students reported a wide variety of distractions at home including Facebook, television, video games, and texting. Online students stated that home distractions far exceeded the distractions at school during a study hall period because many of the distractions were not allowed in school. “Facebook is blocked at school.” Face-to-face students reported that they didn’t have control over many of the distractions at school, but they would have control outside of school.

Online students reported they learned to overcome obstacles in order to complete assignments. Many chose to work during study hall periods at school in order to minimize obstacles. Some online students reported that they felt they could accomplish some of the more rote assignments even when in the presence of distracters. They reported that since assignments often didn’t require much thinking, they could more easily be distracted and then get back to the assignment without too much trouble. “The distractions were not a huge problem with the simple items.” Additionally, some online students reported that they were able to focus more and learned to turn off distractions as deadlines approached. Research points to the importance of creating learning environments where students with various learning characteristics can choose the environment that best meets their individual needs (Dyrud, 1997; Terry, 2001).

In summary, online students felt they learned to deal with many more distractions and overcome more obstacles than face-to-face students in order to complete required assignments. This was particularly true for work done at home. However, face-to-face students perceived that they faced more distractions which decreased the amount of time to work on assignments.
Students in both groups had similar success dealing with distractions while working on assignments, which further supports the no significant difference finding.

**Supports.** In many cases online and face-to-face students had access to similar resources including peer support. There were two distinct differences; face-to-face students watched more teacher demonstrations and online students had greater access to the textbook. Overall, the availability of resources was fairly similar supporting the research finding of the second hypothesis. Face-to-face students received regular visual demonstrations from teachers which were not available to online students. Instructors stated that their primary method of teaching content in a face-to-face course was to get up and explain it to them. Teachers created only a few video clips and used some previously created clips to demonstrate concepts which were made available to all students. Online students found these demonstrations extremely helpful but stated there were not enough of these. Instructors reported that because they were teaching this online course for the first time, the delivery of content might have been a “bare bones” experience for students. Face-to-face students had the advantage of seeing and hearing demonstrations on how to accomplish the tasks needed to complete assignments.

Online students had to rely more on other supports such as the textbook. Online students had the advantage of having the textbook available both at home and at school. “I’d keep the book at home and use books available in the labs when at school.” Many assignments came directly out of the textbook and were supported with many color images, allowing students to check their progress as they worked through problems. By having the textbook at home, online students had more time to carefully read through the book.

Students in both learning modes stated peer support was generally available. In most cases, online students supported each other during shared study hall periods. “It was helpful to
have students in my study who were in the same situation.” In general, most students put in more individual effort to solve a problem prior to asking a peer for help, as they didn’t want to bother peers unnecessarily. Some online students reported getting help through friends on Facebook while at home, but many reported they didn’t want to use this social media for school work. They felt this was taboo. Most online students reported they did not receive much peer support at home. They stated if they needed help, they’d seek help during a study hall period. Students in the face-to-face sections reported getting regular support from the students sitting nearby. “I’d just ask the people around me for help if I couldn’t figure it out.” Online and face-to-face students had similar access to support from peers. In addition, with the exception of teacher demonstrations and the access to textbooks at home, students in both modes had access to similar resources, which helps to explain the finding of no significant difference in assignment grades between the two groups.

**Teachers’ interview - assignment grades.** The teachers’ interview supported the four themes identified through the student focus group process in the assignment grade category. A sampling of statements from the interview are presented in Table 15. Teachers were flexible with due dates, promoting high rates of completion. Teachers were very flexible early in the online course. “For the first quarter we were very generous with missed assignments. This was still somewhat true into second term but not in the third term.” Teachers also were flexible with face-to-face students, allowing an extra day to submit work when multiple students needed more time. “If the class got behind, I’d give them an extra day.” Teachers felt strongly that students in the online class developed important independent learning skills. “They got it. They understood that it was their responsibility. They became better organizers with their time.” Teachers stated that the face-to-face students were not
Table 15
Teachers Interview Assignment Grades Themes and Responses

<table>
<thead>
<tr>
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<th>Face-to-face</th>
<th>Researcher’s Comments</th>
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</thead>
<tbody>
<tr>
<td>Completion rate</td>
<td>“For the first quarter we were very generous with missed assignments. This was still somewhat true into second term but not in the third term.”</td>
<td>“If the class got behind, I’d give them an extra day.”</td>
<td>Flexibility was evident early in course for online students and consistently for face-to-face students.</td>
</tr>
<tr>
<td>Independent learning</td>
<td>“They got it. They understood that it was their responsibility. They became better organizers with their time.”</td>
<td>“I think our face-to-face students are at a disadvantage on this. They have no better organizational skills now than they did in September.”</td>
<td>Online students showed significant growth in independent learning skills not needed or shown in the face-to-face class.</td>
</tr>
<tr>
<td>Student focus</td>
<td>“One student reported that her mother had to change her password on Facebook so that during mid-terms she won’t be distracted.”</td>
<td>“Face-to-face students were distracted by the normal stuff like talking with friends and doing other class work. Standard stuff.”</td>
<td>All students lost some time to distractions.</td>
</tr>
<tr>
<td>Supports</td>
<td>“Some of the kids buddied-up for the online class. That’s probably why some of these online students were successful.”</td>
<td>“That’s an advantage to face-to-face; having the instructor or their neighbor right there.”</td>
<td>Students in both modes had peer support when they struggled.</td>
</tr>
</tbody>
</table>

required to develop these skills. “I think our face-to-face students are at a disadvantage on this. They have no better organizational skills now than they did in September.”
Teachers reported there were some distractions reported in both learning modes but nothing out of the ordinary. “Face-to-face students were distracted by the normal stuff like talking with friends and doing other class work. Standard stuff.” One teacher did state, “One student reported that her mother had to change her password on Facebook so that during mid-terms she won’t be distracted.” This was not viewed as the norm. Finally, teachers reported that students sought help from their peers regularly. “That’s an advantage to face-to-face; having the instructor or their neighbor right there.” “Some of the kids buddied-up for the online class. That’s probably why some of these online students were successful.”

**Summary of hypothesis 2 – assignment grades.** Teachers were flexible on assignment due dates and provided targeted reminders for some students which led to a similar assignment completion rate for all students. Teachers listened carefully to the needs of students and made important adjustments to help all students. They interacted more with some students who needed additional support. In general, online students needed this support early in the course but not later in the course as they learned to take the responsibility to schedule and complete work on their own. Online students and teachers reported mixed results when they were challenged on assignments without an instructor’s presence. Many online students benefited from struggling independently through material of their own while others needed more support. Students in both groups reported the ability to successfully maintain focus by either overcoming distractions beyond their control or changing their work environment to overcome obstacles. Face-to-face and online students also reported receiving regular peer support and having access to similar resources. Each of these factors supports the discovery that there were no significant differences between assignment grades for the online and face-to-face groups.
**Hypothesis 3 – project grades.** The finding of no significant differences between project grades of the online students and the face-to-face students was supported by the qualitative findings. Both groups stated projects were of high priority because they were interesting and required application of prior knowledge in a meaningful context. In addition, heavily weighted projects provided motivation for students to maintain focus and control distractions during projects that required critical thinking. All students reported receiving adequate support and timely feedback from teachers. A sampling of statements from online and face-to-face students gathered during the focus groups is presented in Table 16. The sample statements are organized by the three themes that help to explain the finding for the third hypothesis.

Projects involved students learning chunks of knowledge requiring multiple, sequential steps. They were designed to be meaningful to students. While some procedural supports were provided, projects were purposely somewhat unstructured in order to engage student thinking skills at a higher level. They were heavily weighted because they involved applying content learned in discussions and assignments to authentic situations.

**Student interest.** Projects held students’ interest. Both student groups reported projects required the use of higher order thinking skills to solve authentic problems while applying content learned from assignments and discussions. For example, an online student stated, “I’d say they were meaningful in that they summed up what we have learned.” A face-to-face student reported, “Projects were real. You could see how you’d actually use it.” Student interest is critical because students decide how much time they will spend on learning, and expanded learning time has been shown to raise student achievement.

Unlike assignments, both groups agreed that projects required a high degree of critical thinking. Projects were reported to be more interesting than assignments. A face-to-face student
<table>
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</thead>
<tbody>
<tr>
<td><strong>Student interest</strong></td>
<td>“I’d say they were meaningful in that they summed up what we have learned.”</td>
<td>“Projects were real. You could see how you’d actually use it.”</td>
<td>Projects were authentic to both groups of students.</td>
</tr>
<tr>
<td></td>
<td>“You had to use what you learned in the chapter and apply it.”</td>
<td>“The projects were almost like a test on what you just learned.”</td>
<td>Both groups of students reported projects were based on prior learning.</td>
</tr>
<tr>
<td></td>
<td>“The projects challenged your thinking.”</td>
<td></td>
<td>Projects required critical thinking by all students.</td>
</tr>
<tr>
<td><strong>Student focus</strong></td>
<td>“When I was getting close to a project deadline, I’d turn the other stuff off.”</td>
<td>“The projects were worth more than you do every day, so I didn’t find there were many distractions. I was more focused.”</td>
<td>Both groups of student were able to focus and avoiding distractions.</td>
</tr>
<tr>
<td></td>
<td>“Projects were 35% of our grade.”</td>
<td>“I really liked how the projects were weighted more heavily than the tests.”</td>
<td>Projects were weighted heavily for all students.</td>
</tr>
<tr>
<td><strong>Timely teacher feedback</strong></td>
<td>“I thought we had plenty of help from other students and the teacher.”</td>
<td>“Sometimes she’d show you what you did wrong or sometimes just tell you. You’d have to go back and fix it.”</td>
<td>Adequate teacher support for projects for both groups of students.</td>
</tr>
<tr>
<td></td>
<td>“When I entered the data wrong in the first part it made the next part wrong.”</td>
<td>“So if you did something wrong, she’d come back and grade it after you had done it right.”</td>
<td>Timely feedback was important on projects with sequential steps.</td>
</tr>
</tbody>
</table>
stated, “I felt they were really asking you to think.” An online student stated, “The projects challenged your thinking.” Engaging higher order thinking skills once knowledge and comprehension of content is mastered is important (Bloom et al, 1956). Students in both groups reported similar experiences with projects that held their interest because they were meaningful and engaging, requiring application of prior knowledge and critical thinking. These similarities help to explain the finding of no significant differences of project grades between the groups.

**Student focus.** Both online and face-to-face students reported that the intensity of the projects helped them maintain focus during their work. Projects were weighted more heavily than any other aspect of the class, including tests, and students and teachers stated they felt the completion of a project was a better reflection of what students knew and could do than were tests. Most participants believed this warranted the extra grade emphasis and, therefore, extra effort. One face-to-face student stated, “I really liked how the projects were weighted more heavily than the tests.” Required critical thinking and the grade emphasis on projects conveyed a higher level of importance than other aspects of the class which helped students in both the online and face-to-face sections focus and avoid distractions especially as deadlines approached. For example, one online student stated, “When I was getting close to a project deadline, I’d turn the other stuff off.” Online students reported that they altered their learning environment when they understood they needed to maintain a strong focus in order to successfully complete work. In other words, they learned to avoid many of the obstacles to learning in these situations. Wang and Reeves (2007) point out the difficulty for educators in controlling environmental factors for online students, but point out that educators can create engaging instructional activities to increase student motivation in completing tasks. Wegerif (1998) explains how online learning allows students to learn best and when it is best for them if work is motivating and engaging.
Face-to-face students did not report the need to alter their learning environment. A face-to-face student stated, “The projects were worth more than you do every day, so I didn’t find there were many distractions. I was more focused.” As students were engaged with deeper thought processes, distractions seem to dissipate. Some online students stated that they had learned to deal with some distractions when working on assignments, but they were required to further control distractions when working on projects because of the higher level of thinking involved. Similarities between online and face-to-face groups related to student focus during completion of heavily weighted projects help explain the finding of the third hypothesis.

Timely teacher feedback. Students reported that timely feedback was important for success on many of the projects because they involved sequential steps. Students stated that if they made a mistake on an early part of a project, it would affect the next part of the project. Face-to-face students received feedback in person as the teacher walked around and provided individual real-time advice. “So if you did something wrong, she’d come back and grade it after you had done it right.” Online students reported they had to retrieve the feedback from teachers through the course site. Initially students did not remember to check the site regularly. In addition, online students reported that early in the course, feedback was not received prior to the next section of a project being due. “When I entered the data wrong in the first part it made the next part wrong.” Teachers reported improving on the timeliness of feedback to online students as the course progressed. Online students reported that initially they did not receive timely feedback, but that teachers made adjustments and this became less of an issue later in the course. O’Leary and Quinlan (2007) point out that teacher-student interaction must be pervasive for an online course to be effective. Online students and teachers reported that this interaction led to improvement in the timeliness of feedback.
Students in both groups reported receiving good teacher support during projects. For example, an online student reported, “I thought we had plenty of help from other students and the teacher.” A face-to-face student reported, “Sometimes she’d show you what you did wrong and sometimes just tells you. You’d have to go back and fix it.” Rovai (2002) points out that teacher interaction with students has long been established as an important component of learning both online and face-to-face. Timely teacher feedback helps explain the finding of no significant differences of project grades between the online and face-to-face groups.

Projects required application of prior knowledge from prior learning especially from assignments. As projects built on this knowledge, the similarities between the groups related to factors discussed in the second hypotheses also apply to project grades. The factors that help explain the similarities on assignment grades also apply to the project grades. The difference between assignments and projects were that projects were more intense, required critical thinking, were more interesting to students, and required students to maintain greater focus.

