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A Propensity Score Analysis of the Academic Achievement Effect of Increasing In A Blended Learning Environment the Student's Time In the Brick And Mortar Facility

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A PROPENSITY SCORE ANALYSIS OF THE ACADEMIC ACHIEVEMENT EFFECT OF INCREASING IN A BLENDED LEARNING ENVIRONMENT THE STUDENT'S TIME IN THE BRICK AND MORTAR FACILITY

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DEDICATION

There were many times that I questioned if I would complete this dissertation, but I never had any doubt that if I earned my Doctorate there was one individual above all others that I must credit with helping me achieve this success, my wonderful wife Glenda. Her loving tenacity came to light every time that I doubted if the outcome was worth the cost in time and effort. At such times I would say, "I am working full-time" and once I was no longer working it was, "I am retired and need to rest." Invariably Glenda would respond by reminding me that the outcome is worth more than the effort and that my research had the potential to produce some important findings. She believed in me and so I got back to work.

Glenda was more than just a cheerleader, she was a collaborator/proof reader/editor. As we are both educators who worked together in urban settings for well over a decade, we possess in common a calling of serving urban, at-risk youth. Thus, as this dissertation solidified around improving the academic performance of at-risk students, our observations and discussions continually brought both enrichment and clarity to the study's findings and recommendations. The value of having a soul-mate can never be overemphasized.

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This dissertation has been in some form of progress for over a decade. Throughout this time Dr. Galletta has been both mentor and counselor. In the early stages as I explored various topics, Dr. Galletta served as a sounding board and advisor. As my focus intensified on blended learning for at-risk youth Dr. Galletta provided encouragement and guidance. As I moved forward with research and early drafts Dr. Galletta spent endless hours critiquing, encouraging, and providing guidance for reflection and incremental improvements. Never in this long and arduous process did Dr. Galletta give up on me, holding me to her high standards in both research and writing. For this I am forever grateful. It is my hope that the findings of this study provide new information that educators and policy creators can utilize to help students succeed. If I have achieved this goal, I could not have accomplished it without the guidance and support of Dr. Galletta.

Dr. Adam Voight

While it would be exaggerating a bit to say that during my first statistics course we used slide rules, it is not far from the truth. As I moved through the quantitative research course, Dr. Voight made my reengagement into the world of statistics both semi-painless and productive. He understood the scope of my rusty skills and moved me forward with great patience and professionalism. Very early in this statistics course Dr. Voight suggested that I consider a quasi-experiential design for my dissertation and

provided guidance and support as I moved forward with this recommendation. As my statistical analysis progressed I began to understand the wisdom of his recommendation. My findings were more than statistically significant as the findings provided information regarding the difference between the academic gains of the treated and not treated. As an educator I understood the importance of such findings when examining the adoption and implementation of specific teaching/learning initiatives.

Dr. Brian Harper

My association with Dr. Harper goes back to my first year in the doctoral program at Cleveland State University. Thus, I have known Dr. Harper for well over a decade. Throughout this time, I have respected Dr. Harper as a both a professor and a mentor. It was clear to me during my initial meeting with Dr. Harper that his priority was the success of his students and throughout the decade I have never had to question the validity of this perception. Thus, it should not be surprising that Dr. Harper was one of the first individuals that I asked to be on my dissertation committee.

Dr. Marius Boboc

While I have not been a student of Dr. Boboc, I was very aware of his excellent reputation as a professor and a scholar. This fact was reinforced as I continually came across his articles on online learning during my review of relevant literature. Thus, I am extremely proud that Dr. Boboc agreed to serve on my dissertation committee. His comments and suggestions have provided me with guidance as I expanded the scope of my research and findings.

Dr. Jeffrey Snyder

Dr. Snyder's course, *Systems and Processes of Policy Development*, was one of my final classes. As policy had been one of my professional responsibilities, I felt that my understanding of the creation and implementation of policy was somewhat complete. I could not have been more wrong. Not only did Dr. Snyder expand my understanding of policy in general and educational policy specifically, he provided me with great insight into how I could expand the scope and depth of my dissertation. Both his course and his comments as a committee member have enriched my dissertation.

Lisa Jones-Gast

Lisa Jones-Gast is a colleague and friend. We worked together for several years and I found her knowledge, dedication, and leadership to be inspirational. She willingly took responsibility for accomplishing the impossible and was always successful. She continually made those around her better educators and individuals. When I asked her to provide me with support and insight on the dissertation she graciously said "yes" and never wavered no matter how difficult the task appeared. Lisa is an inspiration as a professional, as a leader, and as a friend.

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ABSTRACT

A review of the literature documents two critical facts regarding the status of online education research. First, there exists minimal research on the instructional impact of online learning in K-12. Second, the focus of this limited K-12 research compares the growth outcomes of online learning to the growth outcomes of traditional face-to-face instruction. Therefore, the research found in this dissertation is unique as it is limited to examining in effect of time-in-school on high school students engaged in blended learning.

The findings of this study are based on two years of data from a charter school that utilized a blended learning curriculum. The study compared the academic gains of sixteen treatment groups (students whose in-school attendance met specific percentages of time- in-school) to the academic gains of the corresponding sixteen control groups (students whose in-schools attendance did not meet specific time percentages). These findings document that the academic gains of students in the study's sixteen treatment groups were statistically greater (<.001) than the academic gains of students in the sixteen control groups.

While it is acknowledged these study's findings must be confirmed or refuted through additional research, this study's importance is the identification of an instructional strategy which has the potential of increasing, through personalized scheduling, the academic achievement for all students enrolled in a blended learning high school. Therefore, this study's findings should be of great interest to both blended learning practitioners and educational policy creators.

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CHAPTER I

INTRODUCTION

COVID-19

The final stages of this dissertation and the first few months of the COVID-19 pandemic overlapped. As the pandemic's disruption of the nation's economy, health, and educational institutions increased, it became evident that the findings of this study might be useful as the nation's educators and policy makers struggle to explore strategies that that enable K-12 schools to provide a safe and productive instructional environment for students and staff during the pandemic.

Throughout the summer of 2020, K-12 educators and educational policy experts examined various instructional delivery options with the purpose of determining which might be the most beneficial in terms of student academic gain and student/staff health safety as schools reopened for the 2020-21 school year. In the June 23, 2020, edition of *Education Week*, Lieberman stated that this examination focused on three forms of internet-based instruction: total teacher/student face-to-face, total online learning, and a combination of online learning and face-to-face. Lieberman asserted that the combination of online and face-to-face instruction, which he termed as blended or hybrid,

appeared to be the internet-based option that was favored for the 2020 school opening. Lieberman stated educators preferred blended learning as it enabled educators to customize learning options based upon each student's academic strengths and weaknesses while maximizing the safety of students and staff. This was due to the ability of educators to limit the number of students who utilize the face-to-face component on any given school day and thus ensuring that such critical issues as social distancing, utilization of face masks, and ongoing disinfection of the school facilities were achieved.

This dissertation supported Lieberman's position by providing statistically significant findings which documented that in a blended learning environment the level of student academic gain is related to the number of days the student spends in the school's brick and mortar facility. This finding is valuable as K-12 staff go through the process of creating for each student a school schedule that can range from zero days per week to five days per week of in-school instruction. Finally, this dissertation explored the potential of blended learning to provide social connectivity which enhance the academic success of many at-risk youth.

A more detailed explanation of the learning and safety opportunities that blended learning can offer the nation's educators and students during the COVID-19 pandemic will be presented in the section, "Unanticipated Challenges" of Chapter 5.

Online Learning

Online instruction, instruction that incorporates web-based learning in America's K-12 schools, expanded across the United States with ever increasing speed. Staker (2011) documented that from 2000 to 2010 the number of K-12 students enrolled in one

or more online courses increased from approximately 45,000 to over four million. Staker stressed the point that this movement from teacher-centered to technology-centered curricula is more than the altering of instructional formats, but a disruptive innovation that is fundamentally transforming K-12 instruction by offering students and teachers instructional options that are "much less expensive, simpler, and more convenient" (p. 1). Staker believed that this disruptive innovation "has the potential to…transform a factory-like, monolithic structure…into a new model that is student-centered, highly personalized for each learner, and more productive" (p. 3).

Due to the rapid development and expansion of online learning, Escueta, Vincent, Nickow, and Oreopoulos (2017) concluded that technology advancements have outpaced researchers' ability to conduct meaningful studies from which policy and practices can be crafted that maximize the potential of computer enhanced instruction in K-12. This need for additional research related to both virtual learning (all instruction is off-site and transmitted via the computer) and blended learning. Blended learning, which combines off-site computer instruction with onsite classroom instruction, is viewed by many educational authors as the form of computer learning that will become the most predominate in the nation's K-12 educational environment (Christensen, Horn, & Staker, 2013; Watson, 2008).

Blended learning, which is also referred to as hybrid learning, is defined as "combining online learning delivery of educational content with the best features of classroom interaction and live instruction to personalize learning, allow thoughtful reflection, and differentiated instruction from student to student across a diverse group of

learners" (Watson, 2008, p. 4). As blended learning has two primary components, virtual instruction and face-to-face instruction, this study examined if the amount of time students spend in blended learning's face-to-face component had a statistically significant impact on the students' level of academic achievement. If the study's results are affirmative, policy crafters will have data that supports the position that blended learning positively impacts student academic achievement and that adjusting the amount of face-to-face instruction can impact the level of student academic gain.

The Problem

Informed policy requires data that is supported by empirical research. Unfortunately, current online education research is inconsistent in its findings regarding academic benefits in a K-12 environment. This lack of empirical evidence is well documented (Cavanaugh, Barbour, & Clark, 2009; Escueta et al. 2017; Lewis, Whiteside, & Dikker, 2015; U. S. Department of Education, 2010). Thus, it is not surprising that Rice (2006) stated: "The growth of K-12 distance learning follows in the footsteps of expanded learning opportunities at all levels of public education. Implementation has been accomplished with a limited research base, often drawing from studies in adult distance education and policies adapted from traditional learning environments" (p. 425). Rice noted that the limited K-12 research findings are often challenged because of "small sample size, dissimilar comparison groups, and differences in instructor experience and training" (p. 431). Without rigorous studies, it is difficult, if not impossible, for K-12 educators and educational policy developers to develop and implement research based online instructional practices in K-12.

The Expansion of Online Learning

There exists general agreement in education literature that American's K-12 educational system is in a state of crisis (Alliance for Excellence in Education, 2011; Goldin & Katz, 2011; U.S. Department of Education, 2010). In an effort to address this crisis, the utilization of online education is expanding in America's K-12 educational institutions (Cavanaugh et al. 2009; Linton & Journell, 2015; and Staker, 2011). The expansion of online education is having a disruptive impact on K-12 classrooms as the growth of classroom technology is outpacing the ability of researchers to evaluate its educational impact (Escueta et al., 2017). Critical questions exist regarding such issues as the effectiveness of the various online models in improving student understanding and the identification of which variables within these online education models have a statistically significant positive or negative effect on student academic success (CREDO, 2011; CREDO, 2015; Escueta et al., 2017; Murphy, Snow, Mislevy, Callagher, Krumm, & Xin, 2014; Perry & Plati, 2011; U.S. Department of Education, 2010). Prior to examining the positive or negative effectiveness of online education in the K-12 environment, it is critical to understand how the earliest forms of distance learning became today's virtual and blended learning instructional models.

Such early methods of distance learning as correspondence via mail, radio, television, and satellite lacked the capacity to provide instantaneous communication between the student and teacher. These methods of distance learning are labeled as asynchronous. The advent of online learning provided a platform that enabled teacher and student to have both asynchronous communication as well as synchronous

(instantaneous) communication. Perry and Pilate (2011) state that due to its ability to provide synchronous communication online education is a disruptive innovation with the potential to become transformational.

Building on the distance learning foundation created by correspondence schools that utilized the U.S. Post Office as their communication tool, the electronic wonders of radio, television, and satellite shrunk in time the communication gap between teacher and student. In the late twentieth century educators began employing the World Wide Web to initiate online learning that included both asynchronous and synchronous communication between teacher and student (Caruth & Caruth, 2013; Casey, 2008; Perry & Pilati, 2011).

By 2010 the United States Department of Education stated that "online learning-for students and for teachers-is one of the fastest growing trends in educational uses of technology" (U.S. Department of Education, 2010, p. xi). The Alliance for Excellence in Education (2011) offered two reasons for this expansion. First, K-12 decision makers during the late twentieth and early twenty-first centuries utilized online learning as a proactive strategy to address a simultaneous decrease in funding and increase in mandates and academic expectations. Second, K-12 educational policy makers believed that the cost savings of online learning would assist America in remaining economically competitive in an increasing global economy.

The U.S. Department of Education (2010) documented this rapid expansion of K-12 online education. During the 2003-2004 and the 2004-2005 school years there was a 65% increase in the number of K-12 students engaged in online education with over one million K-12 students engaged in online education by the 2007-2008 school year. Linton

and Journell (2015) predicted that by 2016 over five million K-12 students would be engaged in online education and by 2020, 50% of all high school students would be enrolled in one or more forms of online education.

Escueta et al. (2017) acknowledged that the rapid expansion of online education has generated two obstacles that need to be addressed. The first obstacle is that expansion of online education has outpaced the ability of researchers to evaluate the outcomes and thereby validate what is working and what is not working. The second obstacle is the inequality inherent in online education. The authors stated that the ability of students to access online education is not equal with household income being the driver of this inequality.

Blended Learning

It is within this acknowledged lack of empirical research regarding the educational impact of online education in the K-12 academic environment that this study focused on blended learning. Blended learning, a subset of online learning, is defined by Powel, Watson, Staley, Patrick, Horn, Fetzer, Hibbard, Oglesby, and Verma (2015) as placing "the student at the center of the learning process, harnessing the power of technology to create a more engaging, efficient, and success-oriented learning environment" (p. 4). Christensen et al. (2013) predicted that blended learning "will be the dominate model of schooling in the United States in the future" (p. 4). Perry and Plati (2010) acknowledged that blended learning is in a state of development and that there currently exists no specific suggestions or requirements for the ratio of online learning to

face-to-face learning within a brick and mortar facility. It is the concern expressed by Perry and Plati (2010) that this dissertation examined.

K-12 Online Learning Research is Limited

The U.S. Department of Education (2010) prefaced its review of K-12 online research by stating that unlike post-secondary education, "Few rigorous research studies of the effectiveness of online learning for K-12 students have been published" (p. xiv). This noted lack of research regarding the online education's success or lack-of-success in the K-12 environment is supported by the following researchers: Cavanaugh et al. 2009; Escueta et al., 2017; Lewis, Somer, Whiteside, & Dikker, 2015; and Means, Murphy, & Baki, 2013. It must also be emphasized that a common belief exists among researchers that it must not be assumed there is a connection between the academic outcomes of online education in post-secondary education and potential of academic outcomes in K-12 education. This belief is due to such issues as higher levels of maturity and a more well-developed work ethic which may impact the level of academic achievement in the post-secondary environment.

K-12 Online Education Research Focusing on At-risk Students

Lewis et al. (2015) acknowledged their concern that educators targeting virtual and blended learning at at-risk K-12 students are ignoring the fact that there exists limited research as to the effects of virtual and blended learning on at-risk students. The authors noted that in 2009-2010 it was estimated that 62 percent of the nation's K-12 students enrolled in distant learning were engaged, without supportive research, in credit recovery programs, a percentage that Lewis et al. predict will grow.

It must be noted that Lewis et al. (2015) discussed how one modification in an online summer school program increased academic success. The North Carolina's New Hanover Country Schools (NHCS) initiated a strategy that proved to be successful in assisting at-risk students in navigating online learning. This strategy was to convert their virtual credit recovery summer program that required no face-to-face instruction into a computer class program that enabled the student to receive one-on-one guidance from a staff member. The authors note that this one rule change enabled the students to excel as they gained the ability to access immediate support and motivation.

K-12 Research that Compares the Effectiveness of Online and Face-to-Face Instruction

Escueta et al. (2017) and Heppen, Allensworth, Sorensen, Rickles, Walters, Taylor, Michelman, and Clements (2016) cited a Chicago Public School's summer credit recovery initiative for freshmen algebra students that validated face-to-face instruction outperforming virtual instruction. Based on the performance of approximately 1,400 students placed into two cohorts the researchers found "that teachers in the face-to-face course were better able to flexibly incorporate a range of topics, and thus were better able to accommodate and engage the students" (Escueta et al., 2017, p. 73).

CREDO (Center for Research on Educational Outcomes) supported the position of Escueta et al. (2017), Heppen et al. (2016), and Lewis et al. (2015) in two research studies. CREDO (2011) documented that students who attended Pennsylvania virtual charter schools underperformed in reading and mathematics compared to all Pennsylvania charter school students who attended brick and mortar facilities. CREDO

(2015) detailed joining forces with the Center for Reinventing Public Education (CRPE) to examine online charter schools in 17 states and the District of Columba for the purpose of providing the public and policy makers with research-based information regarding the "the landscape and operation of online charter schools and their impact on students' academic growth" (p. 1). Both participating organizations believed that educational policy makers need such data before they commit the resources necessary for expansion of online schools. The results of this 2015 study found student academic growth in most of the studied online charter schools was inferior to student academic growth in the two control groups: students in traditional public brick and mortar schools and students in charter school brick and mortar schools.

K-12 Blended Learning Research

Just as there is disagreement over what to call blended learning (e.g. hybrid learning, technology-based learning, or blended learning), there is also disagreement among researchers regarding the findings of K-12 blended learning research. The most common position is that the research is too limited regarding the impact of blended learning on K-12 students to make any meaningful recommendations (Boboc, 2015; Lewis et al., 2015; U.S. Department of Education, 2010; and Waters, Barbour, & Menchaca, 2014). Sparks (2015) provided a rational for the lack of empirical evidence by citing the Susan Dell Foundation's stance that as students have a say over time, pace, path, and control in a blended learning environment it is difficult to develop a research model that is capable of addressing such a broad learning spectrum.

A considerable number of authors provide examples of the wide divergence regarding the instructional effectiveness of blended learning in K-12. Means et al. (2013) reviewed 47 studies of students in K-12, college, and post-graduate programming for the purpose of analyzing the outcomes of face-to-face, virtual, and blended learning based on effect size. The Means et al. (2013) analysis noted that virtual and face-to-face instruction are equivalent in instructional effectiveness while blended learning, due to its ability to provide additional instructional time and resources, is more instructionally effective than face-to-face instruction. The authors stated that without strategies that include additional instructional time and resources, virtual learning will not provide meaningful students gain. The authors also recommend additional research on blended learning. While Murphy et al. (2014) agreed with Escueta et al. (2017) that blended learning has the potential to become a standard practice in K-12, the research conducted by Murphy et al. was unable to support this position due to issues encountered in the areas of infrastructure and software. Lewis et al. (2015) and Repetto and Spitler (2014) investigated the ability of blended learning to successfully address the learning needs of at-risk students. The findings of Lewis et al. and Repetto and Spitler agreed that an answer cannot be provided due to the lack of empirical evidence. Finally, Kuo et al. (2014) stated that due to the fact that blended learning "combines the strengths of face-to-face learning and virtual learning" (p. 363), it "appears to outperform traditional classroom instruction in terms of effectiveness" (p. 361).

Ohio K-12 Enrollment Status and Trends for Traditional and Online Schools

In 2019 the combined total of students enrolled in Ohio's traditional public-school districts and Ohio's public charter schools was 1,664,346. Included in this total were 836,578 economically disadvantaged students, 252,330 students with disabilities, 42,340 English language learners, and 246,949 students identified as gifted. These 1,664,346 students were enrolled in 612 school districts that had a total of 3,186 schools; 341 public charter schools, and 72 vocational schools. The number of students enrolled in the public-school districts and vocational schools was 1,559,489 with 104,857 students enrolled in public charter schools. These public charter schools comprised 255 brick and mortar general education schools that enrolled 68,279 students; six general education virtual schools that enrolled 22,021 students, 71 brick and mortar public dropout prevention charter schools that enrolled 10,801 students; and nine online dropout prevention charter schools that enrolled 3,756 students. Finally, Ohio's public school enrollment total had been decreasing with a loss of 108,584 students from 2006 to 2019 (Churchill, 2019; Ohio Department of Education: Facts and Figures for 2016-17).

Ahn and McEachin (2017_a) examined the demographic trends of Ohio's virtual schools which they defined as online schools that lack any brick and mortar facilities thus requiring the students to work totally online. The authors cited the following facts about Ohio's virtual schools: Ohio's virtual school enrollment is increasing; students that are underperforming academically and/or fall into a low-income status are more likely to opt out of a traditional high school and into a virtual school; students in virtual schools have lower scores on achievement tests than students in Ohio's traditional and public charter

schools that employ face-to-face instruction; and white students are more likely to enroll in a virtual school while students of color are more likely to enroll in a traditional charter school. Ahn and McEachin (2017_b), utilizing the same Ohio virtual school data suggested that further study needs to focus on why specific demographic populations select a certain type of charter school and if there is cause for policy development that better guides student/family school transfer decisions.

Purpose of the Study

The purpose of this dissertation is to ascertain through a Propensity Score Matching (PSM) analysis if in a blended learning environment, the treatment variable of student time in a brick and mortar classroom, a variable that students and teacher can control, has a statistically significant effect on the covariate variable of graduate credits earned. If there is a positive statistically significant finding, then the premise of this study is that educational policy makers at the federal and state levels may want to explore the potential of creating policy that establishes for students enrolled in a blended learning program a requirement regarding time spent in the brick and mortar facility.

Research Questions

In an effort to provide educators and policy makers with research-based information regarding the relationship between student attendance in a blended learning school's facility and student academic gain, this dissertation will examine the following two research questions:

Research Question One

In a blended learning environment does the percentage of days spent in the school's brick and mortar facility have a positive effect on student achievement based on credits earned?

Research Question Two

If Research Question One is answered in the affirmative, is there a point in time where increasing student time in the brick and mortar facility has diminishing returns based on credits earned?

The Importance of the Research Findings

Regardless of the findings, educational policy developers and implementors will possess information which may cause the reexamination of the blended school's student scheduling practices. For example, if the research documents no statistical significance between time spent in the brick and mortar facility, counselors may be more liberal modifying a student's schedule to reflect fewer or no days in the brick and mortar facility in cases where students have home, work, or parenting obligations. If the research documents that there is a statistical significance between increased student time spent in the brick and mortar facility and academic progress, a counselor may modify a struggling student's schedule to include more days in the brick and mortar facility. Finally, if the research documents that there exist percentage point(s) of time in the brick and mortar facility where the statistical significance between time in the brick and mortar facility and academic progress no longer exists, the counselor may work with a student who has

home, work, or child care obligations to adjust his or her time in the brick and mortar facility so that optimal academic gain is secured.

Organization of the Dissertation

This dissertation is composed of five chapters. Chapter One introduces the history of online education and its many forms; discusses the lack of empirical research devoted to online education; provides the dissertation's problem statements; presents the study's quasi-experimental design; and discusses the study's limitations. Chapter Two reviews the literature that is devoted to online education with a focus on blended learning. Chapter Three focuses on the blended learning data and quasi-experimental design utilized in this study. The study's quantitative findings are presented in Chapter Four while Chapter Five discusses the study's findings and examines the implications of these findings.

Limitations of the Study

The limitations of this study are many. The scope of the student data is limited as it is secured from one blended learning charter school which focused on at-risk students. The study's data covers only two academic school years. The blended school's online curriculum, Pearson's NovaNET, was only one of many online curricula available to blended schools.

Additional limitations of this study are that PSM, a quasi-experimental design that will be utilized in this study for statistical analysis, is susceptible to selections bias. The PSM treatment (days in school) does not accurately reflect the number of hours each student spent in the school on any given day. The PSM dependent variable (credits

earned) would become stronger if it was supported by such data as grades and/or end-of-course exams. It must also be noted that this study is not sensitive to how students use their time when in attendance at a brick and mortar location. Finally, PSM assumes that the researcher has observed all variables that influence treatment, assignment, and outcomes. This assumption has not been met and this fact must be acknowledged. **An Overview of the School Utilized in the Study**

The charter school from which this study's data is taken is given the pseudonym Grace Academy. Grace Academy, which was in operation from the 2003-04 school year through the 2016-17 school, was a charter school sponsored by a local public-school system. Grace Academy, which utilized a blended curriculum, provided educational services to at-risk regular and special education students in grades 7-12.

Grace Academy provided educational services to approximately 750 students per year, which translated into approximately 450 full-time equivalents. There were multiple reasons why a Grace Academy student had dropped out of school or was at-risk of dropping out of school. These reasons generally fell into the categories of personal or family health; the need to work part-time or full-time for the purpose of providing additional income to themselves and/or their family; the need to secure housing for themselves; pregnancy and/or caring for one or more children and/or younger siblings; unidentified special education needs; legal issues including incarceration; gang issues; and a history of academic failure.

Grace Academy, which had four brick and mortar locations with each location providing educational services to a different section of the metropolitan area, operated

under the philosophy that the staff must make every effort to provide each enrolled student with an educational environment and support system that enhanced each student's ability to succeed. Often the support system involved linking the student with needed mental and/or physical health services and/or assisting the student secure housing, employment, and legal assistance. The school's staff believed that a student dealing with physical illness, mental instability, homelessness, pregnancy and/or child care, incarceration and/or other legal matters, bullying or lacking any monitory resources is a student who requires more than academic instruction to be successful.

Upon enrollment, each student, their parents or guardian if available, and the student's counselor would develop an Individualized Educational Plan that provided not only a workable pathway to graduation but any additional resources the student may need to be successful. This plan was then implemented by the student with continual support provided by the school's staff, representatives of those community resources included in the plan, and parents or guardians if available. This Educational Plan was reviewed with student, staff, parents or guardians, and other critical community individuals at least once each school year with necessary adjustments being made and implemented.

