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Effects of Gatekeeper Course Modality, Age, Gender and High School GPA on KAPLAN Subject Area Exam Scores

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Effects of Gatekeeper Course Modality, Age, Gender and High School GPA on KAPLAN
Subject Area Exam Scores

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Education in Adult and Lifelong Learning

by

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Abstract

The question of equivalency regarding course modality has plagued and intrigued educators for as long as multiple modalities have existed. In the modern world of academia, the two prevailing modalities are face-to-face or traditional courses and online courses. A multitude of factors have contributed to the increase in online course offerings, including increasingly dependable technology and fiscal pressures on institutions of higher learning.

A great deal of scholarly research has compared modalities using within-course measures such as course grades and comprehensive final exams. Most of these studies have found the two modalities equivalent. However, a dearth of research exists which uses a measure occurring at some time after the course in question. So, the question of whether the two modalities maintain their equivalency through time remains unanswered.

This study used hierarchical multiple regression to determine if the modality of prerequisite courses, age and, gender affected a student's Kaplan subject area exam scores for students applying for entry to the UACCB Nursing program. Regressions were performed for Human Anatomy & Physiology I, Human Anatomy & Physiology II, College Algebra, English Composition I, and English Composition II courses using the corresponding Kaplan subject area exam score.

In all five analyses, course modality did not have a statistically significant effect on a student's Kaplan scores. Thus, the results support the Equivalency Theory. A student's age and gender were statistically significant in all courses except English Composition II, but at most explained only 7% of the variance observed.

Dedication

I dedicate this dissertation to my best friend and wife, Lydia Hoffman. She has always believed that I was a better person than I believed myself to be. She saw qualities and abilities in me that I could not see. She was always supportive, occasionally forceful, and forever loving. She managed a household with four teenage boys and a doctoral student for a husband. Did I mention that she also homeschooled our children? She ensured that I had quiet time for my coursework, dissertation, and Dr. Roessger's Qualitative Analysis I exams. The flow of food was never-ending. But most importantly, her faith and love provided the sustenance that I required to achieve a goal that I did not believe I could reach. She is my hero. I strive to be the kind of Christian that she is. Thank you.

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To my dissertation committee member, Dr. Kenda S. Grover. Thank you for serving on my dissertation committee. I also appreciate the feedback you provided throughout your courses. Your comments were always detailed and extremely helpful. I have tried to model your style in my courses.

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To my wife, Lydia Hoffman. Thank you for never giving up on me, even when I wanted to give up on myself. This degree should have your name on it as well. You have put in long hours and suffered much throughout this process. I am forever in your debt, but that is nothing new. I have been in debt to you since you said, "I do." My greatest accomplishment in life is all because of you; getting to be your husband and best friend. Now that this dream has been realized, we can pursue some new ones. So long as you are by my side, we can go anywhere!

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I. Introduction

A. Overview

Online instruction has become increasingly prevalent in higher education (see Figure 1) (Harting & Erthal, 2005; Kentnor, 2015; Scott, 1999). IPEDS data indicates that between 2012 and 2018, the percentage of students taking some or all of their courses through distance education has increased while the percentage of students not taking any distance education courses has declined by approximately 10% over the same period (see Figure 1). As previously noted, distance education is almost exclusively delivered online in the twenty-first century.

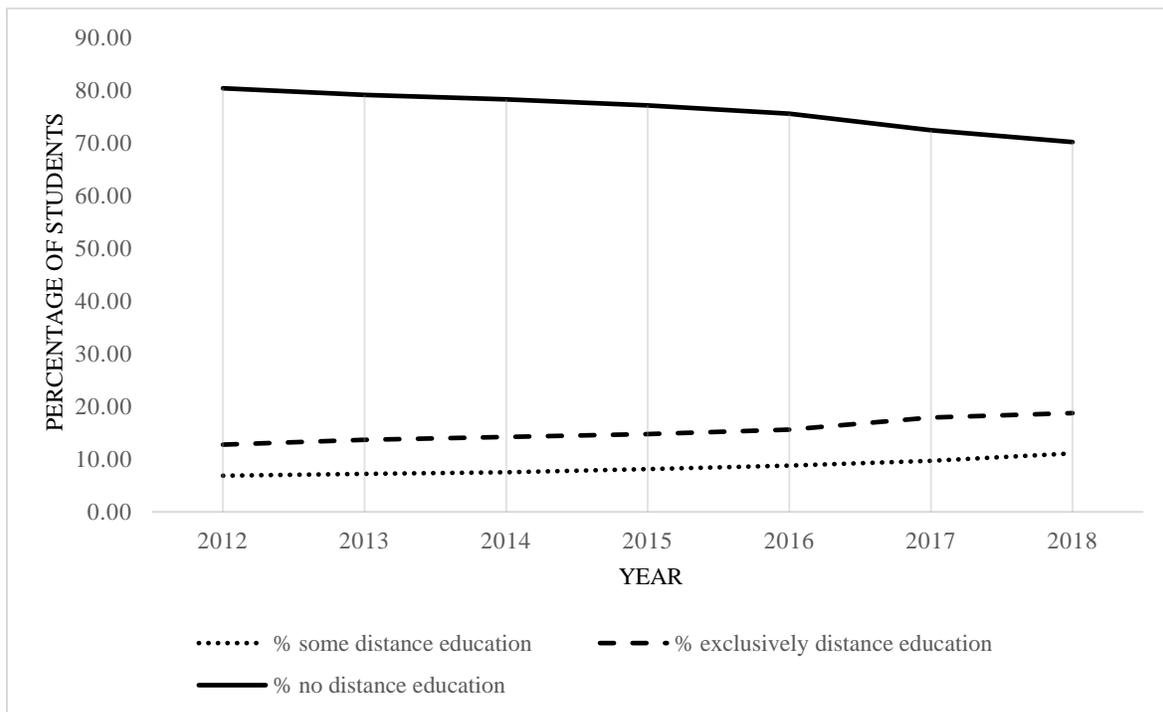


Figure 1. Community College Student Enrollment in Distance Education Courses

A great deal of literature compares various aspects of online methods with traditional face-to-face instruction, including the effectiveness of such instruction and student perspectives of preferences (Attardi & Rogers, 2015; Bolsen et al., 2016; Burke & Fedorek, 2017; Carrol & Burke, 2011; Christmann, 2017; Clark, 1994; Faulconer et al., 2018; Gabrielson & Watts, 2014; Harmon et al., 2014; Keramidas, 2012; Lu & Lemonde, 2013; Means, 2009; Mozer, 2016; Nfor,

2015; Reese, 2013; Rosenzweig, 2012; Russell, 2001; Williams, 2006; Wright, 2013). One difficulty is exploring the equivalency of different modalities of prerequisite courses in subsequent courses. However, given that the purpose of gatekeeper courses is to prepare students for further educational experiences, it is reasonable to measure the equivalency of gatekeeper course modality in a follow-up learning experience. Concepts related to course delivery methods and gatekeeper courses are theoretically defined and questions guiding this study are described. The chapter is concluded with a discussion of the proposed study's scope and limitations.

B. Background of the Study

A gatekeeper course is the first college-level reading, writing, math, or science course a student must complete to continue their degree plan (*The Completion Arch*, n.d.). As the name implies, gatekeeper courses are essential for students as they progress through their college education. All students take certain gatekeeper courses, such as College Algebra and English Composition. Specific degrees may have additional courses that function as gatekeepers. For example, Physics, Chemistry, and Calculus are considered gatekeepers (Redmond-Sanogo et al., 2016) for Engineering students. Human Anatomy & Physiology is a gatekeeper course for Nursing students (Johnston et al., 2015).

As colleges and universities attempt to reach a broader population of students and control costs at the same time, many institutions have adopted the use of additional modalities of delivery for educational content, particularly online methods of delivery (Harting & Erthal, 2005; Kentnor, 2015; Scott, 1999). "Modality" refers to the method or medium through which information is delivered to students (Chandler & Munday, 2011). While the face-to-face interactions between students and instructors are traditional, alternative modalities have existed for over 300 years (Kentnor, 2015). The online modality is the newest and fastest-growing in

education. In the fall of 2017, 34.1% of all college students were taking at least one course online and 16.9% were taking online courses exclusively (*Digest of Education Statistics, 2018, 2018.*) Online delivery allows students to access courses that they could not participate in using the traditional face-to-face delivery. Additionally, online delivery reduces infrastructure demands on community colleges, many of which have limited classroom space (Harting & Erthal, 2005; Kentnor, 2015; Scott, 1999).

The purpose of this study is to compare student scores on the entrance exam (Kaplan) into the nursing program at the University of Arkansas Community College at Batesville (UACCB) to determine if the modality of the student's gatekeeper courses influenced the Kaplan score. Gatekeeper courses for this study include English Composition I, English Composition II, College Algebra, Human Anatomy & Physiology I, and Human Anatomy & Physiology II. The Kaplan exam is used as an entrance exam because it purports to predict a student's success in a nursing program (*Nursing Ed, 2020*). The exam measures a student's reading, writing, basic math, science, and critical thinking (*Nursing Ed, 2020*).

By definition and design, the education gained in these gatekeeper courses influences a student's grade in subsequent courses (Eagan & Jaeger, 2008; Scarbrough, 2002; Valkenburg, 1990). However, the bulk of scholarly research has compared course modalities based upon within-course measures, such as the course completion grade. Little research has investigated the equivalency between gatekeeper courses' modalities in subsequent academic endeavors, such as student grades in courses, exams, or programs occurring after the gatekeeper course.

C. Statement of the Research Problem

As previously stated, a large body of research exists which compares the equivalency of the two primary modalities in higher education: face-to-face courses and online courses. The vast

majority of this research has focused on in-course comparisons such as course grades, exam scores, and student satisfaction. However, little research exists which compares the two modalities beyond the end of the course. This study measures how different gatekeeper modalities influence or predict success in future coursework.

Karatas and Simsek (2009) compared online and face-to-face versions of an Instructional Technologies and Material Development course. They found that student satisfaction between the two modalities was equivalent, but exam scores and permanency of the knowledge gained through the experience were not equivalent. The face-to-face students scored higher on exams and retained the knowledge longer.

