

ONLINE VERSUS TRADITIONAL COURSE ACHIEVEMENT
AT A SMALL LIBERAL ARTS COLLEGE

by

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ABSTRACT

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The purpose of this study was to compare student achievement and satisfaction in online versus traditional introductory statistics courses. The sample studied were undergraduates at a small liberal arts school enrolled in introductory statistics over a period of six semesters. There were a few significant findings in student achievement in the overall sample and other meaningful results were found when assessing nursing and business majors specifically. Student satisfaction results between the two formats were inconclusive. Future studies on this topic can include hybrid education data in addition to online and traditional to see if there are any differences in achievement or student satisfaction in that population. Another possible study could be done regarding achievement in students who took preparatory training prior to enrolling in an online course.

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Chapter I

INTRODUCTION

As the world undergoes changes and evolution, so too must education. Keeping pace with the changes is challenging in education, especially when new technologies are being introduced regularly. At the college level, many institutions have embraced one technological advancement: the use of online courses. Providing courses online is not new to institutions of higher learning; some schools have offered online courses for the past 20 years, but the way online courses are created and offered changes frequently. 20 years ago, an online course was most commonly one in which an instructor put some PowerPoint slides online for students to look at and learn from; today there is a much larger spread of how online courses are delivered at higher education institutions (Dennen, Darabi, & Smith, 2007).

Although a wide range of online courses is offered at higher education institutions, most courses have a similar reason for being created in the first place. Online courses offer higher education institutions a way to deliver content to students who may not have the opportunity to study otherwise (Taormino, 2010). Offering online courses gives students the choice of attending traditional lecture-type courses or utilizing the online option (Gornitsky, 2011). This not only offers flexibility to the student, but also allows the institution to reach students who are unable to study in a traditional setting but who still want to further their education. Learner needs are important to colleges, which, combined with technological advancements in online education, has caused institutions of higher learning to continue to think about online instruction (Taormino, 2010). “...what makes this period momentous is that technology makes it possible to break into another space and time, taking education to a whole new plane” (Harish, 2013, p. 29).

Another reason for the increase in online education offerings is because online courses are often less costly to an institution. Bowen, Chingos, Lack, and Nygren (2012) found that the costs of teaching online and hybrid courses in statistics were significantly lower than in a traditional format. So much lower in fact that colleges were saving anywhere from 36 to 57 percent offering online classes instead of traditional courses.

Students taking these courses are often older and female and often have other obligations outside of school with work and family. This group of distance learners also tends to be quite diverse, with students of varied races, military members, and students with disabilities (Scott, 2012). Due to this population's many responsibilities outside of school, flexibility is a crucial component necessary for these diverse students to be successful. The ability to have continuous course content access allows these learners the freedom to choose when and where to learn. In a study done by Boz and Adnan 2017, flexibility was the most cited advantage of online participants. Flexibility of schedule was also in the top four factors affecting postsecondary schools' decisions regarding distance education, as was providing access to students who couldn't physically attend classes, having more courses available to students who could not attend classes in person, and increasing student enrollment (Scott, 2012).

However, this flexibility and freedom does not fare well for all distance students. On the one hand there are studies that have found that online students learn as much as their traditional counterparts in 25 percent less study time as well as savings on commuting (Bowen et al., 2012). However, many other studies conclude that distance education can cause students to encounter a barrage of issues that they may not be prepared to handle. Some studies are insistent that students cannot be successful in distance education because they do not have realistic expectations on the workload and involvement required to take an online course. Especially for those students who are accustomed to traditional course formats, the more open structure of online courses might cause students frustration and make them unmotivated to put in the work to succeed (McClendon, Neugebauer & King, 2017). Another factor is that the timeframe of online courses is often significantly shorter than that in a traditional course, yet students are still responsible to learn all of the information that they would in a traditional section in approximately

half of the time. This bombardment of material is very challenging for some online learners; especially if they lack the prior knowledge or technical skills needed to move on from that point. Brains have a maximum capacity when storing short-term information, and sometimes these shortened timeframes cause students to hit that short-term memory threshold and physically not allow them to move on in distance education courses (McClendon et al., 2017). Again, this can overwhelm online education students and cause them to lose their motivation to participate fully in the course.

In higher education, there has been a decline in enrollments for traditional, face-to-face education (Scott, 2012); however, in the online sector the number of undergraduate and graduate students has increased steadily from 2012 to 2016. Over those four years the percentage of students taking at least one online course increased 17.2%. These days students often take a mix of classes, some in a traditional classroom and others online to supplement their learning. In 2016 52.8% of higher education students enrolled in distance education also took at least one course in person on campus (Seaman, Allen & Seaman, 2018).

The numbers continue to back up this evolution towards students taking more online courses. By 2016, 31.6% of all higher education enrollments were in at least one distance education course and almost half of that percentage was taking solely online courses. An interesting development over the last few years as compared to the past is that very few higher education students take all of their courses in a traditional classroom setting. Between 2012 and 2016 the number of students only studying on campus continued to drop for public and not-for-profit institutions at a decrease of around 4% for both. The number of students not taking any distance education courses supports this decrease; that percentage has decreased 9.5% for non-profit colleges and universities (Seaman et al., 2018).

Distance education is not just for students at a distance anymore either. Most students taking only distance courses live in the same state as the institution they are enrolled. In New York State the proportion of students taking distance education courses is 51%; lower than the national average of 56.1% in 2016 (Seaman et al., 2018). That means that close to 50% of the students in the state taking distance education courses are not very far from the institutions

offering those same online courses. This decrease in distance allows institutions to be creative in how they offer classes to students to allow for better flexibility for all of their student body. In fact, many of these new distance students live on campus and take their distance courses from a dorm room or library on school grounds (Seaman et al., 2018).

Although enrollments in higher education institutions have been trending downward, private non-profit enrollment in the United States has increased from 4,152,060 to 4,230,003 between 2013 and 2016 (Seaman et al., 2018). Part of this increase is due to online education enrollments rising over the past 14 consecutive years. This implies that some schools in public and non-profit sectors are growing enough in distance education to make up for their lost students in traditional programs.

The combination of more students taking only distance courses in conjunction with the decline of traditional student enrollments means that in 2016 over a million fewer students went to campuses that fall. (Seaman et al., 2018) This gap will continue to grow if distance education increases and traditional enrollments stay steady or decrease. In 2016 there was the smaller loss of traditional students as compared to the three years prior, so perhaps the decline in those enrollments has bottomed out and will start to increase again over the next few years. A side effect of the changing enrollment from traditional to distance means that a small number of academic leaders who work at institutions where there is the highest distance enrollment can make decisions that will reverberate throughout the entire distance education community. Seaman et al. (2018) predict that a change in 10% of the distance education policies at these institutions could potentially impact more than 65% of all distance students.

For the purposes of this research, traditional courses are those that are 100% face-to-face courses where students learn in a classroom, bring homework into class, and take tests in a physical room. The term "online instruction" implies 0% face-to-face interaction between the student and instructor; all content is delivered online, including homework and tests (Allen & Seaman, 2010). Many other combinations of online and face-to-face courses are possible, but this research will not be focusing on them.

Need for Study

Historically, the small liberal arts college utilized in this study has many more full-time than part-time students. In 2017, 2,700 students were on the small liberal arts college's campus, and only 26% of those students were part-time. Recently there has been a boom in enrollment in the nursing and business majors at the college. In fact, for those students who graduated in 2017 with an undergraduate degree, 28.5% were nursing majors and 14.2% were business (Institutional Data).

Both programs cater to full-time students but have also seen an influx of students who work full-time and are going back to school in their free time. For this increasing population of part-time students, flexibility in the course offerings is a must, and the number of online education courses offered has increased 30% between the 2015–2016 and 2016–2017 school years. A majority of the school's online courses are offered during the summer; comparing summer enrollment, the school saw an increase from 273 students in summer 2015 to 448 students enrolled in summer 2016, a 64% increase.

The distance learning department continues to add new offerings of online courses because more and more of the student population need these services. Students who are working full-time jobs and want to keep pace with the industry, or those who have families and need more flexibility, are amongst the biggest contributors to this increase in part-time students (Butcher & Wilson-Strydom, 2013). Research suggests that in some cases online technology can be incredibly effective in the classroom (Bolliger & Martindale, 2004; Fulmer, Hazzard, Jones, & Keene, 1992; Moore, 2002). However, at a small school with limited financial resources, can online classes also produce positive results in student achievement?

To cater to the growing population of part-time students, specifically in business and nursing, who are required to take introduction to statistics for their major, the college needs to offer additional online sections of the course. However, before using valuable resources for growing the online education courses, the college wants to make sure online offerings allow for student success. If found to be comparable to traditional courses, this would provide proof to the institution that the added investment was worth it.

Purpose

The purpose of this study is to look at online versus traditional courses for a small liberal arts college to see if any significant differences in student achievement or satisfaction exist. To achieve its purpose the study will seek answers to the following questions:

Research Questions:

1. Is student achievement in an online introduction to statistics course statistically different when compared to achievement in traditional statistics courses for a small liberal arts college regardless of major?
 - a) Does the achievement of nursing students in an online statistics class differ significantly from that of similar students in a face-to-face statistics class?
 - b) Does the achievement of business students in an online statistics class differ significantly from that of similar students in a face-to-face statistics class?
2. Does student satisfaction in an online course differ significantly from that of students in a traditional course?

Procedures

To address and answer the research questions, this study will be analyzing the data obtained over the course of six semesters at the small liberal arts college. I as both instructor and designer will design and teach both the traditional and online introduction to statistics courses. In designing the courses, I used many best practices for online instruction as per findings from the Quality Matters program (Adair & Shattuck, 2015). First, in both the traditional course and online course the goals and objectives are clearly communicated when the course begins. Students in both courses have a detailed syllabus that gives information about all of the policies, requirements, structure, and support services the college offers to students. This is consistent

with studies that say that communicating this information in an online course potentially helps alleviate student anxiety in an online course (Mood, 1995).

Student achievement is measured based upon the graded material in the courses: two quizzes, three tests, a homework average, and a final project grade are included. All homework, quizzes and tests, and the project are graded by me using rubrics created specifically for that assignment to make the grading as objective and consistent as possible. The online assessments have been developed to fit into the informal asynchronous category according to academic partnerships study (Butcher & Wilson-Strydom, 2013). This means that students have flexibility in when assignments are due and will not need to complete assignments at the exact same time as their peers. Informal assignments for homework are created using WebAssign for both traditional and online participants. The formal assessments have been created using the Moodle software and are the same questions that students in the traditional course have on quizzes and tests. This type of assessment is highly beneficial for the online student in that it doesn't require taking the quiz or test at a specific time or in a particular location. In general, the growth of distance learning has caused a need for the flexibility of online assessment for students who never set foot on campus (Natriello, 2012). However, there are still some constraints on the online student when getting assessed. A time limit is imposed on both online and traditional students. Online students have until 11:59PM on the Sunday of each week to complete their assessment, but once they begin it, they must continue until they are finished or time has run out. This type of assessment still affords a good amount of flexibility to the online student, but the major drawback of this type of assessment is in concerns about student identification and potential cheating. To mitigate these risks, students do need to sign in to their own account and all students are reminded of the academic honesty policy at the college to dissuade them from cheating. Other security measures are available but are expensive and therefore not viable at this time for this small liberal arts school.

The only data used for this study are data routinely obtained from teaching the introduction to statistics course. This includes course type, major, and grades obtained on homework, two quizzes, three tests, and a final project. In addition, the instructor/researcher

customarily gives an anonymous student satisfaction survey at the conclusion of each course, and that survey was used to help assess student satisfaction for both online and traditional students.

Chapter II

LITERATURE REVIEW

The goal of this study was to determine if differences in student achievement and student satisfaction existed between online and traditional introductory to statistics classes at a small liberal arts college. This particular sample of mathematics courses at the college was studied because there was a gap in the literature in this area. An overview of the literature on the topics of online versus traditional learning as well as several studies on the outskirts of this topic were examined and synthesized to emphasize this point.

Based on the literature several areas jumped out as those explored often as well as those that were connected to this particular study. The main topics explored in this literature review are online education growth, adult learners, grade point average (GPA) and prior-learning, self-efficacy and grit, control and self-regulation, instructional design and equivalence, faculty perceptions, and how online compares to traditional courses.

Online Education Growth

Small colleges are often tuition dependent and lower enrollment could cause them to struggle financially. If the enrollment decreases schools will be forced to reduce the number of academic and/or extracurricular programs causing schools to have a harder time enticing new students to their school and further reducing revenue. This could cause a downward spiral and according to Woodhouse (2015), the closure rates of small colleges and universities will likely triple in the next few years due to such declines. Her article was based on predictions from a Moody's Investors Service report in the same year that found that more and more tuition dependent small colleges were being forced to either merge with other institutions or close

altogether. The article indicates three main factors for the decline in enrollment and decline of tuition: fewer students are available overall due to higher enrollments at larger colleges, of those students fewer are attending college, and the institutions are offering more financial aid to get these students causing schools to bring in less revenue even if the student comes to the college. The article suggests that only those schools that are able to come up with imaginative solutions would be able to grow or stay stable.

