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The Relationship of Demographic and Academic Characteristics on Student Academic Success Rates When Using Web-Based Delivery Modalities

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ABSTRACT

Online distance education classes and digital learning tools offer substantial advantages to both students and universities. Institutional benefits include the facilitation of student success in large classes, reducing university expenses, and perhaps even enhancing the students' learning environment. Students benefit from the convenience of scheduling and reduced travel time and many researchers found no significant difference in student learning outcomes between face-to-face classes and online classes on an aggregate or summative level. However, other researchers question the academic success of some students enrolled in online classes based on certain demographic and academic characteristics, such as age, gender, ethnicity, socio-economic status (SES), and grade point average (GPA). Despite the role demographic factors may play in learning outcomes, limited research is available investigating whether the online learning modality is equally effective for students of different ages and ethnicities, men as compared to women, and previously high performing and low performing students.

Much of the research related to online learning has limitations falling into two primary categories: studies comparing primarily face-to-face courses with online classes without including the analysis of hybrid learning; and studies that examine student outcomes at the aggregate level of success without outcomes broken out by specific demographic and academic characteristics. This research sought to remedy these important gaps by examining student learning outcomes in hybrid and online accounting classes based on demographic groupings. This study evaluated whether students' demographic and academic characteristics, (i.e., their age, gender, race/ethnicity, SES, and GPA) mediated whether they were as successful in online versus hybrid classes.

The most salient finding revealed in this study was the contrast in the students' performance based on delivery modality. The results indicated that students earned almost 30 points higher in their final scores when they were enrolled in the hybrid classes in contrast to enrollment in the online classes. This difference in student scores based on delivery modality was found in almost every student demographic.

Keywords: digital, online, hybrid, web-based instruction, self-regulated learning.

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CHAPTER I

Introduction

Over the past twenty years universities have experienced tremendous financial and organizational challenges, including direct competition from private, for-profit schools that feature fully online instructional delivery modalities and hybrid web-based instruction. Degrees from these for-profit universities have gained greater acceptance by students, educators, employers, and the general public. One of the key ways which for-profit universities have used to compete with traditional brick and mortar institutions is the flexibility that the online or hybrid (i.e., partially online and partially face-to-face) classes offer students who are juggling school, work, and family. Online classes offer substantial advantages to both students and universities alike. Digital learning tools allow students to select the time and location they wish to learn; this is an especially important feature for students who are working as well as attending classes. Likewise, online and hybrid courses help universities reduce expenses (e.g., investments in buildings) and manage larger classes (Allen & Seaman, 2008, 2010). This financial incentive makes online learning attractive to university administrators who must balance tight budgets.

Online learning is not the exclusive purview of for-profit universities; public and private institutions have adopted online learning as well. Traditional brick and mortar university faculty consider technology important in students' education; however, fewer of their classes tend to be offered in a completely online modality. Even though public universities may not have embraced online classes as completely as for-profit universities, Sloan-C (2008) reported that over 20% of American college students were enrolled in at least one online course. In the context of perceived benefits for both students and

institutions of higher education, understanding how online classes work – and if all students benefit equally from the increasing availability of online learning – is increasingly important.

As with many technological innovations, the adoption of web-based instruction by institutions of higher education is neither a panacea nor a curse. During this period of rapid technological innovation, universities are also being mandated to focus on student learning outcomes and completion (Obama, 2012). Questions remain about the quality of the online courses offered as measured by student learning outcomes (Katz, 2013b; Dowling, Godfrey, & Gyles, 2003; Boyce, 1999; Potter & Johnston, 2006). University officials and faculty do not appear to be convinced that online classes are identical to in-person or hybrid classes since many institutions continue to offer courses in face-to-face and hybrid, as well as online modalities, allowing students to continue to have the option of interacting on a personal level with the instructor in class. Because of this emphasis on student outcomes, the current proliferation of online learning, and the increasing competitive pressure from for-profit schools, educators and administrators struggle to understand how the fast-paced adoption of web-based instruction (WBI) affects student academic outcomes in online classes.

Given the benefits online learning offers both universities and students, coupled with the rapidly growing popularity of this learning modality, understanding whether all students benefit equally from the shift to online learning is increasingly important. Some evidence has indicated that online classes are equal to or can even improve student performance compared to traditional face-to-face classes (Arbaugh, Godfrey, Johnson, Pollack, Niendorf, & Wresch, 2009; Bernard, 2004; Katz, 2013b). The challenge is that

many of these claims are based upon academic outcomes at the aggregate level between online and face-to-face classes. What is less understood, and critical for university administrators and faculty to know, is whether students' personal characteristics (e.g., their background, their race/ethnicity, and their grade point average [GPA]) influence whether they succeed in an online environment. Additionally, because of the rapid transition from completely online to the adoption of hybrid classes, researchers must be prepared to evaluate online and hybrid modalities of instruction.

Statement of the Problem

Traditional learning pedagogy dictates that higher education students need face-to-face time with the instructor in a classroom to advance the learning process (Enoch & Soker, 2006; Virtanen & Nevgi, 2010). As online courses have become more prevalent in academic institutions and in society (Allen & Seaman, 2008, 2010), education researchers (e.g., Enoch & Soker, 2006; Virtanen & Nevgi, 2010; Means, Toyama, Murphy, Bakia, & Jones, 2009; Moe & Chubb, 2009; Dellana, Collins, & West, 2000; Sullivan, 2002) have studied the effectiveness of online or digital learning but have failed to reach consensus, noting differences in learning success. Some studies that have investigated the influence of online learning methods in both fully online classes and face-to-face/hybrid classes have found no significant difference in student performance compared to traditional face-to-face classes (Russell, 1999; Brownstein, Brownstein, & Gerlowski, 2008; Arbaugh et al., 2009; Dutton, Dutton, & Perry, 2013). Some researchers who have analyzed the effectiveness of WBI even claim that student success in online learning is not only equal to face-to-face learning, but that it is better than the face-to-face classroom learning. Their research indicated that the online-enrolled students' class average on earned grades was higher than

students' grades in face-to-face courses (Sullivan, 2002; LeBlanc, 2013; Navarro & Shoemaker, 2000). Furthermore, historical research suggests that throughout the history of distance education from the early 1900's to the present, adoption of technology seems to neither improve nor damage student performance (Russell, 1999). In *The No Significant Difference Phenomenon*, Russell (1999) provided a certain level of confidence for faculty in their decision to adopt online learning tools for both the online and the hybrid classes by suggesting that over a 50-year period there have been no significant differences in student performance outcomes due to technology delivery modalities. Russell's report is an exhaustive, comparative research bibliography on technology for distance education from 1928-1998, wherein Russell found overwhelming evidence that the adoption of technology did not diminish nor improve student performance. Based on his collections of over 355 research reports, coupled with the consensus of Russell's subsequent research findings, other educators support the claim that there is not now, nor will there ever be, any significant difference in student achievement with the implementation of any WBI and digital technology (Russell, 1999, 2015; Brownstein et al., 2008; Arbaugh, 2000b; Arbaugh et al., 2009). Russell and his supporting colleagues continually update their NSD findings on the website http://www.nosignificantdifference.org/.

Despite the seeming consensus that online education produces equally good results on the aggregate level, other researchers (e.g., Losh, 2003; Coates, Humphreys, Kane, Vachris, Agarwal, & Day, 2001) have argued that although past research has indicated that there was no significant difference at the aggregate level, some culturally diverse groups or students with different demographic and academic characteristics may have more challenges adopting technology tools. Some racial/ethnic minorities, students from

economically disadvantaged backgrounds, or students from diverse cultural backgrounds may not perform as well in online classes as with in-person or hybrid classes. Thirty-nine percent of U.S. college students are classified as an ethnic minority and over 80% of full-time, first time students are categorized as low income socio-economic status (SES), as designated by receipt of federal aid in the form of a Pell Grant (http://nces.ed.gov/fastfacts/#). Furthermore, it has been shown that female college students may not be as technologically proficient in Internet usage as males (Losh, 2003; Miyazoe & Anderson, 2011; Nejad & Hajiheydari, 2012). Despite the concerns that not all students may benefit equally from online education, a comprehensive and empirical analysis of the role that demographic factors (e.g., gender, age, race/ethnicity, SES, and past academic performance) play in student performance in online classes is still lacking. Almost all studies have focused on performance at the aggregate level, not evaluated by demographic variables.

According to Russell (1999) research on web-based instruction has universally indicated no significant difference between academic outcomes for students enrolled in online and face-to-face classes at an aggregate or summative level. In other words, the students' class average on the scores earned is no different, with the emphasis being on final scores, when a class is taught online or face-to-face. However, concerns have been raised about whether online instruction works well for all students. What is missing in the literature is whether different subpopulations or students with different demographic and academic characteristics learn differently when enrolled in classes using online delivery modalities. Because the studies of student outcomes between online and face-to-face classes have been researched primarily at the summative level, there continues to be a lack

of understanding of student performance based on various demographic groups and specific variables such as gender, age, race/ethnicity, and SES. This research fills this important gap by disaggregating student performance by demographic factors and student characteristic of GPA.

Furthermore, research related to college student outcomes in classes that use WBI and face-to-face instruction over the last twenty years has focused primarily on the comparison of the two distinct modalities: online classes versus face-to-face classrooms. Research comparing classes using these two delivery modalities has found that neither modality improved nor diminished student academic outcomes on an aggregate level—with numerous studies indicating no significant difference between the two (Russell, 1999). However, one of the most common approaches to teaching online classes today is the *hybrid* method, in which the course is a combination of in-person and online; this modality has been largely overlooked in the literature. It is only within the last decade that research (e.g., Jones & Chen, 2008; Larson & Sung, 2009; Brown & Liedholm, 2002) has shifted to include analysis of online and hybrid classrooms, not just online and face-to-face classes. Further research is needed to fully understand the impact of hybrid classes on student academic performance.

Interestingly, departments in colleges of business have often led the way in strategically adopting technology in their teaching. However, Arbaugh et al. (2009) argued that there is a dearth of research comparing student academic success by instructional delivery modalities in business classes, thus making any type of conclusions regarding student academic success and digital learning impossible in the various business majors. While examining online and hybrid instructional delivery modalities in accounting and

business classes, Arbaugh et al. found only nineteen studies focused on accounting classes and most of those were written as the instructor's narrative of the online classroom experience, not research based on student success or academic data. According to these studies, business school research of online instruction follows a similar pattern of including best practice recommendations, the influence of prior online experience on student outcomes, the level of support the faculty receive to develop and teach online, and how they developed the skills to teach online (Arbaugh, DeArmond, & Rau, 2013). Insufficient research has focused on the role of online education in accounting classes specifically, and much of this research has been qualitative descriptions of an instructor's classroom experience rather than the empirical evidence needed to make robust conclusions about the efficacy of online learning in accounting classes (Arbaugh et al., 2009). Further research is required to empirically document the impact of delivery modality on student outcomes in business classes.

In summary, there are three important gaps in the literature. First, since most empirical research about online learning modalities has examined primarily aggregate outcomes rather than including individual student level data, the possible impact students' demographic characteristics may have on their academic performance in online classes has been overlooked. This is a particularly important issue given the importance of ensuring that students from disadvantaged backgrounds, ethnic minorities, and non-traditional age students are able to benefit equally from the opportunities a college education provides. Second, very little research has investigated the differences between hybrid and online classes focusing instead on fully face-to-face and fully online modalities. Since hybrid classes are increasingly common, further research is needed to understand the impact they

have on student performance. Lastly, little empirical research has been done on business classes in general and accounting classes specifically; since there are substantial differences in pedagogy between different fields it is important to base decisions about class modalities on research in that specific field (in this case accounting) rather than on more generalized research. The research presented addresses all three of these gaps in the literature.

Purpose Statement and Research Design

The purpose of this study was to compare the academic learning outcomes of undergraduate students enrolled in an introductory accounting course between hybrid and online delivery modalities and to examine academic learning outcomes based upon select demographic and academic characteristics of the students. This research examined how demographically diverse groups of students performed with new digital technologies and online learning tools using adaptive learning software. The study examined differences in the academic performance of students enrolled in introductory accounting classes that were delivered with online and with hybrid modalities and taught by the same instructor for a period of four years.

This quantitative study utilized statistical analysis tools such as Analysis of Variance (ANOVAs) and linear regression to evaluate differences in undergraduate student outcomes grouped by demographic and academic characteristics of gender, age, race/ethnicity, and SES. The following questions guided this quantitative analysis:

1. Are there differences in student mean scores, as measured by selected academic progress variables, when student groups are established for those enrolled in online or hybrid instruction and broken out by demographic and academic variables?

Academic progress variables:

- Practice assignments
- Homework
- Tests
- Final class score

Student variables:

- Gender
- Age
- Race/Ethnicity
- Socio-economic status
- Grade point average

2. To what extent can students' final scores be predicted from the student demographic and academic variables?

3. Are there relationships among the various measures of academic progress? Measurements include scores from selected activities: practice assignments, homework, tests, final class score and student GPA.

4. Given knowledge derived from Question #3, what additional information can be gained from knowledge of selected academic variables in predicting final class score?

Based on the evidence from the literature, it was hypothesized that there would be no significant difference in average scores between the online and hybrid classes, but that demographic variables would impact students' relative performance in online versus hybrid classes. Based on existing literature, it was expected that low-income students would perform relatively worse in online classes than in hybrid modalities, and that older students

would perform relatively better in online classes than in hybrid classes. Finally, it was anticipated that males and white students would perform better in online classes.

Significance of Study

As funding is always a consideration for university administrators, and technology allows larger classes to be taught online, academic administrators may turn more readily to mass education using digital learning tools. Yearly, there is increased usage of both online and hybrid modalities in higher education classes. Regarding business classes specifically, WBI has become an important part of a business student's education. Understanding any difficulties that might arise based on demographic differences is imperative. If educators are to serve all students equally by providing a quality and convenient education, they must inquire about and recognize any possible disadvantages online instruction may impose on some students (Dowling et al., 2003; Baxter & Thibodeau, 2011; Potter & Johnston, 2006). In particular, it is important to investigate the possibility that online education is challenging for already marginalized students (e.g., racial/ethnic minorities or students from low SES backgrounds). If this were the case, then online education might be reducing access to higher education for historically disadvantaged populations rather than expanding it.

This knowledge of differences among students based on specific demographics and characteristics will assist administrators and faculty in developing courses that allow universities to serve more students while incorporating the convenience of online classes, and provide a best fit to student learning while continuing to provide a high quality education. Instruction appropriate to the learner, whether that includes a face-to-face component or not, will prepare students to meet a digitally diverse world when they

graduate and enter their business profession. Critical to educators, these findings will contribute to our understanding of student learning outcomes in online and hybrid accounting classes.

Background

The university under study is a medium-sized land grant university. At the time of the study, over 15,000 students were enrolled in nine colleges, including a College of Business which offered nine departmental programs of study. The university is one of the Top 120 universities in America for funded research according to the Carnegie Foundation and is ranked by U.S. News & World Report as a Tier I Public University. The university offers more than 200 online courses each year through which students, regardless of geographical locations, personal circumstances, and scheduling challenges, can earn credits towards their degree, as well as obtain entire selected degrees, minors, and certificates through an online modality. WebCampus, the university's digital learning management software, is utilized in two thousand courses. According to Katz (2013a) students enrolled at the university under study appear to be willing and eager to try online learning; from 2001 – 2009 there was a 100% growth in online enrollment and 5,500 students took at least one online class, equaling over 30% of the university student population.

The faculty in the College of Business under study adopted WBI fairly early, incorporating digital tools and using campus-wide learning management systems such as WebCampus and Black Board. The faculty in the Department of Accounting combined online homework, adopted textbooks with digital accessibility, and assigned web-based assignments as early as 2005. The College of Business requires all potential business students to pass the introductory accounting course prior to entry into the degree program

and 550 to 750 students enroll in this class each year; approximately 30% are online students and 70% enroll in the hybrid sections. Due to this high level of enrollment, heavy workloads of faculty, and apparent acceptance of online learning and homework assignment tools by students, digital tools had been used in these online and hybrid classrooms for over eight years at the time of this study. The use of the tools became increasingly prevalent as textbook companies provided additional assignments in learning software.