Since the majority of the researcher's students are pre-nursing, the first opportunity to apply their Human Anatomy & Physiology knowledge after completing the course is when they take the nursing entrance exam (KAPLAN). The researcher chose to examine their scores on the science portion of that exam. To make the study more robust and mitigate any potential bias due to being the instructor of Human Anatomy & Physiology of the included courses, the researcher included the additional gatekeeper English Composition and College Algebra courses. By including additional courses, any differences due to the instructor should be minimized. The KAPLAN consists of subject area exams in math and writing, as well as science, that will be used to compare modalities for English Composition and College Algebra.

D. Purpose of the Study

The importance of gatekeeper courses is well established in the literature (Eagan & Jaeger, 2008; Scarbrough, 2002; S. Tobias, 1990; Sheila Tobias, 1995; Valkenburg, 1990). Research has addressed numerous aspects of these courses, including the timing of registration and gender (Hallawell, 2015). In addition, a great deal of scholarly attention has focused on

comparisons between traditional and online methods of delivery (Attardi & Rogers, 2015; Bolsen et al., 2016; Burke & Fedorek, 2017; Carrol & Burke, 2011; Christmann, 2017; Clark, 1994; Faulconer et al., 2018; Gabrielson & Watts, 2014; Harmon et al., 2014; Keramidas, 2012; Lu & Lemonde, 2013; Means, 2009; Mozer, 2016; Nfor, 2015; Reese, 2013; Rosenzweig, 2012; Russell, 2001; Williams, 2006; Wright, 2013). These studies have examined success rates, student learning, and student perspectives. However, there is very little research investigating the effects of the modality of gatekeeper courses on a student's grades in subsequent courses or exams.

The purpose of conducting the study will be to analyze College Algebra, English Composition I, English Composition II, Human Anatomy & Physiology I, and Human Anatomy & Physiology II as gatekeeper courses for the Registered Nursing program at UACCB. The results of the study will be useful for community college administrators and faculty to identify courses that may need improvements and by administrators and faculty in health professional programs to identify students who may need targeted assistance. For example, if the results of this study indicate that students completing College Algebra online score significantly lower than those in face-to-face courses, efforts can be made to address the inequalities. The current study is designed to determine the equivalency between f2f and online prerequisite courses for the nursing program at UACCB as determined by students' scores on the Kaplan entrance exam.

E. Research Questions

Research Question 1: Is there a significant difference in scores on the science portion of the Kaplan exam for pre-nursing students based upon course modality of the student's Human Anatomy & Physiology I course?

Research Question 2: Does a student's gender, age, and high school GPA significantly affect the relationship between scores on the science portion of the Kaplan exam for pre-nursing students based upon course modality of the student's Human Anatomy & Physiology I course?

Research Question 3: Is there a significant difference in scores on the science portion of the Kaplan exam for pre-nursing students based upon course modality of the student's Human Anatomy & Physiology II course?

Research Question 4: Does a student's gender, age, and high school GPA significantly affect the relationship between scores on the science portion of the Kaplan exam for pre-nursing students based upon course modality of the student's Human Anatomy & Physiology II course?

Research Question 5: Is there a significant difference in scores on the math portion of the Kaplan exam for pre-nursing students based upon course modality of the student's College Algebra course?

Research Question 6: Does a student's gender, age, and high school GPA significantly affect the relationship between scores on the math portion of the Kaplan exam for pre-nursing students based upon course modality of the student's College Algebra course?

Research Question 7: Is there a significant difference in scores on the writing portion of the Kaplan exam for pre-nursing students based upon the course modality of the student's English Composition I course?

Research Question 8: Does a student's gender, age, and high school GPA significantly affect the relationship between scores on the writing portion of the Kaplan exam for pre-nursing students based upon course modality of the student's English Composition I course?

Research Question 9: Is there a significant difference in scores on the writing portion of the Kaplan exam for pre-nursing students based upon the course modality of the student's English Composition II course?

Research Question 10: Does a student's gender, age, and high school GPA significantly affect the relationship between scores on the writing portion of the Kaplan exam for pre-nursing students based upon course modality of the student's English Composition II course?

F. Definition of Terms

Course Modality: This term refers to how a course of instruction is delivered, and although there are many different ways that a course can be taught (correspondence courses, experiential courses, etc.), the study primarily refers to either face-to-face instruction or online instruction.

Distance education: defined for accreditation review, by the Southern Association of Colleges and Schools (SACSOC, 2018), is a formal educational process in which most of the instruction occurs when students and instructors are not in the same physical location.

Face-to-face learning: for purposes of this study any course in which instruction is delivered in person (Hallawell, 2015). Face-to-face teaching includes courses in which 0%-29% of the material is delivered online (Allen & Seaman, 2010).

Gatekeeper Courses: a course that is required of all students as part of an earned credential and may be a pre-requisite for many other courses within academic programs.

Online Courses: Courses that are completely online, perhaps except for testing.

Student Success: defined as achievement of a goal such as exam score, grade in a course, or completion of a degree.

Traditional Course: “a course that is delivered in an in-person, face-to-face learning environment” (Hallawell, 2015, p. 15).

G. Scope and Limitations

This study will compare KAPLAN subject area scores of applicants to the UACCB RN nursing program at UACCB based upon the modality of the student’s prerequisite gatekeeper courses of College Algebra, English Composition, Human Anatomy & Physiology I, and Human Anatomy & Physiology II. Also, the data will be examined for interactions between course modality and student age, student gender, and high school GPA for each of the prerequisite gatekeeper courses.

A limitation of this study is that only students who completed their prerequisite coursework at UACCB will be included because it is not possible to determine the course modality of transfer courses since modality or course section number is not recorded on a student’s transcript. Also, due to the way the Registrar’s Office identifies course modality, this study identifies courses as online or face-to-face and does not account for degrees of hybridization between the two.

Additional limitations relate to the instructors of the gatekeeper courses. Some of the instructors in this study taught both modalities of particular courses while others only taught in one modality. Some courses of a particular modality were taught by only one instructor. The author of this study was the only instructor to teach Human Anatomy & Physiology I and II online and also taught many of the face-to-face classes of the same courses.

The sample is comprised of students taking classes over several years. Instructors likely made changes to the courses over the time of the study. Since time is an unmeasured variable in this study, any effects due to these changes will not be accounted for.

H. Theoretical Framework

This study's theoretical framework is the Equivalency Theory (Simonson et al., 1999). In describing The Equivalency Theory, Simonson (1999) wrote "Distance education's appropriate application should provide equivalent learning experiences for all students distant and local –for there to be expectations of equivalent outcomes of the educational experience," (p. 209). The theory is based on three key concepts: equivalency, learning experience, and telecommunications. Equivalency means that even though the learning environments in which learners participate may be different, the value of those events should be the same. Simonson (1999) uses the analogy of two different geometric shapes to explain equivalency. In the same way that a triangle and square are fundamentally different shapes but can have the same area, equivalency refers to the idea that varying learning environments in which learners participate may be different. Yet, the value of learning should be the same. Learning experiences are anything that happens to or with a student that promotes learning. Learning experiences include events that are viewed, heard, felt, or done. Telecommunications is how the learner and educator interact. These interactions may be synchronous or asynchronous.

If equivalency has been achieved, then measured student success on learning outcomes should be equivalent as well. Garratt-Reed, Roberts, and Heritage (2016) tested the Equivalency Theory in Introductory Psychology courses. They compared outcomes between online and face-to-face versions of the same courses and determined that while scores were lower for online students, this was primarily due to a single assignment that was not equivalent between the

modalities. Student satisfaction was equivalent between modalities, but student retention was lower for the online versions. Overall, their results were inconclusive with some indicators (student satisfaction) supporting the Equivalency Theory and others (student scores and student retention) not.

Lapsley and colleagues (2008) used the Equivalency Theory in comparing face-to-face and online versions of a human resources management course. The courses were taught by the same instructor, with the same syllabus, assignments, etc. When controlled for GPA, they found outcomes for the two courses were equivalent as determined by scores on chapter quizzes, discussion threads, and a final report. The authors hypothesize that online students may develop better self-directed learning skills and thus obtain a more practical education.

Learning outcomes include those established by the instructor and those determined by the learner. Instructor-determined outcomes are typically stated as goals and objectives for learners. The learner-determined outcomes reflect what the learner hopes to receive from the experience and are more personal. Simonson et al. (1999) state that equivalent outcomes can be identified when students attempt to use the newly learned skills. Therefore, the equivalency of the two modalities can be assessed by examining the degree of equivalency in learning outcomes. This study will look at KAPLAN exam scores to determine if equivalency exists between the two modalities for the gatekeeper courses of College Algebra, English Composition I, English Composition II, Human A&P I, and Human A&P II.

I. Summary

Community colleges are utilizing online course delivery for a variety of courses. While many studies have investigated various comparisons between online and traditional courses very few have looked at comparisons concerning gatekeeper courses. Most of these comparisons are

based upon course completion, course grade, or end of course assessment. Very little research has evaluated student success in subsequent educational activity-based upon prerequisite course modality. The researcher could find only one study that investigated the effects of gatekeeper course modality on subsequent educational activity by students. While this study has some limitations, it should add significant insight into the degree of equality of face-to-face and online courses regarding the application of the knowledge gained in those courses.

II: Review of Related Literature

A. Overview

Course modality and distance education has been a topic of scholarly interest for over 100 years. In the early 1900s, distance education was provided through correspondence courses. As the telecommunications era began in the 1970s, then various forms of video delivery became possible. Now, in the digital age, students demand the option of completing coursework online. As technology has increased, the debate has continued over whether learning by distance education is equivalent to traditional face-to-face learning. Despite many studies on the subject, there does not appear to be a simple answer.

This chapter consists of a review of the literature of the three concepts of concern: course modality, gatekeeper courses, and student success. Searches were conducted utilizing the resources available through the University of Arkansas library, including EBSCO host, ERIC, and others.

B. Conceptual Framework Related Research

Concept 1: Course Modality

Course modality is defined as the medium through which information is presented (Chandler & Munday, 2011). Various authors have classified course modality in different ways. For this study, two classifications will be used: face-to-face (f2f) courses (to be used synonymously with “traditional courses” or “lecture courses”) and online courses. Online courses are the current form of what was formerly referred to simply as “distance education”.

Face-to-face courses are defined as courses employing a “method of teaching used mainly in higher education, where students are taught in large groups, often in specially designed lecture theatres, which are tiered so that all students have a view of the teacher

(or lecturer) and whatever resources or visual aids are being used” (Forrest, 2015, pp. 18-19).