Despite the declining enrollment in traditional classes, growth in online course enrollments has risen and institutions continue to add more online course offerings. Between the fall of 2012 and 2014 there was a 26% growth in online education enrollments at not-for-profit institutions. More than one in four students are taking some sort of distance education course (Allen & Seaman, 2016). This growth in online course enrollments has not gone unnoticed and many researchers feel that online courses will be a big part of higher education going forward (Berger & Lyon, 2005; Palloff & Pratt, 2003; Snyder & Dillow, 2012). This is in part due to the desire for students to take online courses but also because online courses are less expensive to offer. Typically, online courses require lower overhead costs and do not take up more facility space and allow for more flexibility for both the student and the institution (Whitfield, 2015). Savings could even be as much as 36 to 57 percent in some cases (Bowen et al., 2012). For small liberal arts colleges with a limited amount of facility space offering online courses is a valuable alternative to consider.

Institutions with established online education offerings still believe distance education is crucial to their growth and future success but faculty and chief academic officer perceptions toward online learning are still low. Interestingly, despite the literature to show that online, hybrid and traditional courses are usually quite comparable, academic officers feel much more positively about hybrid or blended courses as compared to fully online offerings (Allen & Seaman, 2016).

The students currently enrolled in distance education courses are quite diverse. Not only are the students varied in race, military status and age but many students also have disabilities (Scott, 2012). Many of these online students are older and have family and work obligations outside of school and require the flexibility of distance education to be able to continue to attain

their educational goals. Some of the many ways distance education offers flexibility are through continual access to a course, not having to complete assignments on one particular day or time, and this lack of rigidity is cited as a huge advantage by distance education students (Boz & Adnan, 2017). Flexibility of schedule was also in the top four factors affecting postsecondary schools' decisions regarding distance education (Scott, 2012).

The online sector at higher education institutions had the number of undergraduate and graduate students increase steadily from 2012 to 2016 despite a steady decline in enrollments for traditional education (Scott, 2012). The percentage of students taking at least one online course increased 17.2% from 2012 to 2016 due to students often taking a mix of classes, some in a traditional classroom and others online. Students who enroll in traditional sections despite also being enrolled in online courses was at 52.8% of all higher education students in 2016.

This evolution towards students taking more online courses is backed up with data. By 2016, 31.6% of all higher education enrollments were in at least one distance education course and almost half of that percentage was taking solely online courses. Whereas in the past most higher education students were taking their course load traditionally, now very few students are taking solely traditional courses. In fact, Seaman et al. (2018) found that between 2012 and 2016 the number of students only studying on campus continued to decrease approximately 4% for both public and not-for-profit institutions. Also, the number of students who do not take distance education courses supports this decrease; the decline has been 9.5% for non-profit colleges and universities (Seaman et al., 2018).

Romero-Hall and Vicentini (2017) conclude, "The traditional notion of the on-campus university experience is changing, with many students choosing to participate wholly or partially away from their institutions' campuses" (p. 142). Although many people think of students taking online classes from a far distance, in reality most students taking only distance courses live in the same state as the institution they are enrolled. A study showed that in New York State this amounted to 51% of the online students, lower than the 56.1% that was the national average in 2016 (Seaman et al., 2018). This amounts to the fact that despite perceptions to the contrary, close to 50% of the students in New York State taking online courses are not far from those

college campuses they are enrolled. Unlike past online students, many of these new distance students live on campus and take their distance courses from a dorm room or library on school grounds (Seaman et al., 2018).

Although many colleges and universities have seen a downward trend in their enrollments over the past few years, one sector that is still seeing an increase in enrollment is for private non-profit higher education institutions. Private non-profit enrollment in the United States has increased from 4,152,060 to 4,230,003 between 2013 and 2016 (Seaman et al., 2018). One crucial reason to account for this increase in enrollment is that over the past 14 consecutive years distance education enrollments have risen. So, although many schools have experienced a loss of revenue due to lower enrollments, some schools in the public and non-profit sectors have used distance education to make up for lost enrollment in their traditional courses.

In 2016 approximately 1,000,000 fewer students physically went to campuses. This decrease was in part due to the decline in traditional enrollments but was also compounded by the fact that more students are taking only distance education courses (Seaman et al., 2018). This gap will continue to grow if traditionally registered students stay steady or decrease and if distance enrollments increase. In 2016 there was the smaller loss of traditional students as compared to the three years prior, so perhaps the decline in those enrollments has hit bottom and will change back to increasing over the next few years. A side effect of the changing enrollment from traditional to distance means that a small number of academic leaders who work at institutions where there is the highest distance enrollment can make decisions that will reverberate throughout the entire distance education community. Seaman et al. (2018) predict that a change in 10% of the distance education policies at these institutions could potentially impact more than 65% of all distance students.

Depending on the type of online education being discussed, there are mixed feelings on whether or not distance education will substitute for traditional education or complement it. Proponents for more online education see the benefits and see online education as a complement to a traditional format; in fact, courses that offer a distance approach could increase the demand for varied teaching techniques and additional uses of examples and applications.

These supporters are often talking about smaller online courses as compared to offering massive open online courses, better known in the industry as MOOCs, that could potentially eradicate traditional lecture-type courses on a grand scale. “While the overall effect on labor demand is unclear, there certainly will be distributional consequences, with winners and losers among educators depending on their skills, willingness to adapt, and ability to innovate” (Navarro, 2015, p. 161).

Adult Learners

One way to combat the pitfall of declining enrollment in the traditional sections is to employ realistic growth strategies and Miller and Fennell (2016) suggests that supplementing traditional programs with a student-centered adult program that includes online offerings can help this growth. Therefore, institutions that have declining traditional enrollment could potentially make up the difference by offering more online courses that would bring in additional part-time learners to the school. Carver, Mukherjee and Lucio (2017) found that in higher education institutions online education continues to have a significant role, particularly for adult students. A lot of the relevant literature regarding adult learners discussed how adults make up a modest amount of the online learners and studied the challenges that existed for this learner type.

Adult learners are going back to school in part or fully due to the options they have in their educational choices and distance education is a big part of that. Many studies find that distance education is a good choice for mature professionals pursuing additional educational goals (Brint & Clotfelter, 2016). Lohr and Haley (2018) uncovered that more graduate students over the age of 30 took online courses or an entire degree at a distance as opposed to their younger peers. Carver et al. (2017) found that graduate students valued the flexibility of online courses and found those courses especially advantageous due to reduced time constraints.

It's no surprise that adult students taking distance education courses appreciate the flexibility (Boz & Adnan, 2017; Cavahaugh, Gillan, Bosnick, Hess & Scott, 2008; Jaggars, 2014; Weems, 2002) including the opportunity to squeeze in educational opportunities around work and

other responsibilities (Butcher & Wilson-Strydom, 2013; Edgecombe, 2011; Gornitsky, 2011; Rutschow et al., 2011; Shea, Motiwalla & Lewis, 2001; Tham & Werner, 2005; Xu & Jaggars, 2013) and allowing for greater flexibility in location and scheduling (Romero-Hall & Vicentini, 2017). In fact, without this flexibility, some adult learners would have to take fewer courses each semester (Jaggars, 2014). Online courses also allow higher education institutions a way to deliver content to students who are unable to study in an on-campus setting but who still want to take courses (Taormino, 2010).

Although this flexibility is incredibly helpful for some students, for others who may not be good at managing their own time it can be a hindrance. In reality, for those students who may be less organized, the open structure of online courses could cause a lack of motivation and frustration (McClendon et al., 2017). This could be exacerbated by the fact that many online students do not have realistic expectations about the time and energy required in online courses. The enormity of the amount of material required can be challenging for online learners; especially if they lack any prior knowledge or technical skills needed. Some of these distance students hit a wall with how much material they can actually take in short-term spurts (McClendon et al., 2017). Again, this can overwhelm distance education students and cause them to lose their motivation to participate fully in the course. These findings, coupled with the fact that most online courses are significantly shorter than their traditional counterparts could set some students up for imminent failure.

That being said, not everyone struggles in online courses. There are reports that show that certain online students learn as much as their traditional counterparts in 25 percent less study time as well as savings on commuting (Bowen et al., 2012). Others show that regardless of age, academically well-prepared students can fare well in a fully online environment (Xu & Jaggars, 2011). There is also evidence found to the contrary. These studies suggest that online learners typically score lower than their traditional counterparts (Alpert, Couch & Harmon, 2016; Bettinger, Fox, Loeb & Taylor, 2017; Xu & Jaggars, 2013) and have lower satisfaction (Davis, 2014). Bettinger et al. (2017) found that "Taking a course online reduces the probability of earning an A or higher by 12.2 percentage points, a B or higher by 13.5 points, a C or higher by 10.1

points, and a D or higher (passing the course) by 8.5 points” (p. 2867). Their study was conducted on a large for-profit campus with over 100,000 students in the undergraduate program and most students taking two-thirds of their courses online. The data was retrieved over four years (2009 to 2013) with over 230,000 participants in more than 750 various course offerings. Xu and Jaggars (2014) also used a large dataset of more than 40,000 community and technical college students in various courses and found that students older than 25 in online courses scored significantly weaker than their younger counterparts. However, adult learners may still opt for the flexibility of an online course despite knowing they will likely performance worse or be less satisfied.

The closer the fit between adult learner expectations and their reality the more likely they are to be successful in a course. Conversely, if the gap between expectations and reality is larger, poor performance and dropouts are a likely result (Ruffalo Noel Levitz, 2011). Included in these expectations are things like the technical parts of online learning and how to access the system, specific requirements and rules for a course, the significantly shorter timeframe in which the course is offered, and understanding just how distance learning differs from taking a traditional course (McClendon et al., 2017; Scheitler, 2015).

In addition, adult learners perform better when they are able to connect course content to their everyday lives or to more realistic life problems. Studies have shown that adult students that find a link between their experiences both in an out of school do better and have a higher level of student satisfaction (Sahin, 2007). As Figure 1 shows, satisfied students are more likely to be successful students; the higher the satisfaction the higher the number of graduates and that amounts to greater alumni giving (Ruffalo Noel Levitz, 2011).

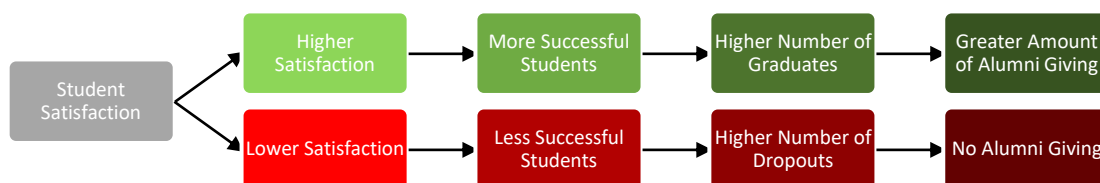


Figure 1: A visual representation of Ruffalo Noel Levitz (2011) results for student satisfaction

In general, adult students do make up a large portion of online course takers at this liberal arts school, but online education is a good choice for anyone who needs to go to school part-time or needs to take a class or two outside of a traditional classroom to get caught up. In fact, part-time students are 1.5 times more likely to sign up for an online section of a course (Conklin, 2008) especially if they live far from the institution (Xu & Jaggars, 2013). Most students take online classes along with some traditional courses; however, those that take only online classes typically drop out in three or less online classes (Xu & Jaggars, 2013).

Although students take online courses due to the flexibility and convenience, very few students take online classes because they believe it will be a better learning experience (Jaggars, 2014). In fact, Jaggars (2014) found that most students only wanted to take the easier subjects online and left the more challenging classes to be taken face-to-face. Many students taking online or hybrid courses felt that they worked harder than they would have in a traditional setting (Roach & Lemasters, 2006; Utts, Sommer, Acredolo, Maher & Matthews, 2003). Depending on how the online student managed their time, the time and effort spent on online classes could fluctuate greatly. Potentially much more work might need to be completed in a short amount of time in an online course as compared the spread-out time spent in a traditional class over the course of the semester (McClendon et al., 2017; Tomei, 2006).

GPA and Prior-learning

Several studies have found connections between previous grades or GPA and success in online classes. These studies showed that students with strong academic skills fare well in online courses (Dynarski, 2018), but those students with lower GPAs that take an online course have larger negative effects in achievement as compared to their peers with higher GPAs (Alpert et al., 2016; Bettinger et al., 2017; Xu & Jaggars, 2014). The gap between online and traditional achievement is also larger for low-income students, those students with weak preparation, as well as those with lower GPAs (Xu & Jaggars, 2013). For these lower achieving students, they might

need additional support or tutoring in order to be successful in an online class (Boz & Adnan, 2017; Lee, 2011; Ni, 2013; Wladis, Hachey & Conway, 2013).