Mirroring the practices of Dowling et al. (2003) and Baxter and Thibodeau (2011), faculty members in the Department of Accounting, Cossitt and Birk, encouraged students to become familiar with accounting and Internet technology. Because the study of accounting is very technical in nature, the classes are ideal for implementing WBI (Dowling et al., 2003; Boyce, 1999). The accounting faculty who had taught the introductory accounting course for over twenty years intentionally adopted textbooks which included significant digital learning and testing tools. The instructors incorporated a large online component into their classes (Cossitt & Birk, personal communications January 5, 2011).

In 2010, these long-term instructors, Cossitt and Birk, collectively, adopted a new type of digital learning technology called intelligent or adaptive learning software, which allows students to work at their own pace and to review the text materials repeatedly in a manner similar to automated flash cards (Cossitt & Birk, personal communications January 5, 2011). The adaptive learning software, Connect®, repeats the concepts and questions in the digital platform until the student masters the materials. The software program is able to recognize individual student difficulties and repetitively focus students' attention on areas

that pose a challenge for them. All assignments, homework, and exams are conducted and graded by the digital tool. Online and hybrid classes use the same self-regulated tools; the distinction is that students in the hybrid classes also attend face-to-face lectures twice weekly. Until Fall 2013, the Department of Accounting offered seven sections of Financial Accounting (ACC 201) each semester—six hybrid classes and one online course.

Recognizing the apparent success and students' acceptance of the digital tools, the number of introductory accounting classes was reduced during the Fall 2013 semester, offering only one hybrid class and one online class, thus increasing the number of students in each class and reducing the number of teaching faculty. Assuming that no student academic outcome differences between the hybrid and online classes exist, it could be argued that there will be no need to continue offering face-to-face lectures for the hybrid classes. Hypothetically, all class sections could ultimately be taught entirely online using the digital tools and adaptive learning technology. However, because not all students may be comfortable with digital and web-based learning tools, and because a hidden digital divide may still exist among college level accounting students, research continues to be needed to ensure that the classroom environment allows for student success based on factors other than demographic traits such as gender, age, race/ethnicity, or SES.

Limitations of the Study

This study evaluated student outcomes among demographically diverse business students in the Accounting 201 classes taught at the university and compared hybrid classes to online classes. The study was limited to undergraduate students who took an online or hybrid accounting class in 2011, 2012, 2013, and 2014. As this study was conducted on

undergraduate students at a public university, the results may not be generalizable to students in different contexts.

Another key hypothetical limitation of this research is that since students were allowed to select into either the hybrid section or the online section, students who knew that they would perform poorly in an online class may have self-selected into the hybrid section. It is thus impossible to eliminate the possibility that online classes may not work as well for all students as it may appear. This slight selection bias did not influence the validity of the analysis of what role student characteristics played in their academic success, but simply suggests that any lack of difference between academic outcomes in hybrid and online classes cannot prove that converting to only online classes would not harm any student.

Definition of Terms

The following terms are defined for the purpose of this study.

Digital and Online Learning – classes that are facilitated by computers and digital technology.

Digital Divide – the differences in knowledge and usage of the Internet and digital tools creating separate populations who are familiar and unfamiliar with the tools, with those having knowledge usually having an advantage.

Digital Technology – technology that provides for information to be converted into electronic format for dispersal through electronic devices such as computers.

Distance Education – learning, where the instructors and the students are separate through space and/or time; almost always separate in space but not necessarily separate in time.

Face-to-Face Classes – traditional classrooms where the students and teachers both meet at the same time, in the same location.

Grade Point Average – student's grade point average upon enrollment in the class.

Hybrid Classes – classes which are a combination of online and face-to-face; often with the inclusion of face-to-face lectures that the student attends.

Information Poverty – a state of lacking in necessary information.

Learning Management System – the software infrastructure that a university employs to assist with digital learning.

Pedagogical Methods – refers to specific components and processes that an instructor can use to facilitate learning.

Online Classes – classes where the students and teachers never meet face-to-face; all learning is facilitated with the use of digital learning management system, e-books and digital learning tools.

Resource Materials and Information – documents and knowledge received from classes.

Self-regulated Learning (SRL) – learning that is guided by the learner; self-paced; self-directed.

Web-based Instruction (*WBI*) – classes that are facilitated by computers and digital technology.

Summary

Chapter I provided an overview of the study regarding digital learning tools, their benefits, and the concerns that some faculty and researchers still have regarding the quality of the classes and student learning outcomes. Overall, university faculty and administrators

need a better understanding of how students' backgrounds impact their performance in online and hybrid classes. Using quantitative analysis tools, this research was designed to compare student academic outcomes between online and hybrid instructional modalities based on the select variables of gender, age, race/ethnicity, SES, and GPA.

The basic question underlying this research was whether characteristics, such as gender, age, race/ethnicity, SES, or GPA are associated with better student academic outcomes in online classes. If not, this would provide strong evidence that online classes are equally effective for all student populations and provide university faculty with a level of confidence regarding student learning outcomes and success using only the online delivery modality. The argument could easily be made that if there are no student outcome differences found at the aggregate or summative level, and there are no differences found at demographic variable levels, all introductory accounting classes can be taught online in future course offerings.

Chapter II is a review of the literature pertaining to student success in online, face-to-face, and hybrid classes. Chapter III provides the details of the methodology of the research. Chapter IV presents the findings of this quantitative study. Finally, Chapter V provides a discussion of the findings, implications for practice, recommendations for future research, and the conclusion of the study.

CHAPTER II

Literature Review

The adoption of online learning classes or web-based instruction (WBI) in recent years could be described as explosive; the rapid implementation of digital tools is found particularly within institutions of higher education. The development of best practices for instruction using the Internet has been the focus for many college faculty: *how do I teach effectively in an online class?* However, by exploring specific pedagogical techniques and recommendations for learning, research studies have also introduced questions regarding student academic success, motivation, and self-regulation; these studies have ultimately created some dissension among educators. The current conversation among faculty and administrators regarding WBI indicates that there are three primary *camps* of belief: those that uniformly believe that there is no significant difference in learning success with WBI; those that believe learning should include time for personal interaction as provided in face-to-face and hybrid courses; and those faculty members that believe that the studies are inconclusive due to the severe limitations of the current research methodologies.

The purpose of this study was to compare the academic learning outcomes of undergraduate students enrolled in an introductory accounting course between hybrid and online delivery modalities and to examine academic learning outcomes based upon select student demographic and academic characteristics of the students. This chapter provides a review of the literature regarding WBI, the digital divide, and factors affecting college student academic learning outcomes in online instruction. The chapter is divided into seven sections. Following this introduction to WBI research, the first section presents a historical context of the development of distance education and WBI; the second explains

the three modes of instructional delivery used by higher education faculty. The third section discusses issues of the digital divide, the *no significant difference phenomenon*, student self-selection, and drop rates. The fourth section presents interactivity, learning communities, Massive Online Open Courses (MOOC's), and adaptive learning software (ALS); the fifth is a brief review of student motivation and learning styles research. The sixth section is comprised of studies that have examined student success based on select demographic and academic characteristics, followed by the final section which is a short summary of the chapter.

Historical Context

Distance education has long been a cornerstone for reaching and educating all peoples in the United States (U.S.), fulfilling educators' motives of providing opportunities for all students regardless of geographic location (Rose & Meyer, 2002; Selwyn & Gorard, 1999). Some of the first distance education classes in the U.S. were correspondence courses provided by Anna Ticknor, generally recognized as the mother of distance education. In 1873, she began a non-degree granting correspondence school for young ladies, The Society to Encourage Studies at Home (Agassiz & Eliot, 1897; Bergmann, 2001). During the 19th and 20th centuries several universities and colleges created correspondence classes and degree programs that were distributed either through the mail, the radio, or later television. In his extensive review of the history of distance education, Russell (1999) concluded that these efforts were relatively successful.

The development of the personal computer in the 1980's and the World Wide Web in the 1990's transformed the manner by which people obtained and shared information. Kim and Bonk (2006) contended that this dramatic improvement in technology allowed the

development and rapid adoption of online distance education or WBI by faculty and students. The mass introduction of personal computers, coupled with the ability to connect electronically through the Internet, allowed students to access classroom materials through digital downloads. Technical components became so readily available that classroom learning management software for distance education was developed and has subsequently proliferated (Alden, 1998; Conrad & Donaldson, 2004; Picciano, 2001; Schrum & Berenfeld, 1997).

Many of the early efforts in technology-based distance education focused on developing an appropriate pedagogy. Simply providing content, consistent with earlier correspondence courses, was considered inadequate for online computer classes (Conrad & Donaldson, 2004; Alden, 1998; Boyce, 1999). Resources, recommendations, guide books, and best practices were created for instructors who wanted to take advantage of the digital tool features (Conrad & Donaldson, 2004). As distance education evolved and course content became available through digital tools, three interrelated things happened in higher education: (1) online courses quickly became established, thus providing purportedly effective education to students, perhaps even displacing face-to-face classes; (2) a proliferation of research occurred comparing traditional and online courses; and (3) discussions about the potential of the digital divide erupted.

Publically funded higher education institutions strive to provide access and learning opportunities to non-traditional students—those living in geographically remote areas, students with family and financial responsibilities, and other students who do not fit the stereotypical definition of college students, ages 18 to 22. While many educators were engaged in developing pedagogical approaches that could capitalize upon technological

advances, the concern regarding providing access to these students erupted; the concern and subsequent debate became known as the digital divide. When educators began adopting WBI and digital tools, older students and working adults were assumed to be the immediate beneficiaries. Some advocates of WBI claimed that using the digital tools would provide these traditionally underserved populations an opportunity for education that they might not ordinarily receive (Moore & Anderson, 2003). Other educators, however, were concerned that these digital tools were not equally accessible to all students and that many students, traditional and non-traditional alike, were at a disadvantage with the increasingly rapid implementation of digital technology (Enoch & Soker, 2006; Harper, 2003). Most of the concern for the digital divide was based on socio-economic and geographical differences among students. The concern was that students who were disadvantaged economically and/or geographically (e.g., inner-city and rural students) would fall further behind because of the lack of access to computers and the Internet. Concerted efforts by philanthropic organizations as well as state and federal governments were undertaken to ameliorate the digital divide based strictly upon access (Bucy, 2000; Attewell, 2001).

Distance education using WBI or online learning is now available through most higher education institutions, both private and public. Seventy to seventy-five percent of colleges offer online classes and include some form of WBI as integral to their strategic future; over one-third of college undergraduates nationwide have enrolled in at least one online class (U.S. News, 2011; Sloan-C, 2008, 2010). Web-based instruction provides benefits for both the students and the institution, including more convenience from flexible scheduling and minimized travel. Adult students, including traditional undergraduates,

prefer distance education over campus-based approaches because of the convenience, flexibility, and adaptability to individual students' needs (Holmberg, 1986; Gagne & Shepherd, 2001).

The new digital technology is also revolutionizing the educational system. A vast number of virtual schools have been created with full online programs for undergraduate and graduate students, as well as for both traditional and non-traditional students. Institutions such as University of Phoenix, DeVry University, and Western Governors University have implemented online learning and students are attracted to these institutions because of the convenience and flexibility of their online classes. As a result, these three schools have transitioned to primarily an online education format. In other institutions, increasing undergraduate student enrollment in online classes has continued at unprecedented rates (Sloan-C, 2013). Competition for students, compounded with the fact that virtual classes reduce the need for additional construction and maintenance of buildings, has driven universities to review their long term strategy and commitment to WBI (Katz, 2013a; Sloan-C, 2013).

Historically, the general populace and most educators considered correspondence education and distance learning to be inferior to face-to-face instruction. They insisted that a true education is comprised of many factors. The absorption of material and information (i.e., content) is a given; however, the interaction and connectivity with instructors and other students have always been considered of equal importance (Agassiz & Eliot, 1897; Bergmann, 2001; Moore, 2005). As WBI emerged in the 1990's, Boyce (1999) was adamant that computer-assisted teaching could never replace the classroom, "it is clear that

the computer cannot completely supplant the need for traditional face-to-face teaching methods..." (p. 194).

Although many educators are receptive to online learning, a few educators harbor a personal bias against online or distance education and others are troubled with the issue of quality and effectiveness of distance education (Facer & Furlong, 2011; Gipson, 1997; Shachar & Neumann, 2003; Sloan-C, 2008; Katz, 2013b). Faculty members are apprehensive that as online learning becomes more prevalent in academic environments, additional issues will arise about the effectiveness of distance learning. Faculty are particularly concerned about student preparedness, quality of coursework, the lack of instructional and developmental assistance, not to mention what happens when connectivity and interactions are lost (Katz, 2013b; Sloan-C, 2013).

Modes of Instructional Delivery

There are three primary modes of delivery for instructional coursework in higher education: face-to-face, hybrid, and online. A primary distinction between these three modes is the amount of interaction or *touch* between the instructor and the students. The traditional face-to-face classes, where students physically see, talk, and connect with the instructor, are considered *high touch*. The students attend class, participate with other students, and are an integrative part of the classroom environment. Hybrid classes allow students to perform most of the requirements for the class as independent or self-regulated learners who use digital tools; however, students still attend lectures or classes to receive the instructor's explanation of class materials and/or engage in discussions about the content that was learned independently. This type of learning is viewed as *low touch;* the students tend to work somewhat independently, but interact with other students and

instructors when attending lectures or discussions. Online classes, where students perform all learning activities without the direct connection of the faculty member, are described as *zero touch*.

In addition to the degree of touch, another facet of WBI that applies to both hybrid and online courses is the timing and method of interaction—asynchronous and synchronous. Initially, digital classes used asynchronous technology which is a mode of online delivery where participants access course materials on their own schedule and students are not required to be together at the same time with each other or with the instructor. Message board forums, email, and recorded video are examples of asynchronous technology. Emails are usually directed to a specific person(s) whereas board forums are digital areas where students may leave a message, a comment, or a question for multiple students. Recorded videos may present lecture material or other conversations regarding course resources. For many years, asynchronous learning dominated the educational online system; it was basically a method to transfer materials and information in a manner similar to how postal carriers delivered materials for correspondence schools. Online communication was, until recently, simply written correspondence using digital tools.

Video and online classroom tools are now taking distance learning in a new direction: real time synchronic presentations. Synchronous technology is a mode of online delivery whereby all participants are present at the same time, thus requiring scheduled interactivity as a course component. Web conferencing, an example of synchronous technology, is a video that takes place *live* at a certain time when the students log into the learning management system to watch, listen, and participate in the presentation.

As technology has changed, the digital tools and classroom management tools have improved for both synchronous and asynchronous classes and many courses use both approaches to timing and interaction. Written communications can now be in group chat rooms and discussion boards where student groups can be assigned to work simultaneously on a project. Students can communicate through the written word and also through verbal communications. Many online classes currently consist of both written and verbal communication, depending on the preference of the instructor and the best pedagogical method for the class being taught.

Instructors of online classes, both synchronous and asynchronous, can combine a variety of modalities including teleseminars, webinars, audio and visual informational sessions, digital magazines, newsletters, articles, discussion forums, and regulated access to participants to improve the student learning. Teleseminars can be offered as an audio digital file that can be downloaded to a computer, phone, MP-3 player, or digital notebook; students listen and review the content at their convenience. Other audio and video tools are built into the learning management system and assist instructors in conveying the materials to the students. Discussion forums provide the opportunity for groups to meet and exchange ideas about concepts and share responses with others.

Because of the concern for the loss of connectivity in online and hybrid classes, interactive online learning platforms have been created (Conrad & Donaldson, 2004; Alden, 1998). There are numerous ways to create online interaction in online and hybrid classes. According to student comments from research surveys (Schrum & Berenfeld, 1997; Leblanc, 2013; Torrens, 2007), the familiarity resulting from such online interactions (i.e., student-to-student and student-to-instructor) enhances the learning environment as

compared to face-to-face classes. Conrad and Donaldson (2004) argued that either of the asynchronous and synchronous tools can increase student interactivity or *touch* if built into the class properly.

At the other end of the spectrum are classes that require students to only engage with the instructional digital materials without interaction with either the instructors or other students. Enrolling in classes that are essentially self-taught, often with the help of intelligent or adaptive learning software, is now possible. Adaptive learning software, discussed further in Section Four, is a digital tool that allows the student to learn independently. With universities emphasizing competency-based learning outcomes, coupled with the ability of this adaptive learning software specifically to measure learning outcomes, it is not a far stretch to imagine universities solely adopting such digital tools for appropriate classes (Dowling et al., 2003; Baxter & Thibodeau, 2011; Potter & Johnston, 2006; Katz, 2013a; Sloan-C, 2008).