Online courses are defined as courses that primarily employ “the use of the Internet to access learning materials; to interact with the content, instructor, and other learners; and to obtain support during the learning process, to acquire knowledge, to construct personal meaning, and to grow from the learning experience.” (Paulsen, 2004, p. 5).

Historical or Conceptual Foundations

Distance education has existed for nearly 300 years. The earliest form of distance education was correspondence via parcel post. The first record of this type of education was an advertisement in the Boston Gazette for lessons in shorthand which stated that students “may be having several Lessons sent Weekly to them, be as perfect as those that live in Boston” (Phillips, 1728 quoted in (Kentnor, 2015, p. 23). Isaac Pitman began teaching shorthand in England by mailing postcards to students and having them transcribe passages from the Bible then sending them back to him for correction (Verduin & Clark, 1991). In 1843, the Phonographic Correspondence Society was founded and later became Sir Isaac Pitman’s Correspondence College (Verduin & Clark, 1991). Anna Eliot Ticknor in Boston, Massachusetts founded the Society to Encourage Studies at Home in 1873 on the correspondence model (Verduin & Clark, 1991). The Chautauqua Movement of the 1870s began as a training program for Sunday school teachers but expanded to include general education and arts courses, which were completed at home (Harting & Erthal, 2005). In 1893, the University of Chicago began offering college-level courses via correspondence (Scott, 1999). The University of Chicago enrolled 3,000 correspondence students in 350 courses with 125 instructors (Rumble, 1986).

In the early to mid-1900s technological advancements brought radio and television to the public. Despite high hopes, these media primarily only played a supplemental role in education, functioning mainly as an auditory or visual aid to face-to-face instruction (Harting & Erthal, 2005). Distance education began to move into educators' consciousness in the 1970s due to improvements in communications technology, instructional designs, and support services for distance students (Keegan, 1990). Initially, distance education was ignored altogether or received perfunctory attention because relatively few students were involved and it was considered a fad (Keegan, 1990).

However, even as the internet was being born in the early 1990s, the University of Phoenix began to offer educational programs online and was soon followed by other colleges and universities (Carlson & Carnevale, 2001). Not-for-profit institutions rapidly began to add for-profit divisions but a subsequent bust followed the boom. The endeavors' failure is attributed to a lack of support by faculty and the absence of an understanding of online pedagogy and learning styles (Marcus, 2001).

Distance education has now moved into the mainstream and discussions are concerned with comparing the outcomes of courses based on their modality, identifying factors that influence student success and preference, and developing theoretical frameworks that speak to the unique characteristics of distance learning (Bates, 2015; Clark, 1994; Harasim, 2012; Keegan, 1990; Levy, 2013; Paulsen, 2004; Santo, 2011; Summers et al., 2005).

Empirical or Theoretical Research

Much research has investigated comparisons between online courses' effectiveness and traditional classroom face-to-face courses. After performing a meta-analysis of the current research, Clark (1994) posited that media are only the vehicles and used the analogy of trucks

delivering groceries; the type of vehicle used to deliver the groceries did not change what was delivered or its value. It is important to note that Clark's analysis was based upon a systematic review of the literature and was not a statistical meta-analysis. Russell (2001) reviewed over 300 published articles and found that the consensus was that there was no significant difference in student success between face-to-face courses and distance education courses. Means (2009) conducted a meta-analysis for the U.S. Department of Education. In this research review, Means found that there was no statistical difference when comparing purely online courses with face-to-face courses ($g^+ = +0.05$), $p = .46$).

Some studies comparing online or blended classes to face-to-face classes found that those courses which incorporate a distance education component were either as effective or more effective than those without the distance education component. For example, in a meta-analysis conducted by Means (2009), courses that blended face-to-face with online content met their learning outcomes at a statistically higher level than purely face-to-face courses ($g^+ = +0.35$, $p < .0001$).

Bolsen et al., (2016) compared four modalities of American Government courses: face-to-face, face-to-face with breakout sessions, face-to-face blended with online content, and online. Their study was a quasi-experimental design that included 13 sections of courses with a total sample size of 1,524. Instructors for the courses agreed in advance on a common textbook, course objectives, and questions to use on each of the three-unit exams. ANOVA comparisons were made between the four modalities based on pre-and post-test scores with no significant difference found (pretest $F=2.31$, $p=.084$ and post-test $F=1.45$, $p = 0.237$; no effect sizes were reported).

Carrol & Burke (2011) compared face-to-face with online modalities in a Masters of Business Administration organizational theory course. The courses were taught by different instructors using similar syllabi. They found no statistical difference between final exam scores in the two courses ($t = 0.2244$, $p = .95$; no effect sizes were reported). However, they did find a significant difference in students' views on instructional effectiveness. Students in the face-to-face course had a higher opinion of instructional effectiveness compared to the online course (mean difference = .71, $t (.95) = 2.339$).

Faulconer et al. (2018), compared online vs. face-to-face chemistry courses and found no significant difference in failure rates between modalities (for lecture: $df = 1$, $\chi^2 = 1.138$, $p = 0.286$; for lab: $df = 1$, $\chi^2 = 0.287$, $p = 0.592$; no effect sizes were reported). However, they did find a significant difference in grade distributions between the two modalities (for lecture: $df = 4$, $\chi^2 = 15.839$, $p = 0.003$; for lab: $df = 4$, $\chi^2 = 14.771$, $p = 0.001$; no effect sizes were reported). Online students were much more likely to earn A's (36.5% vs. 19.6% respectively, $p = 0.1$). The authors did not explain the difference.

Rosenzweig (2012) compared grades between modalities in four science courses: General Biology I, Microbiology of Human Pathogens, Human Anatomy & Physiology I and Human Anatomy & Physiology II. General Biology I ($F(1, 1040) = 2.110$, $p = .147$) and Human Anatomy and Physiology II ($F(1, 1478) = .141$, $p = .708$) had no significant difference based upon modality. Classes with significant differences were Microbiology of Human Pathogens ($F(1, 901) = 23.944$, $p < .000$) and Human Anatomy & Physiology I ($F(1, 1718) = 21.732$, $p < .000$)

Christmann (2017) demonstrates the lack of consensus within the literature with the study that randomly assigned graduate students into either online or face-to-face statistics courses. He

found that the face-to-face class significantly outperformed the online class ($p = 0.001$, effect size = 0.979).

Still, other studies have found that factors such as age, gender, and level of academic preparedness effect which modality is the most effective for a student (Lu & Lemonde, 2013; Williams, 2006; Wright, 2013). The mixed results are further complicated by the observation that students prefer to learn in the classroom but demand access to online courses for a variety of personal reasons (Keramidas, 2012; Santo, 2011).

Concept 2: Gatekeeper Courses

Gatekeeper courses, as the name implies, are courses that must be successfully navigated by a learner to be able to progress down a particular academic path. These courses are prerequisites for other courses. They are often introductory English, math, or science courses intended to be completed in the first year of coursework (Hallawell, 2015; McDowell, 2018). Also, according to (Scarborough, 2002), gatekeeper courses have “disproportionately high non-success rates, relatively large enrollments, and grading distributions that remain constant from semester to semester and year to year” (p. iii).

Historical or Conceptual Foundations

Beginning in the early 1990s, researchers began to take notice of the fact that certain courses appeared to be preventing students from graduating due to their difficulty, fast pace, large enrollments, and grading systems (Scarborough, 2002; S. Tobias, 1990; Sheila Tobias, 1995; Valkenburg, 1990). Since then, gatekeeper courses have attracted increasing attention, especially regarding discussions on student retention and graduation.

(Scarborough, 2002) linked the retention of students in school to student success in gatekeeper courses. In Valkenburg’s (1990) article on the engineering curriculum, most of the

blame for poor retention of potential engineering students was attributed to the quality of instruction in the gatekeeper courses of calculus and chemistry. The author notes that nearly 1/3 of the students who enroll in calculus fail to finish. Campbell (2015) describes gatekeeper courses as courses that are not part of the major degree but if the student cannot perform well in the gatekeeper course then they will likely not perform well in subsequent courses.

STEM (science, technology, engineering, and math) programs in particular experience a great deal of attrition. The majority of attrition occurs during the first two years of science of curriculum (Chang et al., 2008; Gasiewski et al., 2012; Seymour, 2000). Introductory course performance is one of the key indicators determining whether STEM students change majors (Seymour, 2000).

Empirical or Theoretical Research

As higher education institutions come under increasing scrutiny from legislators, students, and society, researchers and educators have begun to look at the factors that contribute to students failing to achieve their academic goals. Gatekeeper courses are among these factors. As such, scholars have begun to investigate the variables that may contribute to the historically low student success rates for these courses and what steps might be taken to improve student outcomes. Eagan and Jaeger (2008) analyzed transcript data from four institutions identified as four-year universities in the southeastern United States. Classification of institutions was as reported by the Carnegie Foundation for Advancement of Teaching (*Carnegie Foundation for the Advancement of Teaching. Classification Descriptions*, 2006). Their hypothesis was that instructor type, either full-time or adjunct, made a significant difference in student success rates in gatekeeper courses. Doctoral students were 20% less likely (odds ratio = 0.80, $p < 0.05$) to persist to the second year for every percentage point increase in exposure to other part-time

faculty in gatekeeper courses. The effect was larger in non-doctoral schools where students were 37% less likely (odds ratio = 0.63, $p < 0.05$) to persist to the second year for every percentage point increase in exposure to other part-time faculty in gatekeeper courses.

Hallawell (2015) took a stratified random sample of 751 students out of a population of 13,437 students enrolled in gatekeeper courses. Half of the students in the sample represented face-to-face courses and the other half represented online courses. Hallawell's primary focus was on the effects of late registration regarding student persistence and success in those gatekeeper courses. She found that 65% of students who register late for a course register for an online course. Success rates for the late registering students were similar (48% for online and 45% for traditional). Significance levels and effect sizes were not reported.

While no doubt the effect of gatekeeper courses has long existed, it has only been in the last 30 years that it has been discussed in the literature. These courses appear to have a disproportionate effect on students' ability to progress academically. Part of the significance of a gatekeeper course is that the knowledge and skills contained therein is essential to subsequent coursework.