Self-efficacy and Grit

Other studies focused on the type of learner that would be successful in an online or blended versus a traditional course. These studies found that in order to be successful in any online learning course students must employ strong self-motivation and self-discipline (Johnston, 2013; Perez & Foshay, 2002; Shapely, 2000) and in part students must spend a lot of time with course content (Gorman, 2011). If students had taken an online class previously their self-efficacy and self-regulation skills in another online course were statistically significant (Holcomb, King & Brown, 2004).

Another study found that students who reported positive attitudes towards online courses were learners who employed self-direction in their studies whereas those with negative feelings needed additional guidance in online environments (Howland & Moore, 2002). Students who are active learners are often academically successful regardless of instructional method (Cavahaugh et al., 2008; Holton, 2005; Snyder, 2006). Duckworth and Quinn (2009) found that students with what they call grit also are successful academically.

Having grit is defined by Duckworth and Quinn (2009) to be pursuing one interest over a sustained period of time. Although closely linked to self-discipline, grit and self-discipline are not the same thing. Self-discipline can be applied to very short-term goals whereas grit needs to be sustained over a long period of time and needs always to be focused on one specific interest (Duckworth, 2016). In the studies about grit in various industries and disciplines the researchers found grit to be a predictor of success beyond just talent, intelligence or self-discipline. Grittier students spent long hours pursuing their passion in order to attain some long-term goal they had set for themselves. In online education this translates to gritty students investing more time in courses and achieving higher grades. Online students often cannot finish their degree in a four-year timeframe like many of their traditional counterparts; therefore, these students need to

continue to work towards their education for many years prior to finishing their respective degree. This sustained period of time will work for some distance students but is a challenge for many more. Therefore, if distance students were to develop grit towards their long-term goal of attaining a degree through online education that change could increase the instances of higher grades, more commitment and focus towards online courses as well as successful completion of the desired program (McClendon et al., 2017).

Regardless of the field studied, non-cognitive elements like grit were found to be a commonality amongst successful individuals. On a study specifically studying grit for doctoral students taking online courses Cross (2014) found that there were strong relationships between grit and GPA as well as grit and age. He concluded that people could become grittier as their life went on due to experiences and education. Unlike talent or IQ researchers argue that grit can be developed over time and does not need to be an inherent trait in an individual for all of their life. If grit can be fostered in adult online students they would have a better chance to be successful in distance education courses and in finishing their degree (McClendon et al., 2017).

Other traits are often looked at as those needed for students to be successful and conscientiousness is another such trait. If a person is conscientious, they are reliable, thorough, organized and self-controlled. The difference between this and grit is mainly the timeframe over which the trait is being employed. As mentioned previously grit is over a very long time with the person exhibiting focus on a specific goal without losing interest or being derailed by anything. Conscientiousness and grit overlap in the achievement aspects but differ in that conscientiousness does not necessarily have to be applied to a long-term goal. Like conscientiousness grit also includes self-control as part of its definition, but the applied definition is a little different in that the self-control employed in grit is specifically dedicated to a consistent goal. That differentiation puts grit above conscientiousness and self-control towards a person achieving their desired goal.

Self-efficacy is related to both self-control and self-regulation but all three have different distinct definitions. Self-control is the ability to adjust behavior to continue to reach goals. Self-regulation refers to an individual's "... self-generated thoughts, feelings, and actions that are

systematically designed to affect one's learning and skills" (Schunk & Zimmerman, 2007, p. 1). Self-efficacy on the other hand is related to one's perceived abilities. So, in other words, self-efficacy is the belief that it can be done successfully and self-regulation is the tool to get it done with the use of self-control.

Self-efficacy is seen to be influenced by several sources including personal experiences, vicarious experiences and feedback from others. Adult learners therefore may inherently have more self-efficacy beliefs due to their enumerable experiences as compared to their younger counterparts (Zimmerman, 2017). Just having more experiences does not guarantee strong self-efficacy however. If all of the past experiences for adult students were negative ones it is unlikely that an adult student would benefit from those experiences. However, on the other hand, if most of the experiences were positive it would foster a strong positive sense of self-efficacy in that student. High self-efficacy was also found in students who had more personal experiences with online education. This in part could be due to the increased use of technology in online courses as several studies found that self-efficacy was strongly linked to the use of technology (Zimmerman, 2017).

Control and Self-regulation

Multiple studies have found that having control over learning options can allow for additional student benefits (Reese, 2007; Trenholm, 2006). The U.S. Department of Education (2009) found that activities in online environments that allow students to reflect or self-monitor their understanding are effective tools.

In an online environment many skills are essential for success. Some of these skills include being goal oriented, being technologically savvy, knowing one's learning preferences, being organized, having good time management and being a good communicator (Plews, 2016; Scheitler, 2015; Taormino, 2010). Students who are independent learners, have self-discipline and read well are also apt to have success in online environments (Eggert, 2009). Wadsworth,

Husman, Duggan and Pennington (2007) found that in online classes concentration, motivation, information processing and self-testing strategies were good predictors of student achievement.

As mentioned previously, students need to be ready for their online classes. This readiness includes being able to perform the necessary online tasks and students being proactive when they encounter a challenge. Those that have realistic expectations and have these readiness skills are often more successful in online courses (Ni, 2013; Scheitler, 2015). Students should also consider their learning environment when taking an online class. Appropriate learning environment has been connected directly with performance in online courses (Puzziferro, 2008). Students must also realize that different learning styles may or may not be conducive to achieving success in a distance education environment (Blau & Drennan, 2017).

The online environment is unique in that it provides students who need more time and repetition for learning that option, but simultaneously allows students who grasp material quickly to move through the lessons at their own pace (Eggert, 2009). The flexibility that is an advantage for those with the right skills can be detrimental for those without them. Those students lacking self-discipline or time management skills and preferring procrastination will struggle in the online environment (Bettinger et al., 2017). Edmundson (2012) puts it well in saying, "A truly memorable college class ... is a collaboration between teacher and students. It's a one-time-only event. Learning at its best is a collective enterprise, something we've known since Socrates. You can get knowledge from an Internet course if you're highly motivated to learn" (p. 1).

Flexibility and convenience are two big advantages of online learning for adult students; however, online classes require a greater degree of self-discipline as compared to traditional courses. A self-directed learner who is responsible for their own learning and willing to actively engage in the learning can be successful in this online environment but others prefer a more structured learning experience (Boz & Adnan, 2017). If students are easily distracted it is challenging to take online courses unless the student has an appropriate area away from distraction to work on the material. This can be very challenging for some students and this lack of self-regulation does not bode well for those students who are easily sidetracked. Therefore, researchers explain that self-regulation, the ability to control behaviors when experiencing

external stimuli, is a crucial skill for distance education learners. This self-regulation allows students to be more independent and take control of and be responsible for their learning experience online (Boz & Adnan, 2017).

Researchers have suggested that self-regulation strategies are more important in an online environment as compared to a traditional one due to the more independent nature of the course. They have also found that these self-regulated strategies are not automatically fostered in an online environment whereas students can get better at them in a traditional course without specific intervention. Therefore, in online learning environments, there is the opportunity for professors designing their courses to include activities that would promote self-regulation which has been proven to have a positive association with academic performance in college students. A few examples of strategies that can be suggested to online course participants are keeping a study log, working with a peer, getting a tutor or emailing the professor.

Not only are these strategies relatively easy to implement but they are typically low in cost, and they can be useful across a large range of subject matter. There is a need for institutions to hang on to their online students and foster growth in that distance education environment, and one way to attempt to combat student attrition is by teaching strategies to students to help them become successful in their courses. This is done by teaching students the tools needed to become more active participants in their online courses as compared to being passive and expecting all of the information to be given to them by the instructor. This will give students the tools to succeed not only in their current course but also in their future courses (Boz & Adnan, 2017).

One specific strategy that can be fostered is help-seeking. This can be seeking help from the instructor, a peer, or various online or written content. Instructors can encourage students to employ this strategy and to look up information that they otherwise wouldn't have encountered in class. This could be a consistent requirement during the time of the class and it has been found that encouraging self-regulation is more effective when it is continued throughout the semester. There are instances where employing these strategies could provide better results and stronger

self-regulated learners would be better at asking for help from an appropriate source that could actually assist them (Boz & Adnan, 2017).

Success in this strategy requires various supports to help promote student learning. One of these techniques is called scaffolding and encourages students to seek help in different ways. Scaffolding encourages students to break up assignments into smaller, manageable pieces. If an assignment has four parts required students can break up the assignment over the given timeframe and do one piece at a time. This would help students who are prone to procrastination if they can self-regulate and force themselves to complete the separate assignment pieces as scheduled. This scaffolding strategy can also be specified by the instructor by asking for one piece of the assignment at a time rather than asking for the complete assignment on one day. This puts more work on the instructor but ensures that students are breaking up longer assignment into smaller pieces (Boz & Adnan, 2017).

Students that have only completed courses in a traditional format and who sign up for an online course may not know what they are getting themselves into. In face-to-face instruction students are relying quite heavily on the instructor to teach them something and to answer all of the questions they might have. Some students in those environments do not even do the reading in the book and their success is hinged quite heavily on how much they take away from the instructor's lecture, assignments and tests. On the other hand, online learning requires students to work much more independently with resources at hand but much less real-time feedback. This learning curve can be steep for some students new to online learning and that could lead to a minimal issue of frustration for the student or at the high end of the range, non-completion of the course or degree (Lohr & Haley, 2018).

One study found that two learning strategies: time management and self-regulation were strongly linked to online learner's grades. These goals allow for online students to schedule time for reading and completing homework and tests, managing study time effectively while avoiding any potential distractions (Broadbent & Poon, 2015).

Instructional Design and Equivalence

Online learning is constantly evolving and has seen many iterations over the years. Years ago, an online course could have simply been PowerPoint slides put on a website for students to look at and learn from; thankfully today there are many more possible ways to deliver online instruction at higher education institutions (Dennen, Darabi & Smith, 2007). Moreover, today most online instructional design attempts to give at least an equivalent experience to the learner compared to what they would learn in a traditional course. Although the experiences will be different between online and traditional learners both courses should be valued similarly (Fonolahi, Khan & Jokhan, 2014).

When an instructor in a traditional course wants to change up the curriculum it is quite easy to edit, delete or add new material into the syllabus and into the course. Changing an online course is often much more cumbersome as it often involves editing content, changing software programs or even reshooting video of the professor teaching the new or edited content. Although these changes can be done in an online environment they often take more time, resources and assistance from other offices. The difference in a traditional course is that if an instructor decides to make some changes to how the content is being taught those changes can happen that very day. This means that changes to online courses are often much less-frequent and require potential additional expenses to the institution (McPherson & Bacow, 2015).

In designing online courses, a person is restricted by some portions of the TEACH Act. Therefore, online educators do not experience the same level of academic freedom as their peers teaching traditional courses. In traditional classrooms instructors are able to decide what material is appropriate to teach without much interference; this is not the case in an online education environment. "TEACH requires educational institutions to meet new standards and continues to perpetuate a somewhat 'lesser citizen' status to educators and students in distance education environments" (Reyman, 2006, p. 37). Reyman's 2006 study stated:

Distance-education requires the use of course materials in digital form. Unfortunately, educational exemptions for using materials in digital form present new threats to copyright owners and impinge on growing markets for licensed resources. The TEACH Act presents instructors with an opportunity to extend educational uses of materials to digital learning environments. At the same time, TEACH is laden with

confusing and ambiguous barriers to application. We need to remind our institutions about their responsibility to support quality educational experiences in their growing distance-education programs. This responsibility involves meeting the requirements of TEACH by creating copyright policies for teaching with technology and providing informational resources to support those policies. (p. 42)

Most schools who offer distance education do something to ensure the quality of the design of their online courses. Many use some sort of standard or best practice in order to assure a quality course is created (Reyman, 2006). Others aim to make sure that they capitalize on the advantages of a traditional classroom while using technology to move those practices onto an online space. Especially crucial in this transformation are the student-to-student and student-to-instructor interactions in an online course (Stanton & D'Auria Stanton, 2017). These goals were once challenging in an online environment, but with the use of technological advancements online classrooms can more easily incorporate the things like student-to-student and student-to-instructor interactions that have made traditional courses successful for years.

One pitfall that has always plagued distance education is the potential for online students to cheat. Studies have found that these fears are mainly unfounded and that the potential to cheat was stronger or comparable in traditional courses (Scott, 2012). Despite these facts, the perceptions still exist and schools use different strategies to try to ensure a fair playing field for both traditional and online students. These strategies include but are not limited to teaching a blended course instead of an online one and testing in person, creating an assignment in week one to attach a current picture to a student's bio and then giving a final in person ensuring the picture that was first posted matches the person taking the test. Technological advances have also emerged that can check student's virtual identity but software that ensures the student behind the screen is who he/she says they are is still expensive and out of reach for most small institutions.