Digital Divide and No Significant Difference Phenomena

The concept of a digital divide in the U.S. is contested territory. When digital and computer technology was first integrated into higher education institutions and distance education programs with online classes, the tools were seen as a panacea providing access to all students. However, unforeseen consequences appeared regarding this assumed universal student access. Researchers and educators immediately recognized a *digital divide* based on geographical and financial limitations (Enoch & Soker, 2006; Holderness, 1998; van Dijk & Hacker, 2003, Attewell, 2001; Hafner, 2000; Harper, 2003; McConnaughey & Lader, 1998; Schiller, 1996; Walsh, Gazala, & Ham, 2000). Researchers have traditionally defined the digital divide as lack of access to the Internet

and digital information, including any distance education technology, learning management systems, and digital learning tools based upon location (i.e., rural and inner city) and personal financial resources (Bucy, 2000; Attewell, 2001). Even as of this writing, 30% of Americans did not have broadband access in their homes (Digital Trends, 2013; Bolognini, 2013; Connect Nevada, 2011). Broadband access to the Internet allows classroom materials to be downloaded quickly and easily. Furthermore, technology adoption by low-income residents in the state where this study was conducted was just 53% for broadband, and 27% of residents did not own a personal computer (Bolognini, 2013).

Because the Internet and other online learning technology have become available relatively free of charge at public schools, libraries, web cafes, economic development locations, and other public points of access, some researchers have argued that America no longer had a digital divide based on economic distinctions; rather the country may instead have a digital divide based on family usage, individual preferences, and adoption factors (Bucy, 2000; Attewell, 2001; Tripp, 2011). Indeed, researchers have increasingly broadened the relatively narrow definition of the digital divide from one that is limited strictly to geographical or monetary access to one of knowledge access, usage, acceptance, and performance based on gender, age, or ethnic demographic distinctions (Bimber, 2000; Dobosenski, 2001; Enoch & Soker, 2006). More recently, it has been suggested by Facer and Furlong (2011) that digital divide issues are actually based on individual choices, aptitudes, and skill levels, which are also affected by demographic factors such as gender, age, or race/ethnicity.

In contrast, other educators are dismissive about whether the digital divide even exists, regardless of the purported cause (Torrens, 2007; Moe & Chubb, 2009). Educators

continue to design and implement online classes and apparently do so successfully. Torrens (2007) found that online education was not only suitable for her subjective-style humanities class, but also provided student discussions that she described as richer and fuller than those that had occurred in a classroom setting; her students appeared to embrace this mode of delivery with no indication of a digital divide. Numerous other stories of online learning success abound (Russell, 1999; Arbaugh, 2000a; Brownstein, et al., 2008) including researchers who specifically claim that digital education is richer and fuller for students (Torrens, 2007; Sullivan, 2002; Means et al., 2009; Moe & Chubb, 2009).

Russell's (1999) compilation of over three hundred studies advised that delivery modality technology implementations over a span of fifty years have not changed student performance and that student outcomes are the same regardless of delivery modality; therefore, no differences should be expected with any technological implementation of additional delivery modality in the future. Odell, Korgen, Schumacher, and Delucchi (2000) also found that there was no digital divide among undergraduates at Florida State based upon their study of students' academic majors, study habits, and time spent online. These extensive results indicating no significant difference between online classes and face-to-face classes have commonly become known as the *no significant difference phenomenon*. Additionally, some researchers found that student outcomes in online classes were even better than compared to face-to-face (LeBlanc, 2013; Means et al., 2009; Moe & Chubb, 2009).

The no significant difference phenomenon suggests to some researchers that there is no digital divide and that student learning outcomes are not related to delivery modality. However, other researchers have suggested that the no significant difference research is

skewed due to two factors: self-enrollment or self-selection and student withdrawal rates. Self-enrollment describes how students who are early adopters of technology and digital learning tools self-select or enroll into the online classes; because they embrace technology in general, they tend to easily succeed in the digital learning environment. In contrast, students who are not digitally adept, financially able, or personally skilled do not enroll in online classes (Carr, 2000; Diaz, 2002). Student withdrawal rates occur when students who are unprepared for, but enroll in online classes drop during the semester due to poor performance. Although researchers acknowledge that the drop or withdrawal rate is higher in online classes than in face-to-face or hybrid classes, the final grade upon withdrawal has seldom been factored into student success research (Carr, 2000; Diaz, 2002).

While some are rejoicing that the digital divide is dead, there is no consensus that its demise is actually at hand, either socioeconomically or culturally (Korgen, Odell, & Schumacher, 2001; Connect Nevada, 2011). The digital divide associated with online learning is more complex than originally believed. Complexities in education often reflect inequalities based on socio-economic status, gender, and personal anxieties and personal preferences of technology use; these traits are inherent to individual users. Ultimately the essential issue in America is not access, but usage (Facer & Furlong, 2011; Haddon, 2000); demographic differences appear to affect usage. For instance, some educators assume that young people are *natural* users of the Internet and readily adopt digital technology; however Facer and Furlong (2011) argued that it is a fallacy to believe that all young people are uniformly accepting of technology and use digital resources equally. According to Facer and Furlong, digital information poverty continues to be based not just on accessibility, but on relevance, educational context, and interest generated through common

socio-ethnic and socio-economic patterns. The question asked by many researchers (e.g., Ashong & Commander, 2012; Bembenutty, 2007; Haddon, 2000; Jong, 2003; Hilton, 2006; Katz, Rice, & Aspden, 2001; Bolognini, 2013) is whether online classes provide easier access to education or whether they create additional barriers, *for whatever reason.* This remains a viable question for educators to ask.

Interactivity and Learning Communities

A pedagogical concept woven throughout the history of higher education is that the student sits at the foot of the master to learn (Woodring, 1975). Face-to-face classrooms, once considered essential for learning, included the interactivity of the student with the instructor and other students; this was believed to create learning communities (Boyce, 1999). Moore (2005) reported at the Sloan Consortium, an online education leadership conference, that Vodanovich and Piotrowski (2005) found many students still learn best through personal interaction with professors and students consistent with face-to-face classes. Vodanovich and Piotrowski found that WBI may not allow the same level of personal interaction and direct involvement with other students; the instructor-student interaction in WBI may be less personal or even lacking, thus affecting the student learning. Interestingly, Anna Ticknor, the mother of distance education in the U.S., attributed her 24 years of success to the fact that her volunteer correspondents always responded to the lady students not just with subject matter wisdom but also with wise counsel and friendly sympathy, a strong form of interactivity (Agassiz & Eliot, 1897; Bergmann, 2001).

Research of pedagogical issues suggests that the best online learning facilitates interaction not just between faculty and students, but also between students (Pauls, 2010).

Interactivity and the formation of learning communities in online academic classes are shown to be increasingly important (Connolly, Hodson, Graff, Jones, & Davies, 2003; Jackson, 1994; Pauls, 2010; Brandzaeg & Heim, 2013). Hybrid classes contain a strong component of interactivity with both the instructor and other students, whereas online classes may lack any interactivity other than with the learning management system or the software program. Moore (2005) reported at the Sloan Conference that The Pennsylvania State University World Campus's community website connects online students to the university and intentionally builds a learning community because student satisfaction is rooted in a learning community; this higher satisfaction results in higher student outcomes. Moore also reported that John Bourne, Executive Director of the Sloan Consortium, attributed social networks to improving online class retention. Individuals tend to form social networks and these networks increase communication among students, thus improve retention. Less isolation leads to a greater feeling of belonging and better student learning outcomes (Kolowich & Moore, 2005). Other researchers (Cappel & Hayen, 2004; Heckman & Annabi, 2005) found that interaction with other students while in a web-based class enhanced student performance and attitudes.

Arbaugh, DeArmond, and Rau (2013) found that the learner-instructor interaction was one of the strongest predictors of student learning. During a bibliographic review of WBI research in business colleges, Arbaugh et al. noted that many studies suggest that one of the primary variables for predicting course learning outcomes is interaction. Allan and Lawless (2003) further recommended that students in digital classes post personal pages that encourage the students to interact with each other, a necessary and required component of online learning.

Additional research has indicated that for online academic classes to be effective and for students to learn, students must be emotionally engaged either with the instructor, with other students, or both. The different combination of communication technologies that allow instructors and students to interact with each other is a key component in effective learning pedagogy (Alden, 1998; Conrad & Donaldson, 2004; Kim & Moore, 2005; Picciano, 2001). The State University of New York Learning Network (SLN) courses emphasize the importance of required interactions between student and faculty, and SLN continuously assesses student satisfaction, reported learning, interaction, and learning community formation to ensure required interactions are being met (Moore, 2005).

Because Internet technology tends to mirror general mass communication, most instructors struggle to keep individuals engaged and connected in online learning so that even when a class is dominated by self-study, each student does not feel alone and isolated (Holmberg, 1986; Conrad & Donaldson, 2004; Alden, 1998). To examine the assumption that online students feel isolated, and therefore perform poorly, Davies and Graff (2005) investigated the benefits of online discussions in digital classrooms in relation to student performance. They found that there was no significant correlation between the time that students spent communicating with class members or their instructor and their final grades. Conrad and Donaldson (2004) suggested that if instructors use best practices in their teaching and use interactive assignments, there will be no difference in student outcomes. In contrast, Davies and Graff (2005) advised that even *without* interactive assignments there were no differences in student outcomes and thus suggested that students do not require interaction in digital classes to succeed.

Interactivity and MOOC's. Most recently, Massive Online Open Courses (MOOC's) have polarized and confused the higher education community; some educational leaders believe that MOOC's are a harbinger of the future, whereas others question the rationale behind the pedagogical phenomenon (Educause Review, 2013). Massive Online Open Courses are online courses with unlimited enrollment, often drawing thousands of students from around the world. The purpose of a MOOC is to revolutionize access to educational topics and provide unprecedented admittance of students to online classes. Primarily hosted by large, prominent universities such as Harvard, Yale, and Duke, MOOC's are taught by internationally renowned experts. To understand how a student might experience a MOOC, this researcher enrolled in an online class in Medical Entrepreneurship through Duke University. The class had over 60,000 students worldwide. Although the materials, the recorded lectures, and homework assignments were adequate to learn the materials, the instructors, apparently in an effort to follow best practices in creating interactivity, developed group online discussions which were part of the grading criteria. Each student was compelled to comment on specific questions; additionally each student was required to comment on others' comments. Not all, but many students readily made more comments than were required for the grade component. Anecdotally, it appeared that some students had a significantly higher need for interactivity than others as evidenced by their several non-required posts and comments.

Interactivity and adaptive learning software. To further complicate the research of student success in online classes, many of the new digital learning programs and textbooks use no online communications between instructor and students and none between students and students. The classes are entirely self-regulated instruction with interaction

only between the student and the *intelligent* software. Competency-based, computerized learning programs are available; when faculty members adopt a textbook or e-textbook, many now include digital tools called intelligent or adaptive learning technology. No longer do students need to interact with the instructor or the other students; they interact solely with the software programs (e.g., Prentice Hall, McGraw Hill, and John Wiley & Sons Publishers).

Critics of online learning remain firm in their beliefs that by losing the actual personal connectivity of a classroom environment, students do not gain the full benefit of the learning experience (Jones, Scanlon, Tosunoglu, Morris, Ross, Butcher, & Greenberg, 1999). Evidence has indicated that while some students readily adopt the digital learning platforms, others may be at a disadvantage in non-classroom learning environments that rely upon digital tools (Jones et al., 1999; Dubois, 1996; Holderness, 1998; Parsons-Pollard, Lacks, & Grant, 2008). However, since much of the research comparing online and face-to-face classes was performed at the aggregate or summative level, it is difficult to extrapolate from aggregate student outcomes to student outcomes disaggregated into demographic groups.

Motivation, Satisfaction, and Learning Styles

Researchers are investigating additional issues, including student motivation and learning styles that may affect self-regulated learning, learning that requires students to take charge of their own learning process (Pintrich & Zusho, 2007; Pintrich, 1995). Since well-designed WBI can either intentionally or accidentally slip into the self-taught or self-regulated learning mode, some researchers are concerned that self-regulated learning will affect not only student satisfaction and motivation in courses but student success as well

(Dowling et al., 2003; Baxter & Thibodeau, 2011; Potter & Johnston, 2006). Research is still limited and inconclusive in regards to any conclusions that specific factors may or may not contribute to students' success outcomes.

Research specifically on student character attributes (e.g., learning styles, personality type and previous digital or Internet experience) has been explored. Virtanen and Nevgi (2010) examined student performance based on satisfaction and found no significant differences between genders; however, due to the limitations of their study they suggested further research into the students' self-regulation of learning. Similar studies by Ames (2003) and Fredericksen, Pickett, Shea, Pelz, and Swan (2000) found no significant differences in student attributes and self-regulated learning. The limitations noted by Niemi, Nevgi and Virtanen (2003) were also noted by Ames (2003) and Fredericksen et al. (2000); their studies were conducted predominantly at the aggregate level of comparison, not at a disaggregated demographic level.

Mupinga, Nora, and Yaw (2006) examined learning styles, expectations, and the needs of online students. Although they found that no specific learning style outweighed another among online students' success, their research led to the development of several crucial recommendations for online instructors: students need prompt and regular communication with professors; students need feedback on assignments, as well as a clear understanding of the professors' expectations. It must be noted that these needs are no different from students' needs in face-to-face classes. Kim and Moore (2005) confirmed the need for students to have prompt and regular communication with professors and recommended increased engagement and interactivity among all participants for successful online class participation. Other advocates of online learning have developed and

recommended pedagogy and best practices to create optimum learning environments for online classes (Bullock & Ory, 2000; Russell, 1999; Schrum & Berenfeld, 1997).

Neuhauser (2002) found that learning preferences and personality types played no role in student success and the effectiveness of WBI. In contrast, Kim and Schniederjans (2005) found that self-described creative and compliant students performed well in online Information Systems courses, but extroverted students had poorer performance. Additional studies noted differences in student motivation and self-regulation between undergraduates and graduate-level students; however, the results were mixed as to which personal traits affected success in online courses (Brown & Liedholm, 2002; Aly, 2013; Brownstein et al., 2008; Coates et al., 2001; Dellana et al., 2000; Grandzol, 2004; Klimek, 2012). At this time, there is no definitive determination of attributes, characteristics, and personalities that are related to student success in online classes.

In a study that measured student traits and success of accounting and MBA majors enrolled in online classes, Arbaugh (2000a) found that two factors ranked the highest for student success: personal interaction and student GPA. When reviewing the qualified studies conducted in business courses, Arbaugh et al. (2013) also found that although performance outcomes based on final grade were generally comparable, student attitudes and perceptions toward the delivery modality varied widely. Kim and Moore (2005) studied student satisfaction and found that for students to be successful, they must modify their view of learning by moving away from one of the student receiving information to one of self-regulation and self-motivation.

Demographic and Academic Characteristics

Besides the examination of personal interaction, learning styles, self-motivation, and personal satisfaction with web-based instruction there remains the concern that some demographic groups will not succeed in WBI as well as other groups. The study of how self-motivation, personality types, learning styles, and satisfaction affect student learning outcomes and final grades is elusive, perhaps due to the ethereal and intangible measurement of the students' traits. Other researchers have investigated how physical or measurable traits such as gender, age, ethnic demography, grade level in college, and GPA affect student success.

Gender studies. Researchers in classroom gender issues, Allan and Madden (2006), argued that many chilling behaviors directed at women may go unrecognized because they reflect socially established patterns. Their study found that classroom climates were important indicators, not only for women, but also for other disadvantaged groups. Allan and Madden suggested that questions such as whether young, white males have an advantage in online classrooms, and do they have an inherent advantage when digital learning technology is adopted in the classroom, and whether digital learning technology places non-whites and/or females at a disadvantage of which educators are unaware should be considered by all faculty, regardless of teaching modality. Research also indicates a level of credibility in these types of questions (Allan & Madden, 2006; Spender, 1997; Brown & Liedholm, 2002). Although comparative results in many studies consistently indicate no significant difference on an aggregate level between student outcomes of those enrolled in online versus face-to-face classes, there are also various studies (e.g., Bimber, 2000; Bucy, 2000; Attewell, 2001) that do indicate that there is a

difference in usage of Internet and digital learning technology by people in diverse demographic groups as distinguished by gender, age, ethnicity, SES and GPA. Bimber (2000) found a digital gap in online usage by gender and economic status; Bucy (2000) found there to be a digital divide based on Internet access by low income individuals, and Attewell (2001) noted potential digital divide in low income individuals.