**Teachers’ interview - project grades.** The teachers’ interview supported the three themes identified through the student focus group process. A sampling of statements from the interview are presented in Table 17. Teachers reported that the projects were design to require students to use higher order thinking. “They are meant for higher order thinking and more independent thinking.” In addition, projects were designed to allow students to add their own personal touch. “One of the keys to our projects is that students can tailor the work to their interest.” Teachers stated that students understood projects were important given the weight of project grades; therefore, students put in extra effort. “Students understood projects were more heavily weighted and were more important.” “There was lot more activity during extra help time when projects were due.” Finally, teachers reported providing regular and timely feedback. The
Table 17

Teachers Interview Project Grades Themes and Responses

<table>
<thead>
<tr>
<th>Themes</th>
<th>Online</th>
<th>Face-to-face</th>
<th>Researcher’s Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student interest</td>
<td>“One of the keys to our projects is that students can tailor the work to their interest.”</td>
<td>“They are meant for higher order thinking and more independent thinking.”</td>
<td>Projects were authentic and required critical thinking.</td>
</tr>
<tr>
<td>Student focus</td>
<td>“There was lot more activity during extra help time when projects were due.”</td>
<td>“Students understood projects were more heavily weighted and were more important.”</td>
<td>Extra effort was shown during project work.</td>
</tr>
<tr>
<td>Timely teacher feedback</td>
<td>“We established a rhythm that before the next part was due, they’d get feedback. I think we did a great job with that.”</td>
<td>“The face-to-face too. We’d try to get that done. I’d usually go around and tell them.”</td>
<td>Adequate teacher support and timely feedback for projects given.</td>
</tr>
</tbody>
</table>

teachers reported they learned to speed up feedback in order to provide meaningful feedback for the online sections. “We established a rhythm that before the next part was due, they’d get feedback. I think we did a great job with that.” Teachers reported that they also provided timely support to the face-to-face students. “The face-to-face too. We’d try to get that done. I’d usually go around and tell them.”

Summary of hypothesis 3 – project grades. The make-up of projects played an important role in students’ interest, perception of importance, and engagement of higher order thinking. Projects were viewed as culminating activities that engage students in critical thinking. These authentic projects used skills and concepts from earlier in the course. Projects were a large percentage of the grade, which conveyed a sense of high importance to students.
Students’ interest helped to control distractions while working on complicated tasks, especially as deadlines approached. When students were challenged with work that required critical thinking, they were able to create an environment that had minimal distractions. Teacher support was valued as students worked through projects. Improved timely feedback by teachers on projects that required sequential components was noted by both teachers and students. Each of these factors helps explain why no significant differences between project grades were found. Projects required knowledge and skills learned through assignments; therefore, the findings of the second hypothesis also help explain the finding of the third hypothesis.

**Hypothesis 4 – test grades.** This section provides insight into the finding that no significant differences were found between the test grades of the online and face-to-face students. An explanation of the tests is followed by the presentation of the issues discussed in the student focus groups and teacher interview. Students and teachers reported similar results about how they took and prepared for the two sections of the tests. Honesty during the tests is discussed as it relates to supervision techniques employed. Tests were designed to be a comprehensive measure of learning from discussions, assignments and projects; therefore, the results of the previous three hypotheses also impacted the fourth hypothesis. A sampling of statements from the online and face-to-face students gathered during the focus groups are presented in Table 18. The sample statements are organized by the themes that help to explain the finding for the fourth hypothesis.

The test grades were composed of two tests, two quizzes each consisting of half the value of a test, and one mid-term exam. The mid-term constituted 10% of the course grade, while the combined test scores of the other tests were only a small part of term grades. Each test had an objective component and an application component. The objective component used primarily
multiple choice questions designed to test knowledge of vocabulary gained from reading the
textbook. The application component required use of various software programs commonly
employed during assignments and projects. The method of supervision of tests and quizzes
varied between online and face-to-face groups; however, all students took the mid-term
examination in a supervised classroom setting.

**Test composition.** The tests given were the same for both groups. Students and teachers
had similar descriptions of how well each section of the test appropriately measured learning
which supports the finding of no significant difference in test grades. Students in both groups
reported that most of the points from the test came from the application section and that the
application section was a fair assessment of what they learned in the discussions, assignments,
and projects. The majority of student comments dealt with the objective part of the tests. Both
online and face-to-face students felt the multiple choice section included many random, detailed,
and irrelevant items. A face-to-face student stated, “You had to know the name of a tool you
used, but we never used the name.” An online student stated, “Multiple choice was way too
detailed.” One online student projected that face-to-face students would have an advantage when
taking the objective section of the test, since they would hear the vocabulary used regularly in
class. This student stated, “I feel like in the face-to-face class, the teacher says those words. The
teacher does other things with the words like put them on the projector, so you hear it and see
someone else use the words.” Face-to-face students did not report this to be the case. One face-
to-face student stated, “We did vocab at the beginning of the year then we stopped.” There was
consensus among all students that the objective section of the test was not a fair assessment of
what was learned from discussions, assignments and projects and that the vocabulary required
for success was not well practiced by either group. Lower level learning which includes building
### Focus Groups Test Grades Themes and Responses

<table>
<thead>
<tr>
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<th>Face-to-face</th>
<th>Researcher’s Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test composition</td>
<td>“Multiple choice was way too detailed.”</td>
<td>“You had to know the name of a tool you used but we never used the name.”</td>
<td>Both groups of students reported the objective section of the test involved detailed information.</td>
</tr>
<tr>
<td></td>
<td>“I feel like in the face-to-face class, the teacher says those words. The teacher does other things with the words like put them on the projector, so you hear it and see someone else use the words.”</td>
<td>“We did vocab at the beginning of the year then we stopped.”</td>
<td>Vocabulary was not well practiced by either online or face-to-face students.</td>
</tr>
<tr>
<td>Test delivery</td>
<td>“The objective section was a test on the computer, and the application part had a document posted.”</td>
<td>“The whole test was on Blackboard.”</td>
<td>The test was delivered in the same fashion for both groups of students.</td>
</tr>
<tr>
<td>Test preparation</td>
<td>“I thought doing the assignments got you ready for the tests. I didn’t really have to study.”</td>
<td>“The application test was an okay test of what we learned.”</td>
<td>Both groups reported completing assignments and projects were good preparation for the application section of the tests.</td>
</tr>
<tr>
<td></td>
<td>“The practice test you had to get 85% or higher. So I guessed repeatedly until I got the score.”</td>
<td>“I had to take the practice test like five times for every test.”</td>
<td>Repeated practice tests were required of both the online and face-to-face students.</td>
</tr>
<tr>
<td>Honor code</td>
<td>“Even though I could have looked up an answer, if I think I had the right answer, I’m not going to look it up.”</td>
<td>“They may have cheated because the objective section was unfair.”</td>
<td>Little motivation to cheat on application section. More motivation on objective section.</td>
</tr>
</tbody>
</table>
of knowledge and comprehension without application likely does not lead to long term retention (Bloom et al, 1956). The test was the same and there were similar student impressions by both groups about the test sections. This shows that there were no real differences between the tests which help to explain why no significant differences were found in test grades.

**Test delivery.** The test was delivered in the same fashion for both groups. The objective section of the test was given through the test feature of the learning management system. Students were presented with true or false and multiple choice questions from a test link. Students answered all the objective questions and then completed the test by turning in all their answers at one time by clicking a submit button. The application section of the test involved reading a teacher created document posted on the learning management system, as well as downloading any needed data files for this section of the test. All students accessed the document and files in the same fashion. Students saved their test files to a personal folder and then submitted completed work through a teacher created link on the learning management system. All students accessed the document and data files and submitted their completed data files in the same method. The entire test was delivered in the same fashion, which supports why no significant differences were found between the online and face-to-face groups.

**Test preparation.** Another theme that helps explain the finding of the fourth hypothesis is how students in both groups prepared for tests. Both groups and the teachers reported that completion of assignments and projects best prepared students for the application section of the test. Instructors reported preparation for the objective section required reading the textbook and memorizing facts and vocabulary. Students were required to complete online practice tests with a high percentage of accuracy in order to complete pre-test assignments. Students in both groups reported that these online practice tests were relatively ineffective in helping them prepare, and
that they simply took the practice tests many times until they scored high enough. A face-to-face student stated, “I had to take the practice test like five times for every test.” An online student reported, “The practice test you had to get 85% or higher. So I guessed repeatedly until I got the score.” There was no requirement for reading the textbook other than sections needed to complete assignments and projects. Very few students in either group reported using the book to study. Most students in both groups reported doing little more than the required online practice tests to prepare for the tests. Students reported that the significant time and effort required for assignments and projects prepared them for the application section. All students viewed assignments and projects as a better measure of their understanding and abilities. Students from both groups had ample time to prepare for tests and prepared in a similar manner, which helps to explain the finding of no significant difference in test grades.

**Honor code.** Teachers must always contend with potential cheating. Cheating is often reported as being pervasive in schools; it is a long standing concern to deal with ethical practice during assessments (Abbot, Siskovic, Nogues, & Williams, 2000). Cheating is possible in face-to-face and online environments. Hinman (2002) discusses three methods to minimize online cheating including the virtues approach, the prevention approach, and the policing approach. All three approaches were used in varying degree during tests examined in this study.

Student comments during focus groups related to opportunities to cheat during the tests further explain the findings of the fourth hypothesis. All students took the mid-term test during a scheduled testing period in a supervised computer lab. The other tests were supervised differently. Face-to-face students took the quizzes and tests in a supervised lab setting. Online students took the quizzes unsupervised either at home or at school. Online students took the two tests at school between the hours of 7:30 and 3:30 in the library on a scheduled day, with limited
adult monitoring. Instructors reported occasionally checking on online students during tests even though they were often teaching another course at the same time. The instructors and online students reported that students were reminded of the academic integrity policy or honor code, which states the expectations and consequences related to cheating. Instructors reported students were told they were not allowed to use other resources such as students, adults, or the textbook. Additionally, the students were told they could not have software applications open during the objective part of the test. The objective sections of the tests were administered through a timed online testing option and the application sections of the tests were presented through a document on the learning management system.

Some online students stated there was an obvious temptation to cheat. When asked what was stopping them, they reported “the honor code.” There was a fear of getting caught and looking bad to parents, teachers, and peers. One online student stated, “It says we are on the honor code. If someone were to walk in, I’d be in so much trouble. There was a huge fear of getting caught. That’s what keeps me from cheating. It keeps me from getting a zero on a test; looking bad in front of a teacher; looking bad in front of the class.” Another online student stated, “If I got caught, I’d be in so much trouble. This would be so embarrassing.” They also felt it would be easy to catch a student talking or with an open book when taking the tests in the library area. Some online students also reported there wouldn’t be enough time to open the program or look in the book for answers since the tests were timed anyway; however, all but one student reported having enough time to complete the test and finish before time was up. Some stated they either knew the answers or didn’t and were not going to go back and look it up. “Even though I could have looked up an answer, if I think I had the right answer, I’m not going to look it up.” One student reported cheating on the objective portion of one test by obtaining a
copy of that part of the test. An instructor reported leaving the review section available to
students on a test so students would review right and wrong answers. A printout was made of this
and used by another student. This option was not available on tests after that point. One face-to-
face student stated “I always assume cheating is going on.” However, no face-to-face student
reported cheating. Another face-to-face student reported that there may have been cheating on
the objective section. “They may have cheated because the objective section was unfair.” The
comprehensive mid-term exam was administered in a supervised computer lab setting for both
online and face-to-face students. There were no reports of cheating on the mid-term. In
summary, there was little difference reported related to the honor code between the two groups,
further supporting the finding of no significant difference in test grades.

Importantly, tests were designed to measure learning from discussions, assignments and
projects. There were a number of themes discussed for each of the three prior hypotheses that
help explain why there were no significant differences between the groups on discussion,
assignment and project grades. To the degree that tests measured knowledge and skills learned,
these findings also help explain the finding of the fourth hypothesis.

**Teachers’ interview - test grades.** The teachers’ interview supported the four themes
identified through the student focus group process in the test grade area. A sampling of
statements from the interview are presented in Table 19. Teachers stated they gave the same tests
to students in both learning modes. The tests consisted of an objective component and an
application component. “We tried to develop a tool to assess students on their different abilities.
Some don’t test well with true and false. Others don’t follow directions well.” “On Wednesday
they took the true/false and on Friday they took the application part.” The teachers also reported
that the mid-term was delivered in the same fashion. “We supervised the mid-term in the
Table 19

Teachers Interview Test Grades Themes and Responses

<table>
<thead>
<tr>
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<th>Researcher’s Comments</th>
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</thead>
<tbody>
<tr>
<td>Test composition</td>
<td>“We tried to develop a tool to assess students on their different abilities. Some don’t test well with true and false. Others don’t follow directions well.”</td>
<td>“On Wednesday they took the true/false and on Friday they took the application part.”</td>
<td>The tests were the same for both groups of students.</td>
</tr>
<tr>
<td>Test delivery</td>
<td>“If they had questions, we were in the building during the tests.”</td>
<td>“We supervised mid-term in the computer lab.”</td>
<td>The test was delivered in the same fashion for both groups of students.</td>
</tr>
<tr>
<td>Test preparation</td>
<td>“They had to go back and read to get an 85% or better on the practice quiz.”</td>
<td>“Projects required more time and effort and were worth more than the tests. They helped students prepare for the application section of the test.”</td>
<td>Practice tests prepared students for objective component and projects for the application component.</td>
</tr>
<tr>
<td>Honor code</td>
<td>“They had to follow the printed Academic Integrity policy.”</td>
<td>“This is in the handbook and they should all be familiar with it.”</td>
<td>The view of the honor code was the same.</td>
</tr>
</tbody>
</table>

computer lab for everybody.” While the teachers didn’t actively supervise the online students during some tests, they reported periodically checking in and that additional staff members provided supervision. “If they had questions, we were in the building during the tests.”