The Grace Academy's curriculum was blended learning which provided the students with the ability to adjust their educational schedule so that such personal demands as working or providing care for children, siblings or older adults could be accomplished with minimal negative impact on the educational process. The expectation was that all students would spend at-least five hours each school day, either off campus and/or on campus, actively engaged in the assigned online curriculum. All students were

encouraged to attend one of the four brick and mortar facilities as frequently as possible for the purpose of securing face-to-face assistance from teachers, counselors, and medical staff on an as needed basis. All students were provided with a bus card which enabled them to take public transportation to and from school at no charge.

Upon arriving at school, all students scanned in via their school ID card. This provided the student and school with evidence regarding their physical attendance in school. Students also scanned out when they left school. At the downtown location, the largest of the four locations, the students also went through a metal detector manned by sheriffs and turned-in their cell phones. In the downtown facility the students selected the computer lab they would attend based on their curriculum and lessons. The two computer labs were math/science and English/social studies. The labs were staffed with the appropriately credentialed teachers and supporting paraprofessionals. When a student had a problem with their online lesson, they would raise their hand and receive one-on-one assistance until they fully understood the troubling concept. Student academic progress, regardless of their being in a brick and mortar location or off site, was continually monitored by teachers, paraprofessionals, and counselors. The three satellite locations worked very much like the downtown location with the exception of having only one lab and fewer staff.

Students in grades 7 and 8 attended the downtown location and were housed on a separate floor from the high school students.

Students who were not onsite could reach out to a teacher, counselor, or administrative staff member at all times of the school day by calling any of the four sites.

All students could access staff during non-school hours seven days per week via the internet capability of the Grace Academy's online curriculum.

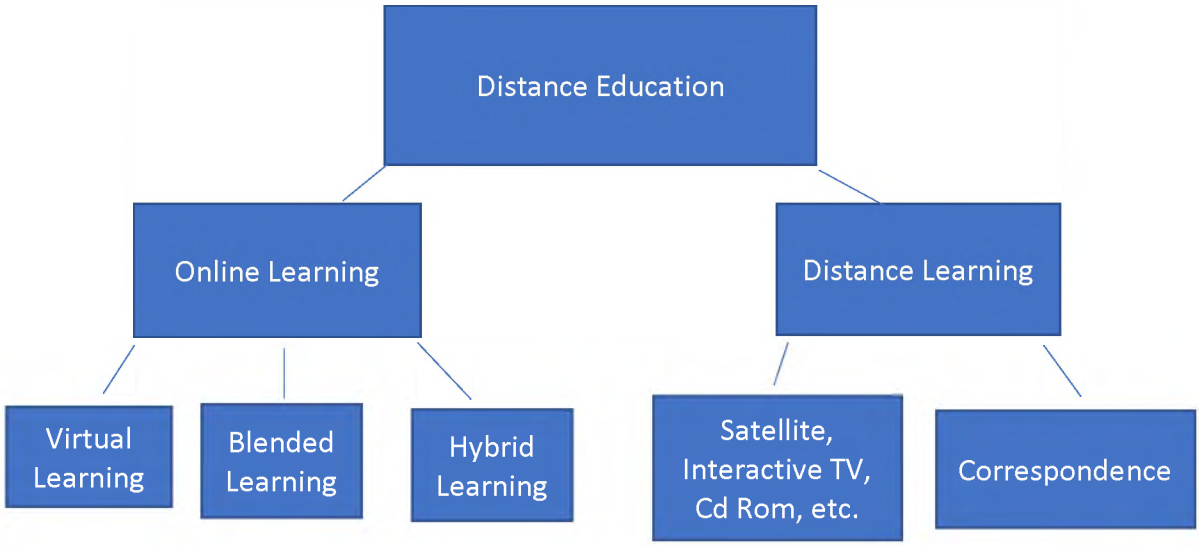
Grace Academy had close linkages with area employment services, colleges and universities, employers, and nonprofits that provided the at-risk students with experiences that were outside their monetary capabilities.

Like most schools that provide services to at-risk students, there was a constant turnover in the enrollment due in large part to the unpredictability many of the students faced in their daily lives. Even with this unpredictability, the Grace Academy's graduation rate was often higher than the graduation rates of area public high schools who served predominately at-risk students.

Terminology Utilized in the Dissertation

Moore, Dickson-Deane, and Galyen (2011) addressed the concern that as distance education and its associated fields continue to evolve, "practitioners and researchers have yet to agree on common definitions and terminologies" (p. 129). The authors stated that this lack of common definitions in the area of distance education creates difficulty when researchers are attempting to compare and contrast the composition and outcomes of various learning technology strategies. Thus, for clarity purposes, this paper will utilize the learning technology terminology provided by Moore et al. This terminology contains eight components which are presented in the following chart.

Figure 1.0. Distance Education Flow Chart



Distance education. Moore et al. (2011) cited Keegan's (1996) definition of distance education as the "umbrella" that covers a variety of education formats that include any form of instruction where there exists a separation between the teacher and student in the form of space. Examples of such instructional formats are correspondence, radio/television, and satellite, and the web-based instruction.

Online learning. Moore et al. (2011) acknowledged that there are several competing definitions of online learning in the literature. For the purpose of this dissertation, the definition of online learning states that it is "web-based, web-distributed, or web-capable" (Moore et al., p. 130). Online learning offers the teacher and student an instructional strategy that to date has been absent from distance education which is the provision of "synchronous and asynchronous communication and collaboration'' (Perry & Pilati, 2011, p. 97). For the purpose of this dissertation, virtual and blended learning are a subset of online learning.

Virtual learning, blended learning, and hybrid learning. Cavanaugh et al. (2009) defined virtual learning as being totally online with a complete physical separation between the student and the teacher. Thus, while the student and teacher may communicate via web-based technology, there always remains a physical separation between the teacher and the student.

Perry and Pilati (2011) defined blended learning as a combination of virtual and in-classroom instruction. The authors go on to stipulate that there exist no requirements regarding the amount of online and in-class instruction provided through a blended instructional model. Perry and Pilati stated that the benefit of a blended learning model is that it combines the components that are critical to instructional success in a traditional classroom, "community, timely feedback, clear expectations, and a reasonable chance of success…" (p. 98) with the flexibility allowed by online learning. Sparks (2015) further defined blended learning by stating that students have "some say over time, pace, path and control" (p. 7).

Perry and Pilati (2011) stated that blended learning and hybrid learning are virtually the same as both involve "a combination of online and in-classroom instruction" (p. 97). For clarity purposes, blended learning will be utilized when referring to the instructional condition of online learning merged with in-classroom instruction.

Distance Learning. Moore et al. (2011) acknowledged that while there is a general lack of clarity regarding the limits of distance learning, there is general consensus that at a minimum distance learning includes all non-web-based forms of distance education. Thus, for the purpose of this dissertation, distance learning will be defined as any form of instruction where the instructor and student are separated by time and space and the communication technology utilized is not "web-based, web-distributed, or web-capable" (Moore et al., 2011, p. 130).

Satellite, Interactive TV, and CD Rom. These are examples of three forms of electronic instruction where there is a time and space separation of student and instructor but web-based technology does not exist.

Correspondence. Correspondence courses, the earliest form of distance education, spans the time and space separating the teacher and student via the physical transfer of information through the post office.

CHAPTER II

LITERATURE REVIEW

With the challenges currently facing the nation's educational system-including a persistent dropout rate of nearly 30 percent, slashed state and district budgets, and the economically and socially important goals of ensuring that more students graduate prepared for college and a career-the nation cannot afford to miss the opportunity that technology and digital learning offer (Alliance for Excellence in Education, 2011, p.1).

The recent expansion of online learning in all levels of education did not occur in isolation, but is the most recent continuum of the evolution of distance education that had its inception in the nineteenth century with the introduction of correspondence courses. While distance education has a long history of providing instructional options in the area of career education, it has not been until the recent development of online learning that distance education made significant inroads into the curriculum and instructional strategies of traditional K-12 and post-secondary educational institutions. Linton and Journell (2015) estimate that by 2020 fifty percent of all high school students will be enrolled in some form of online learning. This rapid expansion of online learning highlights the policy and implementation importance of examining what is known about

the instructional impact of online learning on K-12 and post-secondary students.

Chapter Two provides a brief overview of the evolution of distance education followed by a more in-depth review of the recent expansion and application of online learning throughout the instructional fabric of traditional educational institutions.

Distance Education: From Correspondence Classes to Online Learning

Online learning is a descendent of distance education. Online learning has a shared history with correspondence learning. (Caruth & Caruth, 2013, p.141).

The Expansion and Explosion of Online Learning in K-12 Education

Online learning-for students and for teachers-is one of the fastest growing trends in educational uses of technology (U.S. Department of Education, 2010, p. xi).

Prior to examining the rapid expansion of online learning opportunities that occurred in the early portion of the twenty-first century, it is useful to discuss the reasons for this growth. The Alliance for Excellence in Education (2011) listed two broad reasons for the rapid development of K-12 online learning. The first reason focused on K-12 school districts attempting to be proactive during the late twentieth and early twenty-first centuries in addressing simultaneous reductions in funding levels and increasing mandates and expectations. Thus, K-12 school districts explored online learning as a means to increase cost-effectiveness in the delivery of educational services, while K-12 instructional leaders examined potential opportunities for online learning to increase efficiency in the teaching and learning experience. Online learning offered K-12 educators the ability, at a minimal cost, to increase the scope of instruction, the personalization of instruction, and the re-teaching activity based on data provided through

online assessments. Once the technology was in place and staff development provided, existing staff offered students more courses, customized instruction, and provided students the opportunity to access lessons twenty-four hours a day, seven days a week. Online learning also increased teachers' effectiveness and productivity due to several factors: improved data regarding each student's academic progress; the enhanced ability to communicate with students and parents regarding educational plans and progress; the expedited ability to communicate with other schools and school districts regarding the abilities and needs of entering or exiting students; and the strengthened ability to develop learning communities of students with similar abilities and interests (Alliance for Excellence in Education, 2011).

The Alliance for Excellence in Education's (2011) second broad reason for the rapid expansion of online learning in K-12 was the need for the nation to remain economically competitive in an increasingly competitive global economy. To increase its economic competitiveness three components were necessary, one of which focused on post-secondary institutions. The first component was the large number of students who dropped-out of high school and became only marginally productive. The second component focused on the students who graduated from high school but did not possess the skills required for acceptance in a college or university. The final component examined the number of college students who dropped-out due to inadequate academic skills. These concerns regarding the linkage between the level of high school and college preparation and the nation's economic wellbeing required that the nation's educational and political leaders explore innovative instructional options to reduce high school

dropout rates and increase college graduation rates. Due to online learning's ability to personalize instruction to meet the individualized needs of students, online learning was viewed as one tool for expanding the nation's economy via increasing the numbers of students graduating from high school and college.

Goldin and Katz (2008) stated that the twentieth century was America's century as the nation had the best educated human capital on earth and thus the available skills necessary to invent the tools and strategies needed for continued economic growth. Unfortunately, the authors state, by the first decade of the twenty-first century America was no longer producing the number of educated workers and inventers needed to guarantee continued economic growth. Such educational advancement measures as completion of school levels began to slow in the 1970s. This reality reinforced the belief that Americans would no longer experience the expanding economy and educational opportunities of past generations. At the same time Americans experienced the decline of educational attainment they also witnessed growing economic inequality and lower productivity. Thus, the authors stated that increasing graduation rates and providing a better prepared work force were critical factors to America regaining its world leadership in technical and economic growth.

The Alliance of Excellence in Education (2011) stated that online learning could address the educational deficiencies cited by Goldin and Katz (2008) through "increased equity and access; improved effectiveness and productivity of teachers and administrators; and improved student achievement and outcomes" (p. 3).

The rationale for the expansion of K-12 online learning institutions, as detailed in the previous section of this chapter, was instrumental in creating an instructional revolution in the nation's elementary and secondary schools. The growth trajectory of this K-12 online learning revolution was detailed in three reports. In 2010 the U.S. Department of Education reported that during the 2003-2004 and 2004-2005 school years there was an estimated 65% increase in the number of K-12 students engaged in online learning and that by the 2007-2008 school year over one million K-12 students were involved in online learning. The Alliance for Excellence in Education (2011) reported that by 2010 there were approximately 1.5 million K-12 students enrolled in an online learning curriculum. Linton and Journell (2015) projected that by 2016 there would be over five million K-12 students taking online learning courses and that by 2020 fifty percent of all high school students would be enrolled in one or more forms of online learning. Thus, it is not surprising Cavanaugh, Barbour, and Clark (2009) reported that from the mid-1990s through the middle of the twenty-first century's first decade, the growth in K-12 students engaged in online learning outpaced growth in all other types of educational delivery.

Staker (2011) provided additional data regarding the growth of online learning. She stated that in 2000 approximately 45,000 K-12 students were enrolled in online courses. The number of K-12 students enrolled in online courses increased to over 4 million by 2010 and was projected to have a five-year growth increase of 43 percent. Staker (2011) also made the point that this rapid growth of online learning in the K-12 learning environment is not just the evolution of curriculum and instruction moving

into the era of technology, but is an innovation that "fundamentally transformed" K-12 instruction by providing educators and students with instructional options that were "much less expensive, simpler, and more convenient" (p. 1). Staker (2011) stated that many believe online learning "has the potential to...transform the factory-like, monolithic structure that has dominated American's schools into a new model that is student-centric, highly personalized for each learner and more productive" (Staker, 2011, p. 3).

Obstacles to Online Learning

It must be acknowledged that the educational technology revolution has its downside. Escueta, Quan, Nickow, and Oceopoulos (2017) stated that the rapid growth of online learning is a "double-edged sword" (p. 3). While the technology provided the capability and capacity to increase access to quality education, the development and implementation of technology in the classroom is occurring at a pace that exceeded researchers' ability to effectively evaluate the outcomes of the technology revolution. Thus, it is not surprising that Escueta et al. (2017) stated "While most agree that ed-tech can be helpful under some circumstances, researchers and educators are far from a consensus on what types of ed-tech are most worth investing in and in which contexts" (p. 3). In addition to expanding beyond researchers' ability to evaluate, Escueta et al. (2017) cited another concern regarding educational technology, which is its "deep and persistent inequality" (p. 3). While educational technology has the capacity to expand the access of high-quality education, the capacity of all students to access online learning is not equal. Escueta et al. stated that 98 percent of children in

households with incomes exceeding $100,000 had home computers while only 67 percent of children in households with incomes under $25,000 had home computers. The authors concluded by asserting that the "design and implementation" of educational technologies "could alleviate or aggravate existing inequalities" (p. 3). Blended learning is one such approach that may address some, though not all, obstacles to online learning.

Blended Learning: A Process Undergoing Change

Blended learning models, developed from early experimentation, place the student at the center of the learning process, harnessing the power of technology to create more engaging, efficient, and success-oriented learning environments (Powell et al., 2015, p. 4).

The Process

Staker and Horn (2012), and Staker (2011) asserted that blended learning has three distinct learning components. The first component is that the students are provided instruction in a traditional, classroom-based format which occurs in a brick and mortar location outside the student's home. The second component is that the students are provided instruction via online delivery. The third component is that the students have a varying amount of control over time, place, pace, and path of the online delivery.

While Kuo, et al. (2014) acknowledged that there are many definitions of blended learning, they uniformly state that blended learning must combine "different (a) instructional modalities, (b) instructional methods, (c) instructional technologies and (d) delivery methods (i.e., online and face-to-face)" (pp. 361-362) in order to address specific teaching and learning needs. Kuo et al. supported the position that blended learning

"integrates the strengths/advantages of face-to-face learning and computer-mediated learning, and reduces the limitations of merely applying face-to-face…or computer-mediated instruction…" (p. 362). The authors cited weaknesses of face-to-face instruction as "limited flexibility of time and place" while they referred to the weaknesses of virtual learning as "prevalent procrastination and lack of spontaneity and interaction" (p. 362). Kuo et al. affirmed that the strength of blended education is enhancing "face-to-face learning with the use of online technologies without supplanting regular classroom hours" (p. 362).

Staker (2011) discussed how such factors as limited fiscal resources, teacher shortages, and federal policy guidelines drove school districts and states to explore online learning in general and blended learning in particular as instructional strategies that have the potential to not only address growing budget, staffing and policy concerns, but also transform education from a classroom-based institution into a process that personalizes instruction to each student's academic needs.

The Change

Christensen et al. (2013) offered new insight into how change occurs in the nation's classrooms with the introduction of three concepts: sustaining, disruptive, and hybrid. The goal of sustaining innovation is to improve a current service or product within the existing framework and customer base while the goal of disruptive innovation is to change the existing service or product and modify the current customer base. Finally, a hybrid stage is when disruptive innovation is in process and the product or service incorporates both sustaining and disruptive features. The authors stated that

blended learning is in a hybrid stage in that it has united the personalization features of the traditional teacher based instructional model with the flexibility, individualization, and cost saving components of online learning. Christensen et al. (2013) did not predict the final outcome that the disruptive process will ultimately bring to blended learning, but they did predict that the current form of blended learning will be the "dominant model of schooling in the United States in the future" (p. 4).

Staker (2011) believed that blended learning fits into the category of hybrid innovation due to the four following reasons. First, blended learning combines traditional classroom instruction with non-traditional computer-based learning. Second, due to this combination of traditional and non-traditional instruction, blended learning appeals to both traditional and nontraditional learners. Third, blending learning utilizes existing technology thereby establishing a condition that satisfies the expectations of existing and new users who presume that their performance will be equal to or greater than the traditional instructional format. Finally, blended learning is a partially disruptive learning innovation that requires levels of expertise and wealth similar to traditional instruction.

Watson and Murin (2014) challenged disruptive transformation and the role of "fully blended schools" (p. 13). Citing Christensen et al. (2013), Watson and Murin expressed the opinion that blended learning is not a disruptive transformation in that it supports and sustains the traditional classroom setting rather than attempting to totally transform it. Watson and Murin (2014) also made the distinction between a fully blended school and a traditional K-12 school that utilizes a computer lab staffed by a teacher. The fully blended school utilizes curriculum and procedures which require each

student to spend some time in the brick and mortar school facility while at the same time allows each student to have "control over time/pace/path/place that, in one or more ways, changes the instructional model away from one-to-many (teacher-to-students) instruction and toward a personalized, data-driven approach" (p. 13).

Perry and Plati (2011), while acknowledging that blended education is in a state of evolution, stipulated that the foundation of blended education is a combination of online and in-classroom instruction. The authors stated that no requirements currently exist regarding the amount of online and in-class instruction provided through a blended learning model. The authors did acknowledge that traditional classroom factors critical to a successful blended learning model are "community, timely feedback, clear expectations, and a reasonable chance of success…" (p. 98).

Murphy et al. (2014) stated that the instructional development of blended education is currently in a formative phase where school districts and classroom teachers are experimenting with strategies that successfully "combine online instruction with regular classroom instruction to support teaching and improve students' learning experiences" (p.3).

Blended Education Implementation Models

While Christensen et al. (2013), Murphy et al. (2014), Perry and Plati (2011), Staker (2011), and Watson and Murin (2014) offered clarity to the evolving blended learning definitions, Staker and Horn (2012), Powell et al. (2015) and Boboc (2015) moved beyond the blended learning definitions by outlining four specific examples of

blended education school implementation models. These four models are the rotational model, the flex model, the self-blend model, and the enriched-virtual model.

The most structured of the four models is the rotational model. This model utilizes a specific schedule that designates when the students will rotate among a variety of learning modalities with at least one being online instruction. The authors also provided four examples of the rotational model: station, lab-rotation, flipped, and individual.

The station rotational model consists of students moving through the following classroom-based workstations: teacher directed work, student directed work, and online work. The lab-rotation model is classroom-based and has less structure than the station rotation model. The teacher provides basic face-to-face instruction that the students enhance, as individually needed, via online education. The flipped-classroom rotational model requires the student to engage in the actual instruction online prior to the face-to-face class. This allows the teacher to focus the face-to-face time on higher-level implementation skills based on the online content. The individual-rotation model provides teacher driven lesson customization for the purpose of meeting individual or group learning needs. The teacher has a variety of customization learning options, one being online instruction.

The second blended learning model is labeled flex instruction. This online education model provides students, moving at their individual pace, with online instruction that is followed by such customized face-to-face enhancement activities as collaborative work and enrichment activities.

The third blended learning model is called self-blended or a la carte. This model has students self-enroll in one or more online course(s) while taking their remaining courses in a brick and mortar facility. The online instructor is the teacher-of-record for the online course(s) while the teacher in the brick and mortar location is the teacher-of-record for courses taken off-line.

The final blended learning model is entitled enrich-virtual. In this model the students work entirely online with the opportunity to receive remedial or enrichment in a brick and mortar building. Watson (2008, p. 3) stated that the enrich-virtual blended model will likely become the "predominate model of the future" in K-12 education as it combines the best of both instructional models increased access to an ever-expanding virtual curriculum with the human element provided by face-to-face interaction with a teacher.

Review of Research Literature

Few rigorous research studies of the effectiveness of online learning for K-12 students have been published (U. S. Department of Education, 2010, p. xiv).

The research component of this dissertation will be divided into three major sections. The first section discusses meta analyses research findings that primarily focus on online learning in a post-secondary environment. The second section examines research that assesses the impact of online learning in a K-12 setting but does not stipulate if the online platform is virtual or blended. As this study focused on blended learning, the third section concentrates on research devoted to blended learning.

It must be stated, and will be frequently repeated, that the vast majority of the research addressing online learning in general and blended learning in particular focused on the post-secondary learning environment. The minimal research focused on K-12 is not uniform in supporting or questioning the utilization of online learning in the K-12 environment.

Research on Online Learning in Predominately Post-Secondary Settings

Meta-analyses

Means, Toyama, Murphy, and Baki (2013) stated that "Meta-analysis makes it possible to synthesize data from multiple studies with different sample sizes by extracting an effect size from, and computing a summary effect for, all studies" (p. 9).

The U. S. Department of Education released, in 2010, a research study entitled *Evaluation of Evidence-Based Learning: A Meta-analysis and Review of Online Leaning Studies*. Based on over 1000 empirical studies of online learning that were published between 1996 and 2008, the Department of Education selected 99 empirical studies that met or exceeded the Department's research standards and addressed one or more of the following criteria: utilized a rigorous research design, provided adequate information to calculate an effect size, contrasted online learning to face-to-face learning, and measured student learning outcomes. It is important to note that only nine of the 99 research reports analyzed by the U.S. Department of Education's meta-analysis examined the effects of online learning in a K-12 learning environment. Due to this small representation of K-12 research, the meta-analysis researchers determined that the study's findings would focus on data generated by post-secondary students.

Means et al. (2013) published a meta-analysis entitled *The Effectiveness of Online and Blended Learning: A Meta-Analysis of the Empirical Literature.* This analysis was designed to explore the learning outcomes, based on effect size of face-to-face, virtual, and blended instruction. The meta-analysis utilized 50 effects found in 47 studies that covered students in K-12, college, and post-graduate. The Means et al. meta-analysis findings noted that virtual and face-to-face instruction are equivalent in instructional effectiveness while blended learning is more instructionally effective than face-to-face. The authors hypothesize that the reason for this effect size difference is that blended learning provides students with "more learning time, additional instructional resources, and course elements that encourage interaction among learners" (p. 36). This analysis led the authors to two conclusions. First, putting a course online will not provide any meaningful student learning gain if a strategy is not included that incorporates additional instruction. Second, the meta-analysis study calls for additional "research and development on different blended learning models" (p. 2).

As with the U. S. Department of Education's 2010 study, the Means et al. (2013) meta-analysis utilized an extremely small K-12 data sample thereby creating a situation where the vast majority of the study's data came from post-secondary and post-graduate students. As state earlier, great care must be taken in applying online learning findings secured from post-secondary and/or post-graduate students to K-12 students. This is due to the different maturity levels, independent orientation to learning, self-motivation, and time-management of K-12 students in comparison to post-secondary and or post-graduate

students. Therefore, great caution must be taken in applying the Means et al. findings to elementary and secondary students and schools.

Escueta, Quan, Nickow, and Oreopoulos (2017) conducted a meta-analysis that collected and analyzed all publicly available experimental randomized control trials (RCT) and quasi-experimental regression discontinuity designs (RDD) studies conducted in developed countries that met the following criterion for inclusion. The study must "estimate the effects of an ed-tech intervention on any educational related outcome" (p. 8). It is important to note the authors conducted this research in response to the rapid expansion of educational technology that appeared to outpace the ability of educators and policy makers to determine which forms of online education deserve financial investment. This evidence-based review, which utilized the "rule of thumb that less than 10 percent of a standard deviation is small, 10 percent to 25 percent is encouraging, 25 to 40 percent is large, and above 40 percent is very large" (pp. 7-8) focused on four categories: access to technology, computer-assisted learning, technology-based behavioral interventions in education, and online courses.

Escueta et al. (2017) documented that category one, access to technology, increased the use of computers and computer skills, but only generated student learning outcomes when computer access is linked with learning software. The study also confirmed that there exists great inequality regarding who has access to technology with minority student and students of poverty having a disproportionate lack of access. As is a pattern in the research on educational technology, Escueta et al. cited that the majority of research on access to technology focuses on post-secondary education. The authors

emphasized that the few studies which concentrate on K-12 technology access document no positive or negative effect on academic achievement.