Although Enoch and Soker (2006) claimed that America does not have a gender-defined gap, others have shown that the early adopters of Internet technology and computer science tend to be young, white males (Losh, 2003; Spender, 1997). Odell et al. (2000) found that although the gender gap in Internet usage had narrowed, differences still remained in how male and female undergraduates used the Internet. Morahan-Martin and Schumacher (1999) found male undergraduates possessed greater Internet skills and spent more time online than their female classmates. Kim and Moore (2005) found that although the gender of a student impacted student satisfaction of web-based courses, it did not affect student grade outcomes. Odell et al. (2000) indicated that while the demise of the gender gap may have been true for undergraduates, there was still a significant difference in the purposes for which students visit Internet sites.

While some studies (e.g., Anstine & Skidmore, 2005; Arbaugh & Rau, 2007, Larson & Sung, 2009; Arbaugh, et al., 2009) failed to find an effect between genders and online learning outcomes, other U.S. based studies found male students to be significantly more comfortable than females with computers and that males had higher Internet usage. In an early study, Kay (1992) found males used computers more frequently and had more positive attitudes toward computer use. Subsequently, Comber, Colley, Hargreaves and Dorn (1999) found more positive experience of males using digital tools than females in a

K-12 study. Even more recent research supported the previous findings that males were more positive about online learning than females (Ong & Lai, 2006). Likewise, males in both China and the United Kingdom were more self-confident about their computer skills than females (Li & Kirkup, 2007). Males also self-reported moderately more positive attitudes, higher self-efficacy, and more frequent use than females (Kay, 2008; Tsai & Tsai, 2010). In contrast, other studies have demonstrated that females were slightly more positive about online learning satisfaction and appeared to perform somewhat better on computer-related tasks (Bimber, 2000, Dobosenski, 2001; Gipson, 1997; Losh, 2003; Spender, 1997; Ashong & Commander, 2010).

Age. In one of the earlier studies comparing online and face-to-face classes, Guernsey (1998) found that 60% of online students in his study were older than their counterparts and had full-time jobs or families. These students all did well in his course; however, the younger students had difficulties, withdrew from the online course and tended to move to face-to-face classes. Moore and Kearsley (1996) also found that more online students were working adults, between the ages of 25 to 50; however, their research concluded that age did not necessarily predict success.

According to Coates et al. (2001) underclassmen were vulnerable to underperforming in online classes compared to face-to-face classes. They strongly exhorted educators to use caution when converting courses to WBI for younger students. Coates et al. also found that students who enrolled in online courses worked an average of 85% more hours than students attending face-to-face classes and the face-to-face students were more likely to be traditional college age of 18-22. They also found that the proportion

of older students taking online classes was ten times that of those taking face-to-face classes (Coates et al., 2001).

When evaluating demographic characteristics of students enrolled in online versus face-to-face classes, Brown and Liedholm (2002) found that there was no significant difference in students learning basic concepts; however, online classes were reported to be universally inferior when students dealt with complex materials typically taught in junior and senior-level classes as measured by final grades. Additional studies also found no significant difference among students based on gender, age, and even prior experience with online learning (Arbaugh, 2000b; Larson, 2002).

Race/ethnicity studies. Some researchers (e.g., Lu, Yu, & Liu, 2003) have claimed that student race/ethnicity may also predict performance by students. Wilson and Allen (2011) reported that African American students did not perform as well online as in face-to-face classes. Likewise, African American students' perceptions of online learning were reported to be less positive than Whites (Ashong & Commander, 2012; Hoffman & Novak, 1998); and Blacks used Internet tools less frequently (Sanger,1999). Tripp (2011) also found challenges for Latino students to access the Internet.

Contrary to these findings, van de Bunt-Kokhuis and Weir (2013) reasoned that any technical, language, and cultural barriers can be diminished in online classes. Maxwell and Shammas (2007) contended that most research is too atheoretical, diffuse, and contradictory to establish any set conclusions regarding ethnic students' online success.

Socio-economic status studies. There are relatively few studies examining the role of socio-economic status and online learning in higher education. An early report by National Telecommunications and Administration (1999) indicated that income played a

role in Internet use. Jaggars (2011) suggested that WBI hinders the progression of low-income students because they are more likely to be underprepared and to withdraw from the online courses. Unfortunately, her research also indicated that once students had difficulties with WBI, they were less likely to continue with subsequent course work in any modality.

Grade point average studies. Although Brown and Liedholm (2002) found no gender differences, they did find one factor that significantly affected student success, the student's GPA. A one point increase in GPA was associated with a 15% increase in their final examination score. Similar to Brown and Liedholm in their review of a business management class, Dellana et al. (2000), Arbaugh et al. (2002b); Arbaugh et al. (2009); Klimek (2012), and Wilson and Allen (2011) found that the singularly most important factor for success in WBI was GPA. Grade point average was the factor that was strongly related to success in both the online and face-to-face instructional modalities. Arbaugh and Rau (2007) and Larson (2002) also found that the success of students enrolled in online classes was based primarily on a student's GPA.

Research Related to Web-based Instruction in Colleges of Business

The majority of studies addressing the effectiveness of WBI have been in non-technical studies such as social sciences; these findings may have limited application to technical areas of study such as business and accounting programs (Arbaugh, 2005; Arbaugh et al., 2009; Bryant, Kahle, & Schafer, 2005). Furthermore, Arbaugh et al. (2009) lamented that research comparing student success in online versus face-to-face or online versus hybrid courses in business classes is relatively limited in scope. Accounting courses are technical in nature, requiring students to organize and learn factual materials in a

methodical and logical manner. Homework is assigned and problems are used to allow the students to see how they are progressing. Arbaugh et al. (2009) argued that although the technology used for WBI should allow for effective learning in the accounting classes and that these classes should provide a perfect medium for research, many business instructors have been unrewarded or discouraged from conducting such research.

In early online research, Odell et al. (2000) found that the choice of academic major and personal study habits influenced the amount of time undergraduates spent online; business students spent the most time. Gagne and Shepherd (2001) found no significant difference in online versus face-to-face introductory accounting courses at the graduate level. The few studies that focused on learning outcomes of accounting students using interactive or computer-assisted learning indicated that students performed better than those enrolled in face-to-face classes (Potter & Johnston, 2006; Baxter & Thibodeau, 2011; Dowling et al., 2003).

Summary

This chapter reviewed frequently cited research that contributes to the understanding of student success using WBI and found that researchers, as a whole, have failed to reach a consensus in evaluating difference in delivery modalities. The existing research is primarily based on the aggregate student success of the classes without examining student performance based on demographically diverse groups. Examples of the current debate among university faculty regarding effective teaching with WBI indicate that there is still overall dispute about the benefits and drawbacks of WBI and whether interaction is actually a key component of student achievement. If it is important, how do faculty members create it successfully using digital tools? Are there some types of classes

that allow for a reduced level of interaction? Can adaptive learning software replace the need for student interactions with other participants? Regardless of whether one argues that the digital divide issue is access or usage, it appears that the implementation and adoption of WBI, self-regulated learning, and other online and digital educational venues may leave a number of students at a disadvantage based on their socio-economic, gender, or cultural demographics.

Research examining the relationships between student success and class delivery modality may still be in its infancy with results not being universally applicable. However, if there is an inherent gender or demographic bias in classrooms, regardless of whether the delivery modality is hybrid, or online, then a performance difference among white males and white females and between genders of other ethnic groups will be expected in research that disaggregates the data according to those demographic variables.

CHAPTER III

Methodology

The purpose of this study was to compare the academic learning outcomes of undergraduate students enrolled in an introductory accounting course between hybrid and online delivery modalities and to examine academic learning outcomes based upon select demographic and academic characteristics of the students. Specifically, the study examined the performance of 761 students enrolled in introductory accounting courses who were taught via either online or hybrid modalities to investigate differences in academic learning outcomes based on gender, age, race/ethnicity, socio-economic status (SES), and grade point average (GPA). The following research questions guided the study:

1. Are there differences in student mean scores, as measured by selected academic progress variables, when student groups are established for those enrolled in online or hybrid instruction and broken out by demographic and academic variables?

Academic progress variables:

- Practice assignments
- Homework
- Tests
- Final class score

Student variables:

- Gender
- Age
- Race/ethnicity
- Socio-economic status

- Grade point average

2. To what extent can students' final scores be predicted from the student demographic and academic variables?

3. Are there relationships among the various measures of academic progress? Measurements include scores from selected the activities: practice assignments, homework, tests, final class score, and student GPA.

4. Given knowledge derived from Question #3, what additional information can be gained from knowledge of selected academic variables in predicting final score?

This chapter describes the research design, data sources, data acquisition and management, data analysis, and summary.

Research Design

This study used quantitative measures to examine existing student data to determine how gender, age, race/ethnicity, SES, and GPA impacted student performance in hybrid classes compared to online classes. A quantitative study was used to study relationships and/or predict the outcome based on different factors. "For understanding the best predictors of outcomes, quantitative analysis is best" (Creswell, 2009, p. 18). In this research, student learning outcomes in fifteen classes were examined to determine if a relationship existed between student demographic characteristics and student scores when different delivery modalities were employed. Specifically, existing academic performance and student demographic data were analyzed for differences between the two distinct delivery modalities of hybrid and online classes.

Data Sources, Acquisition, and Management

Fifteen introductory accounting course sections, both online and hybrid, were taught by a single instructor between Fall 2011 and Spring 2014. Eight of the course sections utilized a hybrid delivery method; seven course sections were offered online only. Hybrid classes and the online class enrollment averaged 53.4 and 54.5 students respectively for each semester during the period under study, and this research utilized data from a total of 761 students. All students self-selected into the class section and the delivery modality. Both the online and the hybrid modalities used the same adaptive learning software for assignments, homework, and tests; students in the hybrid class also participated in face-to-face classroom lectures twice weekly. From the student's perspective the only difference between the hybrid and online classes was the twice weekly face-to-face classroom lectures with the professor during which assigned materials were reviewed.

This research was conducted as an exempt study under the auspices of the University of Nevada, Reno Institutional Review Board (IRB) (Appendix A). Two sets of existing data sources were analyzed. One set was classroom academic progress based on selected class activities and analyzed as dependent variables. The other set was demographic data, analyzed as predictors, considered to be the independent variables. Predictor variables are those that may or will influence the outcome of the dependent variable (Creswell, 2009). In this research, the variables were analyzed for their prediction coefficients of students' performance scores and ultimately, the final score.

Classroom academic data. Four variables were used to assess academic learning: practice assignments, homework, tests, and final scores. The same textbook was used in all course sections included in this study. There were twelve chapters in the textbook; for each

chapter, students were assigned practice assignments and homework. All practice assignments, homework, and tests were completed using Connect® adaptive learning software (ALS) for both the online classes and the hybrid classes; the Connect® software automatically recorded the students' performances. The course grade also included the scores of four tests with each test covering one fourth of the assigned chapters; the final test was not comprehensive. Students took the tests digitally in a computer lab where their scores were graded and recorded automatically by the adaptive learning software. Final scores were a compilation of homework, tests, and practice assignments.

Specifically, the following data sources were analyzed from 761 students enrolled in Accounting 201 during academic school years of 2011/12 through 2013/14:

- Practice Assignments – twelve, each worth 10 points
- Homework – twelve, each worth 15 points
- Tests – four, each worth 100 points.
- Final score – final total score earned by student during the semester out of a total possible 700 points.

Although much prior research comparing online and hybrid modalities has failed to find significant differences when using only the final summative score, Aly (2013) claimed that it is theoretically preferable to include scores from multiple assignments (e.g., homework and practice assignments in addition to test scores and final class scores) to have the fullest perspective on student learning outcomes. Therefore, this research examined performance on homework, practice assignments, tests, and final scores, following Aly's recommendations.

The professor who taught the course maintained the student academic data during and after each section that the course was taught. The professor compiled fifteen separate

data files into a master data set, one for each class taught from fall, 2011 through spring 2014; during this time, the student identification code was attached to each student's academic record. Each class file was given a code name based on the delivery modality (i.e., hybrid or online), the year (i.e., 2011 through 2014), term (i.e., fall, spring, summer), and section (i.e., two sections of hybrid and one section of online were taught each term). For instance, one section of a hybrid class taught during fall 2011 was coded HF1101; an online class taught during the same term, fall 2011, was OF1101. These file names were unique class codes.

Institutional demographic and academic characteristic data. To provide the associated demographic data for this research, the professor supplied the master dataset to the Director of Institutional Analysis at the university. The class files included the identification code for each student enrolled in the section of the class. The Director of Institutional Analysis matched each student's academic learning scores case with the institutional data records of gender, age, race/ethnicity, GPA, and whether the student was a Pell Grant recipient. Age and GPA were measured as continuous variables; gender was included as a dichotomous variable with "female" as the reference category; SES was measured as a dichotomous variable for whether the student received a Pell Grant, a federal grant given to students from low-income families; and race/ethnicity was included as dichotomous variables for White, Black, Asian, Hispanic and "Other." Once the match of the datasets was validated, the Director of Institutional Analysis de-identified the data set by removing the student identification number. The data set was stored and accessed in de-identified form to protect student confidentiality.

Data management. The master data file was organized in fixed-length flat files, commonly called a spreadsheet format. One line contained the student's data and each line matched all the other lines in the structure (Einspruch, 2004). Each line with the student's combined data was considered a case; there were 761 cases in the original Master File which consisted of fifteen individual classroom files. Upon receipt of the Master Data File and prior to coding and analyzing, the researcher examined the data for completeness. Although missing data did need to be coded as the statistical analysis program recognized blank cells as missing data, students who did not take exams 3 and 4 were considered an incomplete case and removed from the records. At this point each individual student, or case, was coded with the specific classroom code to indicate which delivery modality, year, term, and class session the student enrolled in the class.

Data Analysis

Statistical package. De-identified, coded data were analyzed using Statistical Package for Social Science (SPSS) (SPSS Inc., Chicago, IL, version 22). SPSS is statistical software used commonly in social sciences and educational research. As the SPSS program did not allow alpha characters to be included for statistical analysis, data for institutional data were coded as follows: Race/ethnicity was included as separate dichotomous variables for each ethnic group (Hispanic, Asian, and Other) compared to the reference group (White). Gender and SES were converted to dichotomous variables with coding 0 for females, 1 for males; SES as a 0 if a student was not a Pell grant recipient and 1 if the student was a recipient of the financial aid. Age and GPA were coded with continuous numerical coding. Once each case had its own unique classroom code and each

dependent and independent variable was coded, each of the fifteen class files were merged into one Master File. Figure 1 illustrates how each case was configured.

Figure 1

Master Coding List

Master Codes												
Delivery Modality	Term	Class ID	Student	Age	Gender	GPA	SES	Ethnicity	HW 1-12	QZ 1-12	T 1-4	Final Score
1= Hybrid	1=Spring	Year-Class	Random Student				Pell Grant		Homewrk	Quiz	Test	
2=Online	2=Summer		Number		F=0		No = 0		Points	Points	Points	Final Points
	3=Fall				M=1		Yes = 1					
1	3	201101	1	Numerical	0	Numerical	0	White	120	180	400	700
1	3	201102	2		0		0	Asian				
1	1	201201	3		0		0	Hispanic				
1	1	201202	4		0		0	Other				
1	3	201201	5		0		0	White				
1	3	201202	6		1		0	Asian				
1	1	201301	7		1		1	Hispanic				
1	1	201302	8		1		1	Other				
2	3	201101	9		1		1	White				
2	1	201201	10		1		0	Asian				
2	3	201201	11		0		1	Hispanic				
2	1	201301	12		0		1	Other				
2	2	201302	13		1		0	White				
2	3	201301	14		1		1	Asian				
1	3	201401	....		1		1	Hispanic				
2	1	201401	811		0		0	Other				

Descriptive statistics. Standard descriptive statistics were examined initially for each class to determine means, range, standard deviations, median, correlations, and frequency distributions of the independent variables to safeguard an analytically correct environment and provide a general understanding of the data. Examination of these statistics demonstrated that the data exhibited normal distribution characteristics, allowing for the use of regression analysis.