Concept 3: Student Success

Student success is the business of everyone involved in education. However, there is little consensus on what "student success" means. The definition varies considerably based on the group providing it. An instructor may define success in terms of grades or course completion, but a student may define it in a more personal way.

Historical or Conceptual Foundations

Historically, student success has been defined in terms of grades, grade point average (GPA), course completion, retention rates, degree attainment, or transfer (Lancia et al., 2013;

Levy, 2013; Ott et al., 2018; Topham, 2016). These measures are problematic due to a lack of consensus across institutions and instructors.

One might think that measuring the retention rate of students, for example, would be straightforward. One of the earliest attempts to identify factors affecting student retention was dates back to 1938 and identified many of the same factors which are investigated today: age, employment, and time to degree (McNeely et al., 1938). There remains much confusion about how retention rates are calculated. Current government guidelines exclude over 60% of students at 4-year schools (Cook & Pullaro, 2010; Glenn, 2010) because the retention rate only includes first-time, full-time students; a point of contention with many college administrators.

Baldwin et al. (2011) note that the six major university ranking systems utilize a wide and seldom overlapping mix of characteristics to rank universities. Also, the majority of these characteristics are inputs, such as money spent, and not outputs. The exception is the widespread use of graduation rates as a measure of student success. Baldwin et al. (2011) argue that student success should be measured and defined in terms of learning outcomes as opposed to graduation rates or GPA because the supposed function of higher learning institutions is learning and not graduation. However, some scholars believe that there is a need for even broader definitions to include success as defined by the student (Topham, 2016).

North Carolina's Community College system can be viewed as an example of how student success is measured (North Carolina Community College System, 2014). Eight measures are utilized to determine student success: 1) Basic Skills Student Progress; 2) GED Diploma Passing Rate; 3) Developmental Student Success Rate in College-Level English Courses; 4) Developmental Student Success Rate in College-Level Math Courses; 5) First Year Progression; 6) Curriculum Student Completion; 7) Licensure and Certification Passing Rate, and 8) College

Transfer Performance. Note that two of the eight measures measure success rates in college-level math and English courses, which are also considered “gatekeeper courses”.

Empirical or Theoretical Research

Student success is generally defined as the achievement of some goal or objective. These goals or objectives are measured by grades, specific learning objectives, or completion of degree or certificate (Christmann, 2017; Lancia et al., 2013; Ott et al., 2018). Christmann (2017) defined success in a graduate statistics course in terms of grades and found that course modality affects success but gender played a moderating role. Female students outperformed male students in the online format but male students outperformed female students in the face-to-face format (effect size = 0.651). Lancia et al. (2013) defined success as completion of the degree. They evaluated high school GPA and entrance exam scores as predictors. They concluded that high school GPA was a good predictor of success but the entrance exam score was not. Students which failed the program had the lowest high school GPA's ($p = 0.000$) and were male ($p = 0.000$). Ott et al. (2018) defined success as degree completion as well. The purpose of their study was to identify predictors of success. They examined over 4,500 academic records and performed descriptive statistical analyses to identify demographic characteristics of successful students. They determined that “more successful students tend to be older, have a higher income and a higher high school grade point average, while those less successful are directly out of high school and have not earned dual credit” (108).

However, some researchers have seen the need to view student success in one course as completion or performance in the subsequent course (Andrade, 1999). Note that one of the Equivalency Theory features discussed below is the measurement of learning outcomes, which

includes applying knowledge gained in one course in a subsequent course of activity (Simonson et al., 1999).

There are many ways of viewing student success. Many educators believe that a more meaningful measure of students' success is best measured by how well prepared they are for the next step in their academic careers (Andrade, 1999; Simonson et al., 1999).

Relationship Between Variables

Course modality has long been a topic of scholarly discussion. As digital media advanced and online courses have become more popular, a great deal of attention has focused on comparing student success in online and face-to-face courses. However, these comparisons do not reflect the full range of courses offered at most community colleges. In particular, there is an apparent dearth of information regarding course modality effects in gatekeeper courses. The studies that do investigate course modality effects on student success in gatekeeper courses take a relatively short-term view of student success and focus on course grades.

One study compared student success in gatekeeper courses to their success in subsequent courses. However, the author did not investigate the effects of course modality. To evaluate the effectiveness of curricular revisions' to a Precalculus course, Andrade (1999) used student success to predict their success in Calculus I. Andrade's data indicated that the reform effort was beneficial but concluded the institution had more work to do improving gatekeeper Precalculus course outcome based on the Index of Course Effectiveness (ICE). While this study does not investigate differences in course modality, it provides a precedent for using subsequent academic activity to evaluate the prerequisite course.

In this literature review, the researcher found numerous studies that examined the effects of course modality on student success. Course modality appears to be a predictor of student

success in some cases but not in others. This suggests that other factors are influencing the relationship between modality and success. The researcher also found some studies that investigated the effects of course modality on student success in gatekeeper courses, but several lack the statistical depth needed to draw adequate conclusions. However, not a single study was found that investigated the effects of gatekeeper course modality on student success in subsequent academic endeavors, which demonstrates the need for this study.

C. Chapter Summary

Enrollment in online courses continues to grow as students seek anytime and anywhere access to education. Online course offerings reach a broader population of students while reducing demands for physical infrastructure, thus saving money. The research into course modality equivalency is not definitive. However, it does suggest that online courses and face-to-face courses should produce equivalent learning outcomes, but many educators and researchers remained unconvinced. Also, many modality comparisons come from relatively few subject areas, primarily Statistics and American Government courses. Few studies were found that compare success based upon modality in gatekeeper courses. Many of the studies reviewed lacked adequate statistical analysis to draw definitive conclusions. Thus, this study should address a literature gap regarding analyzing student success in subsequent academic endeavors such as knowledge-based exams like the KAPLAN based upon the course modality of gatekeeper courses.

In conversations regarding student retention and graduation, it is difficult to overstate the importance of gatekeeper courses. These courses, by definition, control the flow of students into subsequent courses and degree completion. If online and face-to-face courses are not equivalent, then the impact of modality on student success would be greater in these gatekeeper courses.

III: Methodology

A. Overview

This chapter describes each of the 16 research questions along with their respective substantive and statistical hypotheses. The “Methods” section details the design of this secondary data analysis and its setting at the University of Arkansas Community College at Batesville, Arkansas. Also in the “Methods” section, there is a description of the study’s participants and the measures used in this study. The data collection methodology and analysis are identified, followed by a discussion of internal and external validity threats. The chapter concludes with a summary.

B. Study Design

This study is a cross-sectional secondary data analysis of information collected by the Registrar’s Office and the Nursing Department at UACCB. The Director of Institutional Research collected all data at UACCB and student identifiable data was removed before sending the information to the researcher. The Registrar’s Office records the birth date, gender, and high school GPA of all incoming students. The student’s age will be determined from their birthdate. The Registrar’s Office also records the course and section numbers of each student’s courses completed at UACCB. The course section number will determine course modality. All online courses at UACCB use 095 or 099 section numbers. All other section numbers refer to face-to-face courses.

The KAPLAN exam has been used as an entrance exam by the Nursing Department at UACCB for six years. Since its adoption, the KAPLAN subject area scores (science, math, and writing) have been collected for all nursing program applicants over the last six years. The applicants’ list was cross-referenced with data from the Registrar’s Office to determine which

applicants completed their pre-requisite coursework at UACCB since it is impossible to identify course modality for transfer courses. For students who completed their pre-requisite coursework at UACCB, Human Anatomy & Physiology I, Human Anatomy & Physiology II, College Algebra, and English Composition course section numbers were obtained from the Registrar's Office to determine the course modality for each of the pre-requisite courses.

C. Study Setting

This study was conducted at the University of Arkansas Community College at Batesville, Arkansas. Batesville is located approximately 80 miles northeast of Little Rock. Batesville is the county seat for Independence County and is the largest city in the county with a population of 10,727. UACCB is the only community college in the county. Lyon College is a private four-year school located in Batesville and is the only other institution of higher education in the city. UACCB has approximately 1200 students completing roughly 13,000 SSCH's (student semester credit hours). Approximately 25% of those SSCH's are from online enrollments.

Online and face-to-face courses are taught by a mixture of full-time and adjunct faculty. To control for instructor-level effects, this study was limited to instructors which taught both modalities of a course.

D. Participants and Placement

The participants in this study were applying for admission to the Registered Nursing program at UACCB. Due to the inability to determine the course modality of transfer courses, only applicants who completed their pre-requisites at UACCB were part of the study.

UACCB is a two-year community college in the University of Arkansas system. It is in Batesville, Arkansas, which is the county seat for Independence County in North-Central

Arkansas. The college began providing educational opportunities to area residents in 1991 as Gateway Technical College. In 1998, the college joined the University of Arkansas system as UACCB.

In the fall of 2018, 1,328 students were enrolled in 13,460 student semester credit hours (SSCH's). Online enrollment accounted for 3,522 of those SSCH's. Approximately 66% of students reside in Independence County. Over half of all students are age 19 or younger. The student population is primarily Caucasian (83.51%). Approximately 5% of students are Hispanic, 3% are Black and 6% identify as multiple races. UACCB students are predominantly female (67%).

UACCB offers the following degrees and certificates: Associate of Arts (1), Associate of Science (3), Associate of Applied Science (8), Technical Certificates (12), and Certificates of Proficiency (16).

During the 2017-18 academic year, 176 students applied for admission to the RN program, which accepts 90 students. Demographic data was available for those accepted but not for all applicants. Of those accepted, 80 were female and 10 were male. Sixty-three percent of the students were between the ages of 26 and 40; 86% were white, 9 were African-American and 9% were Hispanic. All students who applied for the RN program since 2013 and completed their pre-requisite coursework at UACCB will be included in the study.

A GPower analysis with an effect size of $f^2 = 0.15$, $\alpha = 0.05$, power of 0.8, and with four predictors yields a critical F of 2.486, an actual power of 0.803, and a required sample size of 85. Thus, the sample size from the most recent year would meet the requirement. The numbers of applicants from previous years are expected to be similar, but that data was not available at this time.

E. Measures

This study's dependent variable is student scores on the math, science, and writing portions of the KAPLAN exam. All three are continuous variables. The exam includes 28 math questions, 21 writing questions, and 20 science questions.

The independent variable is course modality. For this study, the modality will be identified as either online or face-to-face (traditional or lecture).