Escueta et al. (2017) defined category two, Computer Assisted Learning (CAL), as the implementation of software that is designed to develop such specific academic skills as "improving math computation or improving reading comprehension" (pp. 21-22). Based on 29 K-12 RCT studies, CAL demonstrated "enormous promise in improving K-12 learning outcomes, particularly when it comes to mathematics" (p. 22) with effect sizes that ranged from 0.18 standard deviations in a Maine math program that required less than 40 minutes per week to 0.63 standard deviations in a Texas math program for seventh grade students. The authors stated that with the assistance of such tools as artificial intelligence and immediate feedback, CAL possesses the ability to personalize instruction at a level that surpasses the abilities of an individual teacher. Finally, Escueta et al. stated that "many CAL interventions compare favorability with such interventions as reduced class size, longer school days, and intensive face-to-face tutoring" (p. 23). The authors acknowledged that there needs to be further CAL research, especially into CAL's impact on subjects other than math, students' long-term retention, and the best methods of integrating CAL with different teaching strategies.

The third area explored by Escueta (2017) was behavioral intervention which the authors define as how technology can be utilized to provide information that assists parents and students in making informed and productive decisions regarding school. Escueta et al. documented that the majority of the 12 behavior intervention

studies reviewed note some level of success in cultivating attitudes that school success is attainable.

The final area of investigation, by Escueta et al. (2017) is online courses. This final area investigated by Escueta et al. is the area that most closely matches the theme of this dissertation. The authors note that the online learning has rapidly expanded from its inception in the 1990's. By 2013, over one-third of U.S. college students enrolled in "an online course at some point in their career…and more than 11 percent enrolled entirely in online programs" (p. 67). The authors noted that the online option increases the university's or school district's revenue as well as offering students the ability to adjust their study schedules based on the difficulty of a particular portion of the curriculum. The authors noted that the drawbacks of online courses are the lack the structure some students require as well as limiting the networking opportunities found in face-to-face instruction. This is a particular concern at the K-12 level, which is discussed next.

Research on Online Learning in K-12 Settings

Escueta et al. (2017) acknowledged that only one of the nine RCT studies they reviewed regarding the academic impact of online courses focused on K-12. This study's findings, which were based on a freshman algebra summer program in the Chicago Public Schools, validated face-to-face instruction outperforming virtual online instruction based on student performance. The authors stated that the belief that students enrolled in virtual online learning would, through interactive and individualized learning experiences, achieve greater academic gains than students in a face-to-face instructional environment did not materialize. Escueta et al. stated the findings of the RCT study of

1,400 Chicago students in two cohorts indicates "that teachers in the face-to-face course were better able to flexibly incorporate a range of topics, and thus were better able to accommodate and engage the students" (p. 73). Escueta et al. (2017) acknowledged that the findings from this single K-12 online learning program must be supported or refuted though additional K-12 studies. The authors made no attempt to transfer the findings of the eight post-secondary online learning programs into the K-12 environment.

Cavanaugh, Barbour, and Clark (2009) reviewed open access research on K-12 online learning between 1997 and 2008. This early literature review established the fact that the majority of online learning research focused on post-secondary students. The authors suggest that there may be differences in the way adults and adolescents learn and that the skills found in adult learners which lead to success in online learning (an independent orientation to learning, self-motivation, and time-management) may not be fully developed in K-12 students and thus there needs to be additional research regarding the effectiveness of online learning with elementary and secondary students.

Lewis, Somer, Whiteside, and Dikker (2015) utilized ethnographic techniques for the purpose of analyzing the impact of online learning on at-risk youth in a K-12 environment. In preparation for this study, the author's literature review noted that while "the literature regarding online and blended learning has evolved over the last decade, research surrounding the benefits and challenges of online and blended learning specifically for at-risk populations of students continues to be scarce" (Lewis et al., p. 145). In order to emphasize the critical nature of this lack of research for at-risk student, the authors cited that in 2009-2010 it was estimated that 62 percent of the nation's K-12

students enrolling distance learning were engaged in credit recovery, a percentage that continued to grow with the expansion of virtual charter schools and public-school virtual learning opportunities.

Based on their literature review of two North Carolina programs that provided credit recovery opportunities via online learning to middle and/or high schools students, Lewis et al. (2015) offered the following programming recommendations that encompass both at-risk and academically successful students. First, over one-half of the surveyed students indicated that they lacked the technical knowledge to be successful in an online environment. Thus, the authors' first recommendation was that all students enrolling in an online course for the first time be provided with an orientation which covers "foundational skills needed to increase online readiness and familiarity with the online learning environment" (p. 151). The second recommendation was that the online instructors establish a relationship with each of their assigned online students in order to create an environment where the students are comfortable seeking assistance either online or face-to-face. The final recommendation was that school districts utilizing online learning for credit recovery implement operational designs and procedures that enable every student to succeed. Examples of such designs and procedures are locating computer laboratories, facilities that are dedicated to students enrolled in online learning, in areas that are easily accessible to the students; providing, when needed, students with transportation to and from the computer laboratories; providing continual intervention assistance for at-risk students; and developing a mandatory attendance policy.

Of particular interest to this dissertation is a finding that Lewis et al. (2015) noted from their review of the online credit recovery program in North Carolina's New Hanover County Schools (NHCS). The authors noted that NHCS offered its students the opportunity to take online learning through the North Carolina Virtual Pubic School (NCVPS). NCVPS, which had existed for seven years and provided services to over 170,000 North Carolina students, offered the local school district's students a proven online curriculum and highly trained teachers and support staff. Based on the fact that many of its at-risk students were struggling with the NCVPS summer credit recovery program, NHCS made one policy modification: credit recovery students were required to work in one of the assigned computer laboratories for the purpose of receiving one-to-one guidance from staff. The result of this modification was that students excelled due to immediate support and motivation.

Online learning Compared to Face-to-Face Learning

Heppen, Sorensen, Rickles, Walters, Michelman, and Clements (2016) discussed the collaboration of The American Institutes for Research, The University of Chicago Consortium on School Research and the Chicago Pubic Schools for the purpose of conducting a study that compared the effects of online learning and face-to-face learning on first-time ninth grade students who enrolled in a summer credit recovery program for the second semester of Algebra One. The study identified 1,224 first-time ninth grade Chicago Public School students who were scheduled to participate in an Algebra 1 credit recovery course in the summers of 2011 or 2012. The students were randomly assigned into either a face-to-face credit recovery class or an online class. The face-to-

face classes totaled 611 students with the online learning classes totaling 613 students. The student demographics were 38% female, 57% Hispanic, 33% African American, 10% other, 86% eligible for the national school lunch program, 12% eligible for special education services, and 47% who spoke Spanish as their native language. The student participants failed an average of 4.5 semester courses during their first year in high school.

The face-to-face courses were taught by Chicago Public School teachers certified in high school mathematics. The face-to-face teachers possessed full control over the formation and presentation of the Algebra 1 second semester curriculum. The online learning curriculum was the Aventa Learning K-12 online credit recovery curriculum which the Chicago school district had implemented in the 2010 school year. The Aventa Learning K-12 second semester Algebra 1 online program utilized in this study was designed for the students to be in a computer lab staffed by an in-class mentor whose responsibilities comprised of assisting the students in implementing the online curriculum and technology and to communicate each student's progress to the online mathematics teacher. The online mathematics teacher's responsibility was to communicate with students identified by the mentor via the software's online chat feature and present these students with online whiteboard math demonstrations.

The Algebra 1 second semester credit recovery course lasted three to four weeks and totaled 60 hours. Based on a 28-item post-test that covered algebra concepts endorsed by the National Assessment of Educational Progress, the study attempted to answer the following two questions (Heppen et al., 2016, p. 2):

1. How do the students' short-term experiences (end-of-course exam score, end-of-course grade, if a credit was earned) compare for students taking online and face-to-face credit recovery courses?

2. How do the students' long-term experiences (standardized mathematics assessment scores, credits and grades in subsequent mathematics courses, on-track status for graduation) compare for students taking online and face-to-face credit recovery courses?

In terms of findings, the Heppen et al. (2016) study found that students enrolled in the online reported that the lessons were more difficult, the course's expectations were less clear, and a lower level of enjoyment than reported by the students enrolled in the face-to-face credit recovery course. The students in the online course were more comfortable with computers than the students enrolled in the face-to-face course. There existed no difference between the face-to-face and online students in their feelings of course engagement and staff support.

The students enrolled in the online learning curriculum earned "lower algebra assessment scores, grades, and credit recovery rates than face-to-face course students" (Heppen et al., 2016, p. 6). The study also found that there were not significantly different long-term outcomes between the two groups in such areas as grades earned in higher mathematic courses and being on-track to graduate based on credits earned at the completion of their second academic year.

In closing, the authors caution educators about engaging in online credit recovery courses for at-risk students. The authors also note that regardless of the credit recovery

format, the student learning gain in this summer credit recovery program did little to close the content achievement gap between the credit recovery students and the students who are academically on track to graduate in four years. Much work needs to be done to develop instructional strategies that put at-risk students "back on track in school" (Heppen et al., 2016, p. 10).

The Center for Research on Education Outcomes (CREDO) published a 2011 research study that explored the learning outcomes of Pennsylvania's traditional public schools and the State's charter schools. As a component of this study, CREDO also examined the student learning differences in reading and math when comparing Pennsylvania's traditional brick and mortar public schools; Pennsylvania's brick and mortar charter schools; and Pennsylvania's virtual charter schools. The 2011 CREDO study documented that the brick and mortar public and charter school students obtained similar reading outcomes, the public-school students outperformed the charter school students in math. The brick and mortar public and charter school students significantly outperformed the virtual charter school students in reading and math.

This 2011 CREDO study also documented differences in the type of student attending Pennsylvania's brick and mortar charter schools and the State's virtual charter schools. Students attending the brick and mortar charter schools were predominately black and receiving free or reduced school lunches. The students attending the virtual charter schools were predominately white and not eligible for subsidized school lunches. In addition, the virtual students had higher assessment scores in reading and math and

were more likely to be repeating a grade than the students attending a brick and mortar charter school.

CREDO, the Center for Reinventing Public Education (CRPE), and Mathematica Policy released a 2015 study that examined online charter schools in 17 states and the District of Columbia. The purpose of the study was to provide school leaders and policy makers with research-based information regarding the "the landscape and operation of online charter schools and their impact on students' academic growth" (p. 1).

The 2015 study surveyed the principals of the online schools for the purpose of developing a data base regarding types of students served, curriculum and method of delivery, teacher certification, and parent involvement. This survey data, combined with student testing data and information regarding the states' policies for online schools formed the data base for a Virtual Control Record (VCR) statistical analysis. The VCR statistical analysis compared the online charter school data (treatment) with control data obtained from traditional public schools and charter brick and mortar schools. The study standardized the data from the participating schools in order to make the data comparable and reported its findings in standard deviations thereby enabling the study to document if "the students were growing academically at a rate which was faster, similar, or slower than that of their peers" (p. 5).

The 2015 research study had six findings and three implications. The findings were that online charter student academic growth was weaker than that of the control groups. That prior to enrolling in an online school no differences existed regarding mobility between the treatment group and the control group while following enrollment

in an online charter school the treatment group became 2 to 3 times more mobile than their control peers. Not all online charter schools performed poorly as some, particularly in Wisconsin and Georgia, who reported growth in reading that surpassed their control groups. Finally, for the most part, online charter school practices had little impact on academic growth while state-level policies had a significant relationship with academic growth in the online charter schools. Unfortunately, the study's reported data was insufficient to determine what policy components were responsible for this significance.

The 2015 study has three implications. The first implication is that online charter schools meet the academic needs of some students, but do not meet the academic needs of the vast majority of students. The second implication is that policy oversight needs to be revisited with the intent of moving the focus of online charter schools from flexibility to academic performance. The final implication is that states should review the performance of their online charter schools before they add to their number.

Online Learning in Ohio

Specifically, in Ohio, the state that is the focus of this study, low income white families are more likely to enroll their children in online charter schools while low-income minority families favor traditional charter schools according to a study by Ahn and McEachin (2017). Ahn and McEachin also found that Ohio's students enrolled in online schools academically underperformed students enrolled in public or charter schools that utilized a traditional curriculum. Ahn and McEachin documented that although Ohio's higher performing students tend to do better academically in online schools than lower achieving students, the achievement level of these high achieving

students still lags behind their peer's performance in a traditional school. As with many other studies of online academic performance in K-12, the Ahn and McEachin Ohio study noted the problem of limited research on "how online learning works for K-12 students" (p. 45).

Blended Learning Research

Blended Learning in a K-12 Environment – Does it Lend to Academic Gain?

Just as there is disagreement over what to call blended learning (e.g. hybrid learning, technology-based learning or blended learning), there is also controversy among researchers regarding the educational benefits of blended learning in a K-12 environment. Sparks (2015) questions if there is definitive evidence that blended learning is providing K-12 students with improved learning. Sparks referenced educational researcher Sarojani S. Mohanned's stance that there is not enough empirical evidence to definitively state if blended learning works or does not work. Sparks also documented the Michael and Susan Dell Foundation's position that with individual students having a say over time, pace, path and control it is difficult to develop and implement a blended learning research model that is capable of addressing such a broad learning spectrum. Sparks also cited a RAND Corporation study of blended learning in the early elementary grades. While this study documents that two-thirds of the students made significant gains in reading or math, the researchers could not guarantee that the blended learning model was the sole cause of this growth. Finally Sparks discussed the U. S. Department of Education's conclusion, based on its 2010 meta-analysis of online learning outcomes, that there is insufficient data for deciding the educational impact of blended

learning in K-12. Thus, Sparks called for researchers to begin securing the data necessary to determine the educational impact of online learning in general and blended learning in particular in order to provide meaningful information regarding the true educational impact of blended learning in a K-12 educational environment.

The following authors supported the fact that there is limited research regarding the effectiveness of blended learning in a K-12 environment. Waters, Barbour, and Menchaca (2014) documented that there exists limited "evidence supporting the effectiveness" and "the problems encountered by young learners" in blended charter schools (p. 1). Lewis, Whiteside, and Dikker (2015) confirmed that the impact of blended learning on K-12 at-risk students continues to be scarce.

In light of the number of authors pointing out the lack of research supporting blended learning in K-12, the following studies provide limited evidence regarding the possibilities and problems with blended learning. Escueta et al. (2017) acknowledged that there is evidence that blended education has the potential to match the learning outcomes of traditional face-to-face instruction while at the same time reducing costs. Karam et al. (2017) documented that in the area of middle and high school implementation of a blended learning algebra curriculum teachers demonstrated a low level of teacher fidelity, a condition that negatively affected student outcomes. Karam et al. recommend that school districts correct this lack of implementation fidelity through intensive and ongoing professional development programs that provide teachers with a better understanding of the blended curriculum's implementation guidelines and provides teachers with proven implementation strategies. While Murphy et al. (2014) predicted that blended learning

will become standard practice in future K-12 classrooms, the result from their 2011-12 school year study of blended learning raises some doubts. The Murphy research study focused on determining if students in blended learning environments secured academic achievement gains that were significantly different from their peers in a face-to-face learning environment. Murphy also explored if the blended learning curriculum achieved better results for specific types of students or subjects. Unfortunately, due to such implementation issues as infrastructure, technology, and software, the Murphy research study did not fully answer these questions. In general, the study's findings were mixed. The teachers, who were learning the software as the year progressed, reported limited use of the student data as it was difficult to secure and the teachers possessed a general lack of confidence in the online assessments. The teachers felt that the blended learning self-pacing function facilitated the instruction targeted to those students with the greatest needs and provided each student with a sense of accomplishment. Some teachers questioned the blended learning software's ability to adequately address higher-level thinking skills. Finally, teacher satisfaction with blended learning varied.

It should be noted that the U. S. Department of Education's 2010 meta-analysis did document that post-secondary students in a blended learning environment secured academic achievement at a higher level than post-secondary students in a virtual online learning environment although the study stipulates that students in a blended learning course often had more learning time and tools than students in a virtual online program. Again, it must be emphasized that there is not empirical evidence that the

success that post-secondary students experience with online education in any form can be successfully transferred into a K-12 school educational environment.

Blended learning: Its Impact on At-risk Students and Social Connectedness

Due to the increasing numbers of K-12 students who are dropping out of school, Repetto and Spitler (2014) endorsed the potential of blended learning providing "a much-needed support structure to struggling students" (p. 105) but also acknowledged that there is "limited empirical research studies that have examined at-risk students in online and blended learning environments" (p.112). This position is also supported by Lewis et al. (2015).

Smith (2014), while not focusing on at-risk students did employ a small study to investigate the relationship between social connectedness and communications technology. Citing research that finds a positive relationship between social connectedness and academic gain, the question that Smith addressed is if the use of technology in the classroom has a negative impact on the development of social connectedness and thus academic gain? Utilizing two classes of senior students (each class had between seventeen and nineteen students who were similar in gender, ethnicity, and academic ability) Smith provided each class with an identical curriculum but different instructional methods. The control class was taught in a traditional face-to-face manner while the experimental class that was taught in a blended format that utilized both face-to-face and online instruction. Using student perception surveys and academic growth assessments, Smith found that there was no difference in academic achievement between the control and experimental classrooms and that some students held a very

strong preference for face-to-face instruction while other students held a very strong preference for blended instruction. Smith did note that while there were no academic gain differences, the students in the experimental classroom rated their levels of learning higher than the students in the control class. Smith noted that this higher level of perceived learning may be due to the fact that the students in the experimental classroom also rated the following factors higher than the students in the control classroom: social connectedness, learning, teacher support and enjoyment. Clearly, there was something happening in the experimental classroom that was not occurring in the control classroom. Smith explored this phenomenon with students in the experimental class and believes that the technology is the primary factor behind the students' positive perceptions in the experimental classroom. These students possessed a tool that allowed them to move beyond the classroom walls at any time, day or night, for needed assistance or self-growth. Learning activities were not contained within the boundary of the classroom with the teacher being the sole facilitator. Online education enabled the teacher to be a facilitator and the student to directly interact with content via the online capabilities of the classroom.

While Smith (2014) acknowledged that as his study was limited in size that the findings may not transfer to other populations, he also cited the need for the positive student learning perceptions in the areas of online learning such as social connectedness, teacher support and enjoyment be further studied to verify and explain these potential benefits of online learning.

Blended Learning in Ohio

In an attempt to move blended learning research from the national level to the state level, Arnett et al. (2015) focused on Ohio with the intent of utilizing surveys to address the following four questions: Who is implementing blended learning? What blended-learning models are being employed? How are these models being developed? What are the challenges to and lessons learned from implementing blended learning? Employing an initial survey to identify the Ohio charter schools and school districts that are utilizing blending learning, the research team identified 122 of Ohio's 994 school districts and charter schools that are implementing blended learning. Of these 122 school districts and charter schools, 67 provided data from which the authors developed key findings, observations, and recommendations. The school staffs utilizing blended learning generally stated that the criteria for success is increased student engagement, course completion rates, and graduation rates. Arnett et al. discovered through the Ohio research that the three most common blended learning implementation challenges are securing "high-quality professional development (36%), staff buy-in (34%), and funding blended learning (32%)" (p. 6). These findings are similar to those from Karam et al. (2017) cited earlier. It must be noted the Arnett et al. documented that one of the primary reasons Ohio schools implemented blended learning was to increase academic achievement as measured by graduation rates. Unfortunately, the authors note there is no documentation regarding success or failure in achieving this goal.

Arnett et al. (2015) concluded by making the following observation and recommendation. The author's observation is that Ohio is at the point where it should

change its blended learning focus from one of exploring possibilities to one of "how to employ blended learning in order to more effectively shift teaching and learning" (p. 7). In this light, Arnett et al. recommend that Ohio' policies should not focus on expanding blended learning, but instead the state's leaders in educational policy should focus on "supporting innovations that move the state toward increasing student achievement, improving the metrics used to evaluate blended learning, improving the quality of the current blended-learning programs, and expanding collaboration among innovators" (p. 7). These recommendations inform, in varying degrees, the focus in this dissertation.

Benefits and Challenges of Blended and Online Education

Benefits

The Alliance for Excellent Education (AEE, 2011) offered three areas where technology is beneficial to the educational process. These three areas are: increased equity and access, improved effectiveness and productivity, and improved student achievement and student outcomes.

Smith (2014) documented that students in a blended classroom rated their levels of learning higher than the students in a face-to-face class. Smith (2014) noted that this higher level of perceived learning may be due to the fact that the students in the blended classroom also rated the following factors higher than the students in the control classroom: social connectedness, learning, teacher support, and enjoyment. The ability of students to access online learning when they desire is also a benefit. Some students learn

better in the evening than in the traditional classroom hours or have jobs and other required activities that conflict with traditional school schedules.

Lewis, Whiteside, and Dikker (2015) listed the following benefits of online learning for potential and actual K-12 dropouts: individualized instruction, rapid feedback, mastery learning, and differentiation. Lewis et al. research supported Smith (2014) by documenting that blended learning appears to be more effective for at-risk students than exclusively face-to-face or pure online instruction.

Kuo et al. (2014) stated that "blended appears to outperform traditional classroom instruction in terms of effectiveness" (p.361). Kuo et al. also stated that a possible reason for this finding is that blended learning "combines the strengths of face-to-face learning and online learning" (p. 363), which appears to increase student satisfaction and thus student achievement.

Challenges to Online Learning

Borup et al. (2013) and Valasquez (2012) discussed the dual sides of teaching in a K-12 environment: the human side and the academic side. The academic side, which is more easily measured and discussed than the human side, has been the focus of continual research and articles while the human side is far less explored. Borup et al. discussed how the core of the human side of teaching is the development of a caring student/teacher relationship, a relationship that may be difficult to maintain in an online instructional environment. This is because the asynchronous communication process, which is the foundation of most online education programs, does not always allow for spontaneous communication between student and teacher that is key to the development of a caring

relationship. Borup et al. stated that while a caring relationship in an online course may not be the norm, their research documents that it is possible to establish such a relationship if the following four components, as provided by Nottings (2008), are incorporated into the online programming: dialogue, modeling, practice, and confirmation. Cavanaugh et al. (2009) detailed how administrators and teachers need to be concerned about such challenges as start-up costs, accreditation, and student readiness as they move into or expand online student programming. Smith (2014) discussed how students involved in virtual education may not acquire skills in presentation and suffer from not having the "communion" like experience that comes from a teacher's actions and words. Lewis et al. (2015) addressed a variety of questions regarding online learning. Is there evidence that virtual learning addresses all the needs of students who have disabilities, who are struggling academically, or who have dropped out of school? Are educational leaders cognizant of the ongoing fiscal and personnel costs required in the planning and successful implementation of online learning and the professional development needs required to ensure the successful implementation of an online learning program? Are educational leaders comfortable with allocating the resources needed to acquire textbooks that align with the online curriculum? Finally, are educational leaders willing to ensure that all students involved in online education have both the motivation and support needed to succeed? Sparks (2014) summarized a variety of studies which indicate that while it appears that there may be student learning benefits related to the implementation of online learning in a K-12 learning environment, it is too

early in the research to make any definitive statements regarding the educational impact of online learning versus face-to-face learning.

It must be acknowledged that the charter school utilized in this dissertation also faced many online learning challenges mentioned in the prior paragraph: developing a student/teacher caring relationship; providing individualized services for special needs students; aligning the online curriculum to both the student's academic abilities and the State's graduation requirements; fostering motivation in at-risk students and providing the support needed to succeed; and offering the teachers and administrators with the professional development needed for continual growth.

Educational Productivity and Blended Learning

The U. S. Department of Education's Office of Educational Technology 2012 study entitled Understanding the Implications of Online Learning for Educational Productivity acknowledged that almost all research that addresses educational productivity is based on data from post-secondary institutions and called for an increase in "experimental or quasi-experimental research" (p. 28) that examines the impact of online learning on student productivity at the secondary level. The report also acknowledged that due to the age and maturity of post-secondary students as well as the post-secondary institutions online history which exceeds the online history of the nation's elementary and secondary schools, the findings of this study should only be applied with caution to K-12 online programs.

The federal study defines educational productivity as a relationship between program inputs (funds) and outputs (improved grades, graduation rates, etc.). Productivity

can be achieved if there are reduced costs and a maintenance of outcomes; improved outcomes with maintained costs; and both reduced costs and improved outcomes. This study was unable to find any research that addressed educational productivity in a K-12 blended learning environment.

Conclusion

Blended learning is a component of the technology revolution that is becoming increasingly relevant on both the post-secondary and K-12 levels. While there is empirical evidence supporting blended learning on the post-secondary level, there is limited empirical evidence regarding the instructional impact of blended learning on the elementary and secondary levels. It must also be acknowledged that at the post-secondary and the K-12 levels there exists a lack of evidence regarding what, if any blended learning components have a positive impact on student academic success. Finally, there lacks discussion regarding the potential of utilizing policy as a tool for improving the academic success secured through blended learning.

It is the lack of empirical evidence regarding blended school factors that may have a significant impact on student academic performance that drives the focus of this dissertation's research. Chapter Three will examine the dissertation's research design and methodology from the perspective of providing empirical evidence regarding how one blended school factor, student time in the school's brick and mortar facility, impacts academic gain. It must be noted that student time in school is a factor over which the blended school's faculty has some control.

CHAPTER III

METHODOLOGY

The purpose of this study is to determine whether the amount of time that high school (grades 9-12) students spend in in-person instruction in a blended learning instructional environment has a statistically significant (<.05) relationship to academic gain based on the criteria of graduate credits earned. The study employed Propensity Score Matching (PSM) for the purpose of establishing a quasi-experimental design that compares the academic gains a treatment group whose in-school attendance met specific time percentages to the academic gains of a control group whose in-school attendance did not meet the specific time percentages.