ANOVAs. A two-way Analysis of Variance (ANOVA) is a statistical test which explores differences between groups of variables when there are two groups of independent variables, such as gender (males and females) and delivery modality (hybrid and online).

The ANOVA tests each of the two groups for a main effect, independently, and tests for an interaction effect between the two groups (Einspruch, 2004).

Regression analysis. After the initial evaluation of relationships among the variables, regression analysis was used to evaluate whether any specific demographic characteristic influenced the final scores earned by a student in each delivery modality. Regression analysis is a multi-variate statistical technique that is used to determine systematic relationships between more than two variables at once. Analysis of Variance (ANOVAs) statistical tests are useful in testing three or more means of variables (Creswell, 2009); however regression analysis tends to provide more precise results from data with multi-variation. Following recent research, regression analysis is now preferred to ANOVA testing because it performs an identical function but provides more precise estimates of the magnitudes of effects (Creswell, 2009).

In general, regression analysis allows for the effects of several different independent variables to be analyzed simultaneously, allowing researchers to more precisely determine the influence of overlapping factors. For instance, if older students were more likely to take the online class, regression analysis would determine if any score difference between the online and hybrid class was a result of the different ages of the students taking those classes or reflected an actual difference between the two modalities. Thus, regression analysis was key to answering the research question of what role demographic factors played in mediating performance in online and hybrid classes.

Regression coefficients distinguished the relative importance of each independent variable in determining the value of the dependent variable. The resulting r^2 coefficients indicated the strength of the relationship between the independent and dependent variables.

Adjusted r^2 indicates the amount of variation of the dependent variable explained by the combination of independent variables in the model.

Research question #1, *are there differences in student scores, as measured by selected academic progress variables, when enrolled in online or hybrid instruction – broken out by non-academic, demographic variables?,* was analyzed using ANOVAs and linear regression. The student scores in the hybrid classes were compared to those in online classes, analyzing student scores by independent variables of gender, age, race/ethnicity, SES, and GPA.

Research questions #2, *can students' final scores be predicted from demographic variables?,* and *#3, are there relationships among the various measures of academic progress?,* were analyzed using multiple regression. The student scores in hybrid classes were compared to those in online classes, analyzing the academic progress variables of scores for practice assignments, homework, tests, and final class score.

Research question #4, *given knowledge derived from question #3, what additional information can be gained from knowledge of selected academic variables in predicting final score?* was analyzed using multiple regression.

Summary

Chapter III contains a description of the research design, data sources, acquisition and management, data analysis, and summary. This study compared higher education student outcomes in introductory accounting classes collected from respective online and hybrid classes and grouped by demographic characteristics of gender, age, race/ethnicity, and SES. This study examined the academic performance of 761 students who took online or hybrid introductory accounting courses at the university under study for academic school

years 2010/11 through 2013/14. This study was conducted with a quantitative research approach. Possible relationships were analyzed and include means, standard deviations, correlations, and regression analyses. This research compared scores from the homework, tests and exams from students in the online and hybrid delivery modalities, and examined whether demographic factors influenced the efficacy of online versus hybrid classes.

Chapter IV

Results

The purpose of this study was to compare the academic learning outcomes of undergraduate students enrolled in an introductory accounting course between hybrid and online delivery modalities to examine academic learning outcomes based upon demographic and academic characteristics of the students. The following research questions guided this study, for which Analysis of Variance (ANOVAs), correlation, and regression analyses were conducted:

1. Are there differences in student mean scores, as measured by selected academic progress variables, when student groups are established for those enrolled in online or hybrid instruction and broken out by demographic and academic variables?

Academic progress variables:

- Practice assignments
- Homework
- Tests
- Final class score

Student variables:

- Gender
- Age
- Race/Ethnicity
- Socio-economic status
- Grade point average

2. To what extent can students' final scores be predicted from student demographic and academic variables?

3. Are there relationships among the various measures of academic progress? Measurements include scores from selected activities: assignments, homework, tests, final class score, and student GPA.

4. Given knowledge derived from Question #3, what additional information can be gained from knowledge of selected academic variables in predicting final class score?

The independent variables included in data analysis included: gender, age, race/ethnicity, socio-economic status (SES), and grade point average (GPA). This chapter presents the results of the tests.

Enrollment

A total of 761 students enrolled in Accounting 201 courses during the time frame of the study, from Fall 2011 through Spring 2014. Of these original students, 685 completed the class in which they were enrolled; 76 students were removed from this research data base due to the failure of the student to take both exams 3 and 4, resulting in incomplete data, thus the researcher was unable to make a discrete case. Therefore, this analysis included 685 individual cases: 404 in the hybrid classes and 281 in the online classes. See Table 1 for the number of cases in the study by the year, semester, and section, as well as for each of the two delivery modalities: hybrid and online.

Table 1

Student Cases by Modality, Year, Semester, and Section

Modality	Year	Semester	Section	*n*
Hybrid	2011	Fall	1	53
	2011	Fall	2	50
	2012	Fall	1	52
	2012	Fall	2	50
	2012	Spring	1	50
	2012	Spring	2	47
	2013	Spring	1	51
	2013	Spring	2	51
		Total		404
Online	2011	Fall	1	32
	2012	Fall	1	40
	2012	Spring	1	38
	2013	Fall	1	72
	2013	Spring	1	33
	2014	Spring	1	66
		Total		281
Combined		Total		685

Student Demographics and Academic Characteristics

The following demographic variables were included in the analysis: gender, age, race/ethnicity, and socio-economic status, as well as student grade point average. Student groupings were established to compare achievement between the two delivery modalities: hybrid and online.

Gender. Gender determination was derived from institutional data with no attempts to clarify biological correctness or student self-report. Six hundred eighty-one students were designated in the gender grouping of male or female. Just over 62% of these students were classified as males and just under 38% were established in the female grouping. Students classified as males were overrepresented consistently throughout the

classes with the exception of students in the online classes during the 2012 fall and spring semesters. These two semesters exhibited an anomaly of male representation of only 40.0% of enrollment as determined by gender during fall, 2012 and 44.7% of the enrollment during spring, 2012.

When the gender of students enrolled in the online classes was compared to the gender of the students enrolled in hybrid classes, female student enrollment was higher in the online classes: 44.1% (online) versus 32.7% (hybrid). Student enrollment for the group defined as males was 55.9% for online classes and 67.3% for hybrid. See Table 2 for details of student enrollment by gender for each class, semester, year, and section broken out by delivery modality.

Table 2

Student Gender Characteristics by Modality, Year, Semester, and Section*

Modality	Year	Semester	Section	*n*	% Female	% Male
Hybrid	2011	Fall	1	53	30.2	69.8
	2011	Fall	2	50	34.0	66.0
	2012	Fall	1	52	30.8	69.2
	2012	Fall	2	50	34.0	66.0
	2012	Spring	1	50	40.0	60.0
	2012	Spring	2	47	21.3	78.7
	2013	Spring	1	49	39.2	60.8
	2013	Spring	2	51	31.4	68.6
	Total			402	32.7	67.3
Online	2011	Fall	1	32	37.5	62.5
	2012	Fall	1	40	60.0	40.0
	2013	Fall	1	72	37.5	62.5
	2012	Spring	1	38	55.3	44.7
	2013	Spring	1	33	42.4	57.6
	2014	Spring	1	64	39.4	60.6
	Total			279	44.1	55.9
Combined	Total			681	37.4	62.6

*Due to rounding, percents may not add to 100 exactly

Age. The data related to age were categorized into two groups based upon institutional data: students of traditional college age were considered to be less than 22 years old; students 22 years and older composed the second group. The overall average age of students enrolled in the classes was 21.6 years. The average age of online students was 23.1 years; the average age of students enrolled in the hybrid classes was 20.5 years. Almost 38% of students in the online classes were 22 and older; whereas, just under 17% of students enrolled in the hybrid classes were 22 years of age and older. See Table 3 for details of student enrollment by age for each class, semester, year, and section broken out by delivery modality.

Table 3

Student Age Characteristics by Modality, Year, Semester, and Section*

Modality	Year	Semester	Sec.	*n*	Average Age	% Younger than 22	% 22 and Older
Hybrid	2011	Fall	1	53	19.9	92.5	7.5
	2011	Fall	2	50	21.2	82.0	18.0
	2012	Fall	1	52	20.1	90.4	9.6
	2012	Fall	2	50	19.8	88.0	12.0
	2012	Spring	1	50	20.3	84.0	16.0
	2012	Spring	2	47	21.9	68.1	31.9
	2013	Spring	1	49	19.9	82.4	17.6
	2013	Spring	2	51	21.1	76.5	23.5
	Total			402	20.5	83.2	16.8
Online	2011	Fall	1	32	28.8	18.8	81.3
	2012	Fall	1	40	23.6	62.5	37.5
	2013	Fall	1	72	22.5	70.8	29.2
	2012	Spring	1	38	24.2	44.7	55.3
	2013	Spring	1	33	20.9	72.7	27.3
	2014	Spring	1	64	21.0	78.8	21.2
	Total			279	23.1	62.3	37.7
Combined	Total			685	21.6	74.6	25.4

*Due to rounding, percents may not add to 100 exactly

Race/ethnicity. The institutional data for the 685 students who reported race/ethnicity were categorized into four demographic groups: White; Asian; Hispanic; and Other. Overall, 67.4% of the students were classified into the White group, 11.4% were classified into the Hispanic group, 7.3% were classified as Asian students, and 10.5% of the students were classified as Other. The students combined into the Other race/ethnicity demographic group included those designated as Unknown, Alien (i.e., foreign born), Multiracial, Black, Pacific Islander, and Native American.

The student enrollment across the fourteen classes exhibited similar enrollment patterns by race/ethnicity groupings. Students classified as White accounted for 40% to 82% enrollments; students classified in the Hispanic grouping ranged from 4.3% to 23% of class enrollments; students classified as Asian ranged from 0% to 13% of class enrollments; and students grouped in the Other classification ranged from 7.5% to 35% class enrollments. The student racial/ethnic diversity was relatively constant across the classes; the data consistently indicated a heavier distribution of students grouped in the White classification for all classes with two exceptions noted above. The Fall 2012 online class presented an anomaly of 35% enrollment categorized as students in the Other race/ethnicity group and the Spring 2013 hybrid class included 23.5% students grouped into the Hispanic category. When questioned, the instructor was unaware of this anomaly and could offer no explanation. See Table 4 for details of student enrollment by race/ethnicity for each class, semester, year and section broken out by delivery modality.

Table 4

Student Race/Ethnicity Characteristics by Modality, Year, Semester, and Section*

Modality	Year	Semester	Sec.	*n*	% White	% Hispanic	% Asian	% Other
	2011	Fall	1	53	81.1	5.7	5.7	7.5
	2011	Fall	2	50	82.0	8.0	0.0	10.0
	2012	Fall	1	52	65.4	11.5	13.5	9.6
	2012	Fall	2	50	66.0	10.0	10.0	14.0
	2012	Spring	1	50	58.0	14.0	10.0	18.0
	2012	Spring	2	47	70.2	4.3	4.3	21.3
	2013	Spring	1	49	54.9	23.5	5.9	15.7
Hybrid	2013	Spring	2	51	72.5	9.8	5.9	11.8
	Total			402	68.8	10.9	6.9	13.4
	2011	Fall	1	32	68.8	9.4	12.5	9.4
	2012	Fall	1	40	40.0	12.5	12.5	35.0
	2013	Fall	1	72	66.7	12.5	8.3	12.5
	2012	Spring	1	38	76.3	10.5	2.6	10.5
	2013	Spring	1	33	69.7	18.2	3.0	9.1
Online	2014	Spring	1	64	69.7	10.6	7.6	12.1
	Total			279	65.5	12.1	7.8	14.6
Combined	Total			681	67.4	11.4	7.3	10.5

*Due to rounding, percents may not add to 100 exactly

Pell grant recipient. Data were examined based on whether students were Pell Grant recipients or not. Pell Grants are need-based financial aid; therefore, this variable was considered a proxy, albeit an inexact one, for socio-economic status in this study. Overall 23.1% of the enrolled students received a Pell Grant. The enrollment of Pell Grant students ranged from 7.7% (Fall 2012 hybrid) to 34.44% (Fall 2011 online). Pell Grant recipients comprised 28.5% of online students, while only 19.31% of hybrid students received Pell Grants. See Table 5 for details of student enrollment by Pell Grant recipients grouped for each class, semester, year, and section broken out by delivery modality.

Table 5

Student Pell Grant Recipient Characteristics by Modality, Year, Semester, and Section*

Modality	Year	Semester	Section	*n*	% receiving Pell Grant	% not receiving Pell Grant
Hybrid	2011	Fall	1	53	17.0	83.0
	2011	Fall	2	50	10.0	90.0
	2012	Fall	1	52	7.70	92.3
	2012	Fall	2	50	16.0	84.0
	2012	Spring	1	50	26.0	74.0
	2012	Spring	2	47	29.8	70.2
	2013	Spring	1	49	29.4	70.6
	2013	Spring	2	51	19.6	80.4
	Total			402	19.3	80.7
Online	2011	Fall	1	32	34.4	65.6
	2012	Fall	1	40	25.0	75.0
	2013	Fall	1	72	30.6	69.4
	2012	Spring	1	38	18.4	81.6
	2013	Spring	1	33	33.3	66.7
	2014	Spring	1	64	28.8	71.2
	Total			279	28.5	71.5
Combined	Total			685	23.1	76.9

*Due to rounding percents may not add to 100 exactly

Average GPA. On a scale of 0.0 - 4.0, the average GPA of students enrolled in the fourteen classes ranged from 2.51 (spring, 2013 hybrid) to 3.13 (fall, 2012 hybrid). The average GPA for the students enrolled in all classes combined was 2.90. Students participating in the hybrid classes had an average GPA of 2.86, and those enrolled in online classes was 2.88. See Table 6 for details of student enrollment by GPA for each class, semester, year, and section broken out by delivery modality.

Table 6

Student Average GPA Characteristics by Modality, Year, Semester, and Section

Modality	Year	Semester	Section	*n*	Average GPA
Hybrid	2011	Fall	1	53	3.00
	2011	Fall	2	50	2.85
	2012	Fall	1	52	3.13
	2012	Fall	2	50	3.00
	2012	Spring	1	50	2.77
	2012	Spring	2	47	2.70
	2013	Spring	1	49	2.89
	2013	Spring	2	51	2.51
	Total			402	2.86
Online	2011	Fall	1	32	2.96
	2012	Fall	1	40	2.81
	2013	Fall	1	72	2.91
	2012	Spring	1	38	2.90
	2013	Spring	1	33	2.73
	2014	Spring	1	62	2.91
	Total			279	2.88
Combined	Total			685	2.90

*Due to rounding percents may not add to 100 exactly

Student Academic Scores

The findings of the students' academic scores, correlations, and associated ANOVAs are summarized in this section. The range of possible scores that a student could earn was identical in each class section; the range was 0 – 700 points. The total points consisted of four exams with 400 points possible (100 points each), twelve chapter quizzes with 180 points possible (15 points each), and twelve chapter homework assignments with 120 points possible (10 points each). The students, overall, earned total points which ranged from 165 to 684; the high and low total scores for each of the delivery modalities were almost identical across the four years. The mean score of students enrolled in all

classes combined over the four-year period was 514 total or 73.5% of possible points. The mean score for students enrolled in the hybrid classes was 528 points total or 75.5% of possible points; while students enrolled in online classes earned an average of 494 points total or 70.6% of possible points. See Table 8 for a summary of the final scores grouped by delivery modality. See Appendix B for the details of scores by each class, semester, year, and section grouped by delivery modality.