Blended learning is often looked at by faculty, administrators and students alike as the best of both worlds scenario in distance education where some part of the course is given online and the remainder is in a face-to-face setting. This belief is in part due to the idea that online courses work just fine for lower level classes but as the topics get more complex students are more successful with some part of the course taught in person (Straus et al., 2013). These hybrid

or blended courses vary from having a handful of face-to-face meet ups to having twice weekly in person classes with the remainder of the course accessed online. The possible inconsistency from one blended learning environment to another is enormous. As mentioned previously, online courses can look incredibly different from one another. Some may just be PowerPoint lessons whilst more advanced courses incorporate videos, synchronous meetings, and online student-to-student discussions to supplement the online content and any face-to-face meetings. The success of the blended approach surely would vary depending on how the course was delivered to students. However, the appeal to this approach is still strong because this mixed option may offer students the benefit of having a professor to teach a topic and ask questions of coupled with the flexibility to complete the online portions at their own pace. "Blended learning provides alternative ways for teachers to deliver their lessons which saves time, space and resources of the school. It makes lessons accessible, anytime and anywhere allowing students to work at their own pace" (Lorenzo, 2017). However, the results are mixed in how well students actually fair in their achievement in these courses.

A very important and challenging portion of this research was in the instructor's desire to create both traditional and online courses with equivalence in mind. It was believed that the closer the two courses were in their design and delivery the closer the students' achievement and satisfaction would be as well. Several discussions about equivalence have transpired over the years, some educators live by the idea; others think it is an almost impossible thing when creating online content, but a few different takes on equivalence are discussed here.

In design a premise exists that if one can take advantage of the comparative concepts in the different modes of instruction students will then have the advantage of being able to overcome the limitations of time, resources and location (Ni, 2013). Those that believe in equivalence between online and traditional learning believe that the more equivalent the learning experiences are between the two groups the more likely they are to obtain similar results. The reality is that no matter how much time and effort is put into making equivalent courses in traditional and online settings the comparison between the two will still depend on who is teaching the material (Ramage, 2002). Two different professors will teach the material in their own way

and therefore may obtain different results. However, “just as a triangle and a square may have the same area and be considered equivalent even though they are different geometrical shapes, the experiences of the local learner and the distant learner should have equivalent value even though these experiences might be very different” (Simonson, Schlosser & Hanson, 1999, p. 7).

This equivalence does not necessarily mean that the same teaching techniques are being applied in face-to-face as well as online courses, but instructors need to figure out the best way to relay the information in both settings in order to make mastery of the information equivalent. In fact, Tomei (2006) found that about 14% more hours were required to teach online as compared to traditional and therefore an ideal class-size for online courses would be smaller than traditional classes. Several studies discuss the fact that teaching online is very complex for a variety of reasons, but one major issue they find is that the techniques used to teach in traditional settings are not effective in online courses (Drijvers, Doorman, Boon, Reed & Gravemeijer, 2010; Dykman & Davis, 2008). However, many agree that if instructors are prepared and practice these additional techniques that teaching online can be an efficient education delivery system (Dykman & Davis, 2008).

Many classroom-level creations in instructional design and technology seem to be working for many online students, but these strategies cannot work on their own. These advances can only work when students have an equal level of accountability for their own learning (Brint & Clotfelter, 2016).

Faculty Perceptions

As with most new jobs there is a learning curve in teaching online courses. Studies have shown that faculty are more satisfied as they gain more experience in the online environment and would like to teach online again in the future. This is coupled with the idea that with time and experience instructors get better at delivering student-to-instructor and student-to-student experiences in their courses. In one study attitudes in teaching online education were directly correlated to an instructor's online experience level (Stanton & D'Auria Stanton, 2017). Another

study found that experienced online faculty not only had positive postures regarding their online courses but they were more likely to recommend their online sections to students (Wingo, Ivankova & Moss, 2017).

Institutions that offer more online course offerings have more faculty that look favorably upon online education. On the other hand, in one study, two thirds of the faculty who had not taught online or in a blended environment viewed online education with fear rather than excitement. From this the researchers concluded that once faculty teach a course online they would be more willing to continue teaching online courses and have a positive view of those courses (Wingo et al., 2017).

In higher education there is still a considerable amount of skepticism by faculty regarding online education. This is sometimes rooted in the fact that many professors still believe that a traditional course is somehow better than an online class and that online degrees are less rigorous than traditional ones. Perhaps this is due to faculty fears that more online courses could lead to less traditional courses and therefore could affect their positions at the institution. Others went so far as to fear that teaching online could affect their prestige at an institution or even worried that teaching more online courses could have a negative bearing on promotion or tenure. These findings happened more often in faculty that were new to an institution and were still uncertain of their job security (Wingo et al., 2017). Administrators at these institutions are aware of these fears and less than positive attitudes regarding online instruction by their faculty and those results have been captured year-over-year by Seaman et al. (2018).

Online versus Traditional: How do They Compare?

Several results arose from studies that looked at online compared to traditional learning. These results included finding achievement improvement in online classes (Ashby, Sadera & McNary, 2011; Feintuch, 2010; Fonolahi et al., 2014; Lynch-Newberg, 2010; Rabe-Hemp, Woollen & Humiston, 2009; Rey, 2010; Standsfield, McLellan, & Connolly, 2004; Suanpang & Petocz, 2006; U.S. Department of Education, 2009; Xu & Jaggars, 2014), finding higher

achievement in traditional classes (Alpert et al., 2016; Bettinger et al., 2017; Conklin, 2008; Dynarski, 2018; Gorman, 2011; Harris & Parrish, 2006; Keller, 2013; Macon, 2011; Nfor, 2015; Summers et al., 2005; Sylvester, 2004; Vilardi, 2013; Warren, 2014), or finding no difference in achievement between the two (Adams, 2014; Blau & Drennan, 2017; Charlson, 2006; Chernish, DeFranco, Lindner, & Dooley, 2005; Fredda, 2000; Herman & Banister, 2007; Johnston, 2013; Jones & Long, 2013; Lorenzetti, 2005; Murray, 2014; Ni, 2013; Pope, 2013; Pucel & Stertz, 2005; Russel, 2001; Summers et al., 2005; Sylvester, 2004; Sweat-Guy & Wishart, 2008; Warren, 2014; Weems, 2002; Yatrakis & Simon, 2002; Yaw & Gillman, 1999). Nguyen (2015) did a meta-analysis on the literature of this type and found that 92% of the distance and online education studies concluded that distance education was at least as effective if not better than face-to-face education. Gorman (2011) suggests that the reported benefits of online classes over face-to-face may be due to online students spending more time with course contents as compared to their traditional counterparts.

Additional studies used a third option, hybrid learning, in comparison to online courses, traditional courses or both. The findings there were also mixed with some studies finding an improvement of student achievement in blended courses (Czaplewski, 2014; Joyce, Crockett, Jaeger, Altindag & O'Connell, 2015), other modes having higher student achievement as compared to hybrid (Ashby et al., 2011; Keller, 2013) or no difference between the modes (Araño-Ocuaman, 2010; Blau & Drennan, 2017; Dynarski, 2018; Ernst, 2008; Hein, 2014; Utts et al., 2003). Interestingly there is evidence to support that academic officers like the idea of the blended model and believe it is better than a strictly online or a traditional option (Allen & Seaman, 2016; Straus et al., 2013).

When comparing student satisfaction between online and traditional courses the results are also mixed. Several studies found that student satisfaction was higher in face-to-face courses (Macon, 2011; Rabe-Hemp et al., 2009; Summers et al., 2005) or found no difference in student satisfaction between the two types of courses (Allen, Bourhis, Burrell & Mabry, 2002; Phillips & Peters, 1999).

Major factors found to support student satisfaction were instructor response time, feedback and overall communication (Bollinger, 2004; Yu-Chun, Walker, Belland & Schroder, 2013). Also, personal relevance was strongly connected to student satisfaction, especially for adult learners (Sahin, 2007). In addition to instructor-student interactions Aman (2009) found that resource material was strongly significant in predicting student satisfaction.

In many studies attention was put on the type of course that was being offered and whether or not it should be offered in an online setting (Carnevale, 2003; Nelson, 2006; Noble, 2004; Paden, 2006; Smith, Heindel & Torres-Ayala, 2008). The main types of courses identified as being poorly suited for online instruction were mathematics (Smith et al., 2008; Sylvester, 2004; Xu & Jaggars, 2011), lab sciences (Carnevale, 2003; Warren, 2014), accounting, economics, English courses (Sylvester, 2004; Xu & Jaggars, 2011), social sciences and applied professions like business, law and nursing (Xu & Jaggars, 2014).

Conclusion

The literature on this topic is broad and continues to expand year-over-year as new articles and studies are developed and implemented. With each new study comes varied circumstances as compared to other studies and therefore the results are very hard to generalize regarding distance education. The fact that the studies mentioned here have completely different findings does not allow anyone to come to a consensus on how online, traditional or hybrid classes will fare in every situation.

What these results can start to show are what will happen in a specific type of class in a specific type of institution with a specific type of population. Therefore, additional studies continue to be needed for other types of institutions, types of students, types of classes in order for the results to be extrapolated beyond one particular study's findings. One thing is certain however, online classes are not going away anytime soon, and as long as there are questions that are vague or unanswered there will be studies that are attempting to answer them.

Chapter III

METHODOLOGY

The institution studied for the purposes of this research was a four-year, small, not-for-profit, liberal arts college with many more full-time as compared to part-time students.

Approximately $\frac{3}{4}$ of the college population of 2,700 students were considered full-time in 2017. On campus the ratio of females-to-males was approximately seven-to-three and a similar ratio is true of the diversity on campus of White/Non-Hispanic students to those of other races.

Of the majors offered at the college there was a large increase in two specific areas over the last several years in nursing and business, and both areas offered both face-to-face instruction as well as online courses. Typical courses on campus had a student-to-faculty ratio of 15-to-1 but introduction to statistics classes are frequently 25-to-1 in traditional classes and 20-to-1 in online courses. Of those students graduating from this institution in 2017 11.3% were business majors and an even larger 30.5% were nursing. Other top majors at this institution are psychology with 8.6%, biology with 7.7%, those going for education certification with 11.9% and other with 30.3% (Institutional Data). Introduction to statistics was a requirement for both the business and nursing majors on campus and thus was the course that the study focused on.

The data obtained for this study were data routinely collected from teaching the introduction to statistics course. This includes major, student year in school, whether the course was taken online or in a traditional setting, grades, and survey data. Specifically in the design of this course the students completed two quizzes, three tests, homework assignments that cover six chapters of course material, and a research project. I as the instructor graded all assessments and was careful to not look at student names while grading. In the traditional course the 25 students per section met two times a week for an hour and 25 minutes of instruction each class.

Online students of approximately 20 each section watched videos of me teaching to a traditional course. Each video was approximately an hour and 25 minutes in length and had supplementary videos from the text embedded in the online platform to give students additional practice problems. Online students had assignments in homework, quizzes and tests due at the end of each week whereas traditional students had homework, quizzes and tests due at either the beginning of the next class (homework assignments) or at the end of a class (quizzes and tests).

As the instructor I attempted to make the courses as comparable as possible so that I could make a direct comparison between online and traditional results. However, a legitimate difference in the courses was the time students had to complete the course. Out of the hands of the instructor and by design of the institution, online sections of the course ran for only eight weeks whereas the traditional semester ran for 15. As an example, chapter two of this course was taught in the traditional section over two weeks, three 85-minute classes of instruction and one class for assessment. That same chapter would be due in one week for the online students. If online students completed everything required in that week, the reading, video watching, homework and assessment would have taken approximately seven to eight hours. The researcher recognized that this time commitment was burdensome for some online students and caused them to become overwhelmed with the course load (McClendon et al., 2017). Therefore, although all of the content, instructional videos and examples are similar between the two courses, online students did have an added pressure to complete two weeks of work in just one week.

The online course was created by me keeping in mind best practices from the Quality Matters program (Adair & Shattuck, 2015). Course goals and objectives were clearly stated for both the online and traditional students, a detailed syllabus was provided including policies, requirements, structure and support services as well as a timeline of when work needed to be completed. Learner-to-teacher interaction is one of the main predictors of student achievement and satisfaction in an online course (Bolliger & Martindale, 2004). Studies have shown that this interaction not only impacts student satisfaction but it also positively impacts teacher satisfaction as well (Abdous & Yen, 2010). The strong positive correlation between instructor performance

and student satisfaction has been connected specifically to the instructor's availability and response time (DeBourgh, 1999). Often considered an important characteristic of education, this interaction is therefore recommended in traditional as well as online environments (Moore & Kearsley, 2012). Positive effects have been found to take place in online courses featuring more interaction with either the course material or the instructor (Bernard et al., 2004). However, too much interaction can be problematic; another study found a threshold where interaction becomes less useful (Dennen, Darabi, & Smith, 2007).

In light of the research findings, the online course had many interactive elements aimed to improve the students' experience, and I communicated with students often and checked in to see if they had any questions. In addition, I uploaded videos of myself teaching to the traditional sections at approximately 85–minutes per lecture. Videos were linked to the online site and were accessible through the ebook as well. Traditional students could also access these videos when they were reading the ebook. Those additional videos were extra problem examples explained in a different way as compared to how I taught them. One goal was to create a pleasant learning experience for both the traditional and online students, and another was to have as many of the same elements as possible in both formats to keep the courses as comparable as was possible.