Site

The site of this study is a dropout prevention school in an urban area in Ohio. This urban area had an estimated 2018 population of 287,208 while the metropolitan area's 2017 estimated population (which combines the urban and suburban data) was 603,668. Both urban and metropolitan areas were similar regarding age distribution with 64% of the population falling between of 17 and 64 years of age. The demographic differences between urban and metropolitan areas come to light when examining race,

income, and education. The race and ethnicity of the urban area were black, 27%; Hispanic, 8%; other, 1%; two or more races, 5%; and white, 59%. The race and ethnicity of the metropolitan were Asian, 2%; black, 14%; other, 7%; two or more races, 3% and, white, 74%. The median household income for the urban area was $35,808 while the median household income for the metropolitan area was $50,389. The percent of individuals in poverty in the urban area was 27 while the percent the metropolitan area individuals in poverty was 16. Finally, in the urban area 84% of the residents were high school graduates with 18% of the population holding a Bachelor's degree or higher. In the metropolitan area 90% of the residents were high school graduates and 28% held a Bachelor's degree or higher (U.S. Census Bureau, 2018 and Census Reporter, 2017).

School and Sample

The dropout prevention school (which for the purpose of this study will be called Grace Academy), was in operation from the 2003-04 through the 2016-17 school years with a stated purpose of providing educational and support services to at-risk students in grades 7-12. Grace Academy defined at-risk as a student who had dropped-out of school; a student who was experiencing academic and/or attendance and/or discipline issues in his or her current school; or a student who was referred from the courts, student advocacy organizations or individuals, or social service agencies. Grace Academy was open to all students that met one or more of these criteria regardless of gender, ethnicity, and special needs.

Grace Academy was a charter school sponsored by an urban public-school district. The school district and Grace Academy signed a contract that stipulated the

Academy's teaching, administrative, and support staff, with the exception of the principal and treasurer, were to be employees of the district who would be placed at Grace Academy pending an interview by the Academy's staff. If the district was not able to supply a teacher, administrator, or support staff that met the Grace Academy's requirements, the academy had to right to secure an employee from outside the district. The school district would then hire this selected employee. Grace Academy reimbursed the district for the salaries and benefits of the district's staff who were placed at the Academy.

Grace Academy's academic curriculum was blended with online instruction provided through a purchased online curriculum. Each student possessed an academic plan for graduation that was jointly developed by the student's counselor, the student, and the student's parents or guardians. Students were assigned by their counselor into the online classes that met the student's academic plan. Ohio charter schools do not have to abide by the state's requirement that a high school student must have 120 hours (i.e. a Carnegie Unit) in a course in order to earn credit toward graduation. Thus, Grace Academy students, without the need to fulfill Ohio's Carnegie Unit requirement, received credit for each assigned course based upon demonstration of proficient in the courses stated goals. Thus, the number of annual credits earned by Grace Academy students could exceed the maximum number of units available to students in the state's traditional senior high schools where the 120-hour requirement was mandated.

Grace Academy's students had in-person access to teaching and administration staff during school hours (9 a.m. through 3 p.m. in the regular school year and 9:00 a.m.

through noon in summer school). The Academy's students also had access to the teaching and administrative staff via the online curriculum's internet capabilities and telephone twenty-four hours per day seven days per week. Grace Academy had four brick-and-mortar locations that serviced different geographic areas of the metropolitan area. Each location was staffed by certified teachers and a one paraprofessional. Students were required to attend at one of the four brick and mortar locations only for end-of-course exams and state mandated assessments. With the exception of end-of-course exams and state assessments which required students to be physically on-site, students enrolled in the Grace Academy determined if and when they would attend a Grace Academy brick and mortar facility.

As paraprofessionals handled such matters as attendance, contacting parents or guardians, and providing counselors with daily updates regarding student progress, the teachers were available to provide immediate academic assistance to enrolled students who chose to attend the brick-and-mortar location on any given day. Whenever a student attended a brick-and-mortar location, they scanned in via Identiphoto. (Identiphoto is a scan in and scan out process which enabled Grace Academy's staff to track when each student was in a one of the academy's four brick and mortar facilities.) This Identiphoto data combined with the student's time spent on the online curriculum was useful when counselors met with students and parents/guardians for the purpose of reviewing and revising a student's academic plan. All enrolled students were given a bus card that enabled them to take public transportation to and from any of the four locations on any day that Grace Academy was in session.

This study utilized data from the 2013-14 and 2014-15 school years. These two school years were selected as they were the last school years that the school employed a well-known online curriculum. Grace Academy staff, based on the review of several online curricula, selected a new online curriculum to be fully implemented with the start of the 2015-16 school year. While the transition to the new software was as seamless as possible, the curriculum was new to both staff and students and as such may have negatively affected student academic progress as determined by credits earned. During the following school year, 2016-17, modifications were implemented to the new online curriculum based on staff and student input from their experiences during the previous school year. The 2016-17 curriculum modifications, as being new to the staff and students, also may have had a negative impact on student academic performance.

As parents often failed to report information regarding family income, the decision was made to determine a student's family income based on the average family income in the zip code of student residence. As would be expected for a dropout prevention school that provided services to primarily urban youth, the overwhelming majority (87%) of the students, based on zip code of residence, resided in a household with an income below $45,237 with almost fifty percent of these students residing in a household where the income range was from $11,220 to $25,999.

As the outcome in this study is graduation credits earned, and as students who were enrolled in the Grace Academy less than ten days had minimal opportunity to secure a credit, those students were eliminated from the 2013-14 and 2014-15 enrollment. For the 2013-14 school year the number of students enrolled less than 10 days was eight

while for the 2014-15 school year the number of students enrolled less than 10 days was 14. This enrollment adjustment reduced the 2013-14 student enrollment from 770 to 762 and the 2014-15 enrollment from 757 to 743.

Data Sources and Measures

Data for the 2013-14 and 2014-15 school years utilized in this study came from three sources: the Ohio Department of Education's (ODE) Educational Management Information System (EMIS), Identiphoto, and the U.S. Census. EMIS provided the following student academic and demographic data: ethnicity, gender, credits earned, grade level, disability condition, and the zip code of home residence. Identiphoto provide data regarding the number of days that a student attended one of the charter school's brick-and-mortar locations. Data regarding the median family income in each enrolled student's zip code of residence was secured from the U.S. Census.

For the purpose of analysis, the data secured through EMIS, Identiphoto, and student zip codes will be coded as the following variables: credits earned (dependent variable), days a student attended in person (main independent variable), and ethnicity, gender, grade level, disability condition, and median income (control variables).

The Data

Gender and Ethnicity

The EMIS breakout by gender for each school year was 390 (51%) females and 380 (49%) males for 2013-14 and 365 (48%) females and 392 (52%) males for 2014-15. EMIS, for both school years, provided data for seven ethnic categories: Asian, black, Hispanic, Indian, multiracial, unidentified, and white. The Grace Academy's ethnic

demographics for the 2013-14 school year were 2 (.26%) students were Asian; 350 (45.5%) students were black, 68 (8.8%) students were Hispanic, 63 (8.2%) students were multiracial, 1 (0.13%) student was Indian, 4 (.52%) students were unidentified, and 282 (36.6%) students were white. In the 2014-15 school year, the Grace Academy's ethnic demographics were 1 (.13%) student was Asian, 383 (50.6%) students were black, 56 (7.4%) students were Hispanic, 3 (.4%) were Indian, 52 (6.9%) students were multiracial, 7 (.9%) were unidentified, and 259 (34.2%) students were white.

Grade Level

Based on EMIS, the number of students by grade level for the 2013-14 school year was 342 (44.4%) freshman, 132 (17.1%) sophomores, 186 (24.2%) juniors, and 110 (14.3%) seniors. The number of students by grade level for the 2014-15 school year was 369 (48.9%) freshman, 156 (20.6%) sophomores, 139 (18.4) juniors, and 93 (12.3%) seniors.

Special Education

EMIS recorded the number of students who possessed and active Individualized Education Plan (IEP), and thus were classified as having a disability, as 163 (21.1%) for the 2013-14 school year and 165 (21.8%) for the 2014-15 school year.

Household Income

It must be noted that EMIS economically disadvantaged data reflects the students' parent's or guardian's household income and is voluntary reported by the parents or guardians to the school. By the time students are in high school, parents and guardians frequently do not report this data to the school thus causing the number of economically

disadvantaged students to be underreported. As such, this self-reporting EMIS data was not utilized in this study with median household income by student zip code providing family economic status for both school years.

For the 2013-14 school year the reported median household income documented that 342 (44.4%) of the students resided in a zip code area with a median income of $18,335; 363 (47.2%) of the students resided in a zip code area with a median income of $36,395; 41 (5.3%) of the students resided in a zip code area with a median income of $58,472; and 24 (3.1%) of the students resided in a zip code area with a median income of $86,210.

For the 2014-15 school year the reported median household income documented that 77 (10.2%) of the students resided in a zip code area with a median income of $24,508; 414 (54.7%) of the students resided in a zip code area with a median income of $35,714; 206 (27.2%) of the students resided in a zip code area with a median income of $63,166; and 60 (7.9%) resided in a zip code area with a median income of $103,085.

Graduate Credits Earned

EMIS provided data regarding the number of graduate credits each student earned based upon work accomplished and exams passed—the dependent variable in this study. In the 2013-14 school year students earned between 0 and 10 units of credit. Of the 770 students enrolled in the school in 2013-14, 334 earned 0 credits, 396 earned from .5 to 4.5 credits, and 40 earned between 5 to 10 credits with a median number of credits earned of 1.27. In the 2014-15 school year students earned between 0 and 15.5 units of credit. Of the 757 students enrolled that year, 321 earned 0 credits, 376 earned between .5 and 4.5

credits, and 60 earned from 5 to 15.5 units with a median number of credits earned of 1.40.

In-Person Attendance

As the documentation of student attendance in a brick and mortar facility is critical to this research study, it is important to review how Grace Academy staff determined student on-site attendance. All students entering the downtown location progressed through a three-step process. The first step was scanning-in a school identification card via the Identiphoto equipment. The second step was turning-in cell phones and/or other electronic equipment. The final step was going through a metal detector under the supervision of county sheriffs. With the exception of the metal detector, the three satellite locations utilized the same process for students entering the buildings. Student dismissal at noon and/or 3:00 p.m. was often mass confusion as most students were lined-up to scan-out and retrieve their cell phones. In order to avoid standing in line, students without cell phones or other electronic equipment to retrieve often left the building without scanning out. Thus, accurate daily scan-out data is unavailable. Therefore, this study credits all scanned-in students with full-day attendance. It is acknowledged that this process artificially inflates the actual student percentage-of-time in the building. When determining if there is a statistically significant correlation between student time in a brick and mortar facility and academic gain based on credits earned, this inflation of student time in a brick and mortar facility means that some, if not most, students earned graduation credits with less time in school than their attendance data documented in this study.

Educational Productivity

The U. S. Department of Education's Office of Educational Technology 2012 study entitled Understanding the Implications of Online Learning for Educational Productivity acknowledged that almost all research that addresses educational productivity is based on data from post-secondary institutions and called for an increase in "experimental or quasi-experimental research" (p. 28) that examines the impact of online learning on student productivity at the secondary level.

The federal study defined educational productivity as a relationship between program inputs (funds) and outputs (improved grades, graduation rates, etc.). Productivity can be achieved if there are reduced costs and a maintenance of outcomes; improved outcomes with maintained costs; and both reduced costs and improved outcomes.

As educational productivity is not the primary outcome of this study's quasi-experimental design, the study will not generate the data necessary to document the Grace Academy's educational productivity levels for the 2013-14 and 2014-15 school years.

Research Questions

Research Question One

In a blended learning environment does the percentage of days spent in the school's brick and mortar facility have a positive effect on student achievement based on credits earned?

Research Question Two

If Research Question One is answered in the affirmative, is there a point in time where increasing student time in the brick and mortar facility has diminishing returns based on credits earned?

Data Analysis

The main analytic approach used in the study is PSM. The study also employed multiple linear regression and sensitivity analysis.

The statistical data analysis software utilized in this dissertation is STATA 15.1.

Propensity Score Matching

As noted above, days spent at brick and mortar locations of the school represent treatment. Caliendo and Kopeinig (2005) stated that a selection bias is a potential problem when analyzing the effects of treatment. This is due to the need to have a treatment group and a nontreatment group that are "similar in all relevant pretreatment characteristics" (Caliendo and Kiopeinig, 2005, p. 1). This way, post-treatment differences between the treatment and nontreatment groups can be assumed to be due the treatment. Unfortunately, the probability of securing a nontreatment group that is similar to the treatment group in all relevant pretreatment characteristics is highly unlikely as those individuals who are inclined to the treatment are likely to be different in such relevant characteristics as initiative and goals than the individuals who are in the nontreatment group, particularly in the case of the present study. In order to ensure that any possible selection bias be attenuated, PSM, a quasi-experimental research design, was utilized in this study for the purpose of establishing treatment and nontreatment

groups that are similar in all reported characteristics with the exception of the time in school treatment. Thus, PSM established a control group for each treatment group whereby the statistical significance (<.05) of the treatment (time in school) was calculated based on credits earned.

The generic equation for the logistic regression model that predicts propensity scores is below. This is a standard linear equation that utilizes Baseline and Demographics data to establish *P* (the probability that the student will be in the treatment group) and *i* representing the student.

$$\text{In}\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \sum_{k=1}^{4} \beta_k \; Baseline_i + \sum_{1-5}^{13} \beta_l \; Demographics_i$$

Voight and Velez (2018) stated that PSM eliminates potential selection bias "by comparing outcomes of participating and nonparticipating students who were similar on certain observed characteristics" (p. 439). PSM accomplishes this by creating a binary of two groups of matched individuals, treated (1) and untreated (0). A score between 0 and 1 provides the likelihood of an individual receiving treatment. An individual received treatment is matched with an individual who did not receive treatment based on their likelihood of receiving treatment. Voight and Velez cited Chen's and Kaplan's (2015) position that PSM has been found to "produce the least biased treatment effects compared to other estimation procedures for treatment effects using propensity scores, including stratification and weighting methods" (pp. 439-440).

There are two primary treatment effects associated with PSM: average treatment effect (ATE) and average treatment effect on the treated (ATT). ATE provides the expected effect if the whole population is moved from control to treatment.

$$\tau_{ATE} = Y(1) - Y(0)$$

ATT provides the effect of the treatment on those in the treatment group.

$$\tau_{ATT}\ (\tau \text{ if } T = 1) = (Y(1) \text{ if } T = 1) - (Y(0) \text{ if } T = 1)$$

As a goal of education is to have a positive impact on all students, and as ATE provides information regarding the treatment's effect on the whole population while ATT limits the effect of the treatment to only the treated thereby providing limited information regarding the counterfactuals, this study will employ ATE.

The PSM analysis utilized percent of time in the building as the treatment, credits earned as the primary dependent variable and female, black, Hispanic, multiracial, grade 9, grade 10, grade 11, disability condition, and median household income as the covariates. The control consisted of Asian, white, Indian, other, and grade 12.

Caliento and Kopeinig (2005) provided five implementation steps that occur during the PSM process.

Step One (Propensity Score Estimation) addresses two questions. The "first question concerns the model to be used for estimation, and the second question concerns the variables to include in this model" Caleinto and Kopeinig (2005, p. 5). The selected model, shown below is logistic regression where $\hat{P}_i$ is the probability of receiving treatment for observation *i.* The variables that will be the logistic regression model fall into the categories of treatment and covariates.

$$In\left[\frac{\hat{P}_i}{1-\hat{P}_i}\right] = b_0 + b_1X_{1i} + \cdots b_kX_{ki}$$

The treatment variable is percent of time in the building (X_{1i}), dichotomized around a specified percent threshold or cut point. The covariates (X_{ki}) in the model are credits earned, female, black, Hispanic, multiracial, grade 9, grade 10, grade 11, disability condition, and median household income. Male, grade 12, Asian, Indian, unidentified and white are left out of the model as reference categories. It must be noted that Asian, Indian, and unidentified are placed in the reference categories as the number of students who were in each of the three ethnic categories for both school years was under five.

Step Two (Choose Matching Algorithm) addresses the selection of one of the following matching algorithms: nearest neighbor, caliper and radius, stratification and interval, kernel and local linear, and weighted for the purpose of contrasting "the outcome of a treated individual with the outcomes of the comparison group members" (Caliendo and Kopeinig, 2005, p. 8). Caliendo and Kopeinig documented the positives and negatives of each matching algorithm. Based on their summaries, the selected matching algorithm is nearest neighbor, the "most straightforward matching estimator" where "the individual from the comparison group is chosen as a matching partner for a treated individual that is nearest in terms of propensity score" (Caliendo and Kopeinig, 2005, p. 9). Nearest neighbor matching also allows for the following customization strategies: with or without replacement, oversampling, and weights for oversampling. This study utilized the with replacement strategy as Caliendo and Kopeinig stated that "the average quality of matching will increase and the bias will decrease" (p. 9).

Unfortunately, the replacement strategy also increases error as it decreases the number of individuals participating in the match.

In order to address the concern of increased error, this study utilized two different matching procedures for each model: the first matching procedure utilized a nearest neighbor of one while the second marching procedure utilized a nearest neighbor of four. Securing similar outcomes with nearest neighbors of one and the four reduced the concern regarding error.

Caliendo and Kopeinig (2005) noted that regardless of matching algorithm employed, the larger the sample size the closer all matching algorithms come to comparing only exact matches. As noted in other parts of this document, this study's sample size excessed of 700 participants in both school years.

Step Three (Overlap and Common Support) addresses how ATE and ATT are "only defined in the region of common support" and making it critical to validate the "overlap and the region of common support between the treatment and comparison group" (Caliendo & Kopeinig, 2005, p. 12). The method utilized in this study for determining treatment and comparison groups overlap in region of common support is the minima and maxima comparison. Caliendo and Kopeinig (2005) defined this approach as eliminating all propensity scores that fall below the minimum and above the maximum in the opposite group. Caliendo and Kopeinig warned that if too many propensity scores are discarded through the minima and maxima comparison process, there should be concern about the estimated effect being truly representative of the remaining individuals.

Step Four (Assessing the Matching Quality) discusses how the matching quality is the process of determining "if the matching procedure is able to balance the distribution of relevant variables in both the control and treatment group" (Caliendo and Kopeinig, 2005, p. 15). This is important because the control and treatment matches are based on a single propensity score rather that each individual covariate. Caliendo and Kopeinig documented several methods for assessing the balance that included a *t* test, standardized mean difference, and variance ratio test. Prior to the propensity score matching process, differences in covariate means for the control and treatment groups are expected. Following the matching process the covariates for the control and treatment groups should be in balance as defined by a value of 0.20 for the standardized difference and a value between 0.5 and 2.0 for the variance ratio. Failure to achieve these balance values means the estimated treatment effects are not trustworthy and that the PSM process must be revisited.

Step Five (Sensitivity Analysis) Caliendo and Kopeinig (2005) described sensitivity analysis as searching for "unobserved heterogeneity" (p. 19). Unobserved heterogeneity is the presence of hidden bias that undermines the matching processes findings. One method of checking for unobserved heterogeneity is to document the study's robustness through rerunning the analysis with such modifications as using more than one nearest neighbor or the inclusion of a calipers if not utilized in the original initial analysis. For the purpose of addressing the concern of increase error, the research study addressed in Step Two the need to rerun the initial analysis that utilized a nearest

neighbor of one with a second analysis that utilized a nearest neighbor of four. This action also addressed the sensitivity analysis's need for robustness.

Statistical significance

This study utilized $p. < .05$ as the standard to determine statistical significance.

Multiple Linear Regression

The multiple linear regression utilized as the continuous dependent variable credits earned. The independent variables (covariates) were percent of time in the building, modeled as a continuous variable, followed by female, black, Hispanic, multiracial, grade 9, grade 10, grade 11, disability condition, and median household income. Male, white Asian, Indian, other, and grade 12 were the constants. The *b* and *p* data provided by the multiple linear regression offered insight regarding the significance of the relationship between the dependent variable (credits earned) and an independent variable (percent of time in the building) while controlling for the other variables. A statistical significance *p* of <.05 and a positive *b* added strength to the PSM *p* scores.

The multiple linear regression utilized in this study will solve the equation $\hat{Y} = b_0 + b_1X_1 + b_2X_2 + \cdots + b_{12}\ X_{12}$ where b_0 is the intercept and $b_1, b_2 \cdots b_{12}$ represent the regression coefficients for the predictors $X_1, X_2 \cdots X_{12}$ (Howell, 2007).

Power

Howell (2007), defined power as "the probability of correctly rejecting the false H_o when a particular alternative hypothesis is true" (p. 214). Howell stated that power can be increased by enlarging type I error or alpha ($\propto$) and thereby decreasing type II error (β), by increasing the distance between the null (H_o) and alternative (H_1) hypotheses, or

the effect size, and by increasing the sample size (n). Howell acknowledged that to ensure the certainty of the finding without increasing $\propto$ or β errors, researchers usually ensure their sample size is adequate to correctly reject the H_0 and detect a small effect size. Howell provided the following example of the connection between sample size and effect size. Utilizing Cohen's definitions for small, medium, and large effective sizes, Howell stated that to generate a small effect size (.20) and thereby increasing the power a sample size of 196 is required. A reduction in sample size to 32 increases effect size to .50 and decrease power. A reduction in sample size to 13 will increase the effect size to .80 and continue the decrease in power.

Utilizing the Howell's (2007) explanation for increasing power through increasing sample size, the sample sizes noted for the 2013-14 and 2014-15 charter school data provide more than adequate power.

Limitations of the Study

A primary limitation is that the study focused on one blended learning charter school that provided educational services to at-risk students and utilized one of many online curricula. Before finalized recommendations can be made to educators and policy developers there must be additional research that greatly expands the number of blended learning schools, the student demographics, and the online curricula.

As documented in Chapter One, the Grace Academy employed procedures that ensured student a student who attended one of the Academy's brick and mortar facilities and experiencing difficulties with an online lesson received immediate one-on-one assistance from a teacher certified in the student's academic area of study. The student

received this one-on-one instruction until both student and teacher were confident that the student thoroughly understood the concept under review. A blended school that does not follow the Grace Academy's form of personalized instruction may have learning outcomes very different from those of the Grace Academy.

It must also be acknowledged that the PSM treatment (days in school) does not accurately reflect the hours each student spent in the school on any given day. This to the fact that students often failed to scan-out when they were exiting school. As such, an accurate accounting of the time spent in school was not possible to obtain. As a default all students were calculated as being in attendance for a full day if they scanned into the one of the school's four sites. Thus, the actual hours spent in school was less than the recorded in-school hours for many of the Academy's students.

It must also be noted that this study was not sensitive to how students used their time when in attendance at a Grace Academy brick and mortar location. While the school's staff make every effort to make certain all students were fully engaged, full academic engagement did not always occur.

The study's findings would be stronger if the outcome variable graduate credits earned was enhanced by such data as test scores and/or end-of-course grades. Unfortunately, as the Grace Academy closed in 2017 securing such data for the 2013-14 and 2014-15 is problematic and will take time and perseverance. It is hoped that this data can be secured in the near future and added as an amendment to this document.

PSM has limitations that must be examined. Steiner and Norman (2012) noted it is possible that selection bias may exist in the PSM data. The presupposition exists in

PSM that the selected variables are key in determining group membership. The authors stated that this is not always the case, especially when the utilized variables are determined by a pre-existing spread sheet. Critical data may be omitted and unbalanced groups may be created. Steiner and Norman stated that studies which utilize PSM must conduct a sensitivity analyses to determine the robustness of the of the data. Steiner and Norman (2012) also stated that problems may occur in PSM if there is limited overlap in the data set which can cause a sizable elimination of participants and create a situation where the finding of β is a difference between the treatment and control exists but is not found in the analysis. This study conducted both a sensitivity and overlap analysis.

Finally, PSM assumes that the researcher has observed all variables that influence treatment, assignment, and outcomes. This assumption has not been met and this fact must be acknowledged.

CHAPTER IV

RESULTS

Chapter Four provides the reader with descriptive statistics followed by research results that address the study's two research questions as discussed in Chapter Three:

1. In a blended learning environment does the percentage of days spent in the school's brick and mortar facility have a positive effect on student achievement based on credits earned?
2. If Research Question One is answered in the affirmative, is there a point in time where increasing student time in the brick and mortar facility has diminishing returns based on credits earned?

Descriptive Statistics

As the outcome in this study is graduation credits earned, and as students who were enrolled in the Grace Academy less than ten days had minimal opportunity to secure a graduate credit, those students were eliminated from the 2013-14 and 2014-15 enrollment. For the 2013-14 school year the number of students enrolled less than 10 days was eight while for the 2014-15 school year the number of students enrolled less

than 10 days was 14. This enrollment adjustment reduced the 2013-14 student enrollment from 770 to 762 and the 2014-15 enrollment from 757 to 743.

Credits Earned

Table 1.0 documents that during the 2013-14 school year 43% of enrolled students did not earn one graduation credit and during the 2014-15 school year 42% of the students did not earn one graduation credit. Table 1.0 also documents that during the 2013-14 school year 52% of the students earned between .5 and 4.5 graduation credits and 5% of the students earned between 5.0 and 10.0 graduation credits. Similar positive results were documented for the 2014-15 school year where 50% of the student earned between .5 and 4.5 credits and 8% of the students earned between 5.0 and 10.0 credits.

Table 1.1 provides the mean, standard deviation and minimum/maximum data for credits earned during the 2013-14 and 2014-15 school years. It is interesting to note that the mean credits earned, the standard deviation, and the minimum and maximum for the 2014-15 school year were larger than for the 2013-14 school year. In part, this may be due to the 2014-15 school year reduction of six more students with zero credits than occurred in the 2013-14 school year.