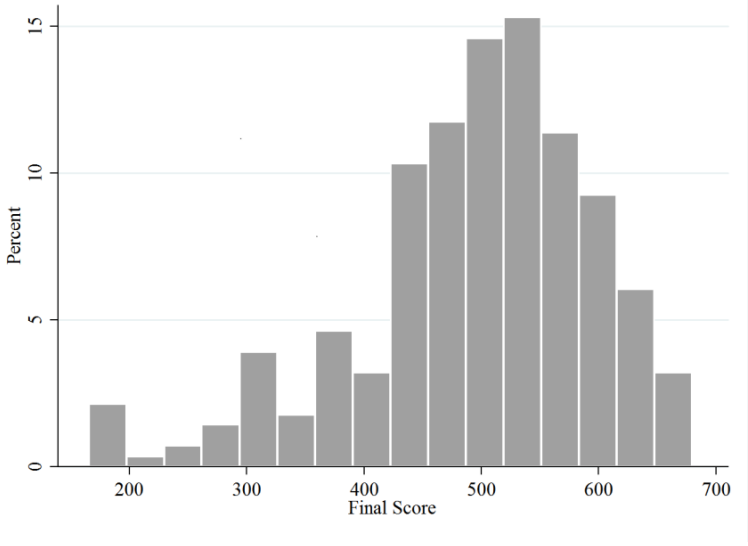
Table 7

Summary of Student Final Scores by Modality—Hybrid and Online; and Combined Scores

	n	Mean Score (/700)	Mean Score (%)	Std Dev	Median Score	Lowest Score	Highest Score
Hybrid	402	528	75.5	84	537	175	684
Online	279	494	70.6	103	508	165	680
Combined	681	514	73.5	94	525	165	684

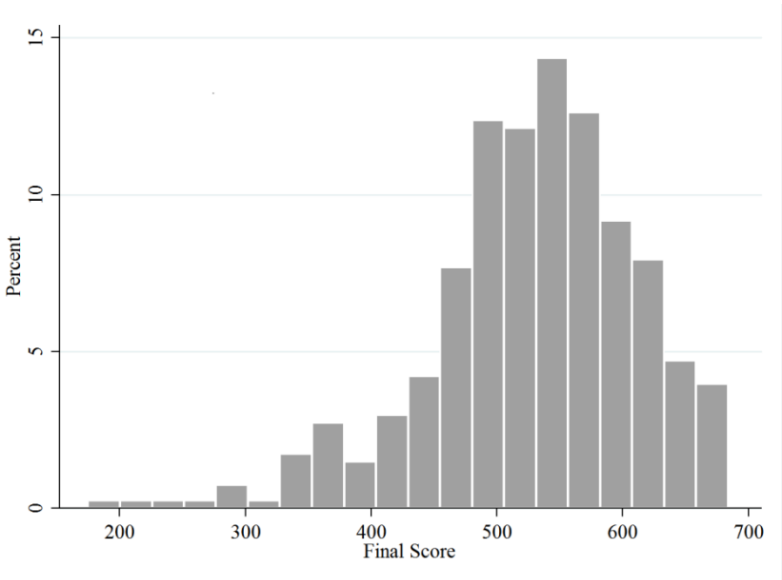
Visual comparisons of the final scores earned by students across the fourteen classes are illustrated in Figures 1 and 2 grouped by delivery modality, online and hybrid. Students enrolled in the online classes earned final scores of 680 high and 165 low. The distribution curve indicates that a majority of the online-enrolled students who passed the class (120 students, or 68%) ranged between 450 and 550 points for their final score.

Figure 2
Summary of Range of Final Scores for Students enrolled in Online Classes



Students enrolled in the hybrid classes earned final scores of 684 high and 175 low. A majority of the students who passed the class scored between 500 and 600 points for their final score (204 students or 56%).

Figure 3
Summary of Range of Final Scores for Students enrolled in Hybrid Classes



Correlations between Final Score and Selected Independent Variables

Correlations, although not indicating causal relationships, do provide measures of linear relationship between two variables. Spearman Correlations were computed on the student data to access the relationship between any two variables. A summary of correlations among the variables is shown in Table 8. The only student characteristic which was significantly correlated with the students' final scores was student GPA. The other demographic variables of gender, age, race/ethnicity, and SES, and did not seem to be significantly correlated with final scores.

The academic variable of student test 1 score was examined to determine if there would be a correlation with the student final scores. The test 1 score was significantly associated with the students' final scores. Approximately 35% of the variance in the final scores was accounted by test 1, and 27% determined by GPA. No significant relationship between other student demographic variables and the students' final scores were found. See Table 8 for details.

Table 8

Correlations between Student Final Score and Other Variables

Variable	Final Score	Test1	Online	Pell	Female	Hispanic	Black	GPA	Age
Final Score	1.00								
Test 1	0.59	1.00							
Online	-0.18	-0.06	1.00						
Pell	-0.04	-0.03	0.11	0.00					
Female	-0.04	-0.05	0.12	0.05	1.00				
Hispanic	-0.08	-0.08	0.02	0.13	0.03	1.00			
Black	-0.04	-0.11	-0.04	0.15	-0.06	-0.07	1.00		
GPA	0.52*	0.40*	0.02	0.00	0.14	-0.04	-0.08	1.00	
Age	-0.05	0.17	0.25	0.14	0.05	-0.01	-0.02	0.04	1.00

* $p < .01$

ANOVA Results of Student Scores

In this research, data were grouped based on various independent variables to enable comparisons using ANOVAs. The student scores were grouped into the two delivery modalities, hybrid and online. Additionally, groups were established by selected student characteristics: gender; age; race/ethnicity; SES; and GPA. A two-way ANOVA was conducted for each of the sets of groups. That is, five two-way ANOVAs were conducted. These ANOVAs provided three statistical test results.

First, the means for modality were analyzed: the main effect for modality. This test analyzed the mean scores for all hybrid results compared to the mean scores for all online results. Second, the mean scores for each specific student characteristic were analyzed: the main effect for the student characteristic. For instance, the mean scores for all male results were compared with the mean scores for all female results. Third, the interaction effect of modality with the selected student characteristic was analyzed: the interaction effect.

Two-way ANOVA - modality by gender. A two-way ANOVA was conducted to evaluate score differences among students when they were grouped by modality and gender categories. The first grouping variable was modality (i.e., online and hybrid) and the second grouping variable was gender (i.e., male and female). The ANOVA indicated that the main effect for modality was significant ($F = 22.80$; df (1, 681); $p < .01$). The mean score for the hybrid classes was 528.60 and the mean score for the online classes was 494.19. Thus, the students in the hybrid classes scored on average 34.41 points higher than the students in the online classes. The results of the ANOVA are summarized in Table 9.

Table 9

Summary of Two-way ANOVA: Modality by Gender

Source	Sum of Squares	df	Mean Square	F	Sig.
Modality	194930.07	1	194930.07	22.80*	<.01
Gender	1836.96	1	1836.96	.21	.64
Modality by Gender	56.52	1	56.52	.007	.94
Error	5785761.83	681	8546.18		

*Significant difference at the $p < .01$ level

The ANOVA indicated that the main effect for gender was not significant. The ANOVA indicated that the interaction between modality and gender was not significant. The mean scores are summarized in Table 10. A graph of the corresponding group means is presented in Figure 4.

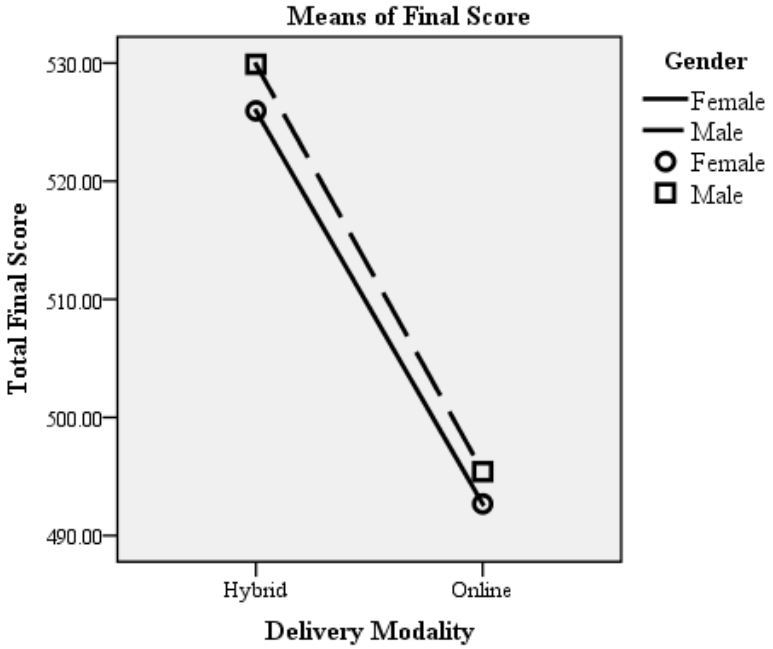
Table 10

Comparison of Scores between Male and Female Students by Delivery Modality

Modality	Gender	Mean	Std. Dev	n
Hybrid	Female	525.95	90.41	132
	Male	529.89	80.54	270
	Total	528.60	83.82	402
Online	Female	492.68	102.95	124
	Male	495.42	104.01	155
	Total	494.19	103.36	279
Combined	Female	509.83	97.92	256
	Male	517.32	91.22	425
	Total	514.50	93.79	681

Figure 4

Plot of Mean Scores by Gender by Modality



Two-way ANOVA - modality by age. A two-way ANOVA was conducted to evaluate score differences among students when they were grouped by modality and age. The first grouping variable was modality (i.e., online and hybrid) and the second grouping variable was age (i.e., students 22 years of age and older and those under 22). The ANOVA indicated that the main effect for modality was significant ($F = 22.62$; df (1, 681); $p < .01$). The mean score for the hybrid classes was 528.44 and the mean score for the online classes was 494.37. Thus, the students in the hybrid classes scored on average 34.07 points higher than the students in the online classes. The results of the ANOVA are summarized in Table 11.

Table 11

Summary of Two-way ANOVA: Modality by Age

Source	Sum of Squares	df	Mean Square	F	Sig.
Modality	192322.36	1	192322.36	22.62*	<.01
Age Grouping	378.55	1	378.54	.045	.83
Modality by Age	406.35	1	406.35	.048	.83
Error	5790808.00	681	8503.39		

*Significant difference at the p < .01 level

The ANOVA indicated that the main effect for age was not significant, and also indicated that the interaction between modality and age was not significant. The mean scores are summarized in Table 12. A graph of the corresponding group means is presented in Figure 5.

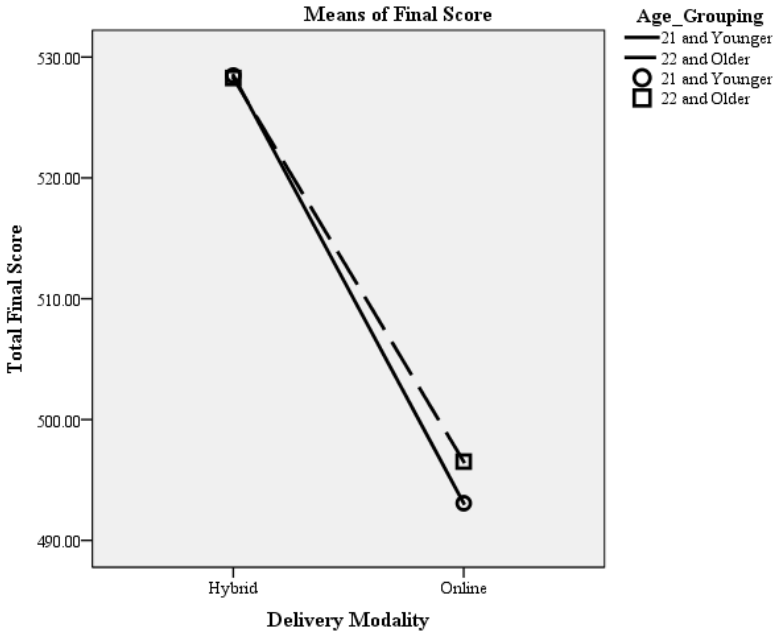
Table 12

Comparison of Mean Scores between Older and Younger Students by Delivery Modality

Modality	Age Grouping	Mean	Std. Dev	N
Hybrid	21 and Younger	528.48	79.37	336
	22 and Older	528.27	102.93	68
	Total	528.44	83.65	404
Online	21 and Younger	493.08	90.91	175
	22 and Older	496.52	120.89	106
	Total	494.38	103.02	281
Total	21 and Younger	516.35	85.09	511
	22 and Older	508.98	114.91	174
	Total	514.47	93.53	685

Figure 5

Plot of Mean Scores by Age by Modality



Two-way ANOVA - modality by GPA. A two-way ANOVA was conducted to evaluate score differences among students when they were grouped in different modality and GPA categories. The first grouping variable was modality (i.e., online and hybrid) and the second grouping variable was GPA (i.e., Above Average GPA and Below Average GPA). The ANOVA indicated that the main effect for modality was significant ($F = 27.17$; df (1, 681); $p < .01$). The mean score for the hybrid classes was 528.44 and the mean score for the online classes was 494.38. Thus, the students in the hybrid classes scored on average 34.06 points higher than the students in the online classes. The results of the ANOVA are summarized in Table 13.

Table 13

Summary of Two-way ANOVA: Modality by GPA

Source	Sum of Squares	df	Mean Square	F	Sig.
Modality	192322.36	1	192322.36	27.17*	<.01
GPA Grouping	971051.41	1	971051.41	137.20*	<.01
Modality by GPA	819.64	1	819.64	.12	.73
Error	4819721.83	681	7077.42		

*Significant difference at the $p < .01$ level

The ANOVA also indicated that the main effect for GPA was significant ($F = 137.20$; df (1, 681); $p < .01$). Students with above average GPA earned a mean score of 547.36 and students with lower than average GPA earned a mean of 472.75. The ANOVA did not indicate an interaction effect between modality and GPA. The mean scores are summarized in Table 14. A graph of the corresponding means is presented in Figure 14.

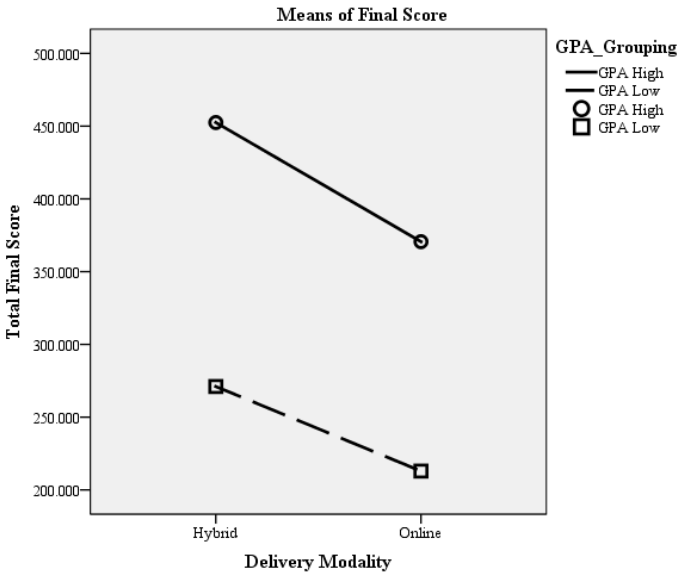
Table 14

Comparison of Scores between Students with Lower and Higher GPA Groupings by Modality

Modality	GPA Grouping	Mean	Std. Dev	N
Hybrid	GPA High	563.83	62.69	220
	GPA Low	486.13	86.02	184
	Total	528.44	83.65	404
Online	GPA High	525.12	93.18	163
	GPA Low	451.91	101.20	118
	Total	494.38	103.02	281
Total	GPA High	547.36	79.39	383
	GPA Low	472.75	93.59	302
	Total	514.46	93.53	685

Figure 6

Plot of Mean Scores by GPA Grouping by Modality



Two-way ANOVA - modality by SES. A two-way ANOVA was conducted to evaluate score differences among students grouped by modality and SES. The first grouping variable was modality (i.e., online and hybrid) and the second grouping variable was SES (Pell Grant Recipient) (i.e., recipient versus non-recipient). The ANOVA indicated that the main effect for modality was significant ($F = 22.65$; df (1, 681); $p < .01$). The mean score for the hybrid classes was 528.44 and the mean score for the online classes was 494.38. Thus, the students in the hybrid classes scored on average 34.06 points higher than the students in the online classes. The results of the ANOVA are summarized in Table.