Teacher’s reported that student prepared for the tests in a similar way. For the application section of the test, completion of the projects was reported as the best preparation. “Projects required more time and effort and were worth more than the tests. They helped students prepare for the application section of the test.” For the objective part of the test, successful completion of
practice tests was viewed as necessary. “They had to go back and read to get an 85% or better on the practice quiz.” Finally, teachers noted no differences in student’s view of the honor code. “They had to follow the printed Academic Integrity policy.” “This is in the handbook and they should all be familiar with it.”

**Summary of hypothesis 4 – test grades.** Tests were designed to measure learning in the course including learning that took place during discussions, assignments and projects. Qualitative findings from the first three hypotheses have a direct impact of the finding of the fourth hypothesis. The major themes discussed by students during focus groups related to tests included the composition of the tests, test delivery, preparation before the tests, and potential cheating during the tests. The same test was given to all students and delivered in the same way.

Students in both groups had similar impressions of the sections of the test including a belief that the application section was a fair assessment but the objective section was not. Both sets of students reported preparing for tests in the same manner including completion of assignments and projects and repeatedly taking online practice tests but not studying from the textbook.

Finally, the heavily weighted mid-term exam was administered under similar conditions but tests and quizzes were not. There appeared to be more motivation to cheat on the objective section of the test than the application portion. In general, both groups of students reported that the risk of violating the honor code and their personal reputation was not worth the reward of a slightly higher score on the objective section. Each of these themes further supports the finding of no significant differences for test grades between the online and face-to-face groups.

**Summary of qualitative findings.** The qualitative component of this project explored the quantitative findings of no significant differences within each grade category in order to further examine the research question. The qualitative section involved student focus groups and
a teacher interview. Discussion questions were generated from the quantitative findings and characteristics of online learning theory and major themes were identified through the literature review. Data from these sessions were gathered, analyzed and reported for each of the four hypotheses.

The analysis of the qualitative data supported the quantitative finding for the first hypothesis. In particular, discussions were similar in design for online and face-to-face students. Teachers’ active presence and feedback were a factor in students contributing to discussions more often and at a higher level. Discussion design encouraged reflection, filtering, and equitable contributions by students in both groups. Online students met a greater challenge in scheduling, attending, and maintaining focus during chats. This success allowed online students to participate at a level similar to face-to-face students.

Qualitative findings also supported the quantitative findings for the second hypothesis. Assignment completion rates were similar for both groups in part because teachers were flexible with due dates and because teachers provided personalized reminders to students who needed them. Online students struggled without regular teacher support. This benefited some online students in their development of independent learning skills but not others. Regular teacher support provided face-to-face students with a more dependent learning model which benefitted some face-to-face students, but not others. Students in the two learning modes faced different obstacles to learning which resulted in a similar loss of time on learning. Both groups had access to similar support resources including access to peers.

Both groups of students reported that projects were interesting and meaningful and required them to engage prior learning to solve problems. Students in both groups reported success in controlling distractions. Online students had more control over their learning
environment and reported successfully altering their environment when needed. Teachers were able to provide adequate timely feedback to support all students. These findings support the quantitative finding from the third hypothesis.

Online and face-to-face students took the same tests in the same manner. They also reported they prepared for the tests in a similar way with equal preparation time. In general, both groups reported that the risk of cheating was not worth the potential benefits. These factors support the quantitative finding from the fourth hypothesis. Like projects, tests measured learning from earlier course components; therefore, findings from the earlier hypotheses also support the findings of the later hypotheses.

**Summary of Research Findings.**

This study was completed to determine in what ways online education at the high school level was as effective as face-to-face instruction. Data was collected and analyzed in this mixed method study resulting in both quantitative and qualitative findings. There were no significant differences found in any of the five dependent variables on discussions, assignments, projects, tests and mid-term grades. The qualitative processes supported these quantitative results. The following is a summary of the key findings:

**Discussion grades.** No significant difference was found between online and face-to-face students based on numerical analysis of discussion grades. In reference to the first hypothesis, the following themes identified during the qualitative component support the quantitative finding:

- Teacher monitoring and feedback were equally robust.
- Discussion sessions were equivalent in design.
- Participation levels were similar.
Assignment grades. No significant difference was found between online and face-to-face students based on numerical analysis of assignment grades. In reference to the second hypothesis, the following themes identified during the qualitative component support the quantitative finding:

- Assignment completion rates were comparable.
- Online students needed to be more independent learners than face-to-face students.
- Both groups felt they were able to work through obstacles to learning.
- Peer support and available resources were analogous.

Project grades. No significant difference was found between online and face-to-face students based on numerical analysis of project grades. In reference to the third hypothesis, the following themes identified during the qualitative component support the quantitative finding:

- Projects held students’ interest requiring critical thinking while employing prior knowledge.
- Equivalent focus was maintained by students. Online students chose a learning environment in which they could be successful.
- Adequate timely feedback was provided by teachers.

Test grades. No significant difference was found between online and face-to-face students based on numerical analysis of test grades. In reference to the fourth hypothesis, the following themes identified during the qualitative component support the quantitative finding:

- The same tests were given.
- Tests were delivered in the same fashion.
- Test preparation was the same.
- Similar motivational factors maintained the honor code.
As projects required knowledge and skills learned from discussion and assignments, findings from the first two hypotheses also support the third hypothesis. Similarly, tests were designed to measure learning from discussions, assignments and projects; therefore, findings from the first three hypotheses support the final hypothesis.

Chapter 5: Discussion of Findings and Implications for Practice, Research and Policy

Developing online learning theory was used as the guiding lens to study the research question, In what ways is online education at the high school level more, less or equally as effective as face-to-face instruction? In this final chapter, the quantitative and qualitative research findings of the study are discussed in relation to the theoretical framework and existing literature and how they add to this body of knowledge. The overall finding of equivalence of measured student outcomes and the key reasons for this finding are discussed. Finally, implications of this finding for educational practice, research, and policy are explored.

Discussion of Findings

This researcher concluded that online education at the high school level is as effective as face-to-face education when measured by identical student outcomes. Discussions, assignments, projects, and test grades from online and face-to-face sections of a computer applications course required for high school graduation were statistically analyzed. There were no significant differences in any of the grade categories.

There is little evidence-based research about adolescent learning in the online environment (Cavanaugh, Barbour & Clark, 2009; Means et al., 2009; O'Dwyer, Carey & Kleiman, 2007). There has been significant research related to adult learning in the online environment, but adolescents have distinct psychological and social behavior patterns when compared to adult learners (Viner & Christie, 2005). This gap in the research dealing with online
education for adolescents was addressed with this study. The limited findings of high school level online courses have shown the online mode of instruction to be a viable alternative to face-to-face classrooms (Cavanaugh et al., 2008; O'Dwyer, et al., 2007). This study supports these findings.

This study examined four similar sections of a required computer applications class, consisting of two online sections and two face-to-face sections. Findings for online learners at the higher education level have shown those students perform at least as well as students taking face-to-face courses (Mean et al., 2009). The results of this study support the overall findings related to higher education based on three characteristics: namely teacher interaction, structure of learning activities and written discussions (Bernard et al., 2004; Paloff & Pratt, 2001).

Online learning theory overlaps many of the traditional learning theories including cognitive and constructivist learning theory (Ally, 2008). However, there are also characteristics that distinguish it from these theories (Anderson, 2008; Siemens, 2005). One of the distinguishing characteristics between online and face-to-face modes of instruction is the independent orientation toward learning needed in an online environment (Barbour & Reeves, 2009). The importance of this orientation is also supported in this study.

In examining the reasons for the similar level of effectiveness found in this study, four main conclusions can be drawn:

1. Robust teacher interaction in an online high school course is an important factor to ensure equality with a face-to-face course. Significant teacher interaction provides instructors important information with which they can tailor instruction to their students and to provide appropriate encouragement, pressure, support and feedback.
2. Online learning activities must be well-designed if online high school courses are to be equivalent to face-to-face courses. Well-designed learning activities are engaging and employ scaffold learning, proceeding from lower order to higher order thinking.

3. It is necessary for online adolescent students to develop independent learning skills in order to achieve measured outcomes similar to students in face-to-face settings. This includes developing organizational skills, improving personal responsibility, learning to control their learning environment, and becoming more active learners.

4. Written discussions using online tools can be used as effectively in the face-to-face mode of instruction as in the online mode. These discussions equalize student participation and provide students additional time to reflect on contributions and content.

**Teacher interaction.** This researcher concluded that, in order to ensure an online high school course is as effective as a face-to-face course, robust teacher interaction is required in the online course. Teacher interaction was a key factor in why equivalence was found. The rapport built between teacher and student, along with teacher monitoring, provided important information to teachers in directing proper feedback to select students. This interaction allowed teachers to develop a learning environment that was student-centered.

Some students struggled early in the course. This was particularly true of some online students. Students’ interactions with instructors that occur within situations that are personally meaningful to students are an important component of online learning theory (Ally, 2008; Dede, 2007). Teachers provided targeted support to students by providing personal prompting and the resources needed to become successful. Online students, in particular, cited the importance of this support from teachers. Teacher presence and monitoring led to student pressure to contribute appropriately in the course. This was particularly true in the use of the online text-based
discussion tools. Teachers actively monitored text-based discussions for both the online and face-to-face students and provided important supervisory pressure in order to support a high quality discussion that remained on topic and included in depth responses.

As teacher interaction helped teachers and students become familiar with one another, individualized instruction resulted. Teachers worked to develop individual knowledge about each student and developed a strong rapport balancing both an empathetic and academic focus. This allowed the teachers to provided appropriate flexibility for each student. Specifically, teachers provided appropriate praise and prompting to encourage and pressure targeted students to perform. Online students commented clearly that they built a strong rapport with the teachers. Through this rapport, teachers could provide individualized learning supports and personalized feedback to support students as needed. It was found that a strong teacher-student rapport supported a learner-centered approach to education in both modes of instruction.

These findings are supported by the literature. Teacher interaction has been well documented as a success factor for students at the higher educational level (Rovai, 2002; Wegerif, 1998). This study found a similar result at the high school level. Teacher interactions that helped develop strong teacher-student rapport led to the teacher’s ability to provide targeted support, flexibility, and feedback. Cavanaugh (2001) explained the importance of focusing on specific performances of students to help them be successful. In addition, it has been shown that a strong teacher-student rapport allows instructors to provide important feedback (Chatti et al., 2007). O’Leary and Quinlan (2007) found that similar to traditional courses, teacher-student interaction must be pervasive if an online course is to be effective. This was found to be true in this study. In addition, real or virtual teacher presence provided pressure on students to be
accountable for discussion contributions. Hew and Cheung (2003) point out the importance of teacher presence in online discussions in order to reduce procrastination and digressions.

The active presence by a teacher is an expectation with online courses (Anderson, Rourke, Archer, & Garrison, 2001). Interactive courses are strongly aligned to the principles of learner-centered education (McCombs & Vakili, 2005). Prior research has shown that meaningful teacher-student interaction supports a strong learning environment (Ally, 2008; Dede 2007; Mayes, 2006). Cornelius-White (2008) reported similar findings with student-teacher online relationships that correlated with positive student outcomes. Salmon (2000) points out that in order for students to be successful in a course, an important first step is to provide access to needed resources and motivation to participate in a course. This was supported in this study. A student-centered approach has been associated with high student achievement (Rice, et al., 2007).

In summary, this study found that significant teacher interaction was a necessary component in the online mode in order to be as effective as the face-to-face mode. Teacher-student rapport and monitoring provided the instructor important insights in order to tailor instruction to the students and help develop a student-centered learning environment. Robust teacher interaction is required in an online high school course in order for the course to be as effective as a face-to-face course.

**Well-structured learning activities.** This researcher concluded that online learning activities must be well-structured in an online course in order to be as effective as a face-to-face course. The design of online learning activities must engage students and be structured to build from lower-order to higher-order thinking. Well-structured projects were a key factor in why grades were found to be equivalent. Students created personalized projects within a structured
approach which built on prior knowledge and comprehension, and then required application and analysis of content.

Students in both learning modes worked on well-designed, authentic projects. Project content was individualized and project concepts were meaningful to students. Documentation and supports presented through a learning management system were similar for both groups. Projects carefully built off prior knowledge, including knowledge gained from discussions and assignments. Students were required to apply critical thinking skills to solve personally meaningful, individualized projects. Online learning theory emphasizes the importance of students exploring in greater depth and managing their own learning paths (Dede, 2007).

Projects in the course were designed to build from lower order thinking to higher order thinking within logical learning units. Projects incorporated chunks of learning that served as building blocks toward useful application and analysis. By allowing students to apply personal content to applications, teachers created projects that engaged students. This structure of learning activities was well suited for the online environment.

These findings are supported by the literature. Piaget (1990) explained the importance of developing a framework from which to build existing knowledge, a strategy employed for the projects in this course. An important principle of constructivist theory is that students gain knowledge by engaging with content (Ally, 2008; Miller, 2002; Piaget, 1990). The projects in this course were engaging. Connecting to prior knowledge is a key tenet related to long term learning. Knowledge and comprehension of material are prerequisites to higher order thinking (Bloom et al, 1956). Vygotsky explained the importance of incremental knowledge growth based on earlier learning in describing the Zone of Proximal Development (Miller, 2002). The structure of the project provided a scaffold as students worked through projects using critical thinking
skills, another component of online learning theory (Ally, 2008; Dede, 2007). These projects were also an example of effective situated learning, which is learning within meaningful authentic situations (Lave & Wagner, 1991).