Including different media in the online learning course not only helped to make the course more comparable to what was happening in the traditional course, but it also worked towards reaching students who had different learning styles as well (Gorman, 2011). Audio and video components were included in the weekly required assignments in addition to reading requirements, homework problems, quizzes and/or tests in order to keep students engaged and help them to understand the material in the way that worked best for them.

I designed the course using these key design principles: consistent layout and design, clear organization, presentation and information, consistent and easy-to-use navigation, and aesthetically pleasing design and graphics (Adair & Shattuck, 2015). In addition, best practices for the types of interactions in online courses were considered. These interactions are specifically learner-to-instructor, learner-to-learner and learner-to-content (Moore & Kearsley, 2012). Anyone with a very basic comfort with computers was able to successfully navigate the online course;

however, several studies have shown that students with more computer knowledge and comfort are those who are the most satisfied in online courses (Abdous & Yen, 2010).

This study sought to answer two major research questions; the first required the collection of student achievement data and the second a way to gauge student satisfaction of a course. In order to tackle the first question, I as the researcher used graded data. Specifically, quiz, test, homework, project and final average data were used to analyze student achievement. The data used to answer research question one were collected starting in the Summer semester of 2015 through Spring 2017. The semesters included were Summer, Fall and Spring sessions. Thus the data included six semesters worth of information and can be found in Table 1. There were fewer students in online courses because these courses were usually taught in Summer sessions and typically had smaller and fewer sections than those taught traditionally in Fall and Spring. Therefore there were 264 total participants; 213 in traditional classes and 51 in online sections. Of the 213 participants in face-to-face classes 68 were in nursing and 44 in business, and for online courses there were 51 total participants with 10 in nursing and 11 in business majors.

Table 1: Breakdown of the number of participants by semester, course type, and major

Semester	Course Type	Majors			Total
		Business	Nursing	Other	
1	Online	3	4	11	18
2	Traditional	10	4	30	44
3	Traditional	15	34	23	72
4	Online	3	3	6	12
5	Traditional	10	9	27	46
6	Online	5	3	13	21
	Traditional	9	21	21	51

Even with the significant timing differences between how quickly students were required to learn course content, the hope was that the design of the online and the traditional introduction to statistics courses lead to very few differences in what material students learned and how they were assessed. The idea behind this was to make the average assessment results between these two courses comparable. Before going any further normality of the data had to be determined. Although these were grades and were assumed to have approximately normal distributions, in reality they were skewed and were not considered to be normal by the Shapiro-

Wilk test of normality. Therefore, I opted to run several independent Mann-Whitney U tests to answer the first research question and sub-parts included.

To answer the second research question regarding student satisfaction, I provided students with a link to an anonymous survey at the end of the course. This survey was completed on surveymonkey.com and had nine questions on it broken into five categories. The categories were descriptive facts (questions one, two and four), grade expectation (questions three and six), motivation (question five), feedback (question nine) and student satisfaction (questions seven and eight). In addition to asking students what their major and year in school was, surveys also asked students their motivation for taking the statistics course in one format or another, their perceived mathematics ability, how useful they found the course to be, their overall satisfaction with the course they took, and asked for additional feedback. Chute, Thompson, and Hancock (1999) determined that end-of-course evaluations gave instructors valuable student satisfaction information.

Because survey completion was not required there were fewer participants in the student satisfaction part of the study. It should be said that due to the low participation the results from this survey cannot and should not be extrapolated further. There were 55 participants in total or 19.8% of the total participants; 40 were in traditional courses (18.3% of all traditional participants) and 15 in online sections (25% of the total online participants). Due to the small number of participants it was not possible to break this group into smaller nursing and business categories; because of this the survey data was only analyzed for all majors.

For the purposes of this study, only questions seven and eight were tested because those were the only two that were specifically directed at student satisfaction. Both reliability and validity tests were performed on the survey questions to ensure that the survey was appropriate. In order to test reliability Cronbach alpha was tested between the two satisfaction questions and validity was tested using correlations. After the survey questions were validated they were analyzed using Mann-Whitney U tests to determine student satisfaction for both online and traditional students.

Chapter IV

RESULTS

Prior to conducting the study I believed that if a traditional and an online course were designed similarly and taught by me, then student achievement and satisfaction in both courses would be similar. The results show that this is not the case; traditional students fair better than their online counterparts in this study.

Student Achievement Results

The first question researched asked if achievement in an online introduction to statistics course was statistically different when compared to achievement in traditional statistics courses for students, regardless of major, at a small liberal arts college. The distributions were found to be non-normal using the Shapiro-Wilk test of normality; all probabilities were < 0.05 , indicating a significant difference from a normal distribution. To be able to answer the question, a test that worked on non-normal distributions had to be used. Therefore, several independent Mann-Whitney U tests were run to compare achievement between online and traditional students over the last six semesters of the course. After removing students who were not undergraduates, those who missed a major quiz or test, and those who dropped the course along the way, the remaining sample was 213 students in traditional courses and 51 in online equivalents. Table 2 again gives a breakdown of student participants by semester, course type, and major.

Table 2: Breakdown of the number of participants by semester, course type, and major

Semester	Course Type	Majors			Total
		Business	Nursing	Other	
1	Online	3	4	11	18
2	Traditional	10	4	30	44
3	Traditional	15	34	23	72
4	Online	3	3	6	12
5	Traditional	10	9	27	46
6	Online	5	3	13	21
	Traditional	9	21	21	51

The five areas compared were quiz, test, homework, project, and final average. I graded these areas during the semester paying careful attention to ignore student names to avoid any grading bias. I graded all assignments each semester in online and traditional classes by using the same grading scale and specific grading rubrics to assure consistency in grading across semesters. The distributions of scores in these five categories based on the type of course and the semester the course was taken are in Figures 2–6.

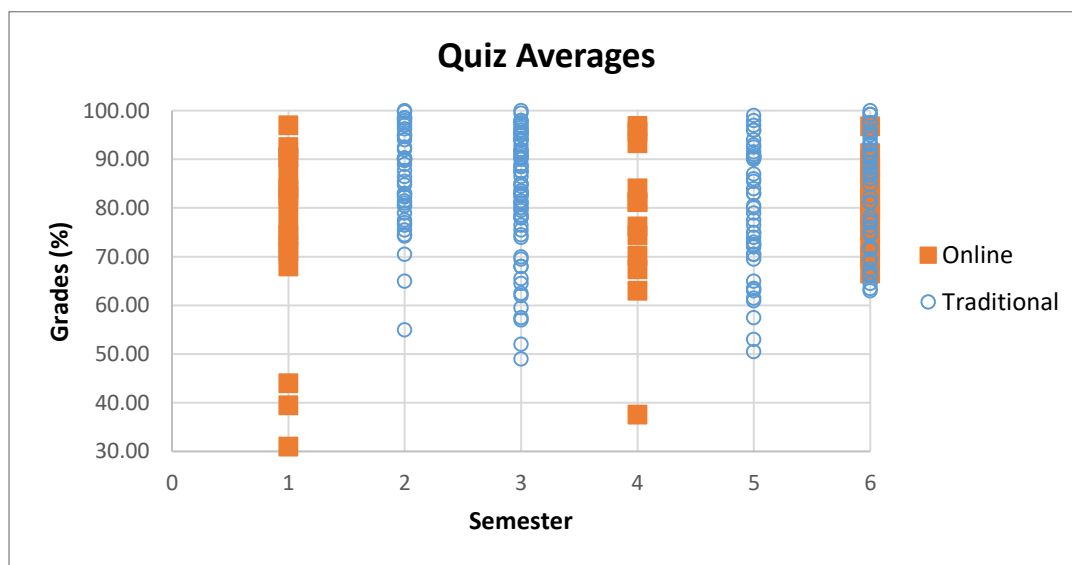


Figure 2: Graph showing the distribution of grades for online and traditional quiz averages over the six semesters of the study

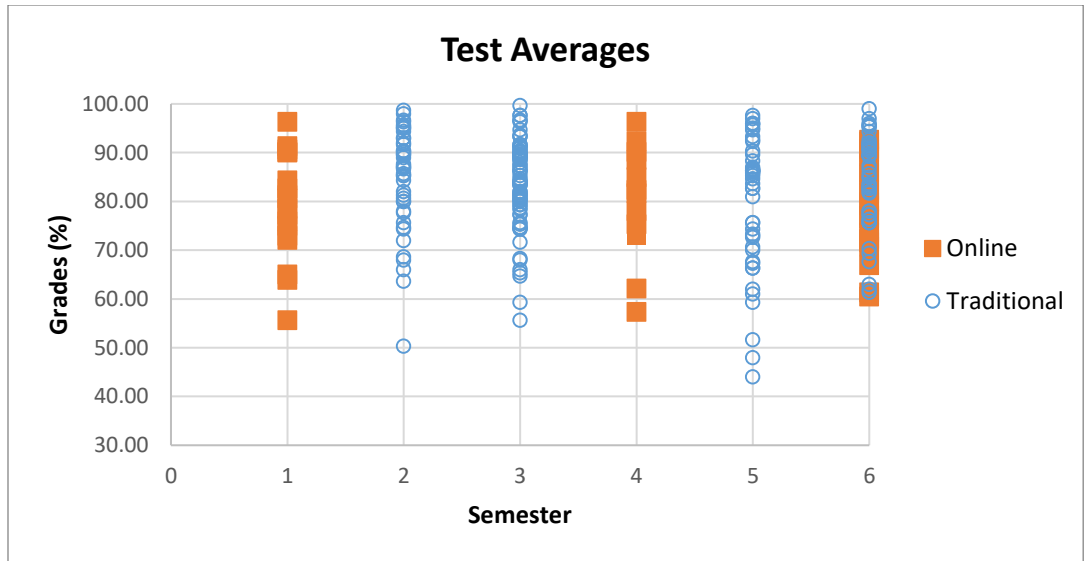


Figure 3: Graph showing the distribution of grades for online and traditional test averages over the six semesters of the study

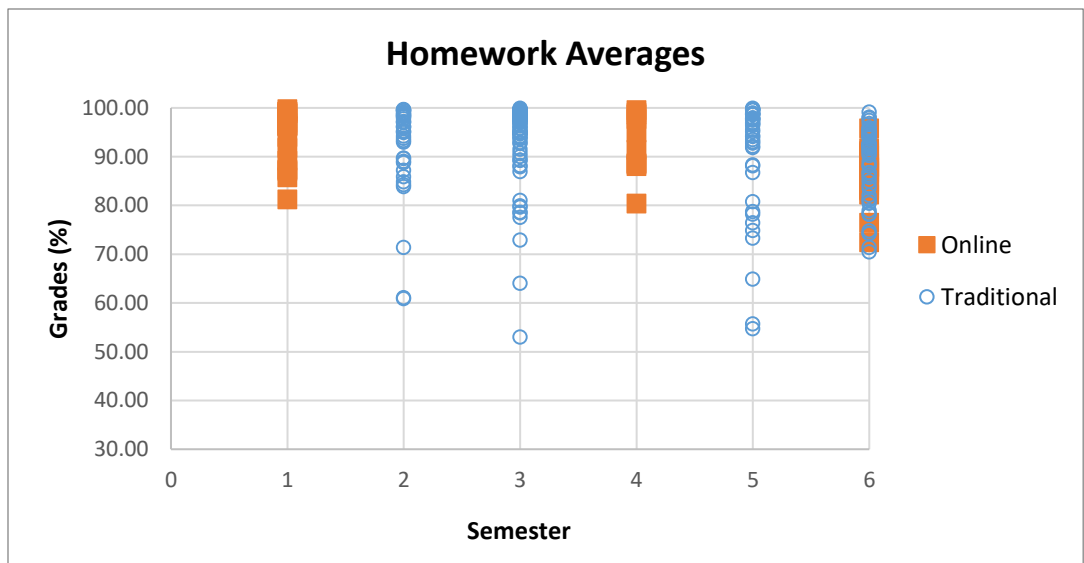


Figure 4: Graph showing the distribution of grades for online and traditional homework averages over the six semesters of the study