Online courses are defined by the use of the Internet to access learning materials; to interact with the content, instructor, and other learners; and to obtain support during the learning process, in order to acquire knowledge, to construct personal meaning, and to grow from the learning experience (Paulsen, 2004, p. 5).

Face-to-face courses are defined as those that utilize a method of teaching used mainly in higher education, where students are taught in large groups, often in specially designed lecture theatres, which are tiered so that all students have a view of the teacher (or lecturer) and whatever resources or visual aids are being used Forrest (2015, p. 19).

Online courses are signified by the UACCB Registrar as having section numbers 095 or 099. All other section numbers identify face-to-face courses.

The moderating variables for this study are gender, age, and high school GPA. Gender is classified as male or female, as students identify themselves on enrollment materials. Age (in years) was determined from birthdates recorded in enrollment materials. Older students are defined as those aged 23 and older. High school Grade Point Average (HSGPA) is the official average of a student's high school coursework and is recorded on a student's high school transcript. High school GPA will be determined from enrollment materials as well. High HSGPA is defined as a student's HSGPA above the mean UACCB student HSGPA.

F. Data Collection

KAPLAN subject area test scores were collected by the author and principal investigator, Vernon Hoffman, from the Nursing Department at UACCB for all applicants since implementation of the KAPLAN exam as an entrance exam for the nursing program in 2013. The author then cross-referenced the list of applicants with data from the Registrar's Office at UACCB to determine which applicants completed their pre-requisite coursework at UACCB. For all applicants that completed their pre-requisite coursework at UACCB, course section numbers for each applicant's Human Anatomy & Physiology I, Human Anatomy & Physiology II, College Algebra, and English Composition courses were collected. Any course section numbers containing 095 or 099 pertain to online courses; all other course section numbers pertain to face-to-face courses.

The author also collected age, gender, and high school GPA for each applicant that completed their pre-requisite coursework at UACCB from the Registrar's Office.

G. Data Analysis

Each hypothesis was tested using Multiple Linear Regression in SPSS version 26. Multiple Linear Regression was chosen because the study contains both categorical (course modality and gender) and continuous (age and high school GPA) independent variables and a continuous dependent variable. Also, Multiple Linear Regression allows for the identification of interactions between variables. Linearity was evaluated using scatterplots. The normality of residuals was evaluated with Q-Q-Plots and the Kolmogorov-Smirnov goodness of fit test. Multicollinearity was checked using a correlation matrix of Pearson's bivariate correlations. Homoscedasticity was checked by evaluating the scatterplots of residuals versus predicted values.

H. Internal and External Validity

An internal threat to validity is the subject characteristics threat. There are likely differences between the applicants other than the modality of their pre-requisite coursework. To address this threat, this study will evaluate the impact of age, gender, and high school GPA in addition to course modality. A potentially confounding variable is the fact that some of the instructors of face-to-face courses were also instructors in online courses. The researcher is a faculty member at UACCB and an instructor of the Human Anatomy & Physiology I & II courses included in the study.

Two potential external threats to validity are related to the sample being a convenience sample: population generalizability and ecological validity. Population generalizability refers to the degree to which a study's results represent the population as a whole (*Generalizability and Transferability in Statistics and Research*, 2016). Population generalizability is addressed by the fact that this study will utilize all applicants to the UACCB RN program that completed their pre-requisite coursework at UACCB during the period of the study. While all of the subjects are applicants to the UACCB RN program, the findings should have application to other small community colleges, particularly in Arkansas. The other external threat is ecological validity. Ecological validity refers to the degree to which the results of a study would be replicated in a different setting (*Ecological Validity: Definition and Examples*, 2016). This concern is addressed by the fact that all of the face-to-face courses are located in similar classrooms at UACCB. By nature, the settings for the online courses will vary by instructor, student, and time. The same student may not participate in a course from the same location.

I. Ethical Considerations

One ethical consideration for the study is that the researcher is also the instructor of the Human A&P courses included in the study. This concern is ameliorated by the fact that the data is historical. Other ethical considerations pertain to student privacy. No identifying student information will be included in this document or subsequent publications.

J. Summary

This chapter provided an introduction and described each of the 16 research questions and their respective hypotheses. This study is a secondary data analysis of KAPLAN exam scores of applicants to the RN program at UACCB in Batesville, Arkansas. Subject area scores in writing, math, and science will be collected and analyzed for all applicants that completed their pre-requisite coursework at UACCB since 2013. The dependent variable is KAPLAN subject area test score and the independent variable is the course modality of the student's College Algebra, English Composition, Human Anatomy & Physiology I, and Human Anatomy & Physiology II courses. Student age, gender, and HSGPA are moderating variables. Multiple Linear Regression analysis of the data will be completed using SPSS software version 26. Internal and external threats to validity are identified and accounted for.

IV. Findings

The number of online course offerings continues to increase as does the number of students who enroll in them. Many educators have embraced the use of the internet as a vehicle to deliver educational opportunities to students, especially those who might encounter difficulty accessing traditional course offerings. The current study is designed to determine the equivalency between f2f and online prerequisite courses for the nursing program at UACCB as determined by students' scores on the Kaplan entrance exam. Also, this study seeks to determine whether a student's gender, age, and HSGPA affect their Kaplan scores.

This chapter begins with a summary of the study, findings of the study, and data analysis. The summary of the study includes a general overview of the study including purpose and research methodology. The research methods used to analyze the data are described and data are analyzed and presented by research question.

A. Study Summary

As stated previously, most scholarly research investigating equivalency between modalities has focused on measurements within the individual courses. This study seeks to determine equivalency based upon the application of the experience, which was gained in the pre-requisite course, in a subsequent assessment. The subsequent assessment used is the Kaplan exam, which functioned as the entrance exam for the UACCB nursing program. The Kaplan exam consists of subject area tests, including Science, Math, and Writing. The prerequisite courses of the Science test are Human Anatomy & Physiology I and II. The prerequisite course of the Math test is College Algebra. The prerequisite courses of the Writing test are English Composition I & II. Pre-requisite course information and Kaplan scores were collected from the UACCB Registrar's office and the Division of Nursing and Allied Health through the office of

the Director of Institutional Research. Student names, social security numbers, and student identification numbers were removed by the Director of Institutional Research and unique identification numbers were assigned to each student before forwarding the data to the researcher.

B. Data Analysis

The sample consists of students applying to the UACCB nursing program between 2012 and 2018, who completed some or all their prerequisite coursework at UACCB (N=557). Most of the students were female (N=490, 88%). Students ranged in age at the time of the exam from 17 to 67 with a median of age of 26. Since some students did not complete all their prerequisite coursework at UACCB, the number of students represented in each prerequisite course varies: Human A&PI, N = 355 (online n = 24 , f2f n = 331; Human A&PII, N = 338 (online n = 68, f2f n = 270); College Algebra, N = 317 (online n = 33, f2f n = 284); English Composition I, N = 357 (online n = 45, f2f = 312); English Composition II N = 331 (online n = 80, f2f n = 251).

High school GPA was not included as an independent variable in any of the analyses because the only students with HSGPA on record were first-time, full-time students. In this sample, only 80 students had HSGPA's on file. If HSGPA had been included and listwise exclusion of cases utilized (Fields, 2013), then the number of students in the sample would have been drastically reduced.

Research Question 1: Is there a significant difference in scores on the science portion of the Kaplan exam for pre-nursing students based upon course modality of the student's Human Anatomy & Physiology I course?

Research Question 2: Does a student's gender, age, and high school GPA significantly affect the relationship between scores on the science portion of the Kaplan exam for pre-nursing students based upon course modality of the student's Human Anatomy & Physiology I course?

A hierarchical multiple regression was performed to determine factors affecting a student's Kaplan Science Exam score (dependent variable). In the first model, the independent variable was the modality of the student's Human A&PI course. In the second model, gender and age were added to course modality as independent variables. See Table 2 for the descriptive statistics of the independent variables.

Table 1: Descriptive Statistics for Human A&PI Multiple Regression

	Mean	Std. Deviation	N
Kaplan Score	53.26	12.740	352
Section Type Code	1.07	.252	352
Gender Code	1.12	.325	352
Age	28.78	9.296	352

Model 2 illustrated better overall model fit, accounting for 5.3% of the variation in Kaplan Science Exam scores, 5% more than model 1, $\Delta R^2 = .051$, $F(2,348) = 3.79$, $p < .001$. Thus, course modality was not a significant source of variance, i.e., the two modalities were statistically equivalent. In the second model, gender and age were better predictors than course modality, and while statistically significant, only accounted for 5% of the variance between students' scores.

Table 2: ANOVA^a for Human A&PI Multiple Regression

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	152.196	1	152.196	.938	.334 ^b
	Residual	56818.233	350	162.338		
	Total	56970.429	351			
2	Regression	3046.770	3	1015.590	6.554	.000 ^{c***}
	Residual	53923.659	348	154.953		
	Total	56970.429	351			

a. Dependent Variable: Kaplan Score

b. Predictors: (Constant), Section Type Code

c. Predictors: (Constant), Section Type Code, Gender Code, Age

Note: * $p < .05$; ** $p < .01$; *** $p < .001$

Assumptions for Human A&PI Multiple Regression

An analysis of standard residuals was carried out, which showed that the data contained no outliers (Std. Residual Min = -2.47, Std. Residual Max = 3.06).

Tests to see if the data met the assumption of collinearity indicated that multicollinearity was not a concern (Section Type, Tolerance = .99, VIF = 1.00; Gender, Tolerance = .99, VIF = 1.00; Age, Tolerance = .99, VIF = 1.00).

The data met the assumption of independent errors (Durbin-Watson value = 2.05).

The histogram of standardized residuals indicated that the data contained approximately normally distributed errors, as did the normal P-P plot of standardized residuals, which showed points that were not completely on the line, but close.

The scatterplot of standardized predicted values showed that the data met the homogeneity assumptions of variance and linearity.

The data also met the assumption of non-zero variances (Section Type, Variance = .63; Gender, Variance = .10; Age, Variance = 85.83; Kaplan Science Exam Score, Variance = 189.30).

