Spring 5-12-2017

ONLINE LEARNING IN A RURAL SCHOOL SETTING

Peter Coombe

ACCEPTANCE

This dissertation, ONLINE LEARNING IN A RURAL SCHOOL SETTING, by PETER ALAN COOMBE, was prepared under the direction of the candidate's Dissertation Advisory Committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree, Doctor of Education, in the College of Education and Human Development, Georgia State University.

The Dissertation Advisory Committee and the student's Department Chairperson, as representatives of the faculty, certify that this dissertation has met all standards of excellence and scholarship as determined by the faculty.

_____
Nicholas J. Sauers, Ph.D.
Committee Chair

_____
James Kahrs, Ed.D.
Committee Member

_____
Robert Heaberlin, Ed.D.
Committee Member

_____
Date

_____
William L. Curlette, Ph.D.
Chairperson, Department of Educational Policy Studies

_____
Paul A. Alberto, PhD.
Dean
College of Education and Human Development

AUTHOR'S STATEMENT

By presenting this dissertation as a partial fulfillment of the requirements for the advanced degree from Georgia State University, I agree that the library of Georgia State University shall make it available for inspection and circulation in accordance with its regulations governing materials of this type. I agree that permission to quote, to copy from, or to publish this dissertation may be granted by the professor under whose direction it was written, by the College of Education and Human Development's Director of Graduate Studies, or by me. Such quoting, copying, or publishing must be solely for scholarly purposes and will not involve potential financial gain. It is understood that any copying from or publication of this dissertation which involves potential financial gain will not be allowed without my written permission.

_____

Peter Coombe

NOTICE TO BORROWERS

All dissertations deposited in the Georgia State University library must be used in accordance with the stipulations prescribed by the author in the preceding statement. The author of this dissertation is:

Peter A. Coombe
Department of Educational Policy Studies
College of Education and Human Development
Georgia State University
Atlanta, GA 30303

The director of this dissertation is:

Nicholas J. Sauers, Ph.D.
Department of Educational Policy Studies
College of Education and Human Development
Georgia State University
Atlanta, GA 30303

CURRICULUM VITAE

Peter Alan Coombe

ADDRESS: 30 Pryor St NW Room 350
Atlanta GA 30303

EDUCATION:

Doctor of Education	2017	Georgia State University Educational Policy Studies
Specialist in Education	2014	University of West Georgia Educational Leadership
Masters of Education	2008	University of West Alabama School Counseling
Bachelor of Arts	2002	University of Florida Business Administration

PROFESSIONAL EXPERIENCE:

2016-Present	Principal, Calhoun Middle & High School Calhoun City Schools
2011-2016	Director of Communications Calhoun City Schools
2015-2016	Assistant Principal, Calhoun High School Calhoun City Schools
2011-2015	School Counselor, Calhoun Middle/High School Calhoun City Schools
2009-2011	School Counselor, Sonoraville Elementary School Gordon County Schools
2003-2009	French Teacher, Gordon Central High School Gordon County Schools

PRESENTATIONS AND PUBLICATIONS:

Coombe, P. (2016, October). *Moving the Classroom Beyond the 4 walls.* Presented at the Georgia Association of Secondary School Principals Fall Conference. Savannah, GA.

Coombe, P., Eubanks, A., Wilson, B. (2015, January). *Educating the impoverished student: Best practices.* Presented at the Winter Georgia Association of Educational Leaders Conference. Athens, GA.

Coombe, P., Taylor, M. (2014, July). *From Partnerships to Prosperity: 21st Century Learners.* Presented at the Summer Georgia Association of Educational Leaders Conference. Jekyll Island, GA.

Coombe, P. (2014, July). *COLA: Calhoun Online Learning Academy – The Future of Excellence.* Presented at the Summer Georgia Association of Educational Leaders Conference. Jekyll Island, GA.