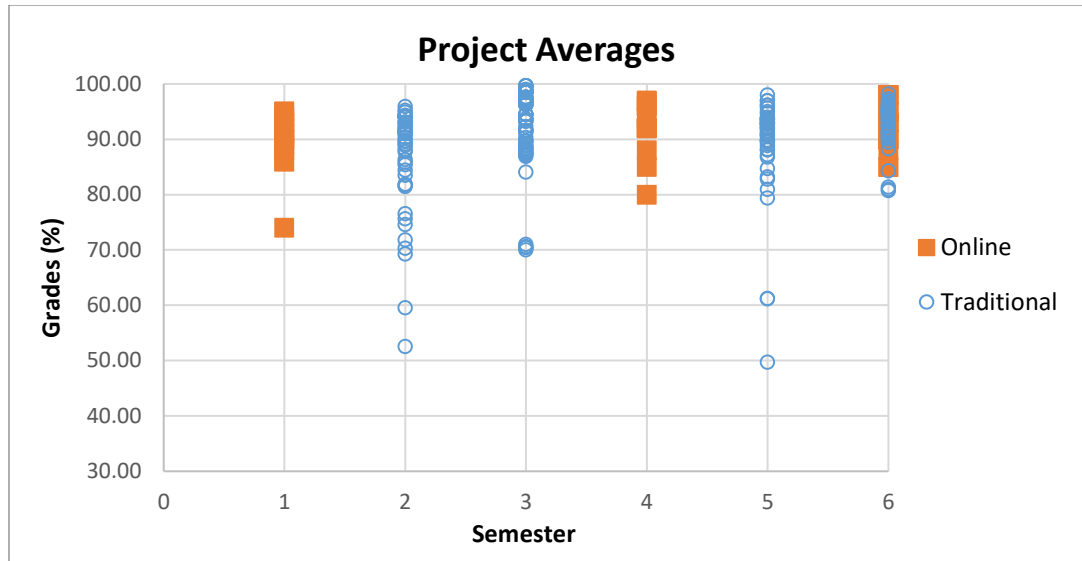


Figure 5: Graph showing the distribution of grades for online and traditional project averages over the six semesters of the study

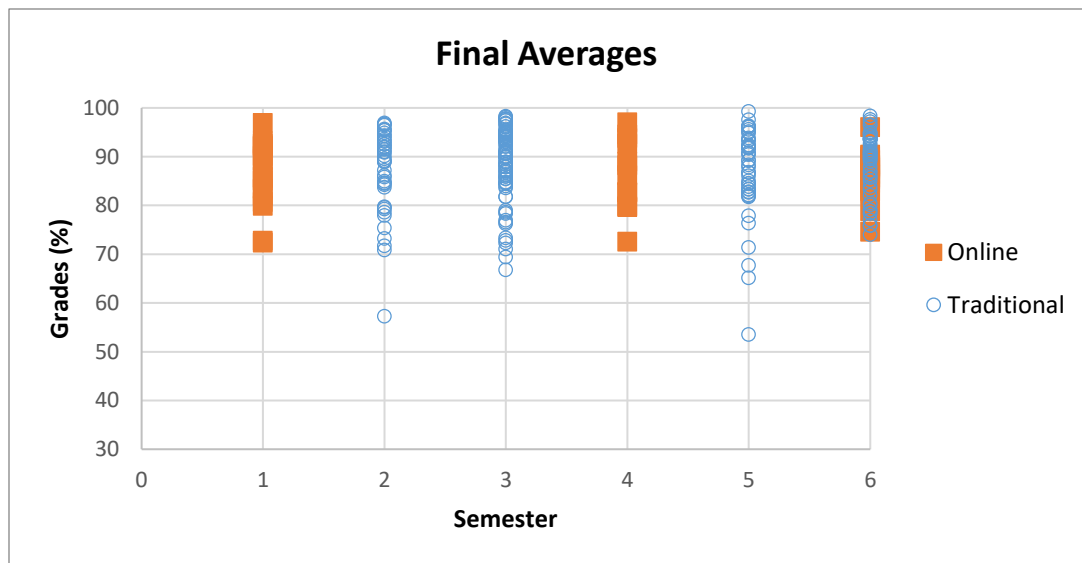


Figure 6: Graph showing the distribution of grades for online and traditional final averages over the six semesters of the study

The means of online achievement scores, regardless of major, were lower in every category except project average when compared to traditional scores. The Mann-Whitney U test found significant differences in all of those same categories, indicating that traditional students did significantly better in those areas as compared to their online counterparts. The summarized results for all of the participants are in Table 3.

Table 3: Quiz, test, homework, project, and final means (standard deviations) comparing face-to-face and online students in all majors

Course Format	Number of Students	Quiz Average*	Test Average*	Homework Average*	Project Average	Final Average*
Face-to-Face	213	83.51 (12.0)	83.20 (10.7)	92.03 (9.5)	90.4 (8.3)	87.90 (7.9)
Online	51	78.38 (14.9)	79.18 (10.4)	90.07 (6.8)	91.65 (4.7)	86.40 (5.9)

*Difference in means was significant at the $\alpha = 0.05$ level

In addition, the Mann-Whitney U gives information based upon mean rank for all of the categories. The student achievement mean ranks and medians were higher in every category for face-to-face students. In order to get a better overall picture of the results from this test it makes sense to include the probability information as well as effect size for all of the five student achievement categories. Effect sizes were all considered small (around 0.10) or very small (below 0.10) (Cohen, 1988). Additional information found from the Mann-Whitney U test is in Table 4.

Table 4: Mean Ranks, Medians, Mann-Whitney U, z-score, probabilities, and effect sizes (r) for quiz, test, homework, project, and final averages for all majors based on course type

	All							
	Mean Rank		Median		Mann-Whitney U			
	Online	Face-to-face	Online	Face-to-face	U	z	p	r
Quiz	110.18	137.85	81.2	86.0	4293	-2.325	0.02*	0.14
Test	106.84	138.64	79.8	85.3	4123	-2.672	0.01*	0.16
Homework	113.37	137.08	90.3	95.2	4456	-1.992	0.05*	0.12
Project	131.57	132.72	92.0	92.5	5384	-0.097	0.92	0.01
Final	111.02	137.64	86.5	89.9	4336	-2.237	0.03*	0.14

*Difference in median was significant at the $\alpha = 0.05$ level

The next question the study tackled was: Does the achievement of nursing students in an online statistics class differ significantly from that of similar students in a face-to-face statistics class? Quiz, test, homework, project, and final averages from 68 traditional students and ten online students in the nursing program were analyzed.

Due to small sample sizes and non-normal distributions, Mann-Whitney U tests were used to compare the student achievement of nursing majors in online versus traditional courses. Although no significant differences were found in the means in any category the online grades were lower in every category for nursing students. This indicates that nursing students in

introductory statistics do get better scores in the traditional format as compared to the online one. The results for nursing majors in quiz, test, homework, project, and final averages are in Table 5. Mann Whitney U results are in Table 6 and once again show higher mean ranks and medians in every category for traditional courses and effect sizes that are small or very small.

Table 5: Quiz, test, homework, project, and final means (standard deviations) comparing face-to-face and online students in nursing

Course Format	Number of Students	Quiz Average	Test Average	Homework Average	Project Average	Final Average
Face-to-Face	68	89.31 (8.8)	88.65 (7.1)	95.31 (6.5)	93.01 (6.0)	91.83 (4.9)
Online	10	84.54 (15.5)	83.98 (9.4)	94.29 (6.0)	90.50 (8.0)	88.74 (6.6)

Table 6: Mean Ranks, Medians, Mann-Whitney U, z-score, probabilities, and effect sizes (r) for quiz, test, homework, project, and final averages for nursing majors based on course type

	Nursing							
	Mean Rank		Median		Mann-Whitney U			
	Online	Face-to-face	Online	Face-to-face	U	z	p	r
Quiz	33.25	40.42	86.5	91.8	277.5	-0.934	0.35	0.11
Test	30.25	40.86	85.8	89.5	247.5	-1.383	0.17	0.16
Homework	35.50	40.09	96.1	97.9	300.0	-0.598	0.55	0.07
Project	33.80	40.34	91.5	94.3	283.0	-0.852	0.39	0.10
Final	29.90	40.91	90.3	93.1	244.0	-1.435	0.15	0.16

The next question considered was: Does the achievement of business students in an online statistics class differ significantly from that of similar students in a face-to-face statistics class? The sample of 44 traditional students and 11 online students is both small and non-normal; therefore, student achievement results were found using independent Mann-Whitney U tests.

Much like the overall group, the business majors had lower online grades compared to their traditional counterparts except in project grade; however, no significant results were found in any category. It can still be seen that business students in the traditional setting did better than their online counterparts despite the lack of significance. We can then conclude that business students in traditional introductory statistics courses have better achievement as compared to their online counterparts. Table 7 provides the results for quiz, test, homework, project, and final

averages amongst business majors. Mann-Whitney U results are in Table 8 and show the mean rank of all categories and medians aside from project to be higher for traditional courses. It also gives effect sizes for all categories that are all in the small to very small range.

Table 7: Quiz, test, homework, project, and final means (standard deviations) comparing face-to-face and online students in business

Course Format	Number of Students	Quiz Average	Test Average	Homework Average	Project Average	Final Average
Face-to-Face	44	79.79 (12.8)	80.05 (11.0)	89.48 (11.3)	90.42 (6.8)	86.04 (7.5)
Online	11	75.90 (17.3)	76.15 (11.1)	88.98 (8.3)	90.82 (4.0)	84.54 (6.4)

Table 8: Mean Ranks, Medians, Mann-Whitney U, z-score, probabilities, and effect sizes (r) for quiz, test, homework, project and final averages for business majors based on course type

	Business							
	Mean Rank		Median		Mann-Whitney U			
	Online	Face-to-face	Online	Face-to-face	U	z	p	r
Quiz	26.41	28.40	78.3	79.8	224.5	-0.368	0.71	0.05
Test	22.55	29.36	78.0	78.2	182.0	-1.263	0.21	0.17
Homework	24.95	28.76	87.1	93.3	208.5	-0.705	0.48	0.10
Project	26.91	28.27	92.0	91.4	230.0	-0.253	0.80	0.03
Final	25.09	28.73	85.7	86.1	210.0	-0.673	0.50	0.09

Student Satisfaction Survey Results

The student satisfaction survey was given at the end of each semester, and students were able to anonymously answer the questions of the survey (Appendix A). Taking the survey was encouraged but not required, leading to fewer responses than the overall data set might suggest. Ultimately 55 students participated, 40 from traditional courses and 15 from online introduction to statistics classes from all majors. Due to the small number of responses on the survey, a further breakdown for nursing and business majors were not possible for student satisfaction. Since there were very few responses as compared to the total number of participants, the results from the survey are not strong and should not be generalized.

The survey was broken into five main categories: descriptive facts, grade expectation, motivation, feedback, and student satisfaction. The two questions of the survey that effect student satisfaction were seven and eight. Question seven asked students how useful the course was, and question eight asked for a ranked overall satisfaction score with the course. These questions were both on a Likert scale, and students had to give an answer ranked from 1–5, with 1 being the lowest and 5 being the highest. 1 would represent strongly dissatisfied; 2, dissatisfied; 3, neutral; 4, satisfied; and 5, strongly satisfied with the course.

Prior to analyzing the student satisfaction questions, a reliability study was done to ensure the survey results were usable. This reliability was found by analyzing the Cronbach alpha between the two student satisfaction questions and course format. The results of that test showed that the alpha was 0.783, meaning that the data were connected to one another. A Cronbach alpha score of 0.7 or higher is accepted as a reliable measure; hence we can conclude that these two questions are reliable (DeVellis, 2003).

Validity of the same survey questions was tested using correlations. According to Poulant (2010), correlations should be > 0.4 between tested variables in order to be considered valid; with a positive correlation of 0.645, these two questions were both valid. Once deemed reliable and valid, questions seven and eight were analyzed using Mann-Whitney U tests comparing ranked scores to course format.

Question seven asked students how useful the course was, and Mann-Whitney U found a probability of 0.15, indicating that between online and traditional students there was no significant difference. Question eight asked students what their overall satisfaction was with the course they took. That question was also analyzed using Mann-Whitney U tests and was found to be significant at the 0.05 level with a probability of 0.01. This indicated that for question eight there were significant differences between online and traditional students. Specifically, for that question, face-to-face students were found to be more satisfied with their experience as compared to their online counterparts. However, these results cannot be over-emphasized since the sample size was so small; it is possible that these results could vary greatly had there been more survey participants. Therefore, since one question found no significance and the other did,

the results are inconclusive regarding student satisfaction. In fact, I would deem the results inconclusive regardless of any found significance due to the less than adequate size of the sample tested. The results of the Mann-Whitney U test for student satisfaction are in Table 9. Mean rank was higher for online students on question seven regarding usefulness, and for traditional students on question eight regarding overall satisfaction. In regards to medians, the medians for online and traditional were the same for both online and traditional for question seven, but for question eight the median for face-to-face students was higher. Effect sizes were in the small to medium range for question seven and medium for question eight.

Table 9: Mean Ranks, Medians, Mann-Whitney U, z-score, probabilities, and effect sizes (r) for student satisfaction (questions seven & eight)

	All							
	Mean Rank		Median		Mann-Whitney U			
	Online	Face-to-face	Online	Face-to-face	U	z	p	r
Question 7	32.97	26.14	3.0	3.0	225.5	-1.451	0.15	0.20
Question 8	19.23	31.29	3.0	4.0	168.5	-2.568	0.01*	0.35

*Difference in mean rank was significant at the $\alpha = 0.05$ level

According to results for question eight, 55 participants in the anonymous survey were satisfied or strongly satisfied with the introduction to statistics course, whatever the format. Of those 27, 24 were in traditional classes and only three were in online courses. The clustered bar graph in Figure 7 emphasizes this point.