In summary, this study found that well-designed projects were needed for online learning to be as effective as face-to-face learning. The design of learning activities was engaging and provided a proper scaffold from which to build from lower-order to higher-order thinking. Both online and face-to-face students developed personalized projects within this structured approach, which was an important factor in regard to grade categories being equivalent.

**Development of independent learning skills.** In addition, this researcher concluded that acquisition of independent learning skills by online students, not required by face-to-face students, was a critical factor in why each grade category was equivalent. In this instance, it was found that online students met the challenge to schedule, attend, and maintain focus during synchronous text discussions and met the challenge to complete assignments and projects by posted deadlines without an instructor’s presence. Face-to-face students did not face these challenges. By regular attendance in scheduled classes and constant teacher reminders, face-to-face students obtained grades equivalent to the online students.

Online students had a higher degree of willingness to struggle with content in order to gain understanding. Online students were willing to experiment using trial and error and to engage others in discussion about challenges they faced when the teacher wasn’t present. Face-to-face students constantly had an expert instructor present and were more apt to request assistance than struggle with the content or employ trial-and-error techniques.

This study found that developing organizational and time management skills was important for students to learn early in the course in order to be successful. These skills needed
to be developed in some learners and this occurred once students accepted responsibility for their own success or failure. There was a distinct learning curve related to participating in discussions and completing assignments and projects. Students were used to daily prompting from teachers in order to complete work which did occur in the face-to-face classes. Without the prompting, online students initially struggled to participate in discussions and complete work. Online students eventually began to assume more responsibility for class work. Face-to-face students relied more on teachers to remind and guide them through discussions, assignments, and projects.

Online students initially struggled to control their learning environment. It was found that online students learned to choose an appropriate learning environment depending on when the work was due and the level of thinking required. As deadlines approached and the level of critical thinking needed increased, students chose a learning environment with fewer distractions. Alternatively, teachers in the face-to-face sections were responsible for controlling the learning environment of students.

These findings are supported by the literature. Online learning theory is uniquely structured to support the acquisition of independent learning skills (Ally, 2008). Weiner (2002) found that without the teacher’s physical presence, older online learners needed to become active, self-directed learners. This study found the same was true for adolescent learners. Phelps, Hase, and Ellis (2005) found that self-direction was important in order to reach the highest levels of thinking. In his guidelines for content acquisition, Ally (2008) includes the struggle to find new meaning by engaging content. Thomas (2005) described the importance of learning without an expert present, using similar techniques. It was found that students in the online class did struggle and had mixed success without an expert present.
Barbour and Reeves (2009) stated that successful online secondary students have developed strong time management skills. Erikson (1980) described the importance of adolescents’ developing sense of responsibility as important in the development of their identity. Online students were successful at taking responsibility for the course and managing to join online meetings and meet deadlines on assignments and projects. Guglielmino and Guglielmino (2002) reported that the ability to avoid distractions has been identified as a prerequisite skill for adult online learners. The same was found for the high school students. Online students were able to pick the appropriate setting or to control their learning environment.

In summary, this study found that, overall, online students developed more organizational skills, assumed a higher degree of ownership, and accepted more responsibility for their work than face-to-face students. These factors fundamentally match the skills identified by the Partnership for 21st Century Skills (Salpeter, 1993). Online students were able to appropriately control their learning environment. By meeting these challenges, online students were able to maintain grades that were statistically equivalent to face-to-face students.

**Written discussions.** This researcher also concluded that the use of written discussions using online tools in both the face-to-face and online mode was an important factor in grade equivalency. Written discussions are not commonly used in face-to-face settings. The use of online written discussions brought numerous benefits to the face-to-face mode of instruction, benefits that are more common in an online mode. Written discussions using online tools allowed for equalization of student contributions and provided more time for reflection. Written discussions involving two online tools, discussion boards, and text-chats, were used successfully by both online and face-to-face students, which led to the equivalent results.
Written discussions provided a level of equalization for student conversations. Students who would not normally speak up during verbal discussions participated more in text chats. The absence of non-verbal cues kept discussions more focused on the academic topic. Students reported they regularly used text to have conversations with peers, and reported they could easily express needed emotions through emoticons, symbols or abbreviations. It was found that written discussions supported rapport building between the teacher and students but did not build rapport between students themselves. However, the absence of student-to-student rapport was not found to be a deterrent to academic discussions. Additionally, the process of writing responses provided more reflection time for students. Extra time on reflection helped students to understand the perspective of their classmates. It was also found that even the short time delay between posts during synchronous text chats offered students more time to reflect.

An important component of online learning theory is the ability to express thoughts in written form (Anderson, 2008). This is typically more important online than in a traditional school setting. In this study, written discussions were used in both learning modes so it was an important component for all students. The use of text chats in learning is a modern example of Vygotosky’s belief in the value of using available cultural tools within a social context (Miller, 2002).

The finding that discussions provided a level of equalization for students is consistent with earlier findings on less assertive or shy, older students (Aviv, Erlich, Ravid, & Geva, 2003). The finding that the absence of non-verbal cues kept the discussion academically focused is also consistent with an earlier finding with older students, namely that written discussions reduce the social games related to race, gender and group status (Warschauer, 1997). However, the finding that the written discussions did not support rapport building between students themselves, yet did
not deter the academic discussion, was contrary to early findings with older students (Burge, 1994; Tiene, 2000; Wiesenberg & Hutton, 1996). This finding could be closely related to the stage of development of the adolescent student where peers are the most important social group (Marcia, 1980). This supports the idea that online discussion tools allow adolescents to avoid many of the social issues that occur in typical verbal discussions, and allows adolescents to keep the focus of online written discussions on the academic issues.

Menchaca and Bekele (2008) found that adult learners reported that the asynchronous nature of discussions provided more reflection time; the same was found to be true with adolescent learners in this study. Mezirow (1990) pointed out that requiring a written response explicitly makes the response more reflective, and allows students to correct and critique presuppositions.

In summary, it was found that written discussions were an important component of the course for both modes of instruction. Written discussions equalized student contributions and provided both online and face-to-face students more time to reflect. The use of written discussions using online tools in the face-to-face course was an important factor as to why the two modes were shown to be equally effective.

**Implications for Practice, Research and Policy**

Based on the analysis of measured student outcomes, no statistically significant difference was found between the online and face-to-face sections of the course studied. In this case, online instruction was shown to be at least as effective as face-to-face instruction. Examining these quantitative results through a qualitative approach provided insights into the significance of online education at the high school level for practice, research and policy.
Implications for educational practice. The finding that the online instructional mode was as effective as the face-to-face mode has major implications for educational practice. Educational theorists including Piaget and Vygotsky espoused the importance of student-centered education (Piaget, 1990; Miller, 2002). Online classes have been shown to act as a catalyst in shifting from teacher-centered to student-centered education for older students (Brown, 2005; McCombs & Vakili, 2005). The shift toward student-centered education through the use of online classes can be realized at the high school level as well. In addition, the use of learning activities that employ online teaching techniques and tools can be used in traditional classrooms to support this shift.

The availability and use of various online tools by students provides a number of educational benefits to support both traditional and online classrooms. Written discussions with online discussion tools either synchronous or asynchronous, show particular promise. These tools can be used during regularly scheduled class periods or during off-hour discussion sessions. Peers are extremely important in the lives of adolescents (Erikson, 1980). This fact impacts the way students communicate with each other face-to-face. Online written discussions have been shown to equalize discussions for students. Students in online discussions are able to sidestep many of the social games and insecurities of face-to-face communication and keep the focus on an academic discussion. Additionally, online written discussions have been shown to provide students more experience in writing and more time to reflect on content. The opportunities to review recorded text discussions provides absent students the chance to review and summarize discussions. Active and after-the-fact teacher monitoring of written discussions places pressure on students which encourages both a higher quantity and quality of participation in the
discussions. Use of these types of online tools in online and face-to-face modes, supports the
writing-to-learn pedagogical approach espoused by Britton and Emig (Flower & Hayes, 1981).

Instructional strategies employed online can also benefit face-to-face classrooms.
Instructional methods have often been transferred from traditional face-to-face instruction to
online instruction. The use of online tools in the face-to-face classroom appears to hold similar
promise for online instructional methods moving into face-to-face instruction. There is likely to
be an increased use of online tools and methodologies with students in the traditional classroom
as the cost of wireless technology continues to drop. The growing feasibility and popularity of
one child, one laptop programs, combined with effective online instructional methods could
influence significant changes to face-to-face education. Effective online instructional practices
should be considered in face-to-face classrooms.

Providing the appropriate level of instructional support is important in both the online
and face-to-face environment. A learning environment without constant teacher support actually
proved beneficial, in the long run, for some online students but not all. Teachers are able to
provide support at home through various technologies to students. This ability to appropriately
support students outside a typical classroom can greatly extend time on learning. Providing the
proper amount and quality of instructional support is important including personal support from
teachers. With the use of online tools, this support can be available more easily during
afternoons, evenings and weekends. Additionally, non-teacher personal supports with
instructional aides, peer-tutors, parent volunteers, and fee-based supports for students through
online tutorial companies, should be considered as well.

Homework is often assigned at the high school level. This work is often viewed by
students as a “best effort” type assignment. Students frequently view in-class and online
assignments as more important than homework and therefore put in more effort to ensure these assignments are correct. Students actively seek support to complete assignments which is not as common for homework. Providing support during after-school hours to students through online tools can lead to work done out of school taking on a higher level of importance; the results could be more time on learning, more effort by students and a better quality of assignments on work done away from the classroom.

Scheduled study hall periods for online students were important as students learned how to be online students. All online students had a study hall period built into their schedule. By building in the time and reducing supervision, students were able to transition from a very structured learning environment to an unstructured one. Early in the course, students developed good work habits and learned to avoid distractions and meet deadlines. One of the independent learning skills developed was the ability of the student to create or choose an appropriate learning environment which was often the study hall period. The study hall period may also be used by guidance counselors, peer mentors, or instructional aides to work with online students to develop these skills.

In addition, periodic face-to-face meetings with instructors helped some adolescent online learners by promoting proper habits and developing better rapport especially early in the school year. Online students and teachers also reported developing a good rapport through online text chats. Online students also appreciated personalized feedback on assignments and projects. Providing targeted support as adolescents learned independent learning skills necessary for online courses is valuable. It is important that instructors use appropriate empathy and provide personalized feedback while progressively raising student expectations as they learn necessary independent learning skills.
Online students had significant gains in time management skills and in taking personal responsibility which greatly impacted the ownership of the learning. They learned to control their learning environment in order to overcome distractions in relation to the level of thinking required and the proximity of a pending deadline. By developing these skills, students will be better prepared for further schooling and work, as both require creating an environment from which a person can be productive.

Development of independent learning skills may also affect the way colleges look at transitional supports that are often provided to college freshmen as they make the shift from a highly supervised high school experience to a less supervised college experience. A recent study estimates that one out of three students entering a four-year public college does not return for their sophomore year (ACT Educational Services, 2010). By focusing the ownership for learning more on students and less on teachers, students become better prepared for today’s dynamic economic climate.

**Implications for research.** The results of this study raise additional questions that should be answered. Does the development of independent learning skills by online students aid students as they continue their education in college? This would address the need to help college freshmen with the transition to the freedom afforded them at the higher education level. Research is needed on the success rate of college freshmen who had completed an online course in high school.

This study looked at one example of K-12 online learning, which is the fastest growing segment of online learning; this segment of online learning involves individual school districts offering their own online classes (Watson, Murin, Vashaw, Germin & Rapp, 2010). Online courses run by individual school districts for local student populations have different
characteristics than online courses run for remote students. These online offerings can fall somewhere between a traditional online course and a hybrid course, where part of the course would be offered online and part offered in person. Locally run online courses offer students and teachers the ability to develop rapport in many ways, including offering personal face-to-face support. The same can be said for online courses being offered to undergraduates in residence at colleges. A critical difference is the age of the student. When examining implications of this finding, it is important to consider that this course was offered to full-time students in high school and taught by full-time instructors at the same school. This study adds to a small body of knowledge related to this particular segment of online learning but more studies are needed in this area.

Additionally, findings from this study also raise questions related to design of learning activities in relation to time on learning, instructional methods, online tools, the presentation and alignment of objectives, and course material. Online students spent more time on learning than face-to-face students. Various inefficiencies may have caused some of that time to be unproductive. For example, online students often struggled with content which took more time. Those reporting success, reported a higher degree of mastery and those that did not report success reported a very low mastery rate. Face-to-face students reported a much lower level of struggle than online students. Additional research is needed in this area to provide the proper level of support for learners in order to promote an appropriate level of struggle, leading to the highest level of mastery of a subject.

While there is a healthy and growing collection of research related to online instructional methods at the higher education level, there remain relatively few such studies at the adolescent level. Adolescents’ developing sense of identity likely plays an important role in how effective
instructional methods requiring interaction with peers will be. Peer interactions are likely viewed as high stakes interactions for adolescents in a local school. This study found that peer rapport was not needed for an effective academic conversation. Additional research is needed to confirm this finding, and a more thorough analysis of online instructional methods used with adolescents is needed.