Table 3: Model Summary^c for Human A&PI Multiple Regression

Model	Adjusted			Std. Error of the Estimate	Change Statistics				Durbin-Watson	
	R	R Square	R Square		R Square Change	F Change	df1	df2		Sig. F Change
1	.052 ^a	.003	.000	12.741	.003	.938	1	350	.334	
2	.231 ^b	.053	.045	12.448	.051	9.340	2	348	.000***	2.053

a. Predictors: (Constant), Section Type Code

b. Predictors: (Constant), Section Type Code, Gender Code, Age

c. Dependent Variable: Kaplan Score

Note: * $p < .05$; ** $p < .01$; *** $p < .001$

Table 4: Coefficients^a

Model	Unstandardized		95.0% Confidence Interval				Collinearity						
	Coefficients		Standardized Coefficients		for B		Correlations						
	B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF	
1	(Constant)	56.05	2.96		18.96	.00**	50.24	61.87					
	Section Type Code	-2.61	2.69	-.05	-.97	.33	-7.91	2.69	-.05	-.05	-.05	1.00	1.00
2	(Constant)	43.79	4.09		10.71	.00	35.75	51.83					
	Section Type Code	-2.91	2.63	-.06	-1.10	.27	-8.09	2.27	-.05	-.06	-.06	.99	1.00
	Gender Code	5.19	2.05	.13	2.52	.01*	1.15	9.23	.15	.13	.13	.99	1.01
	Age	.24	.07	.17	3.28	.001	.09	.38	.18	.17	.17	.99	1.01

a. Dependent Variable: Kaplan Score

Note: * $p < .05$; ** $p < .01$; *** $p < .001$

Research Question 3: Is there a significant difference in scores on the science portion of the Kaplan exam for pre-nursing students based upon course modality of the student's Human Anatomy & Physiology II course?

Research Question 4: Does a student's gender, age, and high school GPA significantly affect the relationship between scores on the science portion of the Kaplan exam for pre-nursing students based upon course modality of the student's Human Anatomy & Physiology II course?

A hierarchical multiple regression was performed to determine factors affecting a student's Kaplan Science Exam score (dependent variable). In the first model, the independent variable was the modality of the student's Human A&PII course. In the second model, gender and age were added to course modality as independent variables. See Table 6 for the descriptive statistics of the independent variables.

Table 5: *Descriptive Statistics for Human A&PII Multiple Regression*

	Mean	Std. Deviation	N
Kaplan Score	54.34	12.612	336
Section Type Code	1.20	.402	336
Gender Code	1.12	.324	336
Age	28.67	9.157	336

Model 2 illustrated better overall model fit, accounting for 5.0% of the variation in Kaplan Science Exam scores, 4.7% more than model 1, $\Delta R^2 = .047$, $F(2,332) = 8.224$, $p \leq .001$. Thus, course modality was not a significant source of variance, i.e., the two modalities were statistically equivalent. In the second model, gender and age were better predictors than course modality. While statistically significant, only accounted for less than 5% of the variance between students' scores on the Kaplan Science Exam.

Table 6: ANOVA^a for Human A&PII Multiple Regression

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	150.252	1	150.252	.944	.332 ^b
	Residual	53135.388	334	159.088		
	Total	53285.640	335			
2	Regression	2658.573	3	886.191	5.811	.001 ^{c**}
	Residual	50627.067	332	152.491		
	Total	53285.640	335			

a. Dependent Variable: Kaplan Score

b. Predictors: (Constant), Section Type Code

c. Predictors: (Constant), Section Type Code, Gender Code, Age

Note: * $p < .05$; ** $p < .01$; *** $p < .001$

Assumptions for Human A&PII Multiple Regression

An analysis of standard residuals was carried out, which showed that the data contained no outliers (Std. Residual Min = -2.62, Std. Residual Max = 2.98).

Tests to see if the data met the assumption of collinearity indicated that multicollinearity was not a concern (Section Type, Tolerance = 1.00, VIF = 1.00; Gender, Tolerance = .99, VIF = 1.01; Age, Tolerance = .99, VIF = 1.01).

The data met the assumption of independent errors (Durbin-Watson value = 1.89).

The histogram of standardized residuals indicated that the data contained approximately normally distributed errors, as did the normal P-P plot of standardized residuals, which showed points that were not completely on the line, but close.

The scatterplot of standardized predicted values showed that the data met the homogeneity assumptions of variance and linearity.

The data also met the assumption of non-zero variances (Section Type, Variance = .161; Gender, Variance = 0.10; Age, Variance = 85.13; Kaplan Science Exam Score, Variance = 190.97).

Table 7: Model Summary^c for Human A&PII Multiple Regression

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.053 ^a	.003	.000	12.613	.003	.944	1	334	.332	
2	.223 ^b	.050	.041	12.349	.047	8.224	2	332	.000***	1.890

a. Predictors: (Constant), Section Type Code

b. Predictors: (Constant), Section Type Code, Gender Code, Age

c. Dependent Variable: Kaplan Score

Note: * $p < .05$; ** $p < .01$; *** $p < .001$

Table 8: Coefficients^a for Human A&PII Multiple Regression

Model	Unstandardized Coefficients		Standardized Coefficients		Correlations			Collinearity Statistics		
	B	Std. Error	Beta	t	Sig.	Zero-order	Partial	Part	Tolerance	VIF
1 (Constant)	56.344	2.171		25.95	.000					
Section Type Code	-1.664	1.713	-.053	-.97	.33	-.05	-.05	-.05	1.00	1.00
2 (Constant)	43.858	3.753		11.69	.000					
Section Type Code	-1.291	1.680	-.041	-.77	.44	-.05	-.04	-.04	.997	1.00
Gender Code	5.283	2.094	.136	2.52	.012*	.15	.14	.14	.987	1.01
Age	.214	.074	.155	2.88	.004**	.17	.16	.15	.985	1.02

a. Dependent Variable: Kaplan Score

Note: * $p < .05$; ** $p < .01$; *** $p < .001$

Research Question 5: Is there a significant difference in scores on the math portion of the Kaplan exam for pre-nursing students based upon course modality of the student's College Algebra course?

Research Question 6: Does a student's gender, age, and high school GPA significantly affect the relationship between scores on the math portion of the Kaplan exam for pre-nursing students based upon course modality of the student's College Algebra course?

A hierarchical multiple regression was performed to determine factors affecting a student's Kaplan Math Exam score (dependent variable). In the first model, the independent variable was the modality of the student's College Algebra course. In the second model, gender and age were added to course modality as independent variables. See Table 10 for descriptive statistics of the independent variables.

Table 9: Descriptive Statistics for College Algebra Multiple Regression

	Mean	Std. Deviation	N
Kaplan Score	73.47	14.721	312
Section Type Code	1.11	.308	312
Gender Code	1.11	.316	312
Age	27.95	9.120	312

Model 2 illustrated better overall model fit, accounting for 6.7% of the variation in Kaplan Math Exam scores, 7% more than model 1, $\Delta R^2 = .058$, $F(2,308) = 11.098$, $p < .001$. Thus, course modality was not a significant source of variance, i.e., the two modalities were statistically equivalent. Gender and age were statistically significant better predictors of students' scores on the Kaplan Math Exam.

Table 10: ANOVA^a for College Algebra Multiple Regression

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	150.252	1	150.252	.944	.332 ^b
	Residual	53135.388	334	159.088		
	Total	53285.640	335			
2	Regression	2658.573	3	886.191	5.811	.001 ^{c**}
	Residual	50627.067	332	152.491		
	Total	53285.640	335			

a. Dependent Variable: Kaplan Score

b. Predictors: (Constant), Section Type Code

c. Predictors: (Constant), Section Type Code, Gender Code, Age

Note: * $p < .05$; ** $p < .01$; *** $p < .001$

Assumptions for College Algebra Multiple Regression

An analysis of standard residuals was carried out, which showed that the data contained no outliers (Std. Residual Min = -2.63, Std. Residual Max = 2.98).

Tests to see if the data met the assumption of collinearity indicated that multicollinearity was not a concern (Section Type, Tolerance = 1.00, VIF = 1.00; Gender, Tolerance = .99, VIF = 1.01; Age, Tolerance = .99, VIF = 1.01).

The data met the assumption of independent errors (Durbin-Watson value = 1.89).

The histogram of standardized residuals indicated that the data contained approximately normally distributed errors, as did the normal P-P plot of standardized residuals, which showed points that were not completely on the line, but close.

The scatterplot of standardized predicted values showed that the data met the homogeneity assumptions of variance and linearity.

The data also met the assumption of non-zero variances (Section Type, Variance = .09; Gender, Variance = 0.10; Age, Variance = 86.76; Kaplan Math Exam Score, Variance = 264.04).

Table 11: Model Summary^c for College Algebra Multiple Regression

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.007 ^a	.000	-.003	14.74	.00	.02	1	310	.895	
2	.259 ^b	.067	.058	14.29	.07	11.10	2	308	.000***	1.94

a. Predictors: (Constant), Section Type Code

b. Predictors: (Constant), Section Type Code, Gender Code, Age

c. Dependent Variable: Kaplan Score

Note: * $p < .05$; ** $p < .01$; *** $p < .001$

Table 12: Coefficients^a for College Algebra Multiple Regression

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
		1	(Constant)	56.34			2.17		25.95	.00	52.07	60.61	
	Section Type Code	-1.66	1.71	-.05	-.97	.33	-5.03	1.71	-.05	-.05	-.05	1.00	1.00
2	(Constant)	43.86	3.75		11.68	.00	36.48	51.24					
	Section Type Code	-1.29	1.68	-.04	-.77	.44	-4.56	2.01	-.05	-.042	-.04	1.00	1.00
	Gender Code	5.28	2.09	.14	2.52	.01*	1.16	9.40	.15	.137	.14	.99	1.01
	Age	.214	.07	.16	2.88	.00**	.07	.36	.17	.156	.15	.99	1.02

a. Dependent Variable: Kaplan Score

Note: * $p < .05$; ** $p < .01$; *** $p < .001$

Research Question 7: Is there a significant difference in scores on the writing portion of the Kaplan exam for pre-nursing students based upon the course modality of the student's English Composition I course?

Research Question 8: Does a student's gender, age, and high school GPA significantly affect the relationship between scores on the writing portion of the Kaplan exam for pre-nursing students based upon course modality of the student's English Composition I course?

A hierarchical multiple regression was performed to determine factors affecting a student's Kaplan Writing Exam score (dependent variable). In the first model, the independent variable was the modality of the student's English Composition I course. In the second model, gender and age were added to course modality as independent variables. See Table 14 for descriptive statistics of the independent variables.