PROFESSIONAL SOCIETIES AND ORGANIZATIONS

2001-Present	Professional Association of Georgia Educators
2015-Present	Georgia Association of Secondary School Principals
2014-Present	Georgia Association of Curriculum and Instructional Supervisors
2014-Present	Georgia Association of Educational Leaders

ONLINE LEARNING IN A RURAL SCHOOL SETTING

by

PETER COOMBE

Under the Direction of Dr. Nicholas J. Sauers

ABSTRACT

Background: Online learning is a growing delivery model for education; however, there exists a void in the literature regarding the adoption of online learning models in rural K-12 school systems. Purpose: To provide pertinent data to the rural school administrator so that they may make an informed decision in regards to the potential implementation of asynchronous online learning within their school and/or district. Literature Review: Explores the history, impact on student outcomes, graduation rates, cost effectiveness and student engagement factors in regards to online learning. Research Design: A quantitative ex-post facto, causal-comparative design was used while embracing Rogers' Diffusion of Innovation Theory. Data Collection and Analysis: Student achievement data were collected from a rural high school where some students participated in an asynchronous online learning environment while other students participated in the traditional face-to-face environment. Results: Students participating in asynchronous online learning environments performed below students in traditional learning environments for all four subjects (a) English Language Arts, (b) mathematics, (c) science, and (d) social studies, on both metrics, test score and percentile rank. Conclusion: Although this study would probably not

result in the exclusion of online learning in rural settings, it may assist school boards and principals to consider the inclusion of online learning carefully, before extensive financial input occurs. The results also assist with identifying key pitfalls to avoid when establishing online learning environments.

INDEX WORDS: Asynchronous online learning, Student achievement

ONLINE LEARNING IN A RURAL SCHOOL SETTING

by

PETER COOMBE

A Dissertation

Presented in Partial Fulfillment of Requirements for the

Degree of

Doctor of Education

in

Educational Leadership

in

Educational Policy Studies

in

the College of Education and Human Development

Georgia State University

Atlanta, GA
2017

DEDICATION

This dissertation is dedicated to my beautiful wife, Natalie, who has loved me unconditionally, and my two beautiful children, Violet and Clyde, who have shared me with my doctoral family for quite some time.

ACKNOWLEDGMENTS

Countless individuals have encouraged me through this process. First, I would like to thank the members of my doctoral cohort for their friendships and partnership these past three years. To Virgil Cole, my friend and classmate, who helped guide and support me through this process, I am eternally grateful.

To my dissertation Chair, Dr. Sauers, thank you for your guidance and patience throughout the entire process. You helped me develop the skills of a researcher and analyst while building confidence in my academic abilities.

To my committee members, Dr. Kahrs and Dr. Heaberlin, thank you for your contributions to my study and for your support through the entire process.

To my parents, Alan and Johannah Coombe, thank you for providing me with a foundation and core set of values upon which to build a bright future.

To Dr. Michele Taylor, thank you for being my role model and mentor as I navigate my educational career. I would not be where I am today if it were not for your support and encouragement.

Finally, I would like to thank my children, Violet, and Clyde, and my wife, Natalie. You have not only provided me with the support needed to complete this program, you have also provided me with the inspiration and motivation necessary to be successful. I work each day so that I can see each of you smile and know that I had a small part in bringing happiness to your lives. I love you now and forever.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

ONLINE LEARNING IN A RURAL SCHOOL SETTING

It is estimated that over half of all American children engage in the use of technology for the purpose of learning outside of the school setting (National Center for Education Statistics, 2013). However, there exists a void in the literature regarding the adoption of online learning models in rural K-12 school systems (Means, Toyama, Murphy, Bakia, & Jones, 2010). Due to an increase in technology accessibility, school systems are able to emulate the traditional learning classroom instructional model within the online learning environment (Skylar, 2009; Stephens & Mottet, 2008), yet the need for research in the K-12 environment is imperative in order to determine the impact of a rural school system adopting such programs (Means, et al, 2010). Broussard, Hebert, Welch, and VanMetre, (2014), stated:

> Technology is ubiquitous in today's world. It allows people to become more efficient workers, more independent consumers, and more connected in terms of networking with others. These reasons provide a natural rationale for the growing presence of technology in the classroom (p. 37).