Table 1.0

Student Credits Earned for the 2013-14 and 2014-15 School Years

School Year	Zero Credits	.5-4.5 Credits	5-10 Credits
2013-14	**327 (43%)**	**395 (52%)**	**40 (5%)**
2014-15	**313 (42%)**	**370 (50%)**	**60 (8%)**

Table 1.1

Student Credits Earned: Means, Standard Deviation, Minimum and Maximum for the 2013-14 and 2014-15 School Years

School Year	Students	Mean Credits Earned	Std. Dev.	Min	Max
2013-14	**762**	**1.28**	**1.76**	**0**	**10**
2014-15	**743**	**1.42**	**2.12**	**0**	**15.5**

Gender, Ethnicity, and Enrollment

Table 2 provides the Grace Academy's 2013-14 and 2014-15 statistics for the following categories: gender, ethnicity, and enrollment. The gender totals for both school years were similar as was the enrollment numbers for both school years. It is important to note the limited representation (<5) of the Asian, Indian, and unidentified ethnic groups for both school years. On the opposite end, the two largest populations for both school years were Black (349 in the 2013-14 school year and 374 in the 2014-15 school year) and White (275 in the 2013-14 school year and 255 in the 2014-15 school year). Hispanic and multiracial student enrollment was in double digits for both school years. The Hispanic enrollment for the 2013-14 school year was 68 and declined to 55 in the 2014-15 school year. The multiracial enrollment documents a similar decline with 63 enrolled in the 2013-14 school year and 52 enrolled in the 2014-15 school year.

Table 2.0

Student Gender and Ethnicity for the 2013-14 and 2014-15 School Years

Gender	2013-14	2014-15	Ethnicity	2013-14	2014-15
Female	**388**	**356**	**Asian**	**2 (.26%)**	**1 (.13%)**
Male	**374**	**387**	**Black**	**349 (45.80%)**	**374 (50.34%)**
			Hispanic	**68 (8.92%)**	**55 (7.40%)**
			Indian	**1 (.13%)**	**3 (.40%)**
			Multiracial	**63 (8.27%)**	**52 (7.00%)**
			Unidentified	**4 (.52%)**	**3 (.40%)**
			White	**275 (36.09%)**	**255 (34.32%)**

Tables 3.0 and 3.1 provide Grace Academy student enrollment percentage data for the 2013-14 and 2014-15 school years. It is important to note that days enrolled and days in attendance are different statistics. Days enrolled documents the number of school days that a student was officially registered in the Grace Academy and thus entitled to participate in both off campus and on campus online learning whereas days in attendance documents those school days where the student was physically present in one of the Grace Academy's brick and mortar facilities.

As a drop-out prevention school, keeping at-risk youth enrolled as well as attending was a challenging goal. Students enrolled in the Grace Academy often had a history of poor attendance which is often cited as a predictor of dropping-out. The goal of the Grace Academy was to break this poor attendance/dropout cycle through a combination of counseling, continual positive feedback from instructional staff, and incentives. Unfortunately, the Grace Academy was unsuccessful keeping all students enrolled and moving forward academically. Despite these failures, the Grace Academy was able to keep a large number of at-risk students successfully engaged in the academic process. Table 3.0 provides, for both school years, the number of students who were enrolled in the following four categories: 10 days through 50 days, 51 days through 100 days, 101 days through 150 days, and 151 days through 180 days. It is important to note that the largest number of students for both school years fell into the 136-180 days of enrollment category. This statistic documents that the Grace Academy helped many at-risk students achieve high levels of school attendance as defined by working either online and/or in a brick and mortar facility.

Table 3.1 provides Grace Academy's mean, standard deviation, and minimal/maximum enrollment data for each school year. Other than securing a slightly larger mean for the 2013-14 school year, the data in Table 3.1 reflects almost identical standard deviations and minimum/maximum data for both school years.

Table 3.0

Student Days Enrolled for the 2013-14 and 2014-15 School Years

Calendar Days Students Were Enrolled	Students Enrolled 2013-14	Student Percentage 2013-14	Students Enrolled 2014-15	Student Percentage 2014-15
10-45	**160 students were in the 10 through 45-day category**	**21.0%**	**173 students were in the 10 through 45-day category**	**23.3%**
46-90	**142 students were in the 46 through 90-day category**	**18.6%**	**142 students were in the 46 through 90-day category**	**19.1%**
91-135	**99 students were in the 91 through 135-day category**	**13.0%**	**104 students were in the 91 through 135-day category**	**14.0%**
136-180	**361 students were in the 136 through 180-day category**	**47.4%**	**324 students were in the 136 through 180-day category**	**43.6%**

Table 3.1

Student Days Enrolled: Means, Standard Deviation, Minimum and Maximum for the 2013-14 and 2014-15 School Years

School Year	Students	Mean Days Enrolled	Std. Dev.	Min	Max
2013-14	**762**	**115.35**	**61.23**	**10**	**180**
2014-15	**743**	**111.52**	**61.16**	**11**	**180**

Grade Levels and Credits Earned

Table 4.0 documents the grade level enrollment and percentage at each grade level based on the graduation credits each student earned. The Ohio Revised Code 3313.603 requires a student to earn twenty credits to graduate with each credit necessitating both documented academic proficiency and a minimum of 120 hours of potential seat-time. This seat-time requirement is waived for Ohio online charter schools such as the Grace Academy where students earn a graduate credit based upon demonstration of proficiency in the course's academic content thus providing these students with the opportunity to earn graduate credits without the requirement of being enrolled in a class for 120 hours. The Grace Academy adhered to the Ohio Department of Education's credits earned standard of five units for sophomore status, ten units for junior status, sixteen units for senior status, and twenty units to graduate.

It must be noted that with the exception of the 2013-14 eleventh grade, the number of Grace Academy students enrolled at each successive grade level decreased. This trend of fewer students at each succeeding grade level was not uncommon in high

schools that utilized credits earned to promote students to the next grade level. This was due to students who failed to secure the necessary credits for promotion and students who dropped out of school. Such factors were often amplified in a dropout prevention high school.

Table 4.0

Students: Disaggregation by Grade Level of Credits Earned for the 2013-14 and 2014-15 School Years

School Year	Grade Level	Grade Levels Defined by Credits Earned	Numbers of Students at Each Grade Level Based on Credits Earned	Percentage of Students at Each Grade Level Based on Credits Earned
2013-14	**Nine**	**0-4**	**336**	**44.09**
	Ten	**5-9**	**131**	**17.19**
	Eleven	**10-15**	**186**	**24.41**
	Twelve	**16-20**	**109**	**14.30**
2014-15	**Nine**	**0-4**	**361**	**48.59**
	Ten	**5-9**	**153**	**20.59**
	Eleven	**10-15**	**136**	**18.30**
	Twelve	**16-20**	**93**	**12.52**

Special Education

Table 5.0 provides data on the number and percentage of special education students enrolled in the Grace Academy for the 2013-14 and 2014-15 school years. It is important to note that for both school years over 20% of the enrolled students were

designated as special education and thus were provided additional services as determined by their annual Individual Education Plan (IEP). It should also be noted that for both school years the number and percentage of special education students were very similar.

Table 5.0

Special Education Enrollment for the 2013-14 and 2014-15 School Years

School Year	Sp. Ed. Enrollment	Percentage
2013-14	**163**	**21.39**
2014-15	**162**	**21.80**

Family Income

Table 6.0 provides for 2013-14 and 2014-15 school years family income ranges for Grace Academy students based on zip code of residence. Table 6.1 provides for both school years the student enrollment, mean, standard deviations, minimum, and maximum. This data documents that for the 2013-14 and 2014-15 there was little fluctuation in enrollment, mean, standard deviation, minimum, and maximum data. This limited fluctuation between the 2013-14 and 2014-15 median income data is highlighted in Table 6.1 which compares the percent of students who fall into the lowest and highest median income categories for each school year. In the 2013-14 school year, 49.21% of the students fell into the income range of $11,220-$22,999. The 2014-15 school year closely mirrored this percentage with 48.86% of the student body residing the $11,220-$22,999 median income range. At the other end of the median income spectrum, 5.63% of the 2013-14 student body were in the median income range of $64,306 while 4.57% of the 2014-15 student body resided in this top median income range.

Table 6.0

Student Median Household Income as determined by Residential Zip Code for the 2013-14 and 2013-14 School Years

Family Income Range	Students: 2013-14 School Year	Median Income	Students:2014-15 School Year
$11,220-$25,999	375 (49.21%)	$11,220-$25,999	363 (48.85%)
$38,589-$45,237	291 (38.19%)	$38,589-$45,237	287 (38.63%)
$46,392-$62,464	53 (6.96%)	$46,392-$62,464	59 (7.94%)
$64,306-$99,063	43 (5.64%)	$64,306-$99,063	34 (4.58%)
Total	762 (100%)	Total	743 (100%)

Table 6.1

Observations, Mean, Standard Deviation and Minimum/Maximum Median Income by Zip Code for the 2013-14 and the 2014-15 School Years

School Year	Students	Mean	Standard Deviation	Min.	Max.
2013-14	762	34383	14000	11220	99063
2014-15	743	34679	14262	11220	99603

Student Attendance in a Brick and Mortar School Facility

Table 7 provides data regarding the percent of days that students attended one of the Grace Academy's brick and mortar locations during the 2013-14 and 2014-15 school years. These data are critical to this study as both research questions addressed the relationship between the time a Grace Academy student spent in one of the Academy's brick and mortar facilities and graduation credits earned.

For the 2013-14 school year, 38 (4.99%) of the students did not attend a brick and mortar facility while 63 (8.34%) did not attend a brick and mortar facility during the 2014-15 school year. As all students were required to attend a brick and mortar facility when taking a course's final examination (passage was the final step in securing a graduation credit) it is possible that some of these students were enrolled in the Grace Academy for an extremely short time period or possibly were students with a disability that made interaction with other students problematic. For students who had such a disability, a Grace Academy staff member visited the student's home and administered the end-of-course exam. Additional examples of students who may not have attended one of the Academy's brick and mortar facilities are: students who shortly after enrollment unexpectedly moved to another county or state; students who violated probation requirements and thus were reincarcerated; and students who were incarcerated due to criminal activity.

As Table 7.0 documents that some Grace Academy students secured no online or in-person attendance, Table 7.0 also documents that in each school year a large percentage of students' online and/or in-person attendance fell in the 1-10 day range.

During the 2013-14 school year 30.18% of the Academy students attended school via online or in-person less that 11 days. This percentage for the 2014-15 school year was 33.39%.

Finally, as might be expected for a school that targeted at-risk students, Table 7.0 documents that for both school years student attendance in Grace Academy's brick and mortar facilities declined as the school year progressed. During the 2013-14 school year the number of students who attended a brick and mortar facility over 150 days was 24 (3%), a number and percentage that was closely matched during 2014-15 school year with 15 students (2%) in attendance at a brick and mortar facility over 150 days.

It is also important to note that possible enrollment days for the two school years differ with the 2013-14 school year reflecting 224 days instead of the state mandated 180 days documented for the 2014-15 school year. The Grace Academy staff extended the 2013-14 school year for nine students who experienced special circumstance that required the successful completion of one or more courses prior to the beginning of the 2014-15 school year. Examples of such circumstances were potential employment, the military, or court mandates. The 2014-15 school year data does not reflect students attending beyond 180 days as the school's staff addressed special end-of-the-school year academic needs by enrolling the students in the Academy's summer school program.

Table 7.0

The Number and Percent of Days that Students Attended a Grace Academy's Brick and Mortar Facilities.

Potential Days in a Brick and Mortar Facility	Number and Percentage of Students in Attendance for the 2013-14 School Year	Number and Percentage of Students in Attendance for the 2014-15 School Year
0	38 (4.99%)	62 (8.34%)
1-10	230 (30.18%)	248 (33.39%)
11-20	93 (12.20%)	95 (12.72%)
21-30	68 (8.91%)	65 (8.75%)
31-40	52 (6.82%)	45 (6.05%)
41-50	48 (6.31%)	39 (5.23%)
51-60	37 (4.83%)	29 (3.90%)
61-70	29 (3.78%)	25 (3.35%)
71-80	26 (3.40%)	21 (2.81%)
81-90	32 (4.18%)	18 (2.42%)
91-100	15 (1.95%)	15 (2.00%)
101-110	21 (2.73%)	14 (1.86%)
111-120	10 (1.30%)	13 (1.73%)
121-130	13 (1.69%)	14 (1.87%)
131-140	10 (1.30%)	9 (1.19%)
141-150	16 (2.09%)	16 (2.14%)

151-160	**10 (1.30%)**	**6 (0.81%)**
161-170	**4 (0.52%)**	**4 (0.52%)**
171-180	**1 (0.13%)**	**5 (0.66%)**
181-224	**9 (1.17%)**	**0 (0.00%)**
Total	**762 (100.00%)**	**743 (100.00%)**

Table 7.1 documents that the mean for days students attended one of the Grace Academy's brick and mortar facilities declined from the 2013-14 school year to the 2014-15 school year. This decline is reflected in the following mean and standard deviation data: 2013-14 n (762) mean 40.88 (s=45.52); 2014-15 n (743) mean 35.11 (s=42.61). One possible factor for this decline is that the 2013-14 included 224 days while the 2014-15 school year, which had 19 fewer students, was reduced by 44 days to 180.

Table 7.1

Students, Mean, Standard Deviation, and Minimum/Maximum for Days in Attendance During the 2013-14 and the 2014-15 School Years

School Year	Students	Mean	Standard Deviation	Minimum	Maximum
2013-14	**762**	**40.88**	**45.52**	**0**	**224**
2014-15	**743**	**35.11**	**42.61**	**0**	**180**

Research Question One

Research Question One: In a blended learning environment does the number of days spent in the school's brick and mortar facility have a positive effect on student achievement based on credits earned?

Caliendo and Kopeinig (2005) discussed the fundamental problem with assessing causation by asserting as it is not possible to simultaneously observe the effects of treatment and nontreatment in the same individual. Caliendo and Kopeinig addressed this problem through the utilization of PSM which establishes control and treatment groups that are "similar in all relevant pre-treatment characteristics" (Caliendo & Kopeinig, 2005. P. 1).

As discussed in Chapter Three, Propensity Score Matching (PSM) utilizes logistic regression to create a treatment group (1) and a nontreatment group (0) thereby allowing for a score between 0 and 1 which predicts the likelihood of the individual receiving treatment.

This study utilized PSM to establish two similar groups of students enrolled in the Grace Academy during the 2013-14 and 2014-15 school years: a treatment group that spent a certain percentage of instructional time in one of the Grace Academy's brick and mortar facilities and a nontreatment group that was similar to the treatment group with the exception of meeting the time-in-school criteria. In nine separate analyses treatment was determined at the following cutpoints: 10%, 20%, 30%, 40%, 50%, 60% 70%, 80%, and 90%. The PSM findings determined if there was a statistically significant (<.05) difference in graduate credits earned between students on either side of these nine cutpoints.

The treatment effects of in-person attendance are presented in Tables 8.0 and 8.1. The outcome is graduation credits earned. In nine different models, the treatment is a different cutpoint for the percent of days in the brick and mortar facility. The covariates

used for matching are: gender (female), ethnicity (Black, Hispanic, multiracial); grade levels (9, 10, and 11); special education; median household income by zip code; and days enrolled in the Academy.

This research study employed Nearest Neighbor (NN) as the PSM matching algorithm. Caliendo and Kopeinig (2005) stated that Nearest Neighbor is the most straight forward means of matching the treatment and control cases. NN matches, based on the closeness of propensity scores, an individual from the control group with an individual from the treatment group. In order to perform a sensitivity analysis for the purpose of determining if the initial estimated effects can be reproduced, PSM in this study utilized two nearest neighbors, one and four. The nearest neighbor of one allowed each control case to be utilized only once while the nearest neighbor of four allowed each control case to be used four times. It must be noted that the utilization of a control case four times increased the quality of the matches thereby reducing bias estimates of treatment effect, but employing a control case four times also reduced the number of individuals used in the match and thus increased error.

Table 8.0

Effects of Various Cutpoints of In-person Attendance on Credits Earned Using Propensity Score Matching with One Nearest Neighbor Match

Treatment Percentage	2013-14 School Year PMS-Match Requested 1	2013-14 School Year PMS-Match Requested 1	2014-15 School Year PSM-Match Requested 1	2014-15 School Year PSM-Match Requested 1
Percentage	Coefficient	Standard Error	Coefficient	Standard Error
10	1.11***	.12	1.25***	.15
20	0.84***	.13	1.32***	.16
30	1.31***	.15	1.81***	.17
40	1.59***	.15	1.86***	.17
50	1.51***	.16	1.68***	.19
60	1.78***	.22	1.86***	.23
70	1.59***	.24	1.86***	.23
80	1.61***	.16	2.38***	.29
90	1.79***	.49	NA	NA

* = p < .05 ** = p < .01 *** = p < .001

Table 8.1

Effects of Various Cutpoints of In-person Attendance on Credits Earned Using Propensity Score Matching with Four Nearest Neighbor Matches

Treatment Percentage	2013-14 School Year PMS-Match Requested 4	2013-14 School Year PMS-Match Requested 4	2014-15 School Year PSM-Match Requested 4	2014-15 School Year PSM-Match Requested 4
Percentage	**Coefficient**	**Standard Error**	**Coefficient**	**Standard Error**
10	**1.05 *****	**.10**	**1.16*****	**.13**
20	**1.00*****	**.10**	**1.38*****	**.14**
30	**1.18*****	**.11**	**1.66*****	**.14**
40	**1.47*****	**.13**	**1.74*****	**.14**
50	**1.45*****	**.13**	**1.78*****	**.16**
60	**1.78*****	**.21**	**1.86*****	**.17**
70	**1.74*****	**.23**	**1.94*****	**.17**
80	**1.69*****	**.16**	**2.34*****	**.30**
90	**1.71*****	**.44**	**NA**	**NA**

* = p < .05 ** = p < .01 *** = p < .001

The 90% cutpoint needs to be treated with caution. First, at .90 the standard error of .40 for 2013-14 and .44 for 2014-15 is much greater than the next largest standard error of .30 found in the 2014-15 school year at the .80 cutpoint. Second, .90 data for school year 2014-15 is unavailable due to PSM perfect failure predictions in the categories of multiracial and grade 11.

The importance of Tables 8.0 and 8.1 is emphasized in Table 9.0 where the increase in student in-person time in school is equated to academic gains as measured by graduate credits earned. That is, in the Grace Academy's blended learning environment during the 2013-14 and 2014-15 school years, Table 9 compares the gains in credits earned for students who had in-person attendance at .10, .20, .30, .40, .50, .60, .70 and .80 to students whose in-person attendance did not meet these eight percent points. For example, in the 2013-14 school year at match one, a student who had .10 in-person attendance at the Grace Academy earned 1.11 more credits than a student who had less than .10 in-person time at the Grace Academy. Similarly, a Grace Academy match one student who had .80 in-person attendance during the 2013-14 earned 1.61 more credits than a student who did not have .80 in-person attendance.

Table 9.0

Table 9.0 provides a summary PSM treatment group findings for eight percentage points during both school years and at both matches. For example, PSM findings document that during the 2013-14 school year at match one, a student whose in-school attendance was .10 earned 1.11 more graduate credits than a student whose in-school attendance was <.10. It is important to note that at all eight percentage points, for both school years, and at both matches the credits earned gain of the treatment group was greater than of the control group. Tables 8 and 8.1 document that this treatment gain was statistically significant (< .001) at all percentage points for both school years and both matches.

Percent of in-person time in the Grace Academy	2013-14 Match 1 Increase in credits earned for students who attended school in-person for a specific percent of time when compared to students who did not attend school in-person for that percent of time.	2014-15 Match 1 Increase in credits earned for students who attended school in-person for a specific percent of time when compared to students who did not attend school in-person for that percent of time	2013-14 Match 4 Increase in credits earned for students who attended school in-person for a specific percent of time when compared to students who did not attend school in-person for that percent of time	2014-15 Match 4 Increase in credits earned for students who attended school in-person for a specific percent of time when compared to students who did not attend school in-person for that percent of time
10%	**1.11**	**1.25**	**1.05**	**1.16**
20%	**0.84**	**1.32**	**1.00**	**1.38**
30%	**1.31**	**1.81**	**1.18**	**1.66**
40%	**1.59**	**1.86**	**1.47**	**1.74**
50%	**1.51**	**1.68**	**1.45**	**1.78**
60%	**1.78**	**1.86**	**1.78**	**1.86**

70%	**1.59**	**1.86**	**1.74**	**1.94**
80%	**1.61**	**2.38**	**1.69**	**2.34**

Narrative Description of Findings for 2013-14 School Year with a Match of One

Based on Tables 8.0, 8.1, and 9.0 the following paragraphs summarize the differences in credits earned between the treatment and control groups for the 2013-14 and 2014-15 employing a match of 1.

A student whose in-person attendance was .10 earned 1.11 more credits than a student whose in-person attendance was less than .10. A student whose in-person attendance was .20 earned .84 more credits than a student whose in-person attendance was less than .20. A student whose in-person attendance was .30 earned 1.31 more credits than a student whose in-person attendance was less than .30. A student whose in-person attendance was .40 earned 1.59 more credits than a student whose in-person attendance was less than .40. A student whose in-person attendance was .50 earned 1.51 more credits than a student whose in-person attendance was less than .50. A student whose in-person attendance was .60 earned 1.78 more credits than a student whose in-person attendance was less than .60. A student whose in-person attendance was .70 earned 1.59 more credits than a student whose in-person was less than .70. A student whose in-person attendance was .80 earned 1.61 more credits than a student whose in-person attendance was less than .80.

Narrative Description of Findings for the 2014-15 School Year with a Match of One

A student whose in-person attendance was .10 earned 1.25 more credits than a student whose in-person attendance was less than .10. A student whose in-person attendance was .20 earned 1.32 more credits than a student whose in-person attendance was less than .20. A student who whose in-person attendance was .30 earned 1.81 more credits than a student whose in-person attendance was less than .30. A student whose in-person attendance was .40 earned 1.86 more credits than a student whose in-person attendance was less than .40. A student whose in-person attendance was .50 earned 1.68 more credits than a student whose in-person attendance was less than .50. A student whose in-person attendance was .60 earned 1.86 more credits than a student whose in-person attendance was less than .60. A student whose in-person attendance was .70 earned 1.86 more credits than a student whose in-person was less than .70. A student whose in-person attendance was .80 earned 2.38 more credits than a student whose in-person attendance was less than .80.

Narrative Description of Findings for 2013-14 School Year with a Match of Four

Based on Tables 8.0, 8.1, and 9.0 the following paragraphs summarize the differences in credits earned between the treatment and control groups for the 2013-14 and 2014-15 employing a match of 1.

A student whose in-person attendance was .10 earned 1.05 more credits than a student whose in-person attendance was less than .10. A student whose in-person attendance was .20 earned 1.00 more credits than a student whose in-person attendance was less than .20. A student whose in-person attendance was .30 earned 1.18 more credits

than a student whose in-person attendance was less than .30. A student whose in-person attendance was .40 earned 1.47 more credits than a student whose in-person attendance was less than .40. A student whose in-person attendance was .50 earned 1.45 more credits than a student whose in-person attendance was less than .50. A student whose in-person attendance was .60 earned 1.78 more credits than a student whose in-person attendance was less than .60. A student whose in-person attendance was .70 earned 1.74 more credits than a student whose in-person was less than .70. A student whose in-person attendance was .80 earned 1.69 more credits than a student whose in-person attendance was less than .80.

Narrative Description of Findings for the 2014-15 School Year with a Match of Four

A student whose in-person attendance was .10 earned 1.16 more credits than a student whose in-person attendance was less than .10. A student whose in-person attendance was .20 earned 1.38 more credits than a student whose in-person attendance was less than .20. A student whose in-person attendance was .30 earned 1.66 more credits than a student whose in-person attendance was less than .30. A student whose in-person attendance was .40 earned 1.74 more credits than a student whose in-person attendance was less than .40. A student whose in-person attendance was .50 earned 1.78 more credits than a student whose in-person attendance was less than .50. A student whose in-person attendance was .60 earned 1.86 more credits than a student whose in-person attendance was less than .60. A student whose in-person attendance was .70 earned 1.94 more credits than a student whose in-person was less than .70. A student whose in-person

attendance was .80 earned 2.34 more credits than a student whose in-person attendance was less than .80.

Multiple Linear Regression

Multiple linear regression (MLR) models were used to support the robustness of the PSM findings. The multiple linear regression models coded a student's percent of in-person attendance as a continuous variable predicting credits earned while accounting for student demographics, grade level, and days enrolled. The results document that in both school years there was a significant positive effect of in-person attendance on credits earned ($b = 2.82, p < .001$ in 2013-14 and $b=3.31, p < .001$ in 2014-15). For the 2013-14 school year the Multiple linear regression findings state that a student with a one unit increase in percent of time in the building would secure a credit earned increase 2.82 units greater than a student whose time in the building increase was less than one unit. For the 2014-15 school year the MLR findings state that a student with a one unit increase in percent of time in the building would secure a credit earned increase 3.31 units greater than a student whose time in the building increase was less that one unit.