Table 13: Descriptive Statistics for English Composition I Multiple Regression

	Mean	Std. Deviation	N
Kaplan Score	61.32	13.47	352
Section Type Code	1.13	.33	352
Gender Code	1.11	.31	352
Age	27.91	9.09	352

Model 2 illustrated better overall model fit, accounting for 2% of the variation in Kaplan Writing Exam scores, 2% more than model 1, $\Delta R^2 = .02$, $F(2,348) = 3.78$, $p = .02$. Thus, course modality was not a significant source of variance, i.e., the two modalities were statistically equivalent. Age was a statistically significant predictor of student Kaplan Writing Exam scores, ($\beta^{\text{standardized}} = -.15$)

Table 14: ANOVA^a for English Composition I Multiple Regression

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.651	1	8.651	.048	.827 ^b
	Residual	63658.429	350	181.881		
	Total	63667.080	351			
2	Regression	1363.650	3	454.550	2.539	.056 ^c
	Residual	62303.430	348	179.033		
	Total	63667.080	351			

a. Dependent Variable: Kaplan Score

b. Predictors: (Constant), Section Type Code

c. Predictors: (Constant), Section Type Code, Gender Code, Age

Note: * $p < .05$; ** $p < .01$; *** $p < .001$

Assumptions for English Composition I Multiple Regression

An analysis of standard residuals was carried out, which showed that the data contained no outliers (Std. Residual Min = -2.54, Std. Residual Max = 2.46).

Tests to see if the data met the assumption of collinearity indicated that multicollinearity was not a concern (Section Type, Tolerance = .98, VIF = 1.02; Gender, Tolerance = .99, VIF = 1.01; Age, Tolerance = .98, VIF = 1.02).

The data met the assumption of independent errors (Durbin-Watson value = 2.00).

The histogram of standardized residuals indicated that the data contained approximately normally distributed errors, as did the normal P-P plot of standardized residuals, which showed points that were not completely on the line, but close.

The scatterplot of standardized predicted values showed that the data met the homogeneity assumptions of variance and linearity.

The data also met the assumption of non-zero variances (Section Type, Variance = .11; Gender, Variance = 0.10; Age, Variance = 87.31; Kaplan Writing Exam Score, Variance = 177.52).

Table 15: Model Summary^c for English Composition I Multiple Regression

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.01 ^a	.00	-.003	13.49	.00	.05	1	350	.83	
2	.15 ^b	.02	.013	13.38	.02	3.78	2	345	.02*	2.00

a. Predictors: (Constant), Section Type Code

b. Predictors: (Constant), Section Type Code, Gender Code, Age

c. Dependent Variable: Kaplan Score

Note: * $p < .05$; ** $p < .01$; *** $p < .001$

Table 16: Coefficients^a for English Composition I Multiple Regression

Model	Unstandardized Coefficients		Standardized Coefficients		95.0% Confidence Interval for B			Correlations			Collinearity Statistics	
	B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
	1 (Constant)	60.79	2.53		24.01	.00	55.81	65.77				
Section Type Code	.47	2.15	.01	.22	.83	-3.76	4.70	.01	.01	.01	1.00	1.00
2 (Constant)	66.40	3.89		17.09	.00	58.82	74.12					
Section Type Code	1.24	2.16	.03	.57	.57	-3.00	5.48	.01	.03	.03	.982	1.02
Gender Code	-.46	2.28	-.01	-.20	.84	-4.94	4.03	-.02	-.01	-.01	.993	1.01
Age	-.22	.08	-.15	-2.73	.01*	-.37	-.06	-.14	-.15	-.15	.980	1.02

a. Dependent Variable: Kaplan Score

Note: * $p < .05$; ** $p < .01$; *** $p < .001$

Research Question 9: Is there a significant difference in scores on the writing portion of the Kaplan exam for pre-nursing students based upon the course modality of the student's English Composition II course?

Research Question 10: Does a student's gender, age, and high school GPA significantly affect the relationship between scores on the writing portion of the Kaplan exam for pre-nursing students based upon course modality of the student's English Composition II course?

A hierarchical multiple regression was performed to determine factors affecting a student's Kaplan Writing Exam score (dependent variable). In the first model, the independent variable was the modality of the student's English Composition II course. In the second model, gender and age were added to course modality as independent variables. See Table 18 for descriptive statistics of the independent variables.

Table 17: Descriptive Statistics for English Composition II Multiple Regression

	Mean	Std. Deviation	N
Kaplan Score	62.64	13.351	337
Section Type Code	1.27	.443	337
Gender Code	1.10	.302	337
Age	28.55	9.242	337

Neither model illustrated a better overall model fit, accounting for less than 1% of the variation in Kaplan Writing Exam scores, $\Delta R^2 = -.002$, $F(2,333) = .332$, $p = .332$. Thus, course modality, gender, or age were not significant sources of variance.

Table 18: ANOVA^a for English Composition II Multiple Regression

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.959	1	.959	.005	.942 ^b
	Residual	59888.311	335	178.771		
	Total	59889.270	336			
2	Regression	395.989	3	131.996	.739	.530 ^c
	Residual	59493.281	333	178.659		
	Total	59889.270	336			

a. Dependent Variable: Kaplan Score

b. Predictors: (Constant), Section Type Code

c. Predictors: (Constant), Section Type Code, Gender Code, Age

Note: * $p < .05$; ** $p < .01$; *** $p < .001$

Assumptions for English Composition II Multiple Regression

An analysis of standard residuals was carried out, which showed that the data contained no outliers (Std. Residual Min = -2.57, Std. Residual Max = 2.37).

Tests to see if the data met the assumption of collinearity indicated that multicollinearity was not a concern (Section Type, Tolerance = .98, VIF = 1.02; Gender, Tolerance = .99, VIF = 1.01; Age, Tolerance = .97, VIF = 1.03).

The data met the assumption of independent errors (Durbin-Watson value = 2.05).

The histogram of standardized residuals indicated that the data contained approximately normally distributed errors, as did the normal P-P plot of standardized residuals, which showed points that were not completely on the line, but close.

The scatterplot of standardized predicted values showed that the data met the homogeneity assumptions of variance and linearity.

The data also met the assumption of non-zero variances (Section Type, Variance = .20; Gender, Variance = 0.10; Age, Variance = 86.82; Kaplan Writing Exam Score, Variance = 178.70).

Table 19: Model Summary^c for English Composition II Multiple Regression

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.004 ^a	.000	-.003	13.371	.000	.005	1	335	.942	
2	.081 ^b	.007	-.002	13.366	.007	1.106	2	333	.332	2.049

a. Predictors: (Constant), Section Type Code

b. Predictors: (Constant), Section Type Code, Gender Code, Age

c. Dependent Variable: Kaplan Score

Note: * $p < .05$; ** $p < .01$; *** $p < .001$

Table 20: Coefficients^a for English Composition II Multiple Regression

Model	Unstandardized Coefficients		Standardized Coefficients	95.0% Confidence Interval for B			Correlations			Collinearity Statistics		
	B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
	1 (Constant)	62.80	2.21		28.42	.00	58.45	67.14				
Section Type Code	-.12	1.65	-.004	-.07	.94	-3.36	3.12	-.004	-.004	-.004	1.00	1.00
2 (Constant)	63.80	3.81		16.76	.00	56.31	71.28					
Section Type Code	.13	1.67	.004	.08	.94	-3.14	3.41	-.004	.004	.004	.98	1.02
Gender Code	1.65	2.43	.037	.68	.50	-3.13	6.42	.03	.04	.04	.99	1.01
Age	-.11	.08	-.076	-1.37	.17	-.27	.05	-.07	-.08	-.08	.97	1.03

a. Dependent Variable: Kaplan Score

Note: * $p < .05$; ** $p < .01$; *** $p < .001$

V. Conclusions and Recommendations

A. Summary of the Study

This chapter provides a synthesis of the study's findings and the literature that guided its design. It also presents a possible rationale for the findings and offers recommendations for future research on this topic. Finally, the summary discusses the implications this study has for practitioners.

This study is important because it evaluates the Equivalency Theory from two perspectives that are underrepresented in the literature: as it applies to gatekeeper courses and as measured by after-course assessments. As a result of the study, the Equivalency Theory can be confidently applied to gatekeeper courses. Also, the study indicates that the equivalency of modalities as measured by student outcomes extends temporally beyond the course in question.

Research Question 1: Is there a significant difference in scores on the science portion of the Kaplan exam for pre-nursing students based upon the course modality of the student's Human Anatomy & Physiology I course?

Research Question 2: Does a student's gender, age, and high school GPA significantly affect the relationship between scores on the science portion of the Kaplan exam for pre-nursing students based upon course modality of the student's Human Anatomy & Physiology I course?

Course modality of a student's Human A&PI was not a statistically significant predictor of a student's scores on the Kaplan Science exam. Thus, the results of this analysis support the Equivalency Theory. Age and gender were statistically significant predictors, but when combined accounted for approximately 5% of the scores' variation. Males scored slightly higher than females ($\beta^{\text{standardized}} = .13$) and as age increased so did scores slightly ($\beta^{\text{standardized}} = .17$).

Research Question 3: Is there a significant difference in scores on the science portion of the Kaplan exam for pre-nursing students based upon the course modality of the student's Human Anatomy & Physiology II course?

Research Question 4: Does a student's gender, age, and high school GPA significantly affect the relationship between scores on the science portion of the Kaplan exam for pre-nursing students based upon course modality of the student's Human Anatomy & Physiology II course?

Course modality of a student's Human A&PII course was not a statistically significant predictor of a student's Kaplan Science Exam scores, providing further support for the Equivalency Theory. Age and gender were statistically significant predictors but combined only accounted for approximately 5% of the variation in scores. Males scored slightly higher than females ($\beta^{\text{standardized}} = .14$) and as age increased so did scores slightly ($\beta^{\text{standardized}} = .16$).

Research Question 5: Is there a significant difference in scores on the math portion of the Kaplan exam for pre-nursing students based upon the course modality of the student's College Algebra course?

Research Question 6: Does a student's gender, age, and high school GPA significantly affect the relationship between scores on the math portion of the Kaplan exam for pre-nursing students based upon the course modality of the student's College Algebra course?