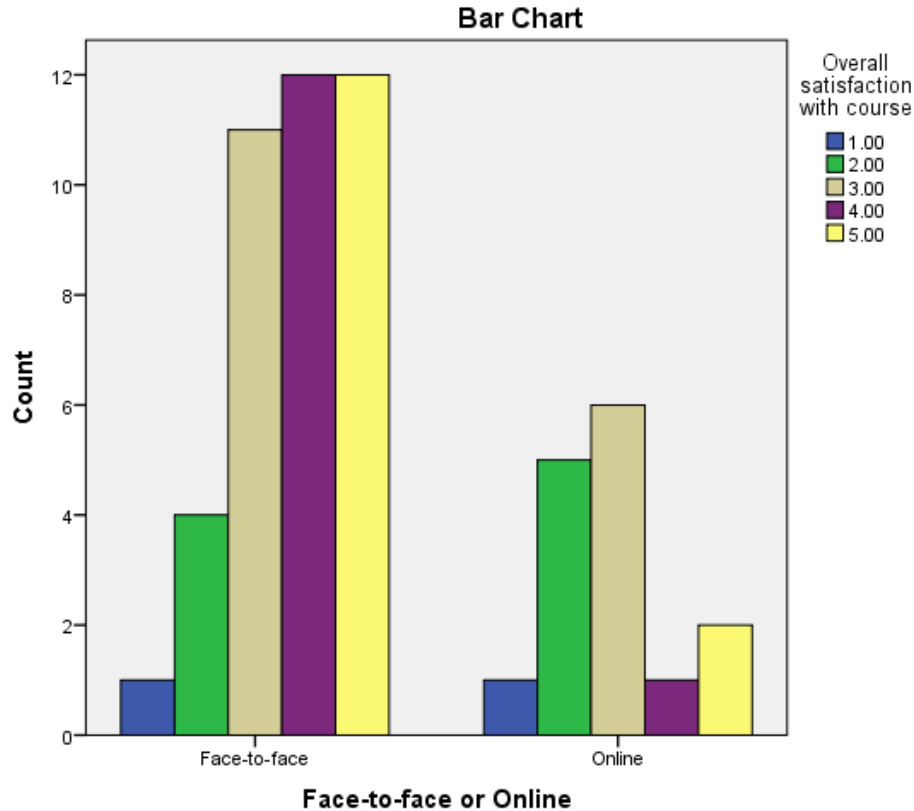


Figure 7: Bar graph showing overall satisfaction with the statistics course (question 8) based on whether the student took the course in a face-to-face or online setting

Based on the analysis, the results of research question one showed that traditional students of any major did better in a traditional introduction to statistics course as compared to an online version of the class. On one hand, achievement in the two formats showed many significant findings for students in general, implying that a difference existed between taking an introductory statistics class online versus in a face-to-face setting. Specifically, the results indicated that in all categories aside from project average students did better in traditional sections rather than online ones. The results for business and nursing majors taking an introduction to statistics class came to the same conclusion despite the results not being significant. Therefore we can conclude that major did not matter and in almost every category the online students had lower grades than their traditional counterparts.

The results of the survey in the student satisfaction category were inconclusive when considering only the two questions that were related to that satisfaction and due to a small

sample size. Mann-Whitney U tests performed on question seven found probabilities higher than 0.05 and thus no significant difference between the two groups. On the other hand, question eight results were statistically significant with a probability of 0.01 and an effect size of $r = 0.35$.

Due to the mixed nature of the results and the fact that the sample size was so small, we cannot conclude one way or the other on student satisfaction between traditional and online students taking introductory statistics in this study. Although unable to come to a statistically significant result, it should be noted that, particularly on question eight, data shows that 24 of 40, or 60%, of the students in the traditional sections were satisfied or strongly satisfied, whereas only three of 15, or 20%, of the students in comparable online sections felt similarly.

Overall the results are still useful to an institution determining whether or not to expand their online offerings to nursing and business students. Nursing and business students in this study were shown to not do as well in online sections of introductory statistics as compared to their traditional counterparts; however, they may be willing to offset that potential lower grade for the flexibility and reduced cost that an online course affords them.

Chapter V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Online education continues to grow in the United States. At private non-profit institutions like the one in this study, the growth has continued year-after-year. In colleges and universities across the nation non-traditional students now outnumber those deemed traditional; therefore, it is no surprise that institutions like the one in this study are investing in the growing online sector. High on the list of priorities, the college being studied cares about the needs of its learners and wants to be sure to offer the non-traditional students opportunities in education that are flexible and still guide them towards their educational goals.

Traditional in this study refers to courses that are 100% face-to-face whereas non-traditional or online refers to a completely online experience. So many other combinations exist in college education but this research did not focus on them.

At the small liberal arts college being studied there is a growing population of nursing and business majors. Both programs cater to full-time students who have historically been traditional students; however, there has been growth in both programs with non-traditional students as well. For this increasing population of non-traditional students, flexibility is crucial and the distance education department has increased the number of online education courses offered each year.

Both the nursing and business majors are required to take an introduction to statistics course and due to the nature of the increase of non-traditional students, online offerings of this course must also be available. This study was done in part to determine if the introduction to statistics online course allowed for student success at a small liberal arts school.

This study analyzed the data obtained over the course of six semesters at the small liberal arts college. I designed and taught both the traditional and online introduction to statistics

courses. In designing the courses, I used as many best practices for online instruction as per findings from the Quality Matters program (Adair & Shattuck, 2015).

Student achievement in this study was measured based upon the graded material in the courses: two quizzes, three tests, a homework average and a final project grade were included. The online assessments were asynchronous so students had flexibility in when assignments were due and did not need to complete assignments at the exact same time as their peers. Informal assignments for homework were created using WebAssign for both traditional and online participants. The formal assessments were created using the Moodle software and had the same questions that students in the traditional course had on quizzes and tests.

The only data used for this study were data routinely obtained from teaching the introduction to statistics course. This included course type, major, and grades obtained on homework, two quizzes, three tests and a final project. In addition, I gave an anonymous student satisfaction survey at the conclusion of each course, and that survey was used to assess student satisfaction for both online and traditional students.

This chapter provides a summary of how the study was carried out, the conclusions based upon results from the two research questions, observations on possible reasons why the results turned out as they did, as well as recommendations for future studies.

Summary

In the traditional course the 25 students per section met two times a week for an hour and 25 minutes of instruction each class. Online students of approximately 20 in each section watched videos of me teaching to a traditional course. Each video was approximately an hour and 25 minutes in length and had supplementary videos from the text embedded in the online platform to give students additional practice problems. Online students had assignments in homework and quizzes and tests due at the end of each week, whereas traditional students had homework, quizzes, and tests due at either the beginning of the next class (homework assignments) or at the end of a class (quizzes and tests).

The data used were collected starting in the summer semester of 2015 through spring 2017. The six semesters included in the study were all summer, fall, and spring sessions. This amounted to a total of 264 total participants; 213 in traditional classes and 51 in online sections. Of the 213 participants in face-to-face classes, 68 were in nursing and 44 in business, and for online courses there were 51 total participants with ten in nursing and 11 in business majors.

To test for student achievement between online and traditional students, scores on quiz, test, homework, project, and final average were compared. Mann-Whitney U tests were chosen as the appropriate test due to the data not meeting normality requirements as per the Shapiro-Wilk test. The results from these tests were able to answer the first research question and sub-parts included.

In addition, I provided a link to an anonymous nine-question survey to students at the end of the course (Appendix A). The five categories on the survey were descriptive facts (questions one, two, and four), grade expectation (questions three and six), motivation (question five), feedback (question nine), and student satisfaction (questions seven and eight). In addition to asking students what their major and year in school was, surveys also asked students their motivation for taking the statistics course in one format or another, their perceived mathematics ability, how useful they found the course to be, and their overall satisfaction with the course they took, and asked for additional feedback.

Attributable to the survey not being required, there were fewer participants to study than overall students. There were 55 survey participants, or 19.8% of the total enrollment; 40 were in traditional courses (18.3% of all traditional participants) and 15 in online sections (25% of the total online participants). Due to the small number of participants, it was not feasible to break this group into smaller nursing and business categories; the survey data was only analyzed for all majors.

The student satisfaction category of the survey was tested, including question seven about how useful the course was, and question eight regarding overall satisfaction. To be sure the results would be useful to the study, both reliability (Cronbach alpha) and validity (correlation) tests were performed on the survey questions to ensure that the survey was suitable. Once the

survey was found to be both reliable and valid, Mann-Whitney U tests were used to determine student satisfaction for both online and traditional students.

Conclusions

This study sought to answer two major research questions: Is student achievement in an online introduction to statistics course statistically different when compared to achievement in traditional statistics courses for a small liberal arts college regardless of major? and does student satisfaction in an online course differ significantly from that of students in a traditional course? In addition, the first research question had two subparts seeking to find if achievement of nursing students or business students in online sections differed from similar students in face-to-face classes.

The first question and subparts required the collection of student achievement data, and the second a way to gauge student satisfaction of a course. In order to tackle the first question, I used graded data routinely collected from teaching the introduction to statistics course. Specifically, quiz, test, homework, project, and final average data were used to analyze student achievement. Administering a survey at the end of the course provided data to answer the second research question on student satisfaction. Survey questions were grouped into categories, and the category with student satisfaction questions (questions seven and eight) was analyzed between the two course formats.

The findings for research questions one and two had conflicting results. In studying student achievement, the means of online achievement scores, regardless of major, were lower in every category except project average when compared to traditional scores. The Mann-Whitney U test found significant differences in all of those same categories, indicating that traditional students did significantly better in those areas as compared to their online counterparts. The significant differences between online and traditional students existed in quiz average (Md = 86, n = 213), U = 4293, z = -2.325, p = 0.02, r = 0.14; test average (Md = 85.3, n = 213), U = 4123, z = -2.672, p = 0.01, r = 0.16; homework average (Md = 95.2, n = 213), U = 4456,

$z = -1.992$, $p = 0.05$, $r = 0.12$; and final average ($Md = 89.9$, $n = 213$), $U = 4336$, $z = -2.237$, $p = 0.03$, $r = 0.14$.

Student achievement mean ranks and medians regardless of major were higher in every category for face-to-face students; probabilities were all significant except for project average, $p = 0.92$. Effect sizes were all considered small or very small, so the significant values should not be overvalued here. It is possible that in this group—the group of all majors with the largest number of students—the significance may be due more to a larger sample size than because of the observed effect (Fritz, Morris, & Richler, 2012).

Non-normal distributions and small sample sizes made Mann-Whitney U tests appropriate to compare the student achievement of nursing majors in online versus traditional courses. Although no significant differences were found in the means in any category, the online grades were lower in every category for nursing students. We conclude that nursing students in traditional sections have higher achievement as compared to those students taking the course online. Mann-Whitney U results once again show higher mean ranks and medians in every category for traditional courses and effect sizes that are small or very small.

Much like the overall group, the business majors had lower online grades compared to their traditional counterparts except in project grade; however, no significant results were found in any category. Again, despite significance it is clear that business students in traditional courses had better student achievement than the online business students. Mann-Whitney U results showed the mean rank and median of all categories to be higher for traditional courses and effect sizes to be in the small to very small range.

Based on the analysis, the results of research question one showed that traditional students, regardless of major in an introductory statistics course did better than their online counterparts. Specifically, the results indicated that in all categories aside from project average students did better in traditional sections than online ones. However, small to very small effect sizes call to question whether these results are truly significant or if they just show as significant due to a large sample size. On the other hand, business and nursing majors taking an

introduction to statistics class showed no significant results, but it is clear that the traditional students in both majors did better than those students taking the course online.

To answer the second research question, only reliable and validated survey questions related to student satisfaction were analyzed. The only two questions of the nine on the survey specific to student satisfaction were questions seven and eight. A reliable Cronbach alpha of 0.783 was found, and a valid positive correlation of 0.645 between these two questions was found, allowing the researcher to continue the analysis. Question seven asked students how useful the course was, and Mann-Whitney U found a probability of 0.15, indicating that between online and traditional students there was no significant difference. The corresponding effect size was low at $r = 0.20$. The following question, question eight, asked students what their overall satisfaction was with the course they took. That question was also analyzed using Mann-Whitney U tests and was found to be significant at the 0.05 level with a probability of 0.01 and an effect size of $r = 0.35$. This indicated that for question eight there were not only significant differences between online and traditional students, but the effect size was also strong. Specifically for question eight, face-to-face students were found to be more satisfied with their experience as compared to their online counterparts.