Table 10.0

MLR P Value and Coefficient Value when Credits Earned is the Dependent Variable and Time-in-School is the Independent Variable for the 2013-14 and 2014-15 School Years

Variables	Coefficient Value and Standard Error 2013-14		Coefficient Value and Standard Error 2014-15	
Percent in Building	**2.82***	**.18**	**3.31***	**.22**
Female	**.34****	**.10**	**. 69****	**.12**
Black	**-.29***	**.11**	**-.21**	**.13**
Hispanic	**-.25**	**.18**	**-.11**	**.24**
Multiracial	**-.40***	**.19**	**-.03**	**.24**
Grade 9	**-.92*****	**.15**	**-1.19*****	**.19**
Grade10	**-.54****	**.17**	**-.77*****	**.21**
Grade 11	**-.50****	**.16**	**-.53***	**.21**
Disability Condition	**.63*****	**.12**	**.61*****	**.14**
Median Income	**3.96**	**3.67**	**6.83**	**4.37**
Calendar Days Enrolled	**.01*****	**.00**	**.01*****	**.00**
Cons	**-.47**	**.24**	**-.73***	**.30**

* = p < .05 ** = p < .01 *** = p < .001

The PSM results suggest that at every cutpoint of percentage of days attended in-person there was a statistically significant ($p < .001$) positive effect on graduate credits earned. The reported MLR findings support the PSM results.

Research Question One Findings

Research Question One is validated by the findings found in Tables 8.0, 8.1, 9.0 and 10 which documented that in a blended learning educational setting the number of days spent in the school's brick and mortar environment has a statistically significant ($p < .001$) positive effect on student academic achievement. The validation of Research Question One supports this research study moving forward with an analysis of Research Question Two.

Research Question Two

Research Question Two: If Research Question One is answered in the affirmative, is there a point in time where increasing student time in the brick and mortar facility has diminishing returns based on credits earned?

Tables 8.0 and 8.1 document that significance ($p < .001$) is secured at each of the eight cutpoints for both school years at match one and match four.

Research question 2 findings

Research Question 2 is "no" with the caveat as detailed in Table 11.0.

Table 11.0

Based on coefficients, increases in credits earned from .10 time in the facility to .40 of time in the facility compared to increases in credits earned from .50 time in the facility to .80 of time in the facility for both 2013-14 and 2014-15 school years with both match requests of 1 and 4.

Treatment Percentage	2013-14 School Year Coefficient Increase with PSM Match of 1	2013-14 School Year Coefficient Increase with PSM Match of 4	2014-15 School Year Coefficient Increase with PSM Match of 1	2014-15 School Year Coefficient Increase with PSM Match of 4
.10 through .40	**0.48**	**0.42**	**0.61**	**0.58**
.50 through .80	**0.10**	**0.24**	**0.70**	**0.56**

Table 11.0 documents that in seven of the eight coefficients the greatest gains in credits earned occurred for students whose in-person time in school fell in the .10 through .40 cutpoint range. Only in the .50 through .80 cutpoint range in the 2014-15 school year at match of 1 were the gains greater than in the .10 through .40 cutpoint range. It must be noted that Tables 8.0 and 8.1 document, in general, larger standard error scores in the .50 through .80 in-person attendance range for both school years and in both matches one and four than in the .10 through .40 in-person attendance range. Thus, caution is called for in interpreting the data in .50-.80 cutpoint range as the larger standard errors reflect a greater means spread and thus an increased likelihood of not accurately reflecting the true mean.

It must also be noted that Table 11.0 documents that student gains in school year 2014-15 were greater than student gains in school year 2013-14. The explanation for this difference centers on the Grace Academy's status as a dropout prevention school. By focusing on at-risk students, students whose personal life was often full of uncertainty, the Academy's enrollment was constantly in flux as large numbers of students entered and exited throughout the school year. The students enrolled in the Academy during the beginning of the school year were very different from the students enrolled in the Grace Academy at the end of the school year. This difference in the student enrollment also was evident when comparing two consecutive school years. Thus, it is not surprising that Academy's academic results for 2013-14 were very different from the academic results from the 2014-15 school year.

Quality and Strength of the Findings

Region of Common Support

The PSM Treatment Effect utilized in this dissertation is Average Treatment Effect (ATE). The ATE region of common support, or overlap, requires that the treatment group contain quality matches for all control group cases. One means of assessing the overlap of control and treatment cases is found in the area of common support identified in the PSM teffects overlap output charts. Figures 2-17 in the Appendices of this dissertation, which are located in the Appendices, documented sufficient overlap at each of the eight cutpoints for both school years and both match of one and match of four.

Assessing Match Quality

Standardized differences and variance ratios are used to ensure that match quality is achieved. Acceptable match quality is defined by a standardized difference value < 0.20 and a variance ration between .05 and 2.0. Standardized differences and variance ratios for the 2013-14 school year are found in Tables 12.0 through 12.7 of the Appendices. Standardized differences and variance ratios for the 2014-15 school year are located in Tables 13.0 through 13.7 of the Appendices.

Tables 12.0 through 12.7, located in the Appendices, document that for the 2013-14 school year standardized differences and variance ratio covariate standards were met at the following percentages of student time-in-school: 10, .20, .30, .40, .50, and .60. It is important to note that at .70 student time-in-school the standardized differences for the covariate days enrolled was not met at .80 student time-in-school the standardized differences for the covariate median income was not met.

Tables 13.0 through 13.7, located in the Appendices, document that for the 2014-15 school year standardized differences and variance ratio covariate standards were met at the following student time-in-school: 10, .20, .30, .40, .50, 60, and .70. It is important to note that at .80 standardized differences for the covariates multiracial and grade 9 as well as the variance ratios of multiracial and median income were not met.

Sensitivity Analysis

This dissertation utilized two methods of rerunning the initial analysis for the purpose of determining if the findings can be duplicated. These two methods were the

utilization of nearest neighbors one and four in PSM as well as MLR data for both school years.

Tables 8.0 documents for the 2013-14 and 2014-15 school years findings for a PSM match request of one. The findings verify that each of the eight cutpoints utilized in this study are statistically significant at $p < .001$ with coefficient gains ranging from 0.84 through 2.38.

Table 8.1 documents for the 2013-14 and 2014-15 school years findings for a PSM match request of four. The findings that each of the eight cutpoints points utilized in this study are statistically significant at $p < .001$ with coefficients results that a range from 1.05 to 2.34.

Table 11.0 documents MLS findings for the 2013-14 and 2014-15 school years. The 2013-14 covariate for percent of time in the building has a coefficient value of 2.78. This coefficient value increased to 3.21 for the 2014-15 school year. Both of these coefficients are statistically significant at $p < .001$. Thus, for the 2013-14 school year, for every one unit increase in student time in the building there was a 2.82 increase in credits earned. For the 2014-15 school year, for every one unit increase in student time in the building there was a 3.31 increase in credits earned. Thus, for the 2014-15 school year, for every one unit of increase in student time in the building there was a 3.31 increase in credits earned.

Summary

The findings discussed in Chapter Four document that based on PSM and MLR data Research Question One is validated. For both school years students in that the Grace

Academy's high school blended learning environment achieved a significant (< .001) positive relationship between the amount of time a student spent in the school's brick and mortar facility and the student's academic progress as defined by graduation credits earned.

The findings in Chapter Four refuted Research Question Two by documenting that academic achievement gains for both school years, based on graduate credits earned were statistically significant ($p < .001$) at all eight cutpoints for matches of one and four.

CHAPTER V

DISCUSSION AND CONCLUSION

A review of the current literature regarding the status, benefits, and drawbacks of online learning is provided in Chapter Two of this dissertation. A review of the literature documented that there are two critical online learning areas that lack robust investigation. These two areas are the academic impact of online learning in the elementary and secondary educational arena and instructional strategies that may improve student academic performance in an online learning environment. This dissertation addressed these two research deficiencies by analyzing data from one charter school that employed blended learning to confront the educational needs of high school at-risk youth. The purpose of this analysis was to determine if the educational strategy of increasing the amount of time a student spends in the school's brick and mortar facility had a significant ($<.05$) impact on student academic gain based on graduate credits earned.

In this light, Chapter Five provides, based on the data analysis of a blended learning high school, the following: a summary of the research questions; the Propensity Score Matching (PSM) data, and multiple linear regression findings; a discussion of the value of these findings and how these findings differed from prior research regarding K-

12 online and blended learning; a review of policy implications raised by the presented data; an overview of the limitations of this study; and recommendations for future research.

Summary of Findings

The purpose of this study was to examine in a high school blended learning environment the strength of the relationship between student academic achievement and the amount of time a student spends in the school's brick and mortar facility. The study employed the following two research questions. In a blended learning environment does the percent of time a student spends in the school's brick and mortar facility have a positive effect on student achievement based on credits earned? Is there a point in time where increasing student time in the brick and mortar facility has diminishing returns based on credits earned? It must be noted that Research Question Two could not be addressed if Research Question One was not answered in the affirmative.

The study examined the 2013-14 and 2014-15 data from an urban dropout prevention high school that utilized a blended learning curriculum. Based on the two Research Questions, the study's goal was to establish the strength of the relationship between students' time in the school's brick and mortar facility and students' academic achievement based on graduation credits earned. PSM was utilized for the purpose of creating treatment and control groups. The treatment group comprised students whose in person attendance fell into one the following nine categories: .10, .20, .30, .40, .50, .60, .70, .80, and .90. The control group comprised students whose in-school attendance fell into the following nine categories.: <.10, <.20, <.30, <.40, <.50, <.60, <.70, <.80, and

<.90. Based on insufficient PSM treatment participation the .90 data was removed from the research analysis. The .10 through .80 PSM treatment data documented that significance ($p < .001$) was secured for each of eight treatment categories in both school years, in both matches of one and four, and with coefficients ranging from .84 to 2.38. These findings, located in Tables 8.0, 8.1 and 9.0, validated the study's first research question. For example, the coefficient of 2.38, which was secured at .80 in school year 2014-15 at match one, documented that a Grace Academy student whose in-person attendance was .80 earned 2.38 more graduation credits than a student whose in-person attendance was less than .80.

With the affirmation of Research Question One, analysis moved to Research Question Two: Is there a point in time where increasing student time in the brick and mortar facility has diminishing returns based on credits earned? Tables 8.0 and 8.1 document that significance (< .001) was secured at each cutpoint in both school years and in both matches of one and four. Therefore, the answer to Research Question 2 is negative with the following caveat. Table 11.0 documents that in all eight percentage cutpoints there was academic gain, but the greatest growth in credits occurred in the .10 to .40 range in both school years and in both matches.

The quality and strength of this study's findings are provided via the following: region of common support, assessment of the match quality, and sensitivity analysis. The PSM treatment of effects employed in this analysis was Average Treatment Effect (ATE). ATE provided confirmation that the treatment group contained quality matches for all control cases. This finding is confirmation via the sixteen PSM effects overlap

output charts found in Appendices Figures 2.0 through 9.0 for the 13-14 school year and Figures 10.0 through 17.0 for the 2014-15 school year. The required match quality of standardized differences < 0.20 and variance ratios between 0.05 and 2.0 are documented in the Appendix Tables 12.0 through 12.6 for the 2013-14 school year and Tables 13.0 through 13.7 for the 2014-15 school year. Finally, the sensitivity analysis for this study successfully utilized two methods for the purpose of determining if the findings can be duplicated: nearest neighbors (one and four) and MLR. The MLR analysis utilized credits earned as the dependent variable and time-in-school as the independent variable with the results for both school years found in Table 10.0. Nearest neighbor data for both school years is located in Table 11.0.

Discussion

The purpose of this dissertation was to validate a research-based strategy that improved the educational outcomes of blended learning. Chapter Two documents that online and/or blended learning research has almost exclusively focused on determining which educational format is superior: traditional face-to-face or online. It is the position of this study that as traditional face-to-face and online instruction will continue to be utilized in the nation's elementary and secondary schools, research should focus on ways to improve the learning outcomes of both instructional formats. Thus, the focus of this study was to determine if there exists a positive correlation in a blended learning environment between the time a student spends in the brick and mortar facility and the student's academic growth. Study results document that student in-person attendance makes a statistically significant (<.001) difference in student academic gain. In both

school years (2013-14 and 2014-15) at all sixteen percentage points of student time in-school, those students with more in-person attendance earned more graduate credits than students with less in-person attendance. The findings of this study support the position that in a blended school environment increased student time in the school's brick and mortar facility correlated with increased student academic achievement. Such information, if supported by additional blended leaning research, may provide meaningful guidance to both K-12 educators and educational policy makers.

The following overview of this study's findings for both school years at a match of one document the potential importance of this study's findings.

2013-14 School Year with a Match of One

A student whose in-person attendance was .10 earned 1.11 more credits than a student whose in-person attendance was less than .10. A student whose in-person attendance was .20 earned .84 more credits than a student whose in-person attendance was less than .20. A student whose in-person attendance was .30 earned 1.31 more credits than a student whose in-person attendance was less than .30. A student whose in-person attendance was .40 earned 1.59 more credits than a student whose in-person attendance was less than .40. A student whose in-person attendance was .50 earned 1.51 more credits than a student whose in-person attendance was less than .50. A student whose in-person attendance was .60 earned 1.78 more credits than a student whose in-person attendance was less than .60. A student whose in-person attendance was .70 earned 1.59 more credits than a student whose in-person was less than .70. A student whose in-person

attendance was .80 earned 1.61 more credits than a student whose in-person attendance was less than .80.

2014-15 School Year with a Match of One

A student whose in-person attendance was .10 earned 1.25 more credits than a student whose in-person attendance was less than .10. A student whose in-person attendance was .20 earned 1.32 more credits than a student whose in-person attendance was less than .20. A student who whose in-person attendance was .30 earned 1.81 more credits than a student whose in-person attendance was less than .30. A student whose in-person attendance was .40 earned 1.86 more credits than a student whose in-person attendance was less than .40. A student whose in person attendance was .50 earned 1.68 more credits than a student whose in-person attendance was less than .50. A student whose in-person attendance was .60 earned 1.86 more credits than a student whose in-person attendance was less than .60. A student whose in-person attendance was .70 earned 1.86 more credits than a student whose in-person was less than .70. A student whose in-person attendance was .80 earned 2.38 more credits than a student whose in-person attendance was less than .80.

In order to place the credits earned data presented in the prior two paragraphs into a real-world context, the Grace Academy was located in a state that requires a high school student to earn twenty units to graduate with the expectation that each student will earn five credits per year in high school. Thus, a Grace Academy 2014-15 student, at a requested match of 1, whose in-school attendance was .40 earned 1.86 more credits than

a student whose in-school attendance was < .40. This 1.86 credits represent .37 of the student's expected five credits for the 2014-15 school year.

Current Status of Online Policy

Chapter One of this dissertation states that "Without rigorous studies, it is difficult if not impossible, for K-12 educators and policy developers to create and implement research based online instructional practices." Unfortunately, as documented in this dissertation, such rigorous studies are sparse. The importance of this dissertation is that it provides policy developers and K-12 educators with a research finding that is critical in the development and implementation of blended learning. There are six areas where this research finding may be useful: the expansion of blended learning, the predominance of research which focuses on the comparison of traditional face-to-face to online learning; the ongoing discussion regarding the instructional values of virtual versus blended learning; unanticipated challenges to blended learning as an effective instruction tool in K-12; implications of the issue of inequity in student access to blended learning opportunities; and the potential for blended learning to help meet educational needs during a time of national or international crisis such as a pandemic.

Expansion of Online Learning

Escueta et al. (2017) and Staker (2011) discussed how the rapid expansion of online learning has created two impediments that need to be addressed: limited research and inequality. The rapid expansion of online learning has outpaced the ability of educators and policy makers to secure the necessary educational research that is required for the development and implementation of informed online education policies and

practices. Without such research, policy makers and educators have little to no guidance regarding which form of online learning is preferred for different grade levels and for various student demographics. Such a condition is unfair to educators, students, and taxpayers.

The findings in this research study provide both policy makers and educators with statistically significant (< .001) data regarding the educational value of having students spend time on-campus in a blended learning environment. Such information must be the beginning point in developing educational policy focused on blended learning implementation procedures.

Traditional Face-to-Face Instruction versus Online Instruction

Educational research and related policy have focused almost exclusively on the comparison of traditional face-to-face instruction with online instruction. There has been limited research that examines the strengths of online learning in general and blended learning in particular. In all probability neither face-to-face instruction or online instruction will vanish from the nation's K-12 educational environment. Therefore, the focus of research should move toward examining what factors do policy makers and education have some control over that improve the outcomes of online learning in general and blended learning in particular? This research study moves in this direction by documenting that in a blended learning environment the variable of increasing student time in the school's brick and mortar facility, a variable over which school personnel have some control, has a positive impact on the student's academic achievement based on graduate credits earned.

Blended versus Virtual Learning

As with the learning outcome comparison of traditional face-to-face instruction to online instruction, the learning outcome comparison of virtual and blended learning is sparse. The findings of this study document that in a high school blended learning environment increasing the face-to-face time increases student academic performance. These findings may inform future efforts to pilot K-12 blended learning opportunities and measure achievement results. Further comparison studies may shed light on whether or not blended learning outperforms the achievement results of virtual learning.

Implications Related to Inequity Issues

Student inequality has multiple sources. There exists inequality based on the socio-economic status of students. Often related to socio-economic inequality is the varying levels of student access to an expanded curriculum. The following authors explored educational inequality and how technology might assist in reducing the current levels of academic inequality.

Escueta et al. (2017) documented the existence of inequality that is a result of uneven access to technology. The authors stated that minority students and students of poverty experience a disproportionate lack of technology access. The findings of this dissertation document that increasing the student's time in the face-to-face blended learning component may also decrease the academic achievement gap that exists between students of wealth and students of poverty.

Smith (2014) expanded upon the above findings by stating that online learning possesses have the potential for providing all students with positive educational

experiences in the areas of increased social connectedness and expanded teacher support. This is due to the ability of blended learning to enable students to interact with other students as well as their instructor during nontraditional school hours. This provides blended learning students and teachers with the capability to expand their one-on-one social connectedness and academic discussions beyond what can occur in a traditional classroom environment where the student teacher ratio is 25 to one and the instructions is limited to 50 minutes per school day.

The Alliance for Excellent Education (AEE, 2011) supported the positions detailed in the prior paragraphs by stating that there are three areas where technology is beneficial to the educational process. These three areas are: increased equity and access, improved effectiveness and productivity, and improved student achievement and student outcomes.

The 2020 COVID-19 Pandemic

The World Health Organization (2020) documented that in January 2020 a new virus appeared in Wuhan China. As President Trump reassured the nation that the risk of COVID-19 was low, federal and state health officials warned the nation's K-12 school leaders that the impact of COVID-19 could greatly affect the means by which schools and students interacted (Superville & Lieberman, 2020).

As the pandemic quickly spread around the world, various Asian and European nations closed their schools for the purpose of protecting their students and teachers. By the Spring of 2020 the virus was rapidly expanding in the Western hemisphere. Following the European and Asian response, American schools began to close their

school buildings and offer educational programming to students online. The online educational programming took one of two forms: complete online or blended (Superville & Lieberman, 2020).

As COVID-19 related death and illness continued to rage across the nation during the summer months, educators and policy makers debated the form of instruction K-12 education should adopt for the 2020-21 school year. This debate generally focused on the three options: total face-to-face, total online (virtual), and blended. Lieberman stated that blended appeared to be the favored option (2020).

Virtual learning's advantage was allowing students to learn from their home and thus avoid the possibility of contracting the virus through contact with other students and staff. Virtual learning's drawbacks were limited opportunities for students to engage with the teaching staff and other students (social connectiveness). Face-to-face instruction addressed student learning and social needs, but often placed students and staff in a situation where they were vulnerable to catching a highly contagious and potential deadly virus. Blended, which combined face-to-face and virtual instruction, allowed school personnel to individualize student schedules by creating schedules that individualized the blend of face-to-face and online learning. Such factors as student maturity, student age, student learning style, student special education standing, and student at-risk condition were considered when creating individual student schedules. Thus, blended learning offered educators the ability to match instruction to student need and thereby establish schedules that enabled school staff to implement such safety

measures as social distancing, the use of face masks, and continual disinfecting of school buildings and busses.

The following example details the academic benefits, as documented in this dissertation, of implementing blended learning during the pandemic. Modification of an at-risk high school student's schedule to .90 online instruction and .10 face-to-face instruction secured an academic gain in excess of one graduate credit when compared to a student whose in-school attendance was <.10. Thus, in school with an enrollment of 500, .10 of the student body is 50 students. This would allow the school to create ten groups of 50 students with each group meeting on-site one day during a two week period. Such a student scheduling format enables the school's staff to effectively establish and implement social distancing, face mask requirement, and disinfection for the purpose of maximizing student and staff safety.

In all probability, not all 500 students would require in-school scheduling. Thus, the percent of time in school could be adjusted from 10% upward based on individual student academic needs. While the staff of each school utilizing a blended curriculum would establish criteria for the identification and scheduling of students into the in-school component, following are some potential guidelines. Tables 8.0 and 8.1 document a gain in credits earned as the student time in the building increases. Table 11.0 provides data that suggests the greatest gains in credits earned occur in seven out of eight categories in the 10% through 40% range. Given the fact that many at-risk students have, for a variety of reasons, poor attendance, scheduling these students into the brick and mortar facility one through four days every two weeks may be the most productive option for both the

students and staff. This is reflected in Tables 8.0 and 8.1 which document that a student who attends the brick and mortar facility .40 will earn from 1.47 to 1.86 more graduate credits than a student who attends <.40.

While this study focused on the impact of blended learning in grades 9-12, there exists the possibility that the impact of blended learning in grades K-8 could match or exceed gains documented in grades 9-12. Thus, blended learning may provide for elementary students a safe and productive environment. As students in grades kindergarten through three are in the process of learning the very basics of reading and mathematics, it may be advantageous for a blended school to prioritize these students for face-to-face instruction. Such consideration should also be given to students with an active Individual Education Plan at all grade levels.

Finally, it is important to note that schools currently providing virtual learning possess the ability to implement blended learning with limited additional costs. As long as the teachers providing the face-to-face instruction have the capacity to monitor a student's online work and the school building has one or more computer labs where the students and teachers can interact with proper social distancing and face masks, additional costs would be limited to transportation, food service, and opening the school building.

Limitations of the Study

A critical limitation of this study is related to the particularities of Grace Academy's form of instruction. This dissertation's findings regarding the significant relationship between time spent in the brick and mortar facility and academic gain cannot

be divorced from the specific instructional procedures utilized at the Grace Academy. These procedures, which are detailed in Chapter Two, ensured that a student attending the Academy's brick and mortar facilities received immediate one-on-one assistance from a teacher certified in the student's academic area of study. Thus, in the Grace Academy's downtown facility a student working in Algebra I was seated in the Academy's math/science lab. If a student experienced difficulty with the Algebra I online curriculum, the student raised his or her hand and received immediate one-on-one assistance from a licensed mathematics teacher. This one-on-one assistance continued until the teacher and student were satisfied that the math concept in question was mastered. A blended school that does not follow the Grace Academy's form of personalized assistance may not be able to duplicate this study's findings.

This research study focuses on one charter school, the Grace Academy, that provided blended learning services to at-risk high school students in grades 9-12, utilizing one of many blended learning curricula. The analyzed data covered only two school years. This study documents a statistically significant correlation between the time a student spends in the blended school's brick and mortar facility and the student's academic growth. This finding provides new information to researchers, educators, and policy makers. Validation of this finding must be secured through additional research regarding the relationship between time spent in a blended school's brick and mortar facility and student academic gain. Additional research may expand upon the grade levels, the student demographics, and the online curricula utilized in this study. Such

studies may consider expanding the outcome variables to include test scores and end-of-course grades.

There are also some PSM limitations that must be noted. Steiner and Norman (2012) state that PSM is susceptible to selection bias when the data utilized is secured from pre-existing spread sheets, which is a condition of this study. This is due to the fact that critical data may be omitted thereby allowing the creation of unbalanced groups. The authors also state that limited overlap in the data-set may create problems in the PSM results due to potential sizable reductions in the number of participants, thus causing a situation where the finding is incorrectly identified as ß due to the analysis not finding the difference that exists.

This study addressed such selection bias concern by employing a sensitivity analysis, as recommended by Steiner and Norman (2012), to determine if there is insufficient overlap in the PSM data and thus a potential ß finding. The finding regarding this study is that the PSM data contains sufficient overlap to secure balance treatment and control groups.

Recommendations for Future Research

Some researchers have identified blended learning as the form of distance learning that will dominate online learning in the nation's elementary and secondary schools in the near future (Christensen et al., 2013; Murphy et al., 2014). In light of this prediction, there are two immediate needs. First, the need for additional research that may or may not validate and/or build upon this study's findings is imperative. Second, the

establishment of guidelines that guide the planning and implementation of blended learning programs. This second blended learning need is the focus of this section.

Recommendations for Conditions that will Improve Blended Learning Outcomes

Teachers and Social Connectiveness

Blended learning teachers must be both comfortable with educational technology and flexible in addressing student educational and support needs. Blended learning teachers must also understand the impact that social connectiveness has on student academic gain and their ability to develop relationships in a blended learning environment where students interact with other students in both online and face-to-face environments. The development of social connectiveness is often the first step in an at-risk student moving from a feeling of isolation into a support network consisting of other students who provide support and encouragement.

As blended learning curricula is presented to students at-home and in-school, there exists the need for teachers to become comfortable with and competent in online learning. Blended learning teachers must have the ability to quickly analyze student online progress and develop online activities that can assist the student master an area of difficulty. In the area of face-to-face instruction, the teacher must possess both mastery of the subject area, patience, and the ability to be a cheerleader for those students attempting to grow academically and those students who have not yet reached this academic level.

Administration

Information contained in Tables 8.0, 8.1, and 11.0 provide documentation regarding academic gains that can be secured by at-risk high school students in a blended

learning environment. In order to replicate or improve upon these academic gains, administration must ensure that the Grace Academy's blended learning procedures, as detailed in this dissertation, are replicated by his or her teaching and support staff. Failure to do so may lead to academic results that are not statistically significant at the <.001 level or possibility not statistically significant.