Table 15
Summary of Two-way ANOVA: Modality by SES

Source	Sum of Squares	df	Mean Square	F	Sig.
Modality	192322.36	1	192322.36	22.65*	<.01
Pell Grouping	3665.12	1	3665.12	.43	.51
Modality by Pell	5732.33	1	5732.33	.68	.41
Error	5782195.43	681	8490.74		

*Significant difference at the $p < .01$ level

The ANOVA indicated that the main effect for SES was not significant. The ANOVA also indicated that the interaction between modality and SES was not significant. The mean scores are summarized in Table 16. A graph of the corresponding means is presented in Figure 7.

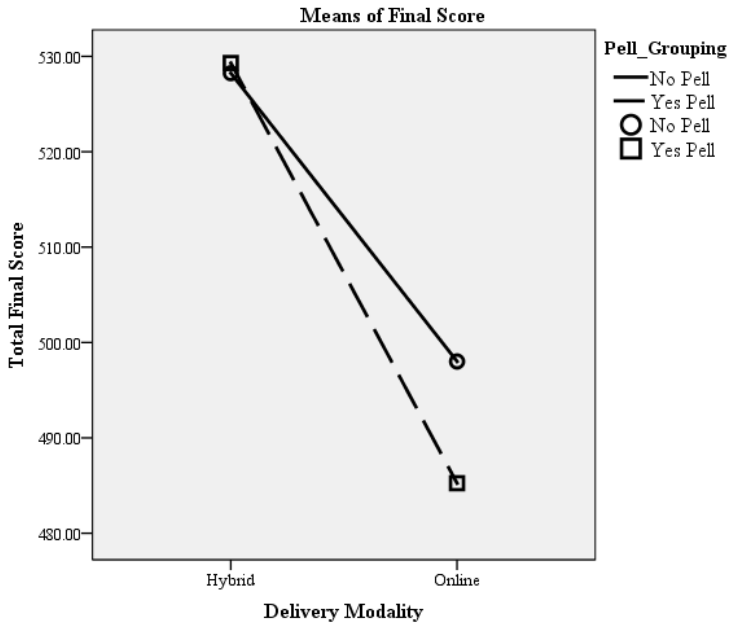
Table 16

Comparison of Mean Scores between Students receiving Pell Grant or Not

Modality	Pell Grouping	Mean	Std. Dev	N
Hybrid	No Pell	528.23	82.11	326
	Yes Pell	529.30	90.35	78
	Total	528.44	83.65	404
Online	No Pell	498.01	103.41	201
	Yes Pell	485.24	102.10	80
	Total	494.38	103.02	281
Total	No Pell	516.71	91.91	527
	Yes Pell	506.99	98.68	158
	Total	514.47	93.53	685

Figure 7

Plot of Mean Scores by SES by Modality



Two-way ANOVA - modality by race/ethnicity. A two-way ANOVA was conducted to evaluate score differences among students when they were grouped by modality and race/ethnicity. The first grouping variable was modality (i.e., online and hybrid) and the second grouping variable was race/ethnicity (i.e., White, Asian, Hispanic, and Other). The ANOVA indicated that the main effect for modality was significant ($F = 22.7$; df (1, 677); $p < .01$). The mean scores for the hybrid classes were 528.44 and the mean score for the online classes was 494.38. Thus, the students in the hybrid classes scored on average 34.02 points higher than the students in the online classes. The results of the ANOVA are summarized in Table 17.

Table 17

Summary of Two-way ANOVA: Modality by Race/Ethnicity

Source	Sum Squares	df	Mean Square	F	Sig.
Modality	192322.36	1	192322.35	22.74*	<.01
Race/Ethnicity	50207.02	3	16735.67	1.97	.12
Modality by Ethn	17660.73	3	5886.90	.66	.56
Error	5723725.13	677	8454.54		

*Significant difference at the $p < .01$ level

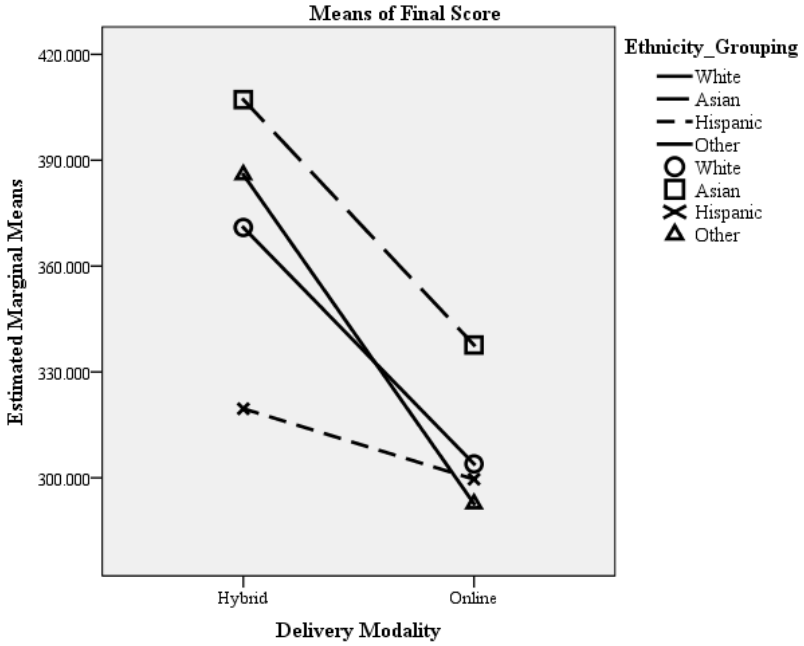
The ANOVA indicated that the main effect for race/ethnicity was not significant. The ANOVA indicated that the interaction between modality and race/ethnicity was not significant. The group sizes were disproportionate; due to the small size in some of the racial/ethnic groups, the results cannot be generalized beyond this study. The mean scores are summarized in Table 18. A graph of the corresponding means is presented in Figure 8. Please note that sample sizes are disproportional which may cause some visual distortion.

Table 18

Comparison of Mean Scores between White, Asian, Hispanic and Other Students by Delivery Modality

Modality	Ethnicity	Mean	Std. Dev	N
Hybrid	White	529.58	81.28	278
	Asian	543.36	90.03	28
	Hispanic	499.81	94.69	44
	Other	538.18	79.83	54
	Total	528.44	83.65	404
Online	White	494.35	102.13	184
	Asian	521.02	73.88	22
	Hispanic	486.86	115.79	34
	Other	486.45	110.20	41
	Total	494.38	103.02	281
Combined	White	515.55	91.70	462
	Asian	533.53	83.25	50
	Hispanic	494.17	103.90	78
	Other	515.85	97.08	95
	Total	514.47	93.53	685

Figure 8
Plot of Mean Scores by Ethnicity by Modality



Regression Analysis, Predictors of Final Score

Regression analysis can be used to predict levels of a dependent variable from knowledge of selected independent variables. That is, to what extent can students' final scores be predicted from knowledge of the independent variables? In this study, regression analysis was used to predict final scores using both continuous and categorical variables. The predictor variables used in this study were: modality; gender; age; race/ethnicity; SES; and GPA. Modality, gender, age, SES, and GPA were binary coded. For race/ethnicity, four categories were established: White; Hispanic; Asian; and Other. For each of these categories, student characteristics were binary coded on a four dimensional system. That is, for a student who indicated White, the responses were coded 1, 0, 0. For a student who indicated Asian, the responses were coded 0, 0, 1. For the regression analysis, the independent variables were entered as a group. That is, the SPSS program determined the order of importance for each independent variable based on the relationships among the variables.

The results of the regression analysis supported the results of the ANOVAs. Results indicated an overall model with three significant predictors of final score: GPA, modality, and gender. GPA was the largest predictor of final scores with a coefficient of 86.79. Delivery modality and gender were also found to be significant predictors. These three variables accounted for 31% of the variance in student final scores. Thus, when the selected student characteristics were treated as binary variables, three variables significantly predicted final score. See summary of results in Table 19 which indicates the coefficients for three predictors of students' final scores.

Table 19

Predictors of Final Score

Variable	Coefficient*
Modality	-30.25*
Pell Recipient	ns
Gender	-19.59*
Ethnicity	ns
GPA	86.79*
Age	ns
R^2	0.31

* Only relationships significant at the $p < .01$ level are reported.

The Regression Equation:

Predicted final score = (86.79*GPA) + (-30.25*Modality) + (19.59*Gender) + 308.4*Constant.

Analysis of test 1 scores on overall score. An analysis was conducted to determine whether test 1 scores would add knowledge of the students' final scores. The results indicated that every extra point a student scored on the first test resulted in a coefficient of 3.25. The larger predictor of students' final score was still the students' GPA, however. See summary in Table 20 which indicates the coefficients for predictors of students' final score.

Table 20

Predictors of Final Score, Including Test 1

Variable	Coefficient*
Test 1	3.25*
Modality	-21.72*
Pell Recipient	ns
Gender	-9.60*
Ethnicity	ns
GPA	56.09*
Age	-2.61*
R^2	0.48

* Only relationships significant at the $p < .01$ level are reported.

The Regression Equation:

Predicted final score = (3.25*Test1) + (-21.72*Modality) + (-9.60*Gender) + (56.09*GPA) + (-2.61*Age) + 183.53*Constant

Analysis of test 1 scores to determine predictors of test 1 scores. Further analysis was conducted to ascertain if select student demographic variables could predict test 1 scores. Results indicated that an overall model with four significant predictors of test 1 scores: GPA, modality, age, and gender. GPA was the largest predictor of final scores with a coefficient of 9.43. These four variables accounted for 21% of the variance in student test 1 scores. See Table 21 which shows predictors of student scores on test 1. This regression conducted on test 1 scores emphasized the impact of GPA, but provided practically little other insights.

Table 21

Predictors of Test 1 Scores

Variable	Coefficient*
Modality	-2.62*
Pell Recipient	ns
Gender	-3.07*
Ethnicity	ns
GPA	9.43*
Age	0.46*
R^2	0.21

* Only relationships significant at the $p < .01$ level are reported.

Analysis of predictors on test scores. Results indicated that an overall model with four significant predictors of test scores: GPA, modality, age, and gender. GPA was the largest predictor of final scores with a coefficient of 48.19. Gender was also relatively influential in predicting scores on the tests. The four variables accounted for 29% of the variance in student test scores. See summary in Table 22 which indicates the coefficients for four predictors of students' test scores.

Table 22

Predictors of Scores on Tests

Variable	Coefficient*
Modality	-10.91*
Pell Recipient	ns
Gender	-20.98*
Ethnicity	ns
GPA	48.19*
Age	1.46*
R^2	0.29

* Only relationships significant at the $p < .01$ level are reported

Analysis of predictors on homework scores. Results indicated an overall model with three significant predictors of homework scores: GPA, age, and gender. GPA was the largest predictor of final scores with a coefficient of 13.94. The three variables accounted for 14% of the variance in student homework scores. See summary in Table 23 for the coefficients of predictors on student homework scores. This regression conducted on homework scores emphasized the impact of GPA, but provided practically little other insights.

Table 23

Predictors of Scores on Homework

Variable	Coefficient*
Modality	ns
Pell Recipient	ns
Gender	4.11*
Ethnicity	ns
GPA	13.94*
Age	-0.35*
R^2	0.14

* Only relationships significant at the $p < .01$ level are reported

Analysis of predictors on quiz scores. Results indicated that an overall model with two significant predictors of quiz scores: GPA and modality. GPA was the largest predictor of final scores with a coefficient of 26.02. The two variables accounted for 23% of the variance in student homework scores. See summary in Table 24 for the coefficients of predictors on student quiz scores.

Table 24

Predictors of Scores on Quizzes

Variable	Coefficient*
Modality	-13.86*
Pell Recipient	ns
Gender	ns
Ethnicity	ns
GPA	26.02*
Age	ns
R^2	0.23

* Only relationships significant at the $p < .01$ level are reported

Students Eliminated from Research Data Base

Additional analysis of the students who were removed from the data base due to incompletion of exams 3 and 4 indicated that of the original 761 students enrolled in the course, 685 completed the course, revealing a drop rate in the combined classes of approximately 10%. There was a total of 15.8% incomplete in the online classes in comparison to only 5.4% incomplete in the hybrid classes. Of the students who completed the class, another 88 received scores of less than 60% (420) and were considered failing. Overall, almost 31% of online enrolled students were unsuccessful; whereas 14% of hybrid-enrolled students failed. A two-by-two Chi ^{2} analysis was conducted. Categories were established by complete, fail, and modality. The obtained Chi^2 value was 22.905; the P value was 2E-06. This result was significant at $p < 0.05$ level; thus the distribution across the groups was not random. See Table 25 for details.

Table 25

Completion and Failure Rates for Online and Hybrid Classes

	Enrolled	Complete	Incomplete	% Incomplete	Additional Failed	Additional % Failed	% Unsuccessful
Online	334	281	53	15.8	50	14.9	30.7
Hybrid	427	404	23	5.4	38	8.9	14.3
Total	761	685	76	10.0	88	11.6	21.6

Of the students who were removed from the data base, almost 70% were enrolled in the online classes and 30% were hybrid students. The students' average GPA for those not completing the classes was lower than the overall GPA of the students who completed the course. See Table 26 for summarized data.

Table 26

Summary of Students with Incomplete Data Set by Modality and GPA

	n	% Online	Average GPA
Complete	685	41.0	2.9
Incomplete	76	70.8	2.5
Failed	88	56.8	2.4

Of the female students who completed the class, 14.5% failed; and of the male students who completed the class, 12% failed. See summary in Table 28.

Table 27

Summary of Unsuccessful Students by Gender

	% Female	% Male
Failed	14.5%	12.0%

Further analysis also indicated no differences in students' race/ethnicity between students who completed the course and those who withdrew. See summary in Table 27.

Table 28

Summary of Students with Incomplete Data Set by Race/ethnicity

	% White	% Hispanic	% Asian	% Other
Incomplete	65.3	11.1	9.7	11.1
Complete	67.4	11.4	7.3	10.5

Summary

This study evaluated the relationships between student demographic and academic characteristics, their enrollment in hybrid or online classes and their final scores in the Accounting 201 class. The findings of the research offer insights into student success, or

lack thereof, in online classes. Final scores in Accounting 201 may be predicted from the knowledge of students' characteristics, particularly the variables of whether the student is enrolled in the class in an online or hybrid modality and the student's GPA. Furthermore, it can be concluded that students enrolled in the hybrid classes uniformly earned scores higher than those students enrolled in the online classes; this finding was revealed for almost all demographic categories.

This chapter presented the results of the analyses completed for this study. Chapter V will discuss the study's significance and relationship to existing studies, and provide suggestions for additional research.

CHAPTER V

Discussion and Conclusions

The purpose of this study was to compare the academic learning outcomes of undergraduate students enrolled in an introductory accounting course between hybrid and online delivery modalities and to examine academic learning outcomes based upon select demographic and academic characteristics of the students. This research examined how demographically diverse groups of students performed with new digital technologies and online learning tools using adaptive learning software. The study examined differences in the academic performance of students enrolled in classes that were delivered with online and with hybrid modalities. All classes were taught by the same instructor using the same class materials and sophisticated adaptive digital learning system over a period of four years.

This quantitative study utilized statistical analysis tools such as ANOVA, correlation, and linear regression. Undergraduate student outcome data were grouped by characteristics of gender, age, race/ethnicity, socio-economic status (SES), and grade point average (GPA). The following questions guided this quantitative analysis:

1. Are there differences in student scores, as measured by selected academic progress variables, when student groups are established for those enrolled in online or hybrid instruction and broken out by demographic and academic variables?

Academic progress variables:

- Practice assignments
- Homework
- Tests

- Final class score

Student variables:

- Gender
- Age
- Race/ethnicity
- Socio-economic status
- Grade point average

2. To what extent can students' final scores be predicted from the student demographic and academic variables?

3. Are there relationships among the various measures of academic progress? Measurements include scores from selected activities: practice assignments, homework, tests, and final class score and GPA.

4. Given knowledge derived from Question #3, what additional information can be gained from knowledge of selected academic variables in predicting final class score?