Well structured, authentic projects presented through a learning management system were an important component of the course studied. Learning management systems are often used to present a significant amount of material in an organized form in online courses. How this information is presented to communicate student expectations, learning objectives, and assessment of stated objectives is important. As more face-to-face courses are supported with online content, organization of course content on learning management systems will impact the traditional classroom as well. More research in this area is needed.

Online courses can be developed by a curriculum specialist or by the teacher who will deliver the course. There may be differences related to the enthusiasm and ownership of a course developed by a teacher and delivered by that same teacher, versus a model involving a curriculum specialist. These areas require more research. Questions can be raised about the effectiveness of teachers who have little experience teaching online and about teachers who are teaching a course developed by others. This study was conducted utilizing a long established face-to-face course taught for the first time online. Both instructors had taught multiple iterations of the course in a face-to-face setting in prior years. This was the first time these experienced teachers had taught an online course. As with face-to-face courses, it is likely that online instructors become better as they gain experience in the instructional mode. Studies related to longevity of high school online courses and various experience levels of instructors are needed.
Implications for policy. Based on the results of this study and supporting research, there are a number of implications for educational policymakers. Policymakers at the school, district and state levels should consider changes to current policies. Online education shows promise in assisting the development of student responsibility. School districts should consider changes to current policies in order to develop independent learning skills in students. For example, a policy may include changes that lead to student-driven senior projects supported by online tools in a hybrid approach incorporating the strengths of both face-to-face and online modes of instruction. The research shows that online students develop independent learning skills gradually. Policies that support this gradual shift toward taking more ownership of work should be encouraged.

Policies should consider allowing for additional choice in instructional modes. As has been shown in this study, either face-to-face or online modes produced similar results. There are many benefits of online education including equitable access and the cost of education (Anderson et al., 2006). In many cases, diverse course offerings cannot be provided to students because of cost. By providing online courses, small and medium sized schools work together to offer a wealth of options typically available only to students in larger schools. This combining of offerings may lead to increased partnerships between smaller school districts and could promote regionalization of school systems. As an alternative, schools could charge non-district students for open seats in online courses, which may lead to more competition between school systems.

The majority of students in higher education today take all their courses in physical classrooms. By 2014, the majority will be taking a combination of online and in-room coursework. School districts should consider providing online courses to high school students as preparation for higher education. This study showed equivalence for a high school graduation requirement. School systems that do not allow online courses to count toward graduation
requirements should consider changing this policy. In addition, policy changes that promote options for students who cannot attend school during typical school days or typical school hours should be considered.

Online courses have been shown to assist in retaining teachers (Archambeaut & Crippen, 2009). The flexibility offered to instructors might help rural and inner-city schools who struggle with obtaining and retaining highly qualified teachers. This increase in the available teaching pool may help address inequitable access to top teachers. Policy changes that support additional online classes could therefore improve the quality of teaching and address equity issues.

As online education continues to show that it is at least equivalent to face-to-face instruction, state regulations should evolve. State education agencies should consider changes to time on learning requirements, and focus on mastery of objectives rather than supervised instructional time. As school districts look for new approaches to increasing student capacity to compete in the global marketplace, policymakers should consider online courses and the use of online tools within face-to-face instruction. Effects of changes on state educational regulations will also impact union contracts.

Both online and face-to-face modes of instruction were supported by strong teacher-student rapport and through the use of written discussions. State educational agencies and school districts should consider incorporating best practices, including supporting effective teacher interaction and written discussions, into instructional design. This has implications for teacher certification and teacher evaluation requirements.

Finally, schools should examine assessment practices. Supervised tests are often used to evaluate student knowledge and achievement. In this study, project-based learning was shown to be effective in both learning modes. Assessing projects are a viable alternative to traditional
testing (Ally, 2008; Anderson, 2008; Dede, 2007). In fact, traditional testing may not be the most appropriate method of assessment given such considerations as student-centered instruction, project-based learning and the online environment.

In summary, the finding of no significant differences in this study, combined with current literature, provides opportunities and challenges requiring educators and policymakers to examine educational practice and policy at the high school level. In addition, the conclusions of this study help to identify additional questions that should be examined by educational researchers.

**Conclusion**

There are currently over two million K-12 students taking online coursework and this number is estimated to grow to 10 million by 2014 (Adkins, 2010). Online education at the higher education level has been shown to be at least equivalent to face-to-face education (Means et. al., 2009). This study addressed the question, *In what ways is online education at the high school level more, less or equally as effective as face-to-face instruction?* Equivalency in measured student outcomes for a course developed and taught in online and face-to-face instructional modes at a public school district was found. Locally, the results of this study have contributed to the extension of the pilot of online courses. It was important to the local community to know if this pilot offered students a quality rigorous learning experience at least equivalent to those taking the comparable face-to-face courses.

This research study showed equivalency in measured student outcomes by examining an independent grouping variable consisting of online and face-to-face instructional modes. The overall effectiveness was compared by grades based on categories, specifically, interaction
through discussion, knowledge building through assignments and projects, and overall results through tests. The categorized grades formed the dependent variables.

The mixed method design that was used fit this type of educational research scenario (Webb et al, 1966). The causal-comparative design was the most appropriate quantitative choice given the research conditions. Tests for population same equivalence and for significant differences for each hypothesis were conducted; these results were reported along with descriptive statistics on the groups’ characteristics. Focus groups and the teacher interview further informed the numeric findings by triangulating different data on the same topic. The available sample size met the requirements for a statistically powerful study. Validity, credibility, and ethical considerations were addressed.

Online education at the high school level was equally as effective as face-to-face instruction because of effective teacher interaction and the design of effective instructional activities in both learning modes. Teachers’ interactions with students provided teachers with insights to target appropriate support for students. Use of well-designed learning activities, such as meaningful projects and written discussions, were used successfully in both learning modes. Finally, online students met the challenge to develop the independent learning skills required. Because of the unique nature of online learning, face-to-face students were not challenged in this way. These findings have helped address a gap in the literature in the area of effectiveness of online education at the high school level. As a result of these findings, there are significant implications for practice, research, and policy for all modes of instruction at the high school level, not just for online education.
References


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http://www.census.gov/newsroom/releases/archives/education/cb08-54.html


APPENDIX A

Explanation of College Placement I level

Dedham High School offers courses at various levels including Advanced Placement, Honors, College Preparatory I and College Preparatory II. The computer graduation requirement is offered only at the College Preparatory I and College Preparatory II levels. These levels differ in depth of coverage and intensity or pace of study. Levels do affect class rank and weighted grade point average, but do not affect placement on the honor roll. Students select the level at which they would like to study. The list of selections is reviewed by staff to ensure students will be appropriately challenged and successful (Dedham Public Schools, 2011).

College Preparatory I classes are courses that go beyond the standards and are quick in pace. College Preparatory II classes are described as courses that focus on mastery of essential standards and are deliberate in pace. Additional differences are shown in the Table 20.

Table 20

<table>
<thead>
<tr>
<th>College Preparatory I</th>
<th>College Preparatory II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beyond the standards</td>
<td>Mastery of essential standards</td>
</tr>
<tr>
<td>Very rigorous</td>
<td>Rigorous</td>
</tr>
<tr>
<td>Quick in pace</td>
<td>Deliberate in pace</td>
</tr>
<tr>
<td>Considerable independent and group work</td>
<td>Independent and group work with direct instructional support</td>
</tr>
<tr>
<td>Demonstrate good organizational skills to manage daily assignments and in-depth research projects</td>
<td>Develop organizational skills to manage daily assignments and research projects.</td>
</tr>
<tr>
<td>Emphasis on critical analysis</td>
<td>Emphasis on application of material</td>
</tr>
<tr>
<td>Coursework prepares students for competitive four year colleges</td>
<td>Coursework prepares students for two or four year colleges</td>
</tr>
</tbody>
</table>
APPENDIX B

Parent/Guardian Consent with Child Assent to Participate in a Research Study

COPY TO BE SIGNED AND RETURNED TO RESEARCHER

PARENT/GUARDIAN CONSENT WITH CHILD ASSENT TO PARTICIPATE IN A RESEARCH STUDY

Northeastern University, Doctor of Education Program, School of Education.

Investigator: Don G. Langenhorst, Ed.D. Candidate, Dr. David Szabla, Principal Investigator.

Title of Project: The Effectiveness of Online Instruction: Exploring Differences in Measured Student Outcomes in Online versus Face-to-face Instruction at the High School Level

Informed Consent to Participate in a Research Study:

We are inviting your child to take part in a research study. This form will tell you about the study. Mr. Langenhorst has explained the project to your daughter/son and is available by phone to explain it to you. He can be reached at 781-326-4773 during the school day or email him at dlangenhorst@dedham.k12.ma.us and he will call you at your desired time (please provide time and phone number in your email). You may ask Mr. Langenhorst any questions that you have. When you are ready to make a decision, you may tell the Mr. Langenhorst if you want your daughter/son to participate or not. You do not have to participate if you do not want to. If you decide to participate, the Mr. Langenhorst will ask you to sign this statement and will give you a copy to keep.

Why am I being asked to take part in this research study?

Your daughter/son is being asked to participate in one 90 minute focus group meeting because s/he has been enrolled in the Computer Business Applications course either online or face-to-face with Dr. Rouse or Mrs. Pepin.

Why is this research study being done?

The purpose of the research is to find out if the online sections of the course were as effective as the face-to-face sections and how they may differ in effectiveness.

What will my daughter/son be asked to do?

If you decide to allow your daughter/son take part in this study, Mr. Langenhorst will ask her/him to participate in one 90 minute focus group. S/he will receive instructions on the flow of the focus group and be asked to discuss questions related to effectiveness of online and face-to-face learning. The investigator will summarize answers and you daughter/son will be asked to reach consensus with other group members about topics that have been discussed. The session will be audio recorded for review by the investigator. The recording will be destroyed once the project is finalized. Results of the project will be made available to you and your daughter/son.

Where will this take place and how much of my time will it take?

The focus group meeting will be held in a conference room at Dedham High School and take 90 minutes. The meeting time will include the lunch block and lunch will be served. If your daughter/son has a study hall period, efforts will be made to schedule the focus group when the study hall backs up to the lunch period.
Will there be any risk or discomfort to me?

There are no foreseeable risks from participation in the focus groups. All information acquired from the study will be kept confidential. No psychological harm, financial, social, or legal damages as well as physical risks should be incurred during this study. The time and date of the focus groups will be announced well in advance in order to minimize any disruptions to routines.

Will I or my daughter/son benefit by being in this research?

There are no direct benefits to your child for participating in this study. However, it is hoped that the Dedham community in general may benefit from this study as we consider online course offerings in the future. It is also hoped that students may learn about the focus group process and benefit from insights gained during the group meeting.

Who will see the information about me?

Only the participants and the researcher will know who contributed responses. Only the researcher will take written notes and there will be NO matching of responses to participants. This study will be confidential. Only the researchers on this study will see the information. No reports or publications will use information that can identify students in any way.

The written notes and the audio recording will remain secure with the researcher. Notes and audio recording will be destroyed once the project is complete. In rare instances, authorized people may request to see research information about your child and other people in this study. This is done only to be sure that the research is done properly. We would only permit people who are authorized by organizations such as Northeastern University to see this information.

Can I stop my participation in this study?

Participation in this research is completely voluntary. Your daughter/son does not have to participate if you or s/he does not want to and they can refuse to answer any question. Even if s/he begins the focus group, s/he may quit at any time. If you do not participate or if you decide to quit, you will not lose any rights, benefits, or services.

Who can I contact if I have questions or problems?

If you have any questions about this study, please feel free to call Don Langenhorst at 781-326-4773 or dlangenhorst@dedham.k12.ma.us, the person mainly responsible for the research. You can also contact Dr. David Szabla at d.szabla@neu.edu, the Principal Investigator overseeing his research.

Who can I contact about my rights as a participant?

If you have any questions about your rights as a participant, you may contact Nan C. Regina, Director, Human Subject Research Protection, 960 Renaissance Park, Northeastern University Boston, MA 02115 Telephone: 617-373-4588; email: irb@neu.edu. You may call anonymously if you wish.
COPY TO BE SIGNED AND RETURNED TO RESEARCHER

Will I be paid for my participation?
No. Lunch will be provided.

Will it cost me anything to participate?
No.

Is there anything else I need to know?
All students need to have parent or guardian written permission to participate.

Consent of Parent/Guardian and Assent of Child

I agree to have my child take part in the focus group.

SIGNATURE OF PARENT/GUARDIAN

DATE

PRINTED NAME OF PARENT/GUARDIAN

SIGNATURE OF CHILD

DATE

PRINTED NAME OF CHILD

APPROVED

NU IRB# 11-02-01
VALID THROUGH 3/1/12

3
APPENDIX C

Focus Group Detailed Plan

Welcome Statement: Thank you for agreeing to be members of this focus group. We are here to explore your ideas on why you believe the Computer Business Application course is more, less or equally as effective taken in a traditional classroom as opposed to an online environment based on your experiences. I will moderate the discussion to be sure we are able to discuss each item and that everyone has a chance to contribute during our 90 minutes together. The idea is that this group will provide information and knowledge about the effectiveness of face-to-face and online modes of education.

We will begin discussing your general experiences and then move to specific issues based on the four statistical findings related to how you were graded on tests, assignments, projects and discussions. It would be helpful if we could hear from everyone about general beliefs about the issues first, before digging into the specifics of the discussion. At the end of each section, I will summarize what I have heard and ask you if what I have summarized is accurate. We will conclude with an opportunity for you to add any other thoughts about the effectiveness of online and face-to-face classes.