Needed External Support Services

Access to day care, medical support, and legal support are critical to student success. The ability of the at-risk student to attend the brick and mortar facility is often hindered due to the lack of child care, personal illness, or court related matters. To achieve academic growth success, the blended school's leadership must establish meaningful linkages with an array of area social service agencies. These agencies can often provide child care, medical care, and legal representation to students and at times families.

The Student is Always the Number One Priority

The blended learning's face-to-face programming must be welcoming to both the student and his or her parents/guardians. Often the student and parents/guardians have experienced unwelcoming environments from both school and community agency staffs. Thus, there often exists in both students and parent/guardians a defensive posture that must be bridged before meaningful instruction and counseling can occur. One strategy that the Grace Academy utilized to bridge distrust was prompt access to teachers and support staff. Students who were working online or in the brick and mortar facility received immediate assistance during school hours and timely assistance during non-

school hours. The assistance was always provided in a respectful manner with the intent of successfully addressing the problem or concern. The philosophy of respectful and meaningful assistance was reflected in the Grace Academy's face-to-face instructional programming. Students attending one of the Grace Academy's four brick and mortar facilities were assigned a to a computer based on the student's area of study. For example, in the downtown facility a student studying mathematics was assigned to a computer in the school's math and science lab. This guaranteed the student had immediate access to certified math teachers who would provide one-on-one instruction when the student raised her or his hand. This one-on-one assistance would be provided until the teacher and student were confident that the area of concern had been successfully addressed. In short, Grace Academy's students and parents were confident that their questions or concerns would always be handled in a timely and respectful manner.

Conclusion

Due to such factors as reduced educational funding levels and growing numbers of students who cannot or will not function in a traditional face-to-face curriculum, blended learning will continue to expand throughout the nation's K-12 school system (Escueta et al., 2017; Murphy et al., 2014). This expansion demands additional research which identifies those implementation procedures that secure the greatest student academic gain. To obtain the best possible results, these research findings need to be incorporated into educational policy. The critical question is no longer whether online learning and/or blended learning is equal to or better than traditional face-to-face

learning. The critical question is what are the factors over-which administrators and teachers have some influence which increase the effectiveness of blended learning? This study begins to address this question.

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APPENDICES

Table 12.0

Standardized Differences and Variance Ratio for the 2013-14 School Year with .10 Percent of Student Time In-school

Percent In Building	Covariates	Standardized Differences		Variance Ratio	
		Raw	Matched	Raw	Matched
.10	Female	.013	.048	.997	1.00
	Black	.456	-.017	1.18	.997
	Hispanic	-.187	-.028	.600	.924
	Multiracial	.020	-.011	1.06	.969
	Grade 9	.241	-.026	1.08	.994
	Grade 10	.218	.024	1.52	1.04
	Grade 11	-.152	.036	.842	1.04
	Disability	.067	.048	1.10	1.07
	Median Income	-.291	-.012	.600	.878
	Days Enrolled	.214	.008	.944	.947

Table 12.0 documents in the Matched columns that adequate balance (Standardized Difference (<0.20) and Variance Ratio (0.5-2.0) is secured for each covariate.

Table 12.1

Standardized Differences and Variance Ratio for the 2013-14 School Year with .20 Percent of Student Time In-school

Percent In Building	Covariates	Standardized Differences		Variance Ratio	
		Raw	Matched	Raw	Matched
.20	Female	-.046	-.019	1.00	1.00
	Black	.203	.030	1.07	1.01
	Hispanic	-.141	-.012	0.67	1.03
	Multiracial	.009	.046	1.03	1.15
	Grade 9	.253	.035	1.07	1.01
	Grade 10	.146	-.005	1.30	0.99
	Grade 11	-.187	-.045	0.81	0.95
	Disability	.038	-.010	1.05	0.99
	Median Income	-.177	-.035	0.68	0.84
	Days Enrolled	.332	-.056	0.91	0.96

Table 12.1 documents in the Matched columns that adequate balance (Standardized Difference (<0.20) and Variance Ratio (0.5-2.0) is secured for each covariate.

Table 12.2

Standardized Differences and Variance Ratio for the 2013-14 School Year with .30 Percent of Student Time In-school

Percent In Building	Covariates	Standardized Differences		Variance Ratio	
		Raw	Matched	Raw	Matched
.30	Female	-.013	.006	1.00	.999
	Black	.254	.095	1.04	1.02
	Hispanic	-.157	-.010	.625	.973
	Multiracial	-.040	-.018	.885	.948
	Grade 9	.179	.011	1.04	1.00
	Grade 10	.146	-.038	1.29	.938
	Grade 11	-.172	.025	.811	1.03
	Disability	-.004	.011	.995	1.02
	Median Income	-.090	-.077	.801	.843
	Days Enrolled	.353	-.041	.907	.975

Table 12.2 documents in the Matched columns that adequate balance (Standardized Difference (<0.20) and Variance Ratio (0.5-2.0) is secured for each covariate.

Table 12.3

Standardized Differences and Variance Ratio for the 2013-14 School Year with .40 Percent of Student Time In-school

Percent In Building	Covariates	Standardized Differences		Variance Ratio	
		Raw	Matched	Raw	Matched
.40	Female	-.006	.031	1.00	.999
	Black	.305	.046	1.03	1.00
	Hispanic	-.172	.009	.585	1.03
	Multiracial	-.052	-.031	.852	.909
	Grade 9	.139	.038	1.03	1.01
	Grade 10	.138	-.010	1.26	.982
	Grade 11	-.154	-.073	.825	.917
	Disability	-.017	.024	.979	1.04
	Median Income	-.092	-.060	.717	.766
	Days Enrolled	.338	-.041	.973	1.06

Table 12.3 documents in the Matched columns that adequate balance (Standardized Difference (<0.20) and Variance Ratio (0.5-2.0) is secured for each covariate.

Table 12.4

Standardized Differences and Variance Ratio for the 2013-14 School Year with .50 Percent of Student Time In-school

Percent In Building	Covariates	Standardized Differences		Variance Ratio	
		Raw	Matched	Raw	Matched
.50	Female	.071	-.012	.998	1.00
	Black	.182	.060	1.02	1.01
	Hispanic	-.091	.004	.761	1.01
	Multiracial	-.113	-.005	.694	.984
	Grade 9	.188	.029	1.03	1.01
	Grade 10	.140	.001	1.26	1.00
	Grade 11	-.272	-.071	.685	.917
`	Disability	-.073	.022	.902	1.03
	Median Income	-.152	-.021	.725	.821
	Days Enrolled	.235	-.062	1.02	1.08

Table 12.4 documents in the Matched columns that adequate balance (Standardized Difference (<0.20) and Variance Ratio (0.5-2.0) is secured for each covariate.

Table 12.5

Standardized Differences and Variance Ratio for the 2013-14 School Year with .60 Percent of Student Time In-school

Percent In Building	Covariates	Standardized Differences		Variance Ratio	
		Raw	Matched	Raw	Matched
.60	Female	.022	.052	1.00	.995
	Black	.111	.064	1.02	1.01
	Hispanic	-.141	.048	.637	1.14
	Multiracial	-.044	-.050	.877	.849
	Grade 9	.207	-.037	1.03	.990
	Grade 10	.034	-.012	1.06	.978
	Grade 11	-.274	.014	.672	1.02
	Disability	-.095	-.014	.872	.981
	Median Income	-.040	-.076	.751	.711
	Days Enrolled	.279	.050	.970	1.06

Table 12.5 documents in the Matched columns that adequate balance (Standardized Difference (<0.20) and Variance Ratio (0.5-2.0) is secured for each c

Table 12.6

Standardized Differences and Variance Ratio for the 2013-14 School Year with .70 Percent of Student Time In-school

Percent In Building	Covariates	Standardized Differences		Variance Ratio	
		Raw	Matched	Raw	Matched
.70	Female	.004	-.017	1.01	1.00
	Black	.071	.064	1.02	1.01
	Hispanic	-.101	.063	.733	1.19
	Multiracial	-.180	-.100	.523	.713
	Grade 9	.184	-.021	1.03	.994
	Grade 10	-.027	-.063	.962	.891
	Grade 11	-.163	.005	.806	1.01
	Disability	-.082	.026	.892	1.04
	Median Income	-.109	-.087	.542	.582
	Days Enrolled	.353	-7.28	.980	1.15

Table 12.6 documents, based on Matched column data, that adequate balance is secured for Standardized Differences (<0.20) and Variance Ratio (0.5-2.0) in all but the following covariant: Standardized Difference (Days Enrolled -7.28).

Table 12.7

Standardized Differences and Variance Ratio for the 2013-14 School Year with .80 Percent of Student Time In-school

Percent In Building	Covariates	Standardized Differences		Variance Ratio	
		Raw	Matched	Raw	Matched
.80	Female	.056	-.041	1.01	1.00
	Black	-.017	.096	1.01	1.01
	Hispanic	-.023	.151	.950	1.47
	Multiracial	-.141	-.131	.617	.631
	Grade 9	.128	-.094	1.03	.967
	Grade 10	.078	-.084	1.15	.855
	Grade 11	-.160	.083	.812	1.09
	Disability	-.179	.038	.756	1.05
	Median Income	-.234	-.210	.514	.585
	Days Enrolled	.361	.021	.994	1.11

Table 12.7 documents, based Matched column data, that adequate balance is secured for Standardize Differences (<0.20) and Variance Ratio (0.5-2.0) in all but the following covariant: Standardized Differences

Table 13.0

Standardized Differences and Variance Ratio for the 2014-15 School Year with .10 Percent of Student Time In-school

Percent In Building	Covariates	Standardized Differences		Variance Ratio	
		Raw	Matched	Raw	Matched
.10	Female	-.024	.035	.996	1.00
	Black	.387	.024	1.04	1.00
	Hispanic	-.009	.014	.971	1.05
	Multiracial	-.078	-.022	.771	.928
	Grade 9	.330	-.001	1.05	1.00
	Grade 10	-.064	-.025	.911	.963
	Grade 11	-.112	.001	.835	1.00
`	Disability	.097	.041	1.15	1.06
	Median Income	-.309	-.042	.672	.981
	Days Enrolled	,354	-.024	.959	.988

Table 13.0 documents in the Matched columns that adequate balance (Standardized Difference (<0.20) and Variance Ratio (0.5-2.0) is secured for each covariate.

Table 13.1

Standardized Differences and Variance Ratio for the 2014-15 School Year with .20 Percent of Student Time In-school

Percent In Building	Covariates	Standardized Differences		Variance Ratio	
		Raw	Matched	Raw	Matched
.20	Female	-.024	.000	.998	1.00
	Black	.358	.022	.996	1.00
	Hispanic	-.096	-.033	.729	.901
	Multiracial	-.130	.024	.639	1.08
	Grade 9	.264	.026	1.02	1.00
	Grade 10	-.053	-.026	.925	.960
	Grade 11	-.104	-.004	.843	.994
	Disability	.019	.028	1.03	1.04
	Median Income	-.229	.021	.720	1.10
	Days Enrolled	.251	-.029	.978	1.00

Table 13.1 documents in the Matched columns that adequate balance (Standardized Difference (<0.20) and Variance Ratio (0.5-2.0) is secured for each covariate.

Table 13.2

Standardized Differences and Variance Ratio for the 2014-15 School Year with .30 Percent of Student Time In-school

Percent In Building	Covariates	Standardized Differences		Variance Ratio	
		Raw	Matched	Raw	Matched
.30	Female	.051	-.002	1.00	1.00
	Black	.329	.014	.972	1.00
	Hispanic	-.046	-.020	.860	.936
	Multiracial	-.090	.025	.733	1.09
	Grade 9	.235	-.013	1.00	.999
	Grade 10	-.052	-.037	.927	.946
	Grade 11	-.107	.043	.826	1.07
	Disability	-.002	.057	.999	1.08
	Median Income	-.269	-.014	.689	1.01
	Days Enrolled	.278	.023	.957	.979

Table 13.2 documents in the Matched columns that adequate balance (Standardized Difference (<0.20) and Variance Ratio (0.5-2.0) is secured for each covariate.

Table 13.3

Standardized Differences and Variance Ratio for the 2014-15 School Year with .40 Percent of Student Time In-school

Percent In Building	Covariates	Standardized Differences		Variance Ratio	
		Raw	Matched	Raw	Matched
.40	Female	.079	-.023	1.01	.997
	Black	.360	-.029	.948	1.00
	Hispanic	.008	.044	1.03	1.15
	Multiracial	-.124	.054	.640	1.19
	Grade 9	.214	.022	.997	1.00
	Grade 10	-.101	-.021	.859	.968
	Grade 11	-.104	-.004	.839	.993
	Disability	-.001	.032	1.00	1.04
	Median Income	-.283	-.006	.623	.983
	Days Enrolled	.307	.027	.974	1.02

Table 13.3 documents in the Matched columns that adequate balance (Standardized Difference (<0.20) and Variance Ratio (0.5-2.0) is secured for each covariate.

Table 13.4

Standardized Differences and Variance Ratio for the 2014-15 School Year with .50 Percent of Student Time In-school

Percent In Building	Covariates	Standardized Differences		Variance Ratio	
		Raw	Matched	Raw	Matched
.50	Female	.032	-.064	1.01	.991
	Black	.255	.058	.967	.997
	Hispanic	.057	.072	1.20	1.24
	Multiracial	-.132	.005	.613	1.02
	Grade 9	.256	-.022	.984	.998
	Grade 10	-.095	-.028	.868	.958
	Grade 11	-.140	.019	.782	1.03
	Disability	-.058	.015	.925	1.02
	Median Income	-.250	.005	.691	1.02
	Days Enrolled	.306	.001	.918	.998

Table 13.4 documents in the Matched columns that adequate balance (Standardized Difference (<0.20) and Variance Ratio (0.5-2.0) is secured for each covariate.

Table 13.5

Standardized Differences and Variance Ratio for the 2014-15 School Year with .60 Percent of Student Time In-school

Percent In Building	Covariates	Standardized Differences		Variance Ratio	
		Raw	Matched	Raw	Matched
.60	Female	.024	.003	1.01	1.00
	Black	.238	.020	.967	1.00
	Hispanic	-.035	-.015	.895	.951
	Multiracial	-.131	.025	.611	1.09
	Grade 9	.338	.026	.953	1.00
	Grade 10	-.183	-.092	.743	.863
	Grade 11	-.217	.037	.663	1.06
	Disability	-.076	.014	.901	1.02
	Median Income	-.175	-.079	.709	.776
	Days Enrolled	.273	-.018	.923	1.05

Table 13.5 documents in the Matched columns that adequate balance (Standardized Difference (<0.20) and Variance Ratio (0.5-2.0 is secured for each covariate.

Table 13.6

Standardized Differences and Variance Ratio for the 2014-15 School Year with .70 Percent of Student Time In-school

Percent In Building	Covariates	Standardized Differences		Variance Ratio	
		Raw	Matched	Raw	Matched
.70	Female	-.059	.063	1.00	1.00
	Black	.123	.005	.996	1.00
	Hispanic	-.055	.063	.835	1.22
	Multiracial	-.088	.007	.731	1.02
	Grade 9	.260	.025	.974	1.00
	Grade 10	-.089	-.015	.877	.977
	Grade 11	-.153	-.053	.760	.915
	Disability	-.154	-.025	.794	.965
	Median Income	-.027	.005	.772	.762
	Days Enrolled	.263	.002	.987	1.02

Table 13.6 documents, based on data in the Matched columns, that adequate balance is secured for Standardized Difference (<0.20) and Variance Ratio (0.5-2.0) in all covariates.

Table 13.7

Standardized Differences and Variance Ratio for the 2014-15 School Year with .80 Percent of Student Time In-school

Percent In Building	Covariates	Standardized Differences		Variance Ratio	
		Raw	Matched	Raw	Matched
.80	Female	-.060	-.005	1.01	1.00
	Black	.314	.099	.931	.989
	Hispanic	-.160	.078	.543	1.27
	Multiracial	-.258	-.202	.287	.404
	Grade 9	.178	-.202	1.00	.948
	Grade 10	.076	-.052	1.13	.924
	Grade 11	-.261	.029	.587	1.06
	Disability	.044	.023	1.08	1.03
	Median Income	-.049	.020	.424	.365
	Days Enrolled	.186	.148	1.05	.977

Table 13.7 documents, based on data in the Matched columns, that adequate balance is secured for Standardized Difference (<0.20) and Variance Ratio (0.5-2.0) in all but the following covariates: Standardized Differences (Multiracial: -.202 and Grade 9: -.202) Variance Ratio (Multiracial: .404 and Median Income: .365).

Figure 2. Overlap of Treatment and Control for 2013-14
with .10 In-school Student Attendance

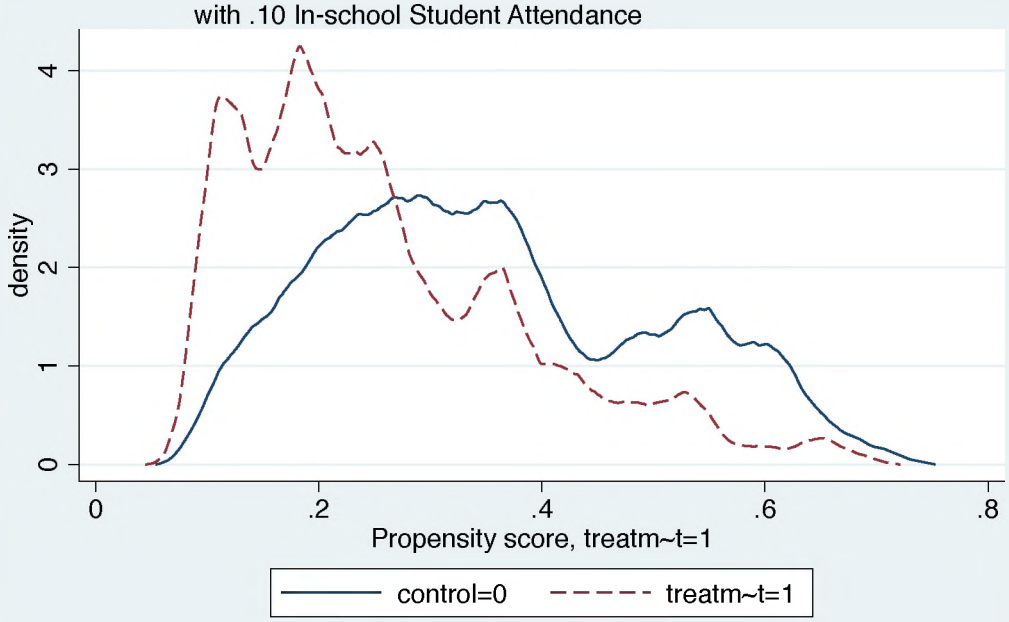


Figure 2 provides evidence of adequate treatment and control overlap.

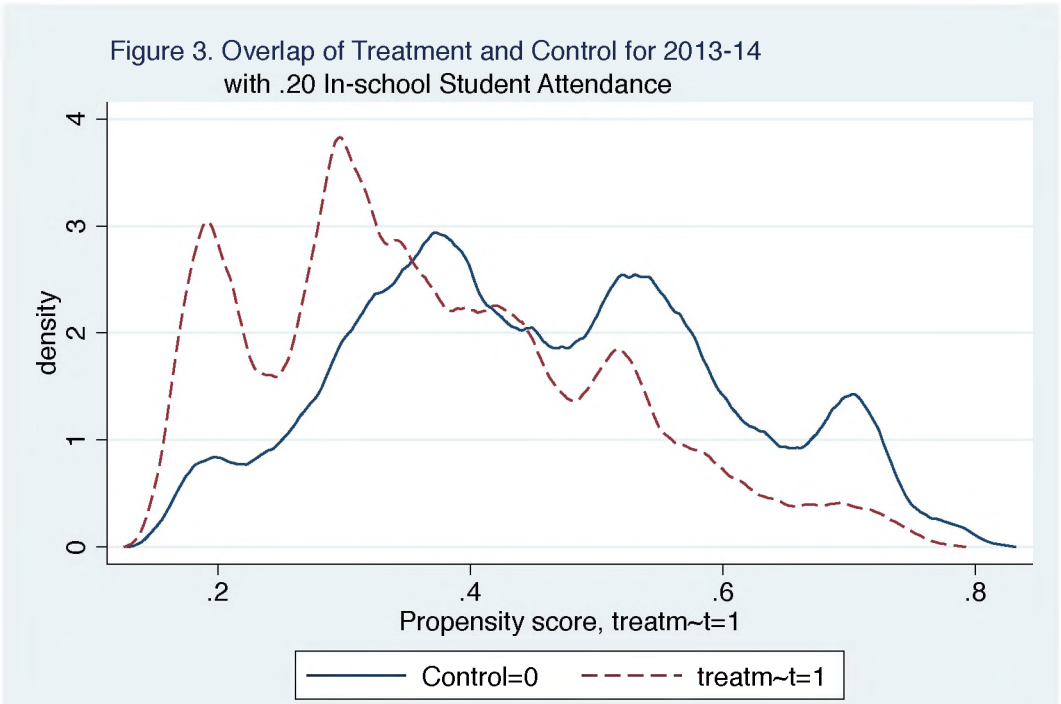


Figure 3 provides evidence of adequate treatment and control overlap.

Figure 4. Overlap of Treatment and Control for 2013-14
with .30 In-school Student Attendance

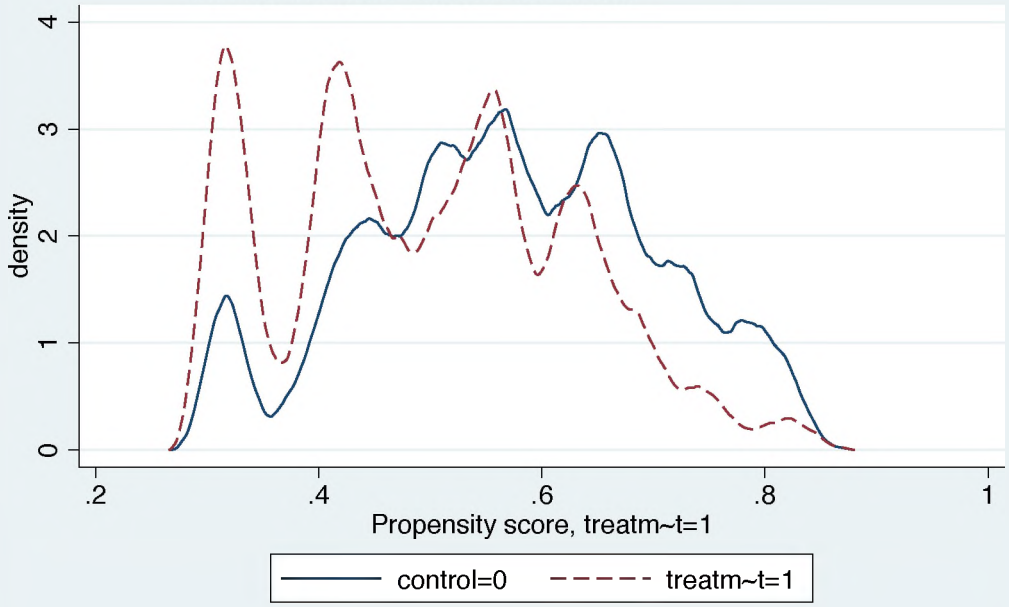


Figure 4 provides evidence of adequate treatment and control overlap.

Figure 5. Overlap of Treatment and Control for 2013-14
with .40 In-school Student Attendance

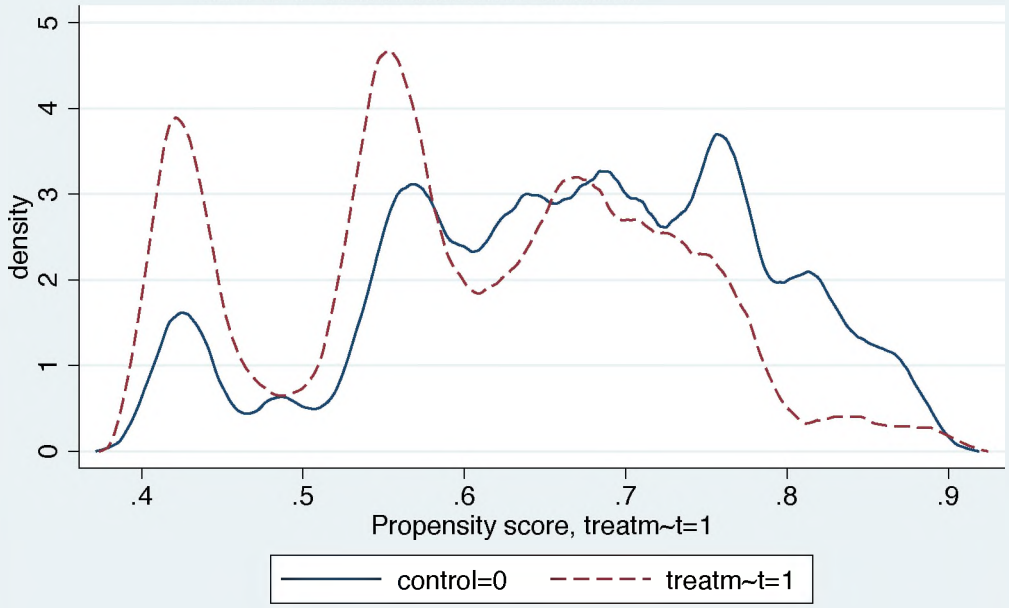


Figure 5 provides evidence of adwquate treatment and control overlap.