Based on the evidence from the literature, it was hypothesized that there would be no significant difference in average scores between the online and hybrid classes, but that demographic variables would impact students' relative performances in online versus hybrid classes. Based on existing literature, it was also expected that lower-income students would perform relatively lower in online classes than in hybrid modalities and that older students would perform relatively better in online classes than in hybrid classes. Finally, it was anticipated that males and white students would perform better in online classes.

The data from 685 student cases were evaluated using descriptive statistics, correlation, ANOVAs, and regression. The independent variables in the study were examined to see if they were related to the students' final scores. Additional analysis was conducted on the 76 students who were removed from the data base due to incompletion of the third and fourth exams, and the students who failed the class. This chapter will discuss this significance of the relationship to existing studies, implications for practice, and provide suggestions for additional research.

Discussion

A review of the literature identified a plethora of studies that compared online and face-to-face classes, but illustrated a lack of research comparing online and hybrid delivery modalities. Furthermore, much of the existing research has been based on a summative basis and only a few provided relevant insights regarding the impact of digital learning on students when grouped by selected demographic and academic variables. The third important gap in the literature is the dearth of empirical research on business classes and specifically, accounting (Arbaugh, 2005; Arbaugh et al., 2009). Because there are substantial differences in pedagogy between different academic fields, it is important to base decisions about class delivery modalities on research in that specific field (in this case accounting) rather than on a more generalized basis. Accordingly, this study was created to both evaluate final scores in online versus hybrid classes taken by college accounting students; and to study the results of disaggregated scores by student characteristics. The student variables included in this research were gender, age, race/ethnicity, SES, and GPA.

The results of this study revealed three somewhat interrelated findings. The first relates to the GPA of the students who completed the class, failed the class, and those who

dropped from the class. The second obtained a significant difference in the final scores between the two delivery modalities: hybrid and online. The third relates to the relationship of demographic and academic characteristics in the final scores. Each finding will be addressed separately.

Perhaps the most salient finding revealed in this study was the difference found in the students' performance based on the student's GPA. The student's GPA appeared to be a key factor in the results of both the online and hybrid instructional modalities. Arbaugh (2002b), and Larson (2002) found that the success of students enrolled in online classes was based primarily on a student's GPA. Consistent with these and other studies **(**Dellana et al., 2000; Arbaugh, 2005, Arbaugh et al., 2009; Klimek, 2012; and Wilson & Allen, 2011), GPA was found to be significantly related to the students' final scores as revealed in both the ANOVAs and the regression analysis**.**

This role of GPA in the students' final scores is further supported when two additional findings from the additional analyses were considered. When results of the students who failed the class are included with the results of the students who were dropped from the data base, a more complete pattern emerged. Fundamentally, if a student's GPA was relatively strong (2.9 and above) upon entering the course, it appeared that the student could have enrolled in either class modality and completed the class successfully with a score above 420 points or 60%. However, students with lower GPAs had a higher likelihood of dropping or failing the class (below 420 points). The students who dropped the classes, whether online or hybrid, had an average GPA of 2.5; the students who completed the class and failed had an average GPA of 2.4. This analysis indicated that

students who enrolled in an introductory accounting class with a lower GPA were more apt to fail or to not complete the class, regardless of the delivery modality.

Another important finding indicated that students earned almost 30 points higher in their final scores when they were enrolled in the hybrid classes compared to those enrolled in the online classes. This finding is in contrast to many studies which compared online and face-to-face classes which found no significant difference in student success rates based on delivery modality (Russell, 1999; 2015; Brownstein et al., 2008; Arbaugh, 2000b; Arbaugh et al., 2009). At an aggregate or summative level, Russell has generally indicated that there is no significant difference between academic outcomes for students enrolled in online and face-to-face classes (http://www.nosignificantdifference.org). Yet this research found significant differences between scores of students enrolled in online and hybrid classes at both the aggregate and the disaggregated levels.

A closer look at Figures 2 and 3 (page 74) provides a compelling perspective of this finding. At first glance, the distributions of scores appear to be fairly consistent because the skews of the distribution curves are similar. However, as reflected in Figure 2, there is a cluster of scores below 420 (60%) for the classes taught online. This same clustering is not found in Figure 3 for classes taught in a hybrid modality. The difference between the two figures was the higher number of students who failed the class in the online modality, thus affecting the overall average mean for the online group. As such, there appears to have been some component in the hybrid modality that allowed students who might have been struggling with the class an opportunity to stay connected and earn higher scores. To illustrate the picture more fully, 71% of the students who did not complete the course as evidenced by the absence of tests 3 and 4, were enrolled in the online sections as were 57%

of the students who failed the class. Furthermore, of the students who self-selected into the online classes, over 30% of them were unsuccessful; they either failed or were incomplete in the class. Of the students enrolled in the hybrid class, only 14% were unsuccessful by dropping or failing.

Student achievement in the hybrid classes could be explained by a number of factors. The issue of interaction between instructor and students cannot be overlooked. The hybrid class in this study included a twice weekly face-to-face component. Boyce (1999) argued that the interactivity of the students with their instructor and other students created effective learning communities. Even Anna Ticknor, considered the mother of distance education, insisted that her volunteer correspondents respond to the lady students with wise counsel and friendly sympathy, a strong form of interactivity (Agassiz & Eliot, 1897; Bergmann, 2001). Likewise, Arbaugh, et al. (2013) as well as Allan and Lawless (2003) found that learner-instructor interaction was one of the strongest predictors of learning in their research of accounting classes. Arbaugh was so strongly convinced that this interaction resulted in better student success that he recommended to students that they post personal pages to encourage sharing and interacting with each other. This study supports these findings. In this study, the hybrid classes included an element that provided a level of interactivity.

Additional explanations for the higher scores of the hybrid-enrolled students may be the emotional connection, sense of belonging, an increased level of student motivation, a higher degree of accountability, and/or greater degree of focus and discipline by the students (Kolowich & Moore, 2005; Cappel & Hayen, 2004; Heckman & Annabi, 2005). Kolowich and Moore (2005) found that students who felt less isolated in their classes and

had a feeling of belonging had better learning outcomes. Capel and Hayen (2004) found that student interaction with others, while enrolled in a web-based class, enhanced student attitudes and ultimately performance. In essence, many educators are aware that some students seem to have a higher need for interactivity than others; the findings from this research tend to confirm that many students, particularly students who struggle academically, perform better with a face-to-face component. Based upon the findings of this study, interaction with intelligent software or adaptive learning technology, instead of a living instructor, does not seem to be sufficiently adequate to ensure equivalent success for all students enrolled in the online accounting classes.

Student Demographics and Academic Characteristics

Although most of the research and related literature about web-based instruction has been conducted at the aggregate level, some research suggests a digital divide; that there may be differences in the learning outcomes based upon demographic and other characteristics. For instance, researchers (e.g., Losh, 2003; Coates et al., 2001) suggested the likelihood of differences in student scores based on student demographic characteristics. However, the results of this study indicated that differences based on demographic variables were minimal; the differences found in this research were more likely the result of the delivery modality and the students' GPA, rather than gender, age, race/ethnicity, and SES demographic variables.

Gender. Previous researchers (Losh, 2003; Odell, Korgen, Schumacher, & Delucchi, 2000) found male students might possess greater Internet skills, spend more time online than females, use computers more frequently and have more positive attitudes about computers, thus potentially having an advantage over females in online classes. The

regression findings of this study indicated that there was a minor relationship between gender and final scores. The ANOVA indicated that the difference between the genders was not measured as significant. It would be remiss not to note a curious difference in this study; males scored, on an average, 8 points higher in the class overall than females.

Age. Although Coates et al., (2001) found underclassmen vulnerable to underperforming in online classes compared to face-to-face classes, in this study there appeared to be no significant differences in scores based on the ANOVA for students 22 and older and those under 22 years of age. The ANOVA indicated no significant differences in students grouped by age: between older and younger students. It must be noted, however, that younger students did appear to score somewhat better in the hybrid classes than in online classes; the difference between delivery modalities for older students was not so markedly different. Likewise it is interesting that students 22 and older performed less well on homework, but earned almost 1.5 points more for each year of age.

Race/ethnicity. The ANOVA in this research indicated no significant difference in mean score for students of different racial/ethnic backgrounds. This contrasts with findings made by researchers (Lu, Yu, & Liu, 2003; Wilson & Allen, 2011) who suggested that student race/ethnicity may negatively predict performance by students.

Socio-economic status. There are relatively few studies that examine the role of socio-economic status and online learning in higher education. Jaggars (2011) suggested that web-based instruction hinders the progression of low-income students; however, the ANOVA of this study indicated no significant difference between students receiving Pell Grants and those not receiving grants.

Overall, this study indicated that online education did not reduce mean scores of students of historically disadvantaged populations, but that students, as a whole, were not as successful when enrolled in online classes. In direct contrast to Russell's no significant difference phenomenon, the mean scores of the students in this study indicated that, as a whole, students performed better in hybrid classes. They either completed the class or received a passing grade of 420 points or higher. The larger number of students failing the online class created a mean that was significantly lower for students enrolled in the online classes versus the hybrid classes.

It can be concluded that the accounting students in this study who were enrolled in the hybrid classes earned scores higher than those students enrolled in the online classes. In summary, the findings that indicate students earned significantly higher scores in hybrid classes in Accounting 201 adds to the literature currently available in two ways. These insights fill a gap where relatively little research between online and hybrid is available; and is one of the relatively few studies examining differences in student demographics and academic characteristics.

Implications for Practice

The findings of this study provide guidance to educators in determining how to assist students as they enroll in online classes in increasingly larger numbers. The variables of GPA and class modality selection clearly are related to the students' final scores in Accounting 201. The added differences in drop rate and pass rate suggest that students need help navigating online classes, especially if they are students with lower GPAs. The almost universal significant finding that students scored higher overall when enrolled in hybrid classes suggests that educators use caution when replacing hybrid classes with

online ones. Also educators might consider implementing a required training class prior to students enrolling in online classes or providing additional support for students enrolled in online classes, again particularly those students with low GPAs.

These findings further suggest that common demographic variables are not related to student success. Many students have difficulty completing and/or passing an online class. These are substantial findings that not only help to fill the literature gap in demographic analysis between hybrid and online analysis, but also aid in the implementation of additional online classes by providing insights into potential student success.

Arbaugh et al. (2009) found a dearth of studies regarding online and hybrid delivery modalities in business and accounting classes. All student demographic groups' means were higher in hybrid classes, most significantly so; and GPA and class modality were significant factors in those final scores. This research adds to the empirical evidence needed to make decisions about the efficacy of online learning in accounting classes.

Recommendations for Future Research

Further research should continue to evaluate student success among classroom modalities broken out by demographics to ensure that college educators are providing equivalent education to students from all backgrounds. This study focused on students enrolled in Accounting 201 classes taught by one instructor during 2011, 2012, 2013 and 2014. To gain a more comprehensive knowledge of student success, a similar study could be designed which includes all Accounting 201 classes taught by the two additional instructors who taught hybrid classes during this same period and included the same

adaptive learning software for assignments, homework, and tests. From the student's perspective the only difference between the classes would have been the professor.

Furthermore, an additional qualitative or mixed method study could be prepared to provide insights into the online students who dropped or failed the class. Of particular interest is the 30% of students who self-selected into the online class, then ultimately did not complete or failed the class. Questions addressing comparable drop rates, whether this was the student's first online class, what caused the student to drop, and what the student learned from the experience of taking Accounting 201 unsuccessfully could be asked. It would also be interesting to know if these students took other online classes; if so, did they complete another online class successfully? Have they graduated from college? Have they earned a degree in business? Furthermore, if this study had included knowledge of the students' previous online experiences, the study may have provided more insight into the students' academic success.

Conclusion

The findings of this research suggest that for students who perform well academically, as measured by GPA, there is little difference in their final scores between taking classes online or via a hybrid modality. However, these findings suggest that there may be a difference for students who struggle academically. The clustering of the students who failed the class, as indicated of a final score below 420 points, coupled with the students who did not complete tests 3 and 4, suggest that online learning may be missing a crucial element to allow students to succeed in online classes. This study supports a more nuanced assessment of the difference between online and hybrid approaches to teaching accounting.

This research indicated that there is a significant difference in student performance between online and digital modalities, as measured by the mean scores. Overall, students' scores were significantly higher in the hybrid classes compared to the online classes. Time spent with an instructor in person seemed to contribute to learning of all student groups; the students enrolled in the hybrid classes seemed to benefit as measured by passing the class. This research found that students had challenges adapting to the online modality; these challenges were not associated with the demographic variables studied. This study did not find significant differences among student demographic variables, but found the differences to be primarily between online and hybrid modalities and students' level of GPA.

This research adds to the body of knowledge that helps educators more fully understand the impact of hybrid classes and online classes on student performance. As educators, these findings will contribute to our understanding of student learning outcomes in online and hybrid accounting classes. These results exemplify the current debate among university faculty regarding effective teaching with digital tools and highlight whether personal interaction is actually a key component of student achievement. Indeed, if personal interaction is important, how do faculty members create it successfully when using digital tools to teach classes? Can adaptive learning software replace the need for student interactions with other participants and the instructor? Although the findings cannot be generalized to all situations, this research adds to the body of research that is currently evaluating student performance between online and hybrid delivery modalities in college accounting classes.

APPENDIX A

University of Nevada, Reno

Research Integrity Office
218 Ross Hall / 331,
Reno, Nevada 89557
775.327.2368 / 775.327.2369 fax
www.unr.edu/research-integrity

DATE:	November 17, 2014
TO:	Janet Usinger, Ph.D.
FROM:	University of Nevada, Reno Social Behavior and Education IRB
PROJECT TITLE:	[682781-1] The Relationship of Demographic Characteristics on Student Academic Success Rates when Using Web-based Delivery Modalities
REFERENCE #:	
SUBMISSION TYPE:	New Project
ACTION:	DETERMINATION OF EXEMPT STATUS
DECISION DATE:	November 17, 2014; Expiration date: November 17, 2017; Next Status Report Due: November 17, 2015
REVIEW CATEGORY:	Exemption category # *4*

The UNR Institutional Review Board has determined this project is EXEMPT FROM IRB REVIEW according to federal regulations. Please note, the federal government has identified certain categories of research involving human subjects that qualify for exemption from federal regulations. The IRB is authorized by the federal government to determine whether studies thought by the principal investigator (PI) to be exempt from federal regulations actually qualify for exemption criteria. Only the IRB has authority to make a determination that a study is exempt from federal regulations and from IRB review and approval. The above-referenced protocol was reviewed and the research deemed eligible to proceed in accordance with the requirements of the Code of Federal Regulations on the Protection of Human Subjects (45 CFR 46.101 paragraph [b]).

- Application Form - Exempt Review of Existing Records Not Medical SOC 071714.docx (UPDATED: 11/14/2014)
- University of Nevada, Reno - Part I, Cover Sheet - University of Nevada, Reno - Part I, Cover Sheet (UPDATED: 11/17/2014)

We will retain a copy of this correspondence within our records.

If you have any questions, please contact Nancy Moody at 775.327.2367 or nmoody@unr.edu. Please include your project title and reference number in all correspondence with this committee.

Sincerely,

Nancy Moody JD MA
Director, Research Integrity Office
University of Nevada Reno

APPENDIX B

Appendix B

Details of Scores by Each Class, Semester, Year, and Section Grouped by Delivery Modality

Modality	Year	Semester	Sec	N	Av Score	St Dev	Median Score	Av Score	Low	High Score
Hybrid	2011	FALL	1	53	543	77	548	77.6	320	682
	2011	FALL	2	50	532	72	545	76.0	342	673
	2012	FALL	1	52	554	72	557	78.0	331	684
	2012	FALL	2	50	516	94	537	73.7	278	669
	2012	SPRING	1	50	520	93	519	74.3	175	660
	2012	SPRING	2	47	515	92	523	73.6	260	675
	2013	SPRING	1	51	539	78	549	77.0	251	672
	2013	SPRING	2	51	506	83	519	72.2	215	658
Online	2011	FALL	1	32	468	135	478	66.9	187	680
	2012	FALL	1	40	496	114	525	70.8	167	652
	2013	FALL	1	72	512	97	523	73.1	234	663
	2012	SPRING	1	38	492	109	525	70.3	165	636
	2013	SPRING	1	33	510	96	503	72.9	303	662
	2014	SPRING	1	66	481	82	489	68.7	176	606

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