Agenda:

- Welcome (5 minutes)
- Discuss each of the four sets of questions including summarizing the discussion (15-20 minutes each)
- Concluding Discussion (5-15 minutes)

Hypothesis 1:

- Why do you believe there was a (no) significant difference between the online students and the face-to-face students’ discussion grades?
- What experiences have you had that could explain this finding?
- Were the discussion topics interesting to you?
- How do you prefer to communicate with peers?
- How important are non-verbal cues in understanding a classmate?
- Did you feel you were an important contributor to the discussion?
- Did you feel you were helping steer the conversation?
- When did you contribute to the discussions and was that a time that you were prepared and focused on the topic at hand?
- Did you feel freer to contribute when using online discussion tools (discussion boards and chats) than offering items in class?
- Does it take longer to participate in an online discussion than a face-to-face discussion?
- How well did you get to know your classmates?
- Did your discussions lead toward developing a shared understanding between the group discussing the items?
- Did you find it a challenge to express your thoughts in writing?
• What was your experience with discussion boards?
• What was your experience with real-time chat discussions?
• How did you receive feedback on discussion grades?
• How motivated were you to “get into” the discussion?
• Is there anything else connected to this finding that you feel strongly about and would like to bring up now?

Hypothesis 2:

• Why do you believe there was a (no) significant difference between the online students and the face-to-face students’ assignment grades?
• What experiences have you had that could explain this finding?
• Did you feel assignments were meaningful?
• How important were the assignments?
• What distractions did you have when working on assignments?
• What kinds of resources were used in helping you complete the assignments?
• Were there too many, too few, or just about the right amount of resources available to help complete the assignments?
• Did you receive any assistance on assignments from the instructor, classmates, or others?
• How effective was teacher support and prompting in getting you to complete your assignments including submitting them in a timely fashion?
• Was it clear how to go about completing the assignments and when items were due?
• What happened when you didn’t turn in your assignment?
• How did you get feedback on your assignment?
• Is there anything else connected to this finding that you feel strongly about and would like to bring up now?

Hypothesis 3:

• Why do you believe there was a (no) significant difference between the online students and the face-to-face students’ project grades?
• What experiences have you had that could explain this finding?
• Did you feel projects were meaningful?
• How important were the projects?
• How motivated were you to make the project meaningful?
• Did the projects challenge your thinking or were they mostly just following instructions?
• What distractions did you have when working on projects?
• Were there too many, too few, or just about the right amount of resources available to help complete the projects?
• How effective was teacher support and prompting in getting you to complete your projects including submitting them in a timely fashion?
• Did you receive any assistance on projects from the instructor, classmates, or others?
• What kinds of resources were used in helping you complete the projects?
• Was it clear how to go about completing the projects and when items were due?
• How did you get feedback on your projects?
Is there anything else connected to this finding that you feel strongly about and would like to bring up now?

Hypothesis 4:

- Why do you believe there was a (no) significant difference between the online students and the face-to-face students’ testing grades?
- What experiences have you had that could explain this finding?
- Did you feel the tests were a good measure of your achievement in the course?
- Were you the one who decided if you’d take the course online or face-to-face?
- How do you think that played into your effort in the course?
- How would you rate your computer skills prior to starting the course?
- Did you feel that you had the necessary technical skills to be successful in an online course?
- Do you consider yourself a self-directed learner?
- What did you like or not like about the tests?
- How did you study for the tests? About how much time did you study for the tests?
- Did having a book at home help?
- How motivated were you to study for the tests?
- Is there anything else connected to this finding that you feel strongly about and would like to bring up now?

Conclusion:

Is there anything else you would like to add related to the online or face-to-face classes at the high school level?
APPENDIX D
Teacher Consent Form to Participate in a Research Study

Northeastern University, Doctor of Education Program, School of Education.

Investigator: Don G. Langenhorst, Ed.D. Candidate, Dr. David Szabla, Principal Investigator.

Title of Project: The Effectiveness of Online Instruction: Exploring Differences in Measured Student Outcomes in Online versus Face-to-face Instruction at the High School Level

Request to Participate in a Research
You are being invited to take part in a research study because you are a teacher who has experience with both online and face-to-face course instruction. The purpose of the research is to find out if online sections of courses are as effective as face-to-face sections and how they may differ in effectiveness.

The study will take place in classroom at Dedham High School and will take about 90 minutes. If you decide to take part in this study, you will be asked to participate in a small group interview to discuss questions related to effectiveness of online and face-to-face learning. The investigator will summarize answers and you will be asked to verify the summarizations. The session will be audio recorded for review by the investigator. The recording will be destroyed once the project is finalized. Results of the project will be made available to you.

There are no foreseeable risks or discomforts to you for taking part in study.

There are no direct benefits to you for participating in this study. However, it is hoped that the Dedham community in general may benefit from this study as we consider online course offerings in the future. It is also hoped that you will benefit from insights gained during the interview and from the results of the study.

Only the participants in the group interview and the researcher will know what your responses are. Only the researcher will take written notes and there will be NO matching of responses to participants. This study will be confidential. Only the researchers on this study will see the information. No reports or publications will use information that can identify you in any way.

The written notes and the audio recording will remain secure with the researcher. Notes and audio recording will be destroyed once the project is complete. In rare instances, authorized people may request to see research information about you and other people in this study. This is done only to be sure that the research is done properly. We would only permit people who are authorized by organizations such as the Northeastern University Institutional Review Board to see this information.

Participation in this research is completely voluntary. You do not have to participate if you do not want to and you can refuse to answer any question. Even if you begin the interview, you may quit at any time. If you do not participate or if you decide to quit, you will not lose any rights, benefits, or services that you would otherwise have as an employee.

You will not be paid for your participation in this study.

If you have any questions about this study, please feel free to call Don Langenhorst at 781-326-4773 x 1223 or dlangenhorst@dedham.k12.ma.us, the person mainly responsible for the research. You can also contact Dr. David Szabla at d.szabla@neu.edu, the Principal Investigator overseeing his research.

If you have any questions about your rights as a participant, you may contact Nan C. Regina, Director, Human Subject Research Protection, 950 Renaissance Park, Northeastern University Boston, MA 02115 Telephone: 617-373-4588; email: irb@neu.edu. You may call anonymously if you wish.

You may keep this form for yourself.

Thank you.
Don Langenhorst

[Signature]
APPENDIX E

Teacher Interview Guide

This plan includes a description of the follow-up interview with teachers and includes the process, agenda, welcome statement and preliminary question list. There are two types of questions included in the question list, including clarifying questions about the courses and insight questions. The insight questions allow the teachers to provide their thoughts as to the differences in the way online and face-to-face courses are effective.

Process

One session, with two teachers participating will be held at Dedham High School which will last between 90 and 120 minutes.

The two teacher participants will be provided quantitative results and be asked to generate ideas to discuss why the results occurred. A list of questions will be distributed as part of the agenda at the beginning of the interview. Participants will receive instruction as to the purpose and flow of the interview. The researcher will summarize main points that arose during the discussion and obtain participants’ agreement with the summation. On completion of the interview, the analysis and reporting will include the important themes, most noteworthy quotes and unexpected findings.

Agenda

- Welcome (5 minutes)
- Discuss each of the four sets of questions including summarizing the discussion (20-25 minutes each)
- Concluding Discussion (5-15 minutes)

Welcome Statement

Thank you for agreeing to be interviewed. We are here to explore your ideas on why you believe the Computer Business Application course is more, less or equally as effective taken in a traditional classroom as opposed to an online environment based on your experiences. You are here to provide clarification on how the courses ran and your insights about the effectiveness of face-to-face and online modes of education.

We will begin discussing your experiences based on the four statistical findings related to grades on tests, assignments, projects and discussions and results of focus groups help with students. At the end of each section, I will summarize what I have heard and ask you if what I have summarized is accurate. We will conclude with an opportunity for you to add any other thoughts about the effectiveness of online and face-to-face classes.
Hypothesis 1:

- Why do you believe there was no significant difference between the online students’ and the face-to-face students’ discussion grades?

Chats:

- How did you supervise the chats?
- What were the topics of the chat?
- Did students “get into” the discussions in your opinion?
- How often did the chat groups get off topic?
- If they got back on topic, how did that happen?
- Was there movement between face-to-face groups as there was in the online chats?
- Some reported 9 to 10 p.m. as a common time for chats. When were the most common chat times?
- Some reported having conflicts with sports and others events? How was this dealt with?
- Students in the online reported if they missed a chat they could make it up by joining another group. Were face-to-face students afforded makeup chances?
- For the most part, did students stay within their designated group for most chats?
- How many questions did the chat leaders need to pose during the chat?
- How long was the typical chat?
- Did you feel the students stayed focused on the topics during the chats?
- How do you rate how the student leaders did running the chats?
- What are important skills for chat leaders?
- Were their clear objectives defined for the chat? If so, who defined them?
- In general, rate how well students develop an understanding for the topic of the chats.
- How do you think a required summary would have affected learning or your ability to assess learning on the chat?
- Did you notice more participation from quieter students than in an face-to-face discussion?
- What differences do you see in face-to-face discussions and chat discussions?
- What differences do you see in chat discussions in an face-to-face class and an online class?
- Were students able to express themselves well in writing? Were they able to express emotions?
- Since you were active in all the online chats, did you need to go back and review those after the fact? Since you couldn’t be fully active in all the face-to-face chats, did you need to go back and review those?
- What type of feedback was provided to students on chats?
- Did you and the students enjoy the chats?
- What was the feedback you received from students on chats?
- Is there anything else connected to this finding that you feel strongly about and would like to bring up now?
Discussion Boards

- What was the typical discussion board assignment like?
- Did the face-to-face discussion boards happen real-time?
- How regularly were discussion boards used?
- Were these done in small groups or whole class?
- What were the topics of the discussion boards?
- What have been your experiences using the discussion board?
- Did discussion boards lead to shared understanding of a topic? If so, how was that assessed?
- How did students do in expressing their thoughts in writing?
- What was the feedback you received from students on discussions?
- Did students assume roles (like leader) during online discussion boards?
- Is there anything else connected to the discussion finding that you feel strongly about and would like to bring up now?

Hypothesis 2:

- Why do you believe there was no significant difference between the online students’ and the face-to-face students’ assignment grades?
- How did online students get support if they needed individual help?
- The online students all had a study hall to work on the online or other classes. What are your thoughts and experiences on this aspect? How important was it that students were scheduled into a study?
- How important was it that your class was close to the library during a study?
- Some of the online students reported learning the subject better since they had to struggle with the material and figure it out rather than getting immediate support. What are your thoughts on this?
- Online students reported they were very appreciative of your time? As a whole did you spend more time or less time with students in an online class versus a face-to-face class?
- Online students reported poor to mixed results in trying to obtain help for assignments through the Internet including Google, Yahoo Answers, Facebook and Skype. They also had mixed results getting help by texting friends to get help with assignments. What could explain that?
- How often were office hours? When were office hours?
- Most online student felt they had a strong rapport with you. They felt you were very personable and approachable. How was this rapport developed?
- Can you explain a typical way you taught the concepts for an assignment in a face-to-face class? In an online class?
- Face-to-face students reported that demonstrations were very important to knowing how to complete assignments. Please explain the differences in demonstration between online and face-to-face classes.
- Most students reported that they didn’t read the book except for the step by step instructions. Some of the online students reported going back and reading sections when they had trouble. What is your experience with this?
• Online students seemed to benefit from a regular rhythm to the course. As a rhythm was established, did you find they met deadlines better?
• How did you handle missed assignments? Could students turn in work late?
• Do you believe that students learned how to meet deadlines more independently in the online class versus the face to face class?
• What did online students report to you about distractions during a study or at home?
• Did face-to-face students become distracted during parts of your course? If so, how?
• Students in the face-to-face course reported they needed more time to complete their work but this was not reported in the online class. What would explain this?
• Online students reported a time crunch on Monday especially when they didn’t have a study hall on a Monday. Were there multiple assignments due on Monday as oppose to other days? What factors could account for this perception?
• Students seemed to struggle learning Microsoft Access. Is that what you experienced? Why was this topic so different than the others?
• What kind of support did you provide to face-to-face students with MS Access? Was this different than the online students?
• How did you prompt the face-to-face students to get assignments completed? Online students? Did you feel you had to chase the online students more than the face-to-face students?
• Students in the online class reported a social pressure of letting you down if they didn’t do the assignment. How and why do you think this occurred?
• There seemed to be a sense of resignation with the online students that they would miss something. They seemed alert to this factor but not stressed by it. What are your thoughts on this?
• Most students seemed to have most computing resources needed at home except for Microsoft Access. Is this what you thought?
• Online students reported receiving excellent feedback on assignments. How well did you do in keeping up on grades? How did students receive feedback on grades?
• Online students reported not checking feedback in a timely way which sometimes had consequences for further assignments and their grades. Was there any notification when grades were posted?
• Students reported discussion on a topic such as Intellectual Property was most meaningful when utilized in an assignment or project later. Were there many of these integrated items?
• Is there anything else connected to the assignment finding that you feel strongly about and would like to bring up now?

Hypothesis 3:

• Why do you believe there was no significant difference between the online students’ and the face-to-face students’ project grades?
• Students reported projects involved more critical thinking and found them more meaningful than assignments? Did you notice any difference in the quality of the projects from online and face-to-face students?
• Students seemed to struggle both with the content and the timeline with the MS Access project. Can you explain your perceptions of these two items? How were the online and face-to-face group different on these two issues for this project?
• A few online students reported proudly how they struggled through a project and were able to learn the topic well mostly through their own efforts. Some face-to-face students reported being frustrated at the completion of some projects because they didn’t feel they learned anything. How would you explain these perceptions?
• Online students reported many distractions when working on assignments but reported fewer when working on projects. Face-to-face students reported more distractions on projects using the Internet. What are your thoughts on this?
• Is there anything else connected to the project finding that you feel strongly about and would like to bring up now?