The results of the survey in the student satisfaction category were also inconclusive and should not be overemphasized. The results were based on very few participants as compared to the overall study and thus the survey data is not as reliable as I would have liked it to be. However, despite the sample being so small I did still run independent tests on the limited data. Mann-Whitney U tests performed on question seven found probabilities higher than 0.05 and thus no significant difference between the two groups. On the other hand, question eight results were statistically significant with a probability of 0.01. Between small sample size and conflicting results we therefore cannot conclude one way or the other on student satisfaction between traditional and online students. This question also had a medium effect size, indicating that the significant probability had a substantial observed effect on the results (Fritz et al., 2012). Although not able to arrive at a statistically significant result, it should be noted that, particularly on question eight, data shows that 24 of 40, or 60%, of the students in the traditional sections were satisfied or

strongly satisfied, whereas only three of 15, or 20%, of the students in comparable online sections felt similarly. It is possible that these results would be similar if comparing the data of a larger sample, but due to the nature of the small sample it is also possible that results could vary greatly if looking at a larger sample size and therefore the results cannot be overemphasized.

Observations

In spite of the claim that results would be similar between traditional and online student achievement, the results show otherwise. This reinforces the idea that even if classes are designed to be as comparable as possible between these two instructional delivery methods, the results will not necessarily be comparable. However, significant results coupled with small effect sizes indicate that the results for all majors should not be overemphasized.

Regardless of not finding significant differences for business and nursing majors, it must be mentioned that in almost every category the online students had lower grades than their traditional counterparts. This indicates that traditional students do better than their online counterparts, and reaffirms findings by several researchers that online students score lower than traditional students (Alpert et al., 2016; Bettinger et al., 2017; Xu & Jaggars, 2014).

I as the researcher also believe that this may be due to a lack of preparation for some students taking the course online. At this liberal arts institution only nursing and business students are required to take a preparatory course prior to taking online courses; this is not a requirement of other majors (Institutional Data). Although not tested in this study, this preparation may be one of the differences in why there were no significant results in nursing and business students, whereas the overall group had many.

In addition, nursing and business schools have been offering distance courses at this liberal arts school for the longest amount of time, and it is possible that many of the nursing and business students had successfully completed an online course in the past. This reinforces the idea that if students had taken an online class previously, their self-efficacy and self-regulation skills in another online course were statistically significant (Holcomb, King, & Brown, 2004).

Previous success in courses gives students a better chance to do well because students who have realistic expectations and have online readiness skills are often more successful in online courses (Ni, 2013; Scheitler, 2015).

Often the instructors were asked questions from online students that indicated a lack of familiarity with computer procedures, thus putting these students in a challenging position for the course. Not only were they trying to learn all of the material in an accelerated timeframe but they were also trying to figure out how to use the computer on top of learning statistics. The expectation that students will be able to access the system has been shown to be a problem in other studies (Scheitler, 2015).

Recommendations

Two recommendations come out of the results of this study. The first is, when feasible, to allow online students the same amount of time to complete a course as their traditional counterparts. This is not a result that was gathered from specific data or feedback of students in the study, but it seems like a logical roadblock for some students. Occasionally students need more time to process new information in order to be able to build upon that knowledge; it makes sense to me that some of the online scores being lower may be due to this minimized processing time. Ideally this would give both online and face-to-face students 15 weeks to complete their course requirements. This will not guarantee success for online students, but it seems reasonable that the gap between the lower online scores and traditional scores could potentially be smaller if online students had more time to work on the material.

The second suggestion is inferred from the results regarding nursing and business student achievement. It was found that these two particular groups had no significant differences in student achievement in any category despite traditional students still doing better than their online counterparts, and incidentally these were also the only two groups on campus that received preparatory training in online classes. This does not seem like a coincidence, and it appears that the institution should offer training to anyone who is preparing to take online courses

so that all majors can be better prepared. Although this might require an initial investment, employing this technique will mitigate the risk of losing some online-only students over time, because those students who take only online classes typically drop out in just a few semesters (Xu & Jaggars, 2013). Thus the school will make up the difference in continued tuition payments. Another benefit is that preparation to take an online class will improve learner expectations, and those will lead to success in a course, and that will lead to greater graduation rates; which will ultimately lead to higher alumni giving (Ruffalo Noel Levitz, 2011).

Future studies on this topic can focus on a variety of areas. Two particular suggestions come out of the results and literature review connected to this study. The first would be to include hybrid education data in addition to online and traditional to see if there are any differences in achievement or student satisfaction in that population. Administrators and faculty often prefer the idea of hybrid education (Allen & Seaman, 2016), so it would be purposeful to either back up those feelings or refute them.

Isolating the factor that some students receive preparatory online training, another possible study could be done where half of the participants in the study specifically received online training prior to the class beginning and others did not. Additionally, this study would be more useful if the participants' experience level in accessing computer information prior to that online class is known.

There continue to be more studies on the topic of distance education, and even with so many researchers approaching the topic from different vantage points there is still so much more to learn. Hopefully these studies and others will continue to grow the knowledge base regarding online learning and help colleges, educators, and students more completely understand what will work for them in their online endeavors.

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Appendix A

Student Satisfaction Survey Questions

1. What is your major of study at the college?
2. What year in school are you?
3. How would you rate your general mathematics ability?
 1. Low
 2. Medium
 3. High
4. Was your Introduction to Statistics course online or in a face-to-face setting?
5. What was your motivation to take Introduction to Statistics in the setting you answered for #4?
6. What do you expect your final grade to be for this course?
7. On a scale from 1–5, 1 being the lowest and 5 being the highest, how useful do you think this course has been in teaching you about statistics?
8. On a scale from 1–5, 1 being the lowest and 5 being the highest, how would you rate your overall satisfaction with this course?
9. Do you have any additional feedback you would like to give regarding your Introduction to Statistics course?

Appendix B

Traditional Introduction to Statistics Syllabus

Introduction to Statistics (3 credits)

Class meetings:

Section 01: TR 11:10AM – 12:35PM

Section 02: TR 12:45PM – 2:10PM

Course Description:

This course introduces the student to the fundamental concepts of Elementary Statistics, including mean, variance and standard deviation, graphical representation of data, distributions, correlation and regression, contingency tables, and hypothesis testing. Students will also be using SPSS, a statistical software package for the social sciences, and will have access to the software in the computer lab.

Pre-requisites: Algebra

Required text: Johnson & Kuby., Elementary Statistics, 11th Ed, Thomson Publishing, 2007.

The book will be an ebook found through using WebAssign. Students will have to sign up for WebAssign and can purchase the license for the book and program from WebAssign.net.

Additional requirements: Scientific or graphing calculator, WebAssign.

Course Objectives: At the conclusion of this course, the student will be able to:

- Understand the uses and abuses of statistics
- Utilize methods of descriptive statistics and apply them appropriately for data analysis, and interpret results
- Analyze the appropriate methods of hypothesis testing and interpret results
- Utilize SPSS to create and analyze data sets during the semester

Course grade breakdown:

HW/Class Participation/In-class activities:	20%
Projects:	20%
Quizzes:	24%
Tests:	36%

Homework:

Homework constitutes a significant portion of the grade in this class. Homework will be assigned and collected each class. Some homework will be assigned through WebAssign, so WebAssign access is mandatory for this course. Other homework questions may be turned in. Written homework should be neatly written. If the handwriting is illegible, students will be required to type the homework. Illegible assignments will not be given credit.

It is permissible to discuss problems with other students while working on the assignment, however every student must turn in their own work. Copying is not allowed.

Late HW assignments will NOT be accepted.

Quizzes:

Quizzes will be announced a week before being given. There will be several quizzes in class during the course of the semester. The material on the quizzes will be based on the problems given on the homeworks and in class. There will be no make ups for missed quizzes, except in documented and excused cases. You must contact me BEFORE the quiz if you are going to miss it, and I will decide if it can be made up on a case-by-case basis.

Tests:

There will be three exams given in class. The material on the exams will be based on the problems given on the homeworks and in class. There will be no make ups for missed exams, except in documented and excused cases. You must contact me BEFORE the exam if you are going to miss it, and I will decide if it can be made up on a case-by-case basis.

Project:

Students in this course will complete a project based on the techniques you learn in class during the semester. More specific information on the projects will be given at a later time. Projects will be graded for content, as well as grammar.

Class Day	Chapter	Topic
1	1	Statistics Introduction, WebAssign Sign-up
2	1, 2	Analysis of Single Variable Data, Intro to SPSS
3	2	Analysis & Presentation of Single Variable Data
4	2	Analysis & Presentation of Single Variable Data
5	2	Analysis & Review
6		Quiz #1 – Chapter 1/2
7	2	Measures of Position
8	2	Technology Project/Review
9		Test #1 – Chapter 2
10	3	Correlation and Linear Regression
11	3	Correlation and Linear Regression
12	3	Technology Project
13	3	Technology Project/Review
14		Test #2 – Chapter 3
15	6	Normal Distribution
16	6	Normal Distribution
17	6	Normal Distribution
18	7	Sample Variability
19		Quiz #2 – Chapters 6
20	7	Sample Variability
21	8	Introduction to Statistical Inferences
22	8	Introduction to Statistical Inferences
23	8	Technology Project
24	8	Review for Chapters 7 & 8 Test
25		Test #3 – Chapters 7 & 8

26	9, 10	Inferences Involving Two Populations, Chi-Square In-class Activity
27		Written Projects DUE Final Project Presentations Day1
28		Final Project Presentations Day2

Grading Scale:

A	95 – 100	C	73 – 76
A-	90 – 94	C-	69 – 72
B+	87 – 89	D+	65 – 68
B	83 – 86	D	60 – 64
B-	80 – 82	F	below 60
C+	77 – 79		

Appendix C

Online Introduction to Statistics Syllabus

Introduction to Statistics (3 credits)

Class meetings:

This course is entirely online and there will not be any specific class meetings.

Course Description:

This course introduces the student to the fundamental concepts of Elementary Statistics, including mean, variance and standard deviation, graphical representation of data, distributions, correlation and regression, contingency tables, and hypothesis testing. Students will also be using SPSS, a statistical software package for the social sciences, and will have access to the software online.

Pre-requisites: Algebra

Required text: Johnson & Kuby., Elementary Statistics, 11th Ed, Thomson Publishing, 2007.

The book will be an ebook found through using WebAssign. Students will have to sign up for WebAssign and can purchase the license for the book and program from WebAssign.net.

Additional requirements: Scientific or graphing calculator, WebAssign.

Course Objectives: At the conclusion of this course, the student will be able to:

- Understand the uses and abuses of statistics
- Utilize methods of descriptive statistics and apply them appropriately for data analysis, and interpret results
- Analyze the appropriate methods of hypothesis testing and interpret results
- Utilize SPSS to create and analyze data sets during the semester

Course grade breakdown:

HW/Class Participation/In-class activities:	20%
Projects:	20%
Quizzes:	24%
Tests:	36%

Homework:

Homework constitutes a significant portion of the grade in this class. Homework will be assigned and collected each class. Some homework will be assigned through WebAssign, so WebAssign access is mandatory for this course. Other homework questions may be turned in. Written homework should be neatly written. If the handwriting is illegible, students will be required to type the homework. Illegible assignments will not be given credit.

It is permissible to discuss problems with other students while working on the assignment, however every student must turn in their own work. Copying is not allowed.

Late HW assignments will NOT be accepted.

Quizzes:

Quizzes will be announced a week before being given. There will be several quizzes in class during the course of the semester. The material on the quizzes will be based on the problems given on the homeworks and in class. There will be no make ups for missed quizzes, except in documented and excused cases. You must contact me BEFORE the quiz if you are going to miss it, and I will decide if it can be made up on a case-by-case basis.

Tests:

There will be three exams given in class. The material on the exams will be based on the problems given on the homeworks and in class. There will be no make ups for missed exams, except in documented and excused cases. You must contact me BEFORE the exam if you are going to miss it, and I will decide if it can be made up on a case-by-case basis.

Project:

Students in this course will complete a project based on the techniques you learn in class during the semester. More specific information on the projects will be given at a later time. Projects will be graded for content, as well as grammar.

Grading Scale:

A	95 – 100	C	73 – 76
A-	90 – 94	C-	69 – 72
B+	87 – 89	D+	65 – 68
B	83 – 86	D	60 – 64
B-	80 – 82	F	below 60
C+	77 – 79		

Class Week	Chapter	Topic
Week 1	1	Introduction to Statistics, Analysis & Presentation of Single Variable Data
	1, 2	Homework # 1
Week 2	2	Analysis & Presentation of Single Variable Data
	2	Homework # 2
		Quiz #1 – Chapters 1 & 2
Week 3	2	Measures of Position
	2	Homework # 3
		Test #1 – Chapter 2
Week 4	3	Correlation and Linear Regression
	3	Homework # 4
Week 5	3	Correlation and Linear Regression
	3	Homework # 5
		Test #2 – Chapter 3
Week 6	6	Normal Distribution
	6	Homework # 6
		Quiz #2 – Chapter 6
Week 7	7	Sample Variability
	8	Introduction to Statistical Inferences
	8	Homework # 7

Week 8	8	Hypothesis Testing
	8	Homework # 8
		Test #3 – Chapters 7 & 8
		Final Projects DUE