Course modality of a student's College Algebra course was not a statistically significant predictor of a student's Kaplan Math Exam scores, thus providing support for the Equivalency Theory. Age and gender were statistically significant predictors but combined only accounted for approximately 7% of the scores' variation. Males scored slightly higher than females ($\beta^{\text{standardized}} = .14$) and as age increased so did scores slightly ($\beta^{\text{standardized}} = .16$).

Research Question 7: Is there a significant difference in scores on the writing portion of the Kaplan exam for pre-nursing students based upon the course modality of the student's English Composition I course?

Research Question 8: Does a student's gender, age, and high school GPA significantly affect the relationship between scores on the writing portion of the Kaplan exam for pre-nursing students based upon course modality of the student's English Composition I course?

Course modality of a student's English Composition I course was not a statistically significant predictor of a student's Kaplan Writing Exam scores, thus providing support for the Equivalency Theory. Age and gender were statistically significant predictors but combined only accounted for approximately 2% of the scores' variation. Gender was not a significant predictor on its own. As age increased scores slightly decreased ($\beta^{\text{standardized}} = -.15$).

Research Question 9: Is there a significant difference in scores on the writing portion of the Kaplan exam for pre-nursing students based upon the course modality of the student's English Composition II course?

Research Question 10: Does a student's gender, age, and high school GPA significantly affect the relationship between scores on the writing portion of the Kaplan exam for pre-nursing students based upon course modality of the student's English Composition II course?

None of the three predictors (course modality, gender, and age) illustrated a statistically significant effect on a student's Kaplan Writing Exam scores. Once again, the results of this analysis support the Equivalency Theory.

B. Conclusions

Shortly after the internet emerged, researchers began to investigate the equivalency of the online and f2f courses (Clark, 1994). Since then a large body of scholarly research has focused

on the topic. The literature overwhelmingly confirms the equivalency as measured by student outcomes of online and f2f modalities based on student grades and exam scores within classes (Bolsen et al., 2016; Carroll & Burke, 2011; Clark, 1994; Means, 2009; Rosenzweig, 2012; Russell, 200). This study expands the existing research that supports Equivalency Theory by examining its influence beyond within class situations and concerning gateway courses specifically (Simonson et al., 1999). Given the importance of gateway courses to a student's academic progression, educators and institutions of higher learning need to establish equivalency between online and f2f courses student outcomes. With this increasing body of evidence, one wonders why researchers continue to look for differences in outcomes between the two modalities. The possibility exists that educators' experience and biases influence this perception. Teaching an online course is different from teaching a f2f course. Many educators, this researcher included, derive satisfaction and fulfillment through personal interactions with students. Online courses do not provide those interactions as readily. In response, researchers have identified methods to increase the level of personal interaction in online courses (Burns et al., 2018; Hicks et al., 2019; Hung et al., 2017; Kanelopoulos et al., 2017).

Gender and age were better predictors than course modality and were statistically significant in all courses except English Composition I (age only) and English Composition II at this college. However, these variables accounted for no more than 7% of the variation in scores. For Human A&PI, Human A&PII, and College Algebra, Kaplan scores were slightly higher for males and increased with age. Historically, female students were less likely to choose degrees focused on math and science due to social stereotypes (Cheryan, 2012). Cheryan (2012) also pointed to the continued disparity in the enrollment of females in science and math courses and associated careers. Long et al. (2009) noted that female students were less likely to be ready for

college-level math courses. Also, women enrolled in science, technology, and math fields are more likely to perceive their educational environments as threatening, thus contributing to the observed difference in scores (Casad et al., 2019). Age and gender were not significant predictors in English Composition I and II courses. The lack of social stereotypes associated with these non-science courses likely contributed to the absence of a statistical difference.

A large body of research supports the Equivalency Theory based upon within-course assessments such as the end-of-course grades and exam scores. However, relatively little research exists which compares equivalency based upon an assessment after the course. This study supports the conclusion that within-course assessments are as reliable as subsequent course assessments. Perhaps a study that investigated other related variables might arrive at different conclusions. Studies that compared equivalency even further removed from the prerequisite course might find differences based upon modality. For example, a study that compared the success rates of students within the nursing program or the mean lifetime income might find differences based upon prerequisite course modality.

C. Implications for Practice

When starting the study, the researcher believed that online courses were not equivalent in student outcomes to face-to-face courses. This was based upon "gut instinct" and not a review of the literature. This researcher did not enjoy teaching online as much as f2f. The researcher understands that online educational opportunities are important, especially considering that most of the researcher's doctoral coursework was delivered online. He would have been unable to pursue a doctoral degree had it been offered f2f. As mentioned previously, this researcher believes that many educators do not find online teaching as rewarding as f2f but there is disproportionately little research investigating instructor satisfaction (Mersin, Turkey & Koç,

2020; Gregory et al., 2020). However, many studies investigate student satisfaction in online courses (Costley & Lange, 2016).

Online courses should not be viewed as "less than" a traditional f2f course just because the educator prefers to teach in a f2f environment. Higher education professionals should focus their efforts on improving student and instructor experiences in both modalities. Institutions of higher education should put more effort into improving student satisfaction in both online and f2f courses. Also, this researcher believes that attention should be given to instructor satisfaction.

This increased attention to student and instructor satisfaction should begin with professional development training. Educators who have been successful and satisfied in both modalities could provide training to other instructors. This researcher suggests that institutions of higher learning offer course releases to experienced instructors or institutional recognition as incentives. Also, a consortium of educators who teach online and f2f could be constructed to provide useful instructional strategies and suggestions for improving both student and instructor satisfaction in both modalities. Given the increasing reliance on distance education, educational institutions should consider a potential new faculty member's exposure and ability in diverse instructional methods.

Online courses require a substantial time investment by the instructor. Instructional designers should be made available to facilitate the development of effective online courses, mitigate the time investment, and to encourage consistency in course appearance and navigation. Instructional designers could provide the tools instructors needed to manage the online learning environment. The study was conducted at the University of Arkansas Community College in Batesville, Arkansas. UACCB is in a rural area of the state. Batesville is the largest city within Independence county and has a population of approximately 11,000. Rural community college

students are likely to face barriers such as food insecurity, housing insecurity, lack of transportation, and dependable child care (Waters-Bailey et al., 2019). These issues are likely to impact their educational experiences. Also, the resources available to instructors such as access to instructional designers is limited in rural community colleges.

D. Recommendations for Future Research

In this researcher's opinion, the most pressing need for future research is to identify ways to improve course satisfaction. A qualitative study could explore the perceptions of satisfaction among those who teach online. A mixed-methods approach could then determine which aspects of online teaching might be improved to increase instructor satisfaction. Most higher education institutions conduct regular student surveys to determine student satisfaction. However, in nearly twenty years of teaching, this researcher has never been surveyed regarding his teaching satisfaction. It is this researcher's opinion that having an instructor who enjoys teaching increases student satisfaction.

The variables in this study explained 5-7% of the variation observed in Kaplan exam scores. Thus, other variables explain the remaining 93-95% of the variation. Additional research is also needed to identify these variables. Suggestions include comfort with technology, student socioeconomic status, number of credit hours completed per semester, number of hours worked, number of dependents, and the presence/absence of a support network.

As broadband internet becomes more accessible to students and faculty, the online teaching and learning experience is changing. For example, virtual laboratories for science courses are being used to increase student performance (Kumar et al., 2018). With fewer bandwidth limitations, the use of video for instruction and student interactions is becoming more

prevalent (Carlin et al., 2018; Scagnoli et al., 2019). Additional research is needed to identify ways to incorporate the more bandwidth into better student and faculty experiences.

At the time of this manuscript, the Coronavirus Pandemic has been ravaging the world for nearly a year. Many schools have switched to some form of remote learning at, least temporarily, in response to surges in the number of coronavirus infections (Loima, 2020; Romero-Ivanova et al., 2020). Educators and students with no experience in online learning environments have been forced to transition to virtual learning, sometimes overnight (Romero-Ivanova et al., 2020). The pandemic has caused educational institutions around the globe to take a closer look at the importance of online education and how it can be tailored to fit specific student needs (Loima, 2020). However, it has also highlighted disparities in access to suitable devices, broadband internet access, and computer literacy (Romero-Ivanova et al., 2020).

Interestingly, much of the current discussion regarding the shift to remote learning for k-12 and higher education institutions is focused on an apparent decline in student learning. While scholarly research on the topic is limited at this point, it is widely discussed in the popular media. If online and f2f are equivalent to this study and most of the scholarly research indicates, why does there appear to be a discrepancy in outcomes during the pandemic? Variables that this researcher believes should be investigated include the impact of student and instructor choice in course modality, overall workload for instructors, and student environmental factors. Environmental factors could include access to suitable devices, broadband internet access, and having a learning-friendly environment.

The researcher identifies himself as a novice researcher. Previous research experience was over twenty years ago and was organismal. This research was the first human-oriented research in which he had participated. While much of the research proceeded as planned, there

are several things he would change. First, he would include data from multiple institutions of higher learning. The reason for not doing so in this study was to reduce the amount of time required to gather the necessary data. A broader study would have provided deeper insight into the equivalency of the modalities. Also, by using data from multiple institutions, student scores could have been compared by institution, instructor, and longitudinally. Second, the researcher would like to collect the data in real-time to allow for qualitative comparisons of longitudinal comparisons of institutions and instructors. Also, the researcher would like to compare scores based on degrees of online hybridization in f2f courses.

The researcher learned that “gut instinct” is not a reliable standard for making decisions regarding teaching strategy effectiveness. The amount of scholarly research available is impressive. However, the research is of no benefit if practitioners do not utilize it. Institutions of higher learning need to prioritize the use of current educational research by faculty by incentivizing the incorporation of new data-driven techniques and methods into the classroom.

VI. References

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VII. Appendix

A. IRB Letter



To: Vernon E. Hoffman
From: Chair, Douglas J Adams
IRB Expedited Review
Date: 09/11/2020
Action: **Review Not Required**
Action Date: 09/11/2020
Protocol #: 2006270853
Study Title: Effects of Gatekeeper Course Modality, Age, Gender and High School GPA on KAPLAN Subject Area Exam Scores

Please keep this form for your records. Investigators are required to notify the IRB if any changes are made to the referenced study that may change the status of this determination. Please contact your IRB Administrator if you have any questions regarding this determination or future changes to this determination.