Hypothesis 4:

• Why do you believe there was no significant difference between the online students and the face-to-face students’ testing grades?
• Projects were weighted more than tests. Why?
• Students felt that the projects were both a good preparation for tests and, in many ways, a better measure of what they could do. Did you find the tests added anything to your knowledge of their understanding and abilities?
• My understanding is that the four tests were unsupervised for the online students? Was there any level of supervision for them?
• What could and couldn’t students use for resources on the tests? Could they use their book? Could they use online help? Could they use the program?
• Students reported that they were on the “honor code.” What is the “honor code?”
• Students reported the tests had two parts including the multiple choice and the application sections? What was the purpose of each section?
• Why did you change the way online students took the tests moving them to 7 a.m. - 3:30 p.m. in the computer labs? When did you do this? How many tests were given where they could take them at home?
• Is there anything else connected to the project finding that you feel strongly about and would like to bring up now?

Conclusion:

• Students had a choice between taking the course online and face-to-face. Do you think this related to their success or failure?
• Why do you think some students chose face-to-face and some online?
• Online students overall are very pleased they had the opportunity to take this course in this mode. Why do you think this is true?
• Is there anything else connected to this study that you feel strongly about and would like to bring up now?
Appendix F

Focus Group Response Tables

Discussion Grades

*Participation in chats.* Table 21 summarizes 19 responses from the online students and 2 responses from the face-to-face students about attendance in the chat sessions. The table also includes representative examples from the online students’ responses and the two face-to-face students’ responses.

Table 21

Focus Group Responses: Participation in Chats

<table>
<thead>
<tr>
<th>Responses</th>
<th>Online</th>
<th>Face-to-Face</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example #1</td>
<td>“Finding a time to meet was a challenge.”</td>
<td>“We participated in the chats during class.”</td>
</tr>
<tr>
<td>Example #2</td>
<td>“Depending on your reason or your excuse; you’re not allowed to make up for full credit if you didn’t tell the teacher ahead of time. If you needed to reschedule, they’d put you in a different group.”</td>
<td>“I missed one chat and made it up by answering the discussion questions and summarizing the recorded chat.”</td>
</tr>
<tr>
<td>Example #3</td>
<td>“I’ve only been to a couple. I’ve missed a lot during football but the ones I’ve been to I’ve enjoyed actually.”</td>
<td></td>
</tr>
</tbody>
</table>

*Note:* Responses = number of student responses for theme.
Discussion Grades

*Teacher presence in chats.* Table 22 summarizes 7 responses from the online students and 5 responses from the face-to-face students about teacher presence in the chat sessions. The table also includes representative examples from the online and face-to-face students’ responses.

Table 22

<table>
<thead>
<tr>
<th>Focus Group Responses: Teacher Presence in Chats</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Responses</td>
</tr>
<tr>
<td>Example #1</td>
</tr>
<tr>
<td>Example #2</td>
</tr>
<tr>
<td>Example #3</td>
</tr>
</tbody>
</table>

*Note: Responses = number of student responses for theme.*
Discussion Grades

Quality of chat posts. Table 23 summarizes 14 responses from the online students and 19 responses from the face-to-face students about the quality of the chat sessions. The table also includes representative examples from the online and face-to-face students’ responses.

Table 23

Focus Group Responses: Quality of Chat Posts

<table>
<thead>
<tr>
<th></th>
<th>Online</th>
<th>Face-to-Face</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Responses</strong></td>
<td>14</td>
<td>19</td>
</tr>
<tr>
<td>Example #1</td>
<td>“It’s like; okay, I’ve got a lot to do tonight. I have homework. It’s like; I just want to get it done.”</td>
<td>“Because we were in class and not going anywhere, we’d talk about the factual items and then about random items.”</td>
</tr>
<tr>
<td>Example #2</td>
<td>“Social pressure not to get off topic.”</td>
<td>“The first time we did it no one stayed on topic and we didn’t really discuss the topic. The teacher got mad.”</td>
</tr>
<tr>
<td>Example #3</td>
<td>“You couldn’t answer in one word. You had to answer in a complete sentence with our opinion.”</td>
<td>“The teacher wasn’t happy when we’d say I agree, yes, no or I don’t know.”</td>
</tr>
<tr>
<td>Example #4</td>
<td>“If you login on time and participate, you get a four.”</td>
<td>“You usually got a 3.”</td>
</tr>
</tbody>
</table>

*Note: Responses = number of student responses for theme.*
Discussion Grades

Anonymity factors. Table 24 summarizes 19 responses from the online students and 7 responses from the face-to-face students about anonymity factors during chat sessions. The table also includes representative examples from the online and face-to-face students’ responses.

Table 24

<table>
<thead>
<tr>
<th>Focus Group Responses: Anonymity Factors during Chats</th>
<th>Online</th>
<th>Face-to-Face</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>18</td>
<td>7</td>
</tr>
<tr>
<td>Example #1</td>
<td>“It is normally easier to talk to someone who you wouldn’t normally talk to online.”</td>
<td>“Chats were awkward with students sitting only a few feet away.”</td>
</tr>
<tr>
<td>Example #2</td>
<td>“People were more open online than they would be face-to-face.”</td>
<td>“It’s nice to hear other people’s opinions.”</td>
</tr>
<tr>
<td>Example #3</td>
<td>“Even though I didn’t know some of the people in the chat, I still learned from them.”</td>
<td>“At first, I would just say, “I agree” and “yes.” By the third or fourth chat, I started putting stuff in and contributing more.”</td>
</tr>
</tbody>
</table>

Note: Responses = number of student responses for theme.
Discussion Grades

**Distractions.** Table 25 summarizes 11 responses from the online students about distractions during chat sessions. There were no comments about distractions from the face-to-face students. The table also includes representative examples from the online students’ responses.

Table 25

<table>
<thead>
<tr>
<th>Focus Group Responses: Distractions during Chats</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Responses</strong></td>
</tr>
<tr>
<td>Example #1</td>
</tr>
<tr>
<td>Example #2</td>
</tr>
<tr>
<td>Example #3</td>
</tr>
</tbody>
</table>

*Note: Responses = number of student responses for theme.*
Discussion Grades

Discussion Boards. Table 26 summarizes 18 responses from the online students and 7 responses from the face-to-face students about discussion boards. The table also includes representative examples from the online and face-to-face students’ responses.

Table 26
Focus Group Responses: Discussion Boards

<table>
<thead>
<tr>
<th>Responses</th>
<th>Online</th>
<th>Face-to-Face</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example #1</td>
<td>“I’d usually just remember at the last moment. I just do it whenever I’d think about it.”</td>
<td>“Discussion boards you did by yourself and it was just your opinion and you didn’t see the other side.”</td>
</tr>
<tr>
<td>Example #2</td>
<td>“No chance to get a point back. You get 1, 2, 3 or 4. If you get a four, you’d get a complement as well. If you got a three then you’d get some positive feedback with a message about what you did wrong.”</td>
<td>“The teacher would come around and grade you on the rubric. If you messed something up, you’d get a chance to correct it to get the extra point.”</td>
</tr>
<tr>
<td>Example #3</td>
<td>“Discussion board in face-to-face going on simultaneously may be more truthful because in online you can just look at what other people said and alter it a little bit.”</td>
<td>“Sometimes the teacher would tell you to go back and read someone else’s post and post your opinion.”</td>
</tr>
</tbody>
</table>

Note: Responses = number of student responses for theme.
Assignment Grades:

*Time to complete assignments.* Table 27 summarizes 18 responses from the online students and 16 responses from the face-to-face students about the time students had to complete assignments. The table also includes representative examples from the online and face-to-face students’ responses.

Table 27

Focus Group Responses: Time to Complete Assignments

<table>
<thead>
<tr>
<th>Responses</th>
<th>Online</th>
<th>Face-to-Face</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example #1</td>
<td>“Online you really didn’t have any excuse as you had plenty of time to get the work done.”</td>
<td>“We needed more time than the teacher would give us.”</td>
</tr>
<tr>
<td>Example #2</td>
<td>“I had two days to get the work done while they had one class.”</td>
<td>“If you miss a day of class you were really screwed because the class moves on and you have to stay after to do it.”</td>
</tr>
<tr>
<td>Example #3</td>
<td>“I think some assignments took me longer than the face-to-face classes because I had issues of figuring out what was asked. Other times I think I could do the assignment much faster because I didn’t have the teacher talking.”</td>
<td>“I don’t think the assignments would be that different in the online except that you do it on your own time. Mostly they were easy enough.”</td>
</tr>
<tr>
<td>Example #4</td>
<td>“By last minute, I’d wait until the last day but not waiting until the last hour.”</td>
<td>“The teacher would sometimes push off the assignments a bit if the class was getting behind.”</td>
</tr>
</tbody>
</table>

*Note:* Responses = number of student responses for theme.
Assignment Grades:

**Submission of late assignments.** Table 28 summarizes 15 responses from the online students and 5 responses from the face-to-face students about submission of late assignments. The table also includes representative examples from the online and face-to-face students’ responses.

Table 28
Focus Group Responses: Submission of Late Assignments

<table>
<thead>
<tr>
<th>Responses</th>
<th>Online</th>
<th>Face-to-Face</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example #1</td>
<td>“The teacher was strict about the late policy. You had to have the late assignment in before the next one is due.”</td>
<td>“If we didn’t get it done, sometimes we just submit what we had. We’d get 3 of the 4 points.”</td>
</tr>
<tr>
<td>Example #2</td>
<td>“When you didn’t turn in an assignment the teacher would see you and say, ‘Janice, I’m so surprised you didn’t turn it in.’ I felt like I was letting him down.”</td>
<td>“Sometimes we’d be able to finish it at the beginning of the next period.”</td>
</tr>
<tr>
<td>Example #3</td>
<td>“However, there was a point when the teacher said the term is ending, get in as many missing assignments as you can by a due date.”</td>
<td>“If you didn’t turn in an assignment you’d lose credit or you’d make it up.”</td>
</tr>
</tbody>
</table>

*Note: Responses = number of student responses for theme.*
Assignment Grades:

Access to computing resources. Table 29 summarizes 18 responses from the online students and two responses from the face-to-face students about access to computing resources. The table also includes representative examples from online and the two face-to-face students’ responses.

Table 29
Focus Group Responses: Access to Computer Resources

<table>
<thead>
<tr>
<th>Responses</th>
<th>Online</th>
<th>Face-to-Face</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example #1</td>
<td>“I’d do almost all the work, except Microsoft Access, at home.”</td>
<td>“I didn’t work on this class at home.”</td>
</tr>
<tr>
<td>Example #2</td>
<td>“Nine times out of ten, I’d go to the library during my study hall.”</td>
<td>“A few times, when I got behind, I’d come in after school to work on assignments.”</td>
</tr>
<tr>
<td>Example #3</td>
<td>“They were due every Monday, Wednesday and Friday. My computer at home was malfunctioning so I didn’t do much at home. When I didn’t have a study on Monday, that’s when it was late.”</td>
<td></td>
</tr>
</tbody>
</table>

Note: Responses = number of student responses for theme.
Assignment Grades:

*Access to the instructor.* Table 30 summarizes 21 responses from the online students and 12 responses from the face-to-face students about access to the instructor. The table also includes representative examples from the online and face-to-face students’ responses.

Table 30

<table>
<thead>
<tr>
<th>Focus Group Responses: Access to the Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Responses</strong></td>
</tr>
<tr>
<td>Example #1</td>
</tr>
<tr>
<td>Example #2</td>
</tr>
<tr>
<td>Example #3</td>
</tr>
</tbody>
</table>

*Note: Responses = number of student responses for theme.*
Assignment Grades:

*Teacher’s demonstration of content.* Table 31 summarizes 7 responses from the online students and 4 responses from the face-to-face students about teachers’ demonstrations of content. The table also includes representative examples from the online and face-to-face students’ responses.

Table 31

<table>
<thead>
<tr>
<th>Responses</th>
<th>Online</th>
<th>Face-to-Face</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example #1</td>
<td>“The teacher did really good video clips for some things. I didn’t really need them until the database stuff.”</td>
<td>“I needed the teacher to show me how to do the stuff.”</td>
</tr>
<tr>
<td>Example #2</td>
<td>“The mini video demonstrations were helpful; like how to do a wiki entry.”</td>
<td>“It was helpful when the teacher demonstrated what we needed to do before we did it.”</td>
</tr>
<tr>
<td>Example #3</td>
<td>“The more of those the better.”</td>
<td>“Yes, we saw the video clips they made.”</td>
</tr>
</tbody>
</table>

*Note:* Responses = number of student responses for theme.
Assignment Grades:

**Help from peers.** Table 32 summarizes 11 responses from the online students and 5 responses from the face-to-face students about help from peers. The table also includes representative examples from the online and face-to-face students’ responses.