The one size fits all traditional approach to education is no longer a valid application in addressing the needs of the K-12 educational landscape (Caroleo, 2014). This study addresses asynchronous online learning, or the use of a computer network to present educational content that is *neither* face-to-face *nor* designed for simultaneous online participation with an instructor (Coogle, & Floyd, 2015). With only 67% of Georgia high school students graduating from high school (Stetser, M. C., Stillwell, R., & National Center for Education Statistics, 2014), and more than 580,000 students attending rural schools in Georgia, the third largest state population within

the United States of America (Johnson, Showalter, Klein, & Lester, 2014), the number of rural high school dropouts is a prevalent issue in Georgia's educational climate, particularly over the past two decades (National Center for Education Statistics, 2013). It is imperative that today's rural educational institutions combat the growing problem of student engagement and retention (Johnson, et al, 2014). Researchers agree that increased online course offerings and learning opportunities can be used to combat a high school dropout issue which stems from the lack of student engagement (Brown, 2012; Heppen, Allensworth, Walters, Pareja, Kurki, Nomi, & Society for Research on Educational Effectiveness, 2012; Schorr & McGriff, 2012, Wicks, 2010). This dissertation investigates a rural school system in northwest Georgia that has utilized asynchronous online learning.

Guiding Questions

The purpose of this study is to provide pertinent data to rural school administrators and policy makers so that they may make informed decisions in regards to the potential adoption of asynchronous online learning within a rural school setting. The rapid growth of online learning and the fact that the long-term ramifications of its limitation are largely unknown warrants for increased research into the phenomenon (Nguyen, 2015). As of 2008, only five controlled studies meeting meta-analysis criteria existed when contrasting K-12 online learning to face-to-face conditions (Means, et al, 2010). This fuels the need for further research and guides the purpose of this study: to compare student participation in an asynchronous, online, high school learning environment with student participation in a traditional learning environment on end of course assessments and national percentile rank. The study may also help address the belief that the one

size fits all traditional approach to education is no longer a valid application in addressing the needs of the K-12 educational landscape (Caroleo, 2014).

The following research questions will guide the study:

1. How does the achievement of students participating in an asynchronous online learning environment compare to those peer students participating in a traditional learning environment as measured by End of Course assessments (EOCs)?

2. How does the achievement of students participating in an asynchronous online learning environment compare to those peer students participating in a traditional learning environment as measured by national percentile rank?

Review

The purpose of this literature review was to provide a framework for the study of the implementation of an online learning environment that has the potential to impact student achievement. This literature review begins with an overview of the historical context of online learning and 1:1 initiatives. Next, the review provides an in-depth look at the impact of online learning on student outcomes in regards to state assessment. It continues to include the impact of online learning on graduation rates and student promotion, leading into a review of the cost effectiveness of online learning. The literature review concludes with a discussion regarding student engagement and the immediate and long-term impacts of online learning on the 21st century educational landscape.

The precursors to online learning.

Although online learning is often associated with the dawn of the internet, distance learning precedes the advent of online communication in the United States. Five generations of

distance learning existed in the form of correspondence, broadcast radio and television, open universities, telecommunication, and virtual classrooms, although the United States did not engage in open universities that were largely present in Europe (Moore & Kearsley, 2011). In order to fully understand the potential impact of online learning, the reader must first understand a general overview of the history and inception of online learning so that they may fully explore the paradigm shift taking place in today's educational terrain.

Online education, according to Bergman (2001), can be considered a direct descendent of correspondence learning, dating back in the United States to as early as 1878 with increased access to postal services via an expansive railroad network. Students without direct access to classroom instruction at the university and secondary school level were afforded the opportunity to communicate via mail and received a remediated form of instruction tailored