Figure 6. Overlap of Treatment and Control for 2013-14
with .50 In-school Student Attendance

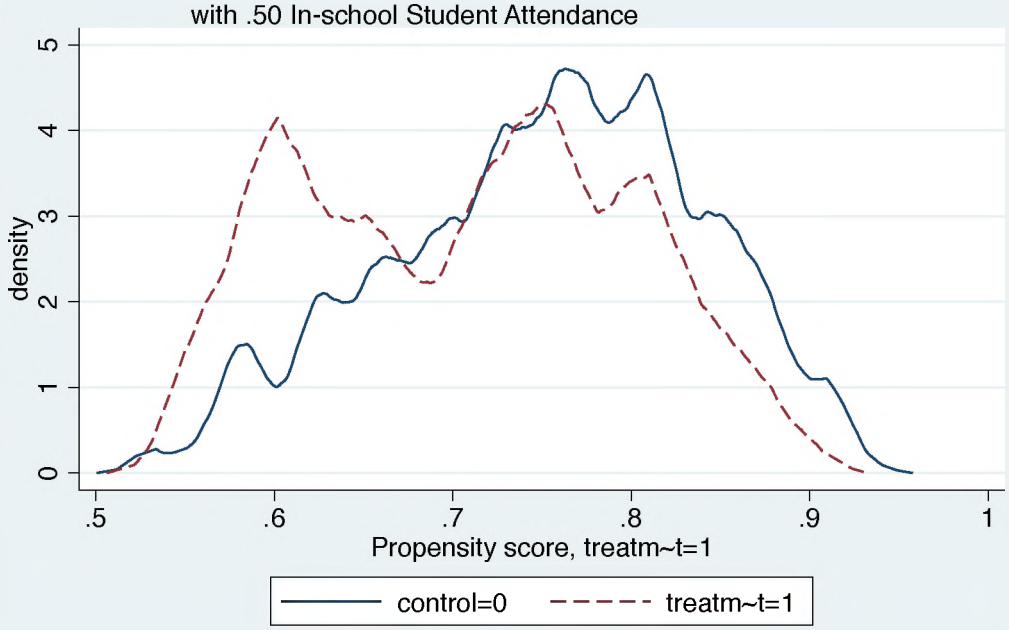


Figure 6 provides evidence of adwquate treatment and control overlap.

Figure 7. Overlap of Treatment and Control for 2013-14
with .60 In-school Student Attendance

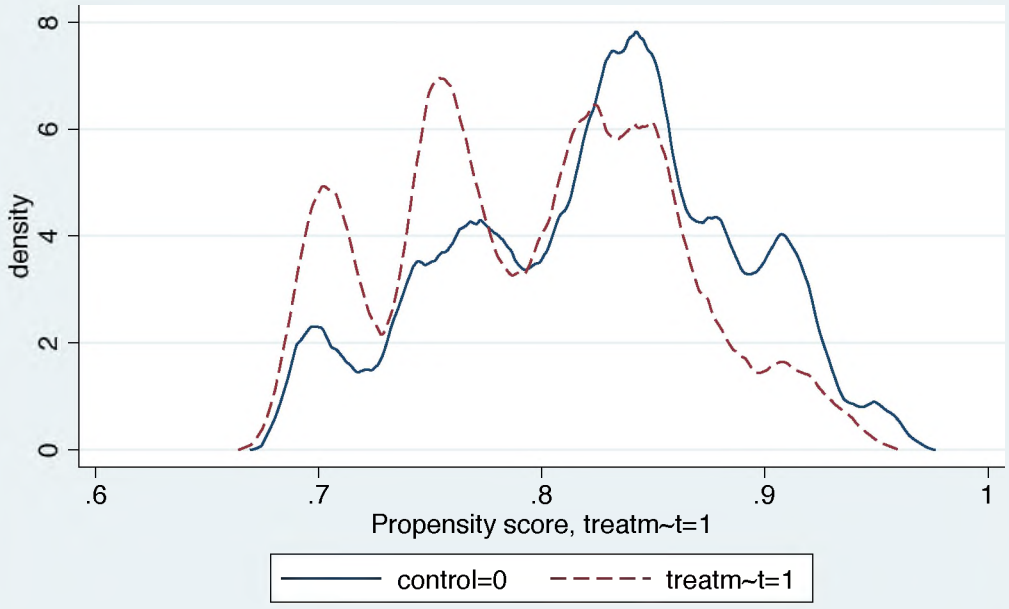


Figure 7 provides evidence of adequate tratment and control overlap.

Figure 8. Overlap of Treatment and Control for 2013-14
with .70 In-school Student Attendance

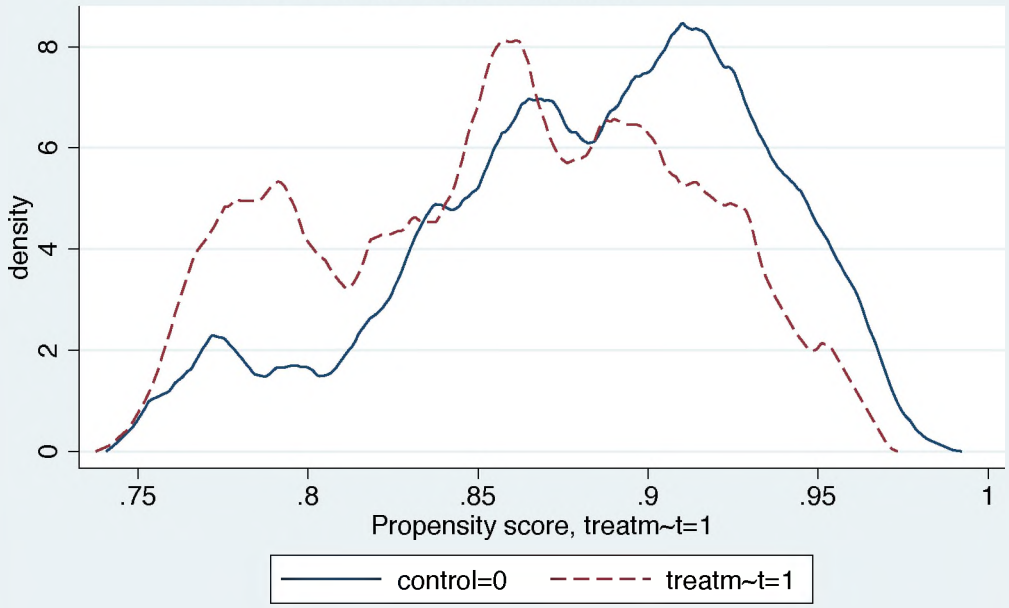


Figure 8 provides evidence of adequate treatment and control overlap.

Figure 9. Overlap of Treatment and Control for 2013-14
with .80 In-school Student Attendance

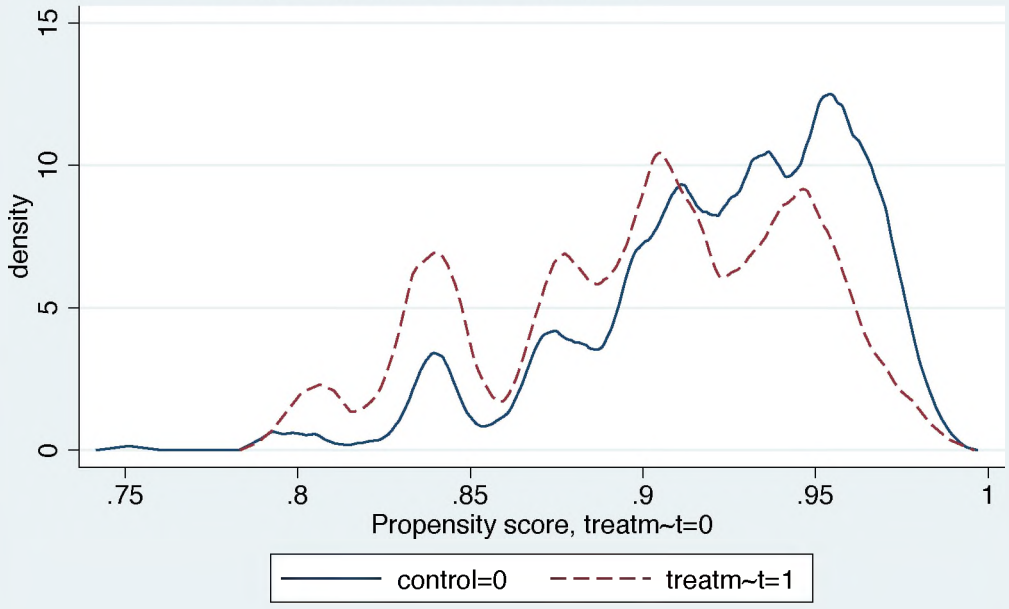


Figure 9 provides evidence of adequate treatment and overlap.

Figure 10. Overlap of Treatment and Control for 2014-15
with .10 In-school Student Attendance

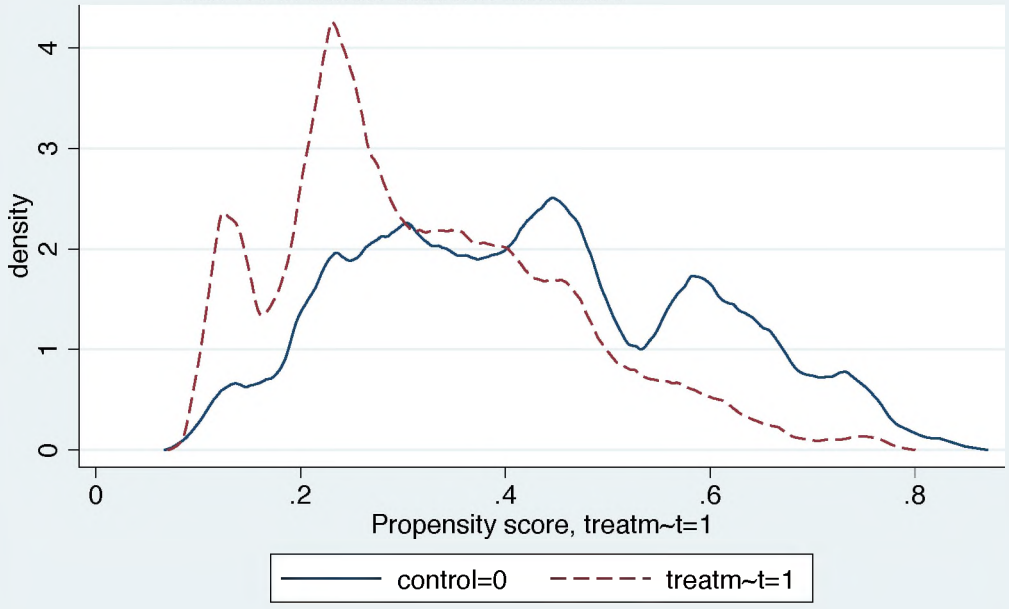


Figure 10 provides evidence of adequate treatment and overlap.

Figure 11. Overlap of Treatment and Control for 2014-15
with .20 In-school Student Attendance

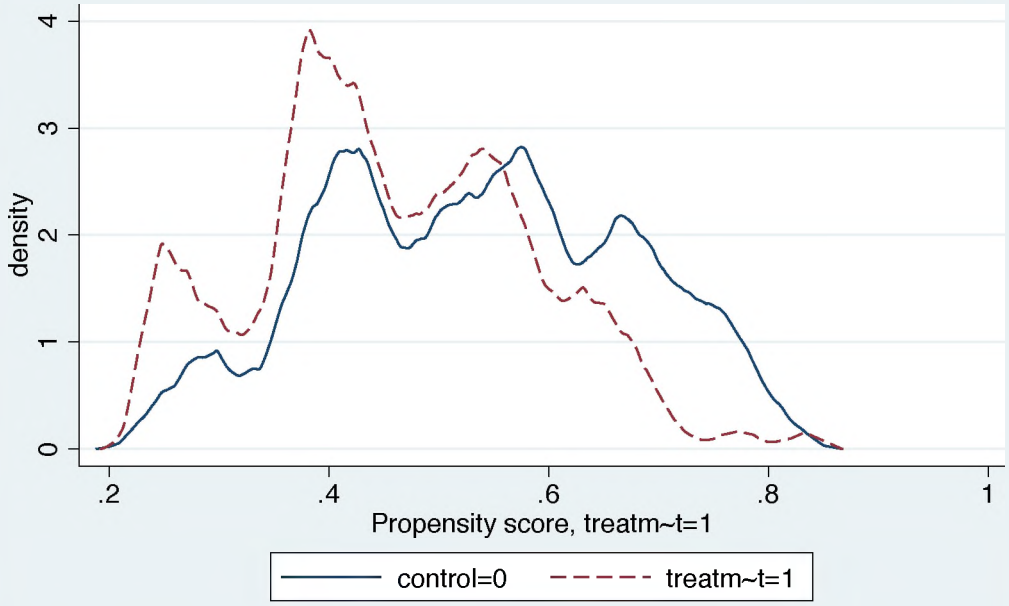


Figure 11 provides evidence of adequate treatment and control overlap.

Figure 12. Overlap of Treatment and Control for 2014-15
with .30 In-school Student Attendance

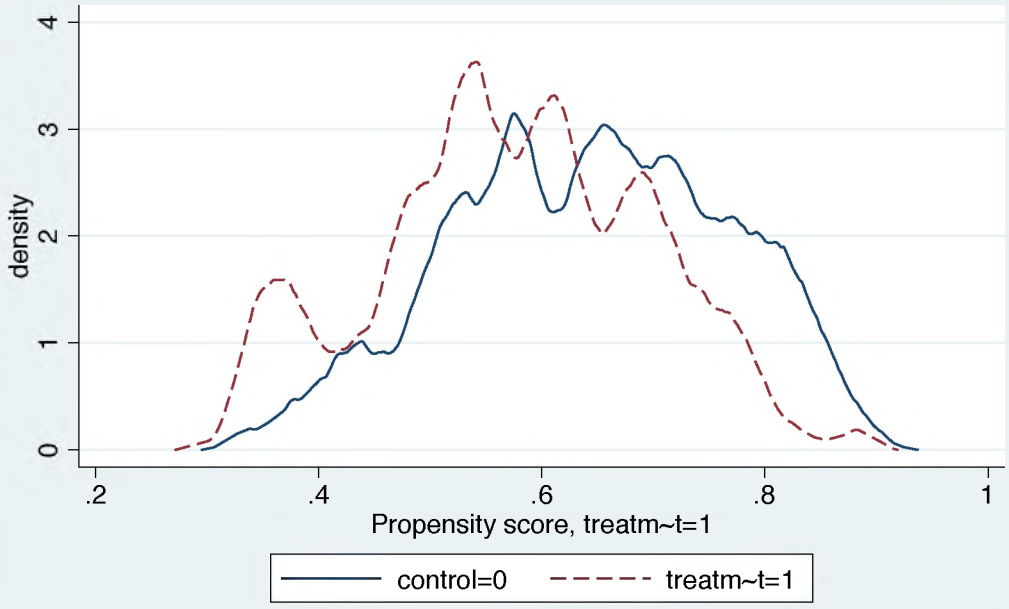
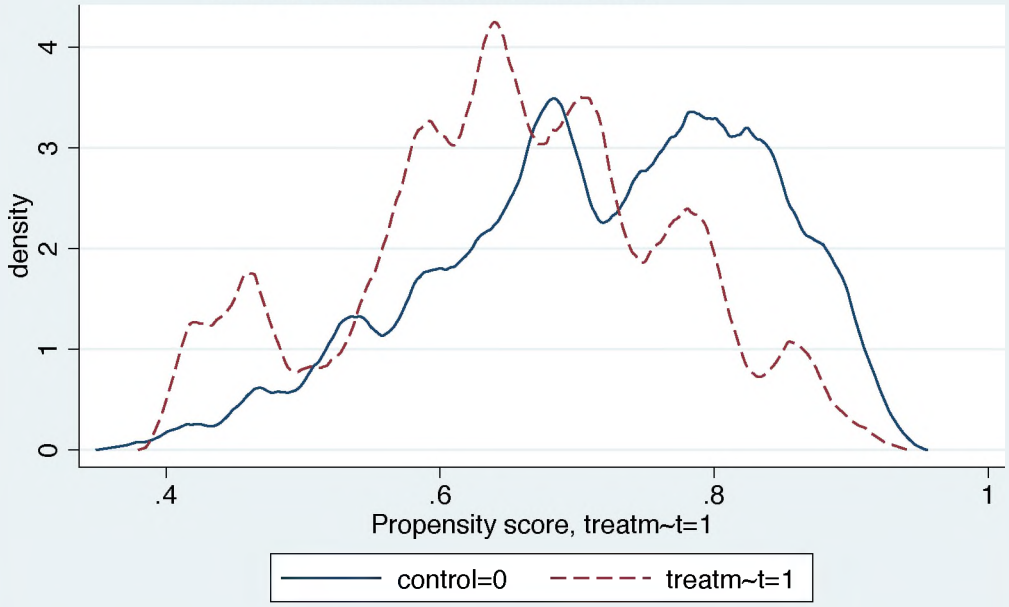


Figure 12 provides evidence of adequate treatment and control overlap.

Figure 13. Overlap of Treatment and Control for 2014-15
with .40 In-school Student Attendance



Fugure 13 provides evidence of adequate treatement and control overlap.

Figure 14. Overlap of Treatment and Control for 2014-15
with .50 In-school Student Attendance

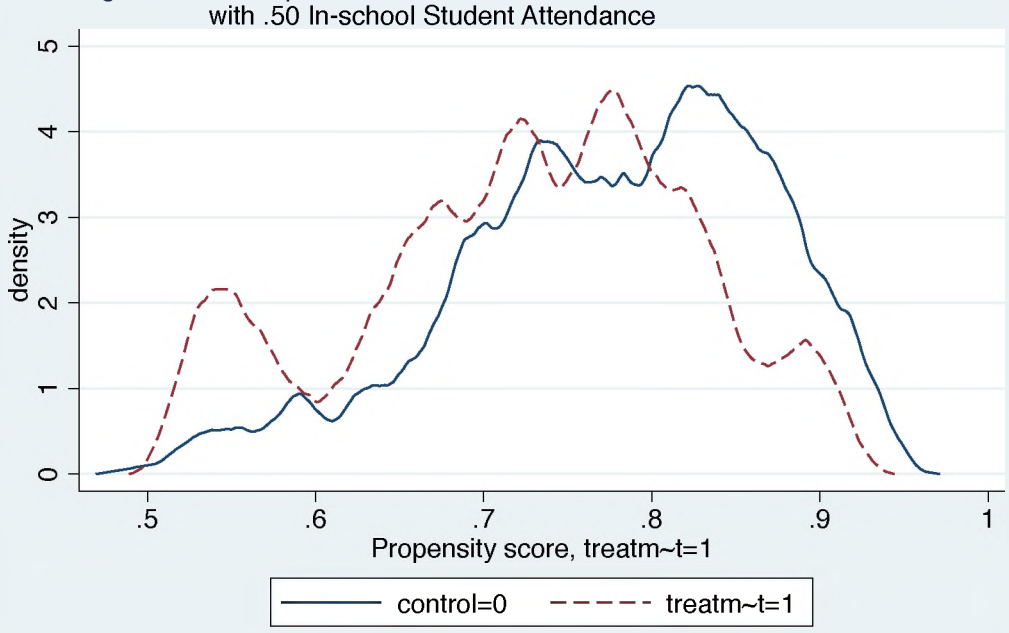


Figure 14 provides evidence of adequate treatment and control overlap.

Figure 15. Overlap of Treatment and Control for 2014-15
with .60 In-school Student Attendance

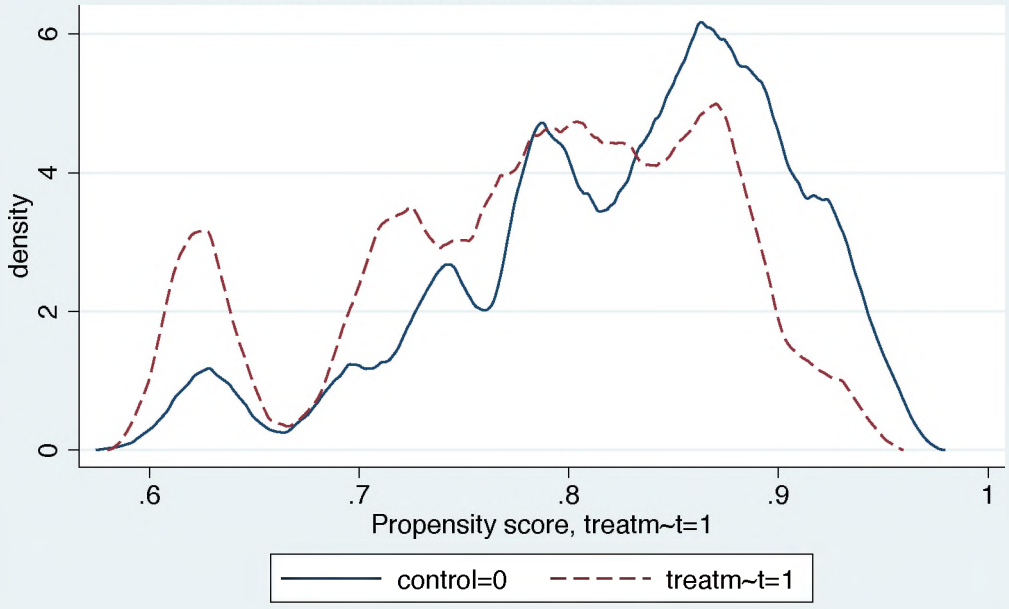


Figure 15 provides evidence of adequate treatment and control overlap.

Figure 16. Overlap of Treatment and Control for 2014-15
with .70 In-school Student Attendance

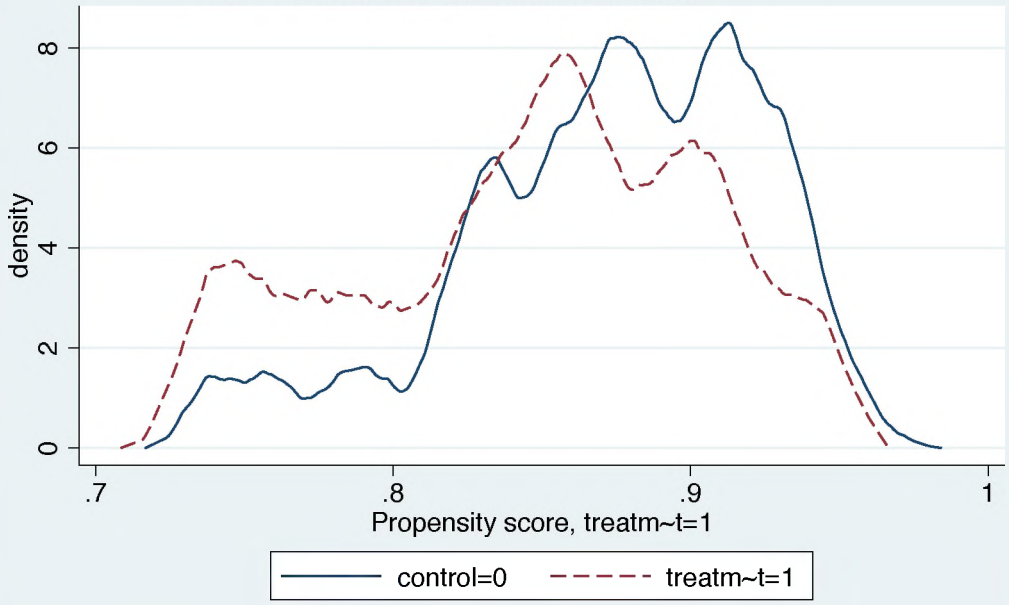


Figure 16 provides evidence of adeauate treatment and control overlap.

Figure 17. 0verlap of Treatment and Control for 2014-15
with .80 In-school Student Attendance

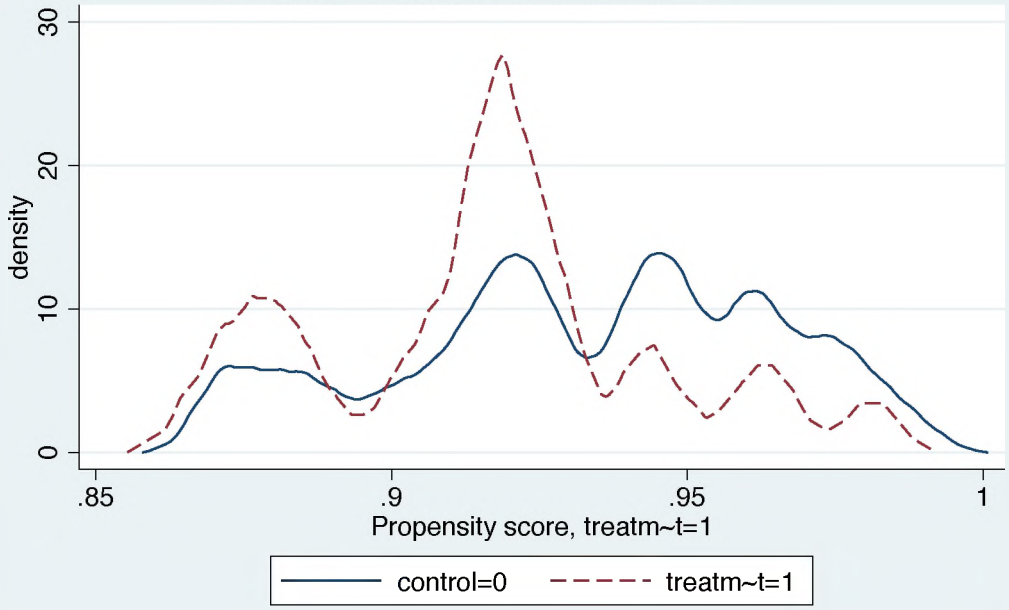


Figure 17 provides evidence of adequate treatment and control overlap.