Table 32

<table>
<thead>
<tr>
<th></th>
<th>Online</th>
<th>Face-to-Face</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td>Example #1</td>
<td>“It was helpful to have students in my study who were in the same situation.”</td>
<td>“I’d get help from the person next to me.”</td>
</tr>
<tr>
<td>Example #2</td>
<td>“Sometimes I’d text someone. I hate talking on the phone.”</td>
<td>“In some classes you get yelled at for talking to the people around you but not in this class.”</td>
</tr>
<tr>
<td>Example #3</td>
<td>“At home, I’d automatically type it in on Facebook every time I had a problem.”</td>
<td>“Sometimes when I’m online, I don’t feel comfortable asking for help with Facebook. On Facebook they don’t want to do school work. They just want to talk to people. But when you are in class, you can ask them because it’s in context.”</td>
</tr>
</tbody>
</table>

*Note:* Responses = number of student responses for theme.
Assignment Grades:

*Distractions while working on assignments.* Table 33 summarizes 11 responses from the online students and 8 responses from the face-to-face students about distractions while working on assignments. The table also includes representative examples from the online and face-to-face students’ responses.

Table 33

<table>
<thead>
<tr>
<th></th>
<th>Online</th>
<th>Face-to-Face</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>11</td>
<td>8</td>
</tr>
<tr>
<td>Example #1</td>
<td>“There are so many distractions, especially at home. There is Facebook. There is TV. If you are into video games, there are video games. There’s other homework.”</td>
<td>“Facebook is blocked at school.”</td>
</tr>
<tr>
<td>Example #2</td>
<td>“When you have a friend in a study, you get distracted because you start a conversation and you forget to get something done. If you have something due then you are rushing.”</td>
<td>“That’s another reason I didn’t choose the online class because of distractions. I know what kind of person I am. I feel I wouldn’t give it my fullest attention.”</td>
</tr>
<tr>
<td>Example #3</td>
<td>“The distractions were not a huge problem with the simple items.”</td>
<td>“I think the distractions are just like in any other class.”</td>
</tr>
</tbody>
</table>

*Note:* Responses = number of student responses for theme.
**Project Grades:**

*Critical thinking during projects.* Table 34 summarizes 23 responses from the online students and 29 responses from the face-to-face students about critical thinking during projects. The table also includes representative examples from the online and face-to-face students’ responses.

**Table 34**

<table>
<thead>
<tr>
<th>Focus Group Responses: Critical Thinking during Projects</th>
<th>Online</th>
<th>Face-to-Face</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>23</td>
<td>17</td>
</tr>
<tr>
<td>Example #1</td>
<td>“I’d say they were meaningful in that they summed up what we have learned.”</td>
<td>“The projects were almost like a test on what you just learned.”</td>
</tr>
<tr>
<td>Example #2</td>
<td>“I think the projects were helpful. I remember we had one due for college. We had to figure out the prices and for us seniors we had to figure out the cost of everything.”</td>
<td>“Projects were more like what you’d see in the work world.”</td>
</tr>
<tr>
<td>Example #3</td>
<td>“The projects challenged your thinking.”</td>
<td>“I felt they were really asking you to think.”</td>
</tr>
</tbody>
</table>

*Note:* Responses = number of student responses for theme.
**Project Grades:**

*Struggles during projects.* Table 35 summarizes 11 responses from the online students and 6 responses from the face-to-face students about struggles during projects. The table also includes representative examples from the online and face-to-face students’ responses.

Table 35

<table>
<thead>
<tr>
<th>Focus Group Responses: Struggles during Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Online</strong></td>
</tr>
<tr>
<td>Responses</td>
</tr>
<tr>
<td>Example #1</td>
</tr>
<tr>
<td>Example #2</td>
</tr>
<tr>
<td>Example #3</td>
</tr>
</tbody>
</table>

*Note: Responses = number of student responses for theme.*
Project Grades:

*Distractions while working on projects.* Table 36 summarizes 5 responses from the online students and 4 responses from the face-to-face students about distractions while working on projects. The table also includes representative examples from the online and face-to-face students’ responses.

Table 36

<table>
<thead>
<tr>
<th>Responses</th>
<th>Online</th>
<th>Face-to-Face</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example #1</td>
<td>“When I was getting close to a project deadline, I’d turn the other stuff off.”</td>
<td>“The projects were worth more than you do every day, so I didn’t find there were many distractions. I was more focused.”</td>
</tr>
<tr>
<td>Example #2</td>
<td>“I work better under pressure.”</td>
<td>“We were on the Internet more with projects so it was a little more distracting.”</td>
</tr>
<tr>
<td>Example #3</td>
<td>“When there was an hour left, I’d completely focus.”</td>
<td>“The use of the Internet was a bit of a distraction.”</td>
</tr>
</tbody>
</table>

*Note:* Responses = number of student responses for theme.
Project Grades:

**Feedback during projects.** Table 37 summarizes 16 responses from the online students and 5 responses from the face-to-face students about feedback during projects. The table also includes representative examples from the online and face-to-face students’ responses.

Table 37

<table>
<thead>
<tr>
<th>Focus Group Responses: Feedback during Projects</th>
<th>Online</th>
<th>Face-to-Face</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>16</td>
<td>5</td>
</tr>
<tr>
<td>Example #1 “He provided whole class feedback on discussions but did individual feedback on the assignments and projects.”</td>
<td></td>
<td>“We get a written rubric handed back to us.”</td>
</tr>
<tr>
<td>Example #2 “Feedback on the projects was more detailed than on the assignments.”</td>
<td></td>
<td>“He was very quick in providing feedback.”</td>
</tr>
<tr>
<td>Example #3 “When I entered the data wrong in the first part it made the next part wrong.”</td>
<td></td>
<td>“She helps us a lot to make sure we understood it before moving on.”</td>
</tr>
<tr>
<td>Example #4 “In these cases, we needed more immediate feedback.”</td>
<td></td>
<td>“But you’d have to ask for her help. So if you did something wrong, she’d come back and grade it after you had done it right.”</td>
</tr>
</tbody>
</table>

*Note: Responses = number of student responses for theme.*
Project Grades:

_Weight of project grades._ Table 38 summarizes 6 responses from the online students and 4 responses from the face-to-face students about the weight of project grades. The table also includes representative examples from the online and face-to-face students’ responses.

Table 38

Focus Group Responses: Weight of Project Grades

<table>
<thead>
<tr>
<th>Example #1</th>
<th>Online</th>
<th>Face-to-Face</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Projects were 35% of our grade.”</td>
<td>6</td>
<td>“Projects are a huge part of the grade.”</td>
</tr>
<tr>
<td>“There should be a way not to lose points for the same mistake done early in the project if you carry it through the right way.”</td>
<td></td>
<td>“If you didn’t know what you were doing, that’s the whole grade without giving you a lot of instruction.”</td>
</tr>
<tr>
<td>“I don’t mind if assignments have a four-point rubric, but projects should definitely have more points.”</td>
<td></td>
<td>“I really liked how the projects were weighted more heavily than the tests.”</td>
</tr>
</tbody>
</table>

*Note: Responses = number of student responses for theme.*
**Test Grades:**

*Sections of the test.* Table 39 summarizes 13 responses from the online students and 14 responses from the face-to-face students about the sections of the test. The table also includes representative examples from the online and face-to-face students’ responses.

Table 39

<table>
<thead>
<tr>
<th>Response</th>
<th>Online</th>
<th>Face-to-Face</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example #1</td>
<td>“Mostly random detailed items on the objective part.”</td>
<td>“You had to know the name of a tool you used but we never used the name.”</td>
</tr>
<tr>
<td>Example #2</td>
<td>“Multiple choice was way too detailed.”</td>
<td>“The multiple choice was terrible.”</td>
</tr>
<tr>
<td>Example #3</td>
<td>“We didn’t learn the vocab and stuff.”</td>
<td>“We did vocab at the beginning of the year then we stopped.”</td>
</tr>
</tbody>
</table>

*Note:* Responses = number of student responses for theme.
**Test Grades:**

*Studying for the tests.* Table 40 summarizes 18 responses from the online students and 17 responses from the face-to-face students about studying for the tests. The table also includes representative examples from the online and face-to-face students’ responses.

Table 40

<table>
<thead>
<tr>
<th>Focus Group Responses: Studying for the Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Online</strong></td>
</tr>
<tr>
<td>Responses</td>
</tr>
</tbody>
</table>

**Example #1**

- Online: “The practice test you had to get 85% or higher. So I guessed repeatedly until I got the score.”
- Face-to-Face: “I had to take the practice test like five times for every test.”

**Example #2**

- Online: “I thought doing the assignments got you ready for the tests. I didn’t really have to study.”
- Face-to-Face: “The application test was an okay test of what we learned.”

**Example #3**

- Online: “Having the book at home helped me. There was an assignment to do vocab for Access and having the book at home was very helpful. At home I could take the time to read the book but if I had class, I’d just copy down the word to save time.”
- Face-to-Face: “We didn’t get to take the book home so whatever we learned in class was it. We couldn’t review.”

*Note:* Responses = number of student responses for theme.
**Test Grades:**

*Academic Integrity* Table 41 summarizes 42 responses from the online students and lists the 2 responses from face-to-face students about academic integrity. The table also includes representative examples from the online responses.

Table 41

<table>
<thead>
<tr>
<th>Focus Group Responses: Academic Integrity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Online</strong></td>
</tr>
<tr>
<td>Responses</td>
</tr>
<tr>
<td>Example #1</td>
</tr>
<tr>
<td>Example #2</td>
</tr>
<tr>
<td>Example #3</td>
</tr>
</tbody>
</table>

*Note:* Responses = number of student responses for theme.
**Test Grades:**

**Effort due to choice of instructional mode.** Table 42 summarizes 17 responses from the online students and 9 responses from the face-to-face students about effort put into the class because they chose the mode of instruction. The table also includes representative examples from the online and face-to-face students’ responses.

Table 42

<table>
<thead>
<tr>
<th>Focus Group Responses: Effort Due to Choice of Instructional Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Responses</strong></td>
</tr>
<tr>
<td>Example #1</td>
</tr>
<tr>
<td>Example #2</td>
</tr>
<tr>
<td>Example #3</td>
</tr>
</tbody>
</table>

*Note: Responses = number of student responses for theme.*
Appendix G

**Mapping Identified Topics to Emergent Themes**

**Table 43**

<table>
<thead>
<tr>
<th>Identified Topics</th>
<th>Emergent Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation in chats</td>
<td>Teacher monitoring and feedback were equally robust.</td>
</tr>
<tr>
<td>Teacher presence in chats</td>
<td></td>
</tr>
<tr>
<td>Quality of chat posts</td>
<td></td>
</tr>
<tr>
<td>Discussion boards</td>
<td></td>
</tr>
<tr>
<td>Quality of chat posts</td>
<td>Discussion sessions were equivalent in design.</td>
</tr>
<tr>
<td>Anonymity factors during chats</td>
<td></td>
</tr>
<tr>
<td>Participation in chats</td>
<td>Participation levels were similar.</td>
</tr>
<tr>
<td>Distractions during chats</td>
<td></td>
</tr>
<tr>
<td>Discussion boards</td>
<td></td>
</tr>
</tbody>
</table>

**Table 44**

<table>
<thead>
<tr>
<th>Identified Topics</th>
<th>Emergent Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to the instructor</td>
<td>Assignment completion rates were comparable.</td>
</tr>
<tr>
<td>Time to complete assignments</td>
<td></td>
</tr>
<tr>
<td>Submission of late assignments</td>
<td></td>
</tr>
<tr>
<td>Access to the instructor</td>
<td>Online students needed to be more independent learners than face-to-face students.</td>
</tr>
<tr>
<td>Teacher’s demonstrations of content</td>
<td></td>
</tr>
<tr>
<td>Help from peers</td>
<td></td>
</tr>
<tr>
<td>Distractions while working on assignments</td>
<td></td>
</tr>
<tr>
<td>Access to computer resources</td>
<td>Both groups felt they were able to work through obstacles to learning.</td>
</tr>
<tr>
<td>Distractions while working on assignments</td>
<td></td>
</tr>
<tr>
<td>Access to computer resources</td>
<td>Peer support and available resources were analogous.</td>
</tr>
<tr>
<td>Help from peers</td>
<td></td>
</tr>
</tbody>
</table>
Table 45

Project Grades Topics Mapped to Emergent Themes

<table>
<thead>
<tr>
<th>Identified Topics</th>
<th>Emergent Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical thinking during projects</td>
<td>Projects held students’ interest requiring critical thinking while employing prior knowledge.</td>
</tr>
<tr>
<td>Struggles during projects</td>
<td>Equivalent focus was maintained by students.</td>
</tr>
<tr>
<td>Distractions while working on projects</td>
<td>Online students chose a learning environment in which they could be successful.</td>
</tr>
<tr>
<td>Weight of project grades</td>
<td>Adequate timely feedback was provided by teachers.</td>
</tr>
<tr>
<td>Struggles during projects</td>
<td></td>
</tr>
<tr>
<td>Feedback during projects</td>
<td></td>
</tr>
</tbody>
</table>

Table 46

Test Grades Topics Mapped to Emergent Themes

<table>
<thead>
<tr>
<th>Identified Topics</th>
<th>Emergent Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sections of the test</td>
<td>The same tests were given.</td>
</tr>
<tr>
<td>Sections of the test</td>
<td>Tests were delivered is the same fashion.</td>
</tr>
<tr>
<td>Academic integrity</td>
<td></td>
</tr>
<tr>
<td>Studying for the tests</td>
<td>Test preparation was the same.</td>
</tr>
<tr>
<td>Effort due to choice of instructional mode</td>
<td></td>
</tr>
<tr>
<td>Academic integrity</td>
<td>Similar motivational factors maintained the honor code.</td>
</tr>
<tr>
<td>Effort due to choice of instructional mode</td>
<td></td>
</tr>
</tbody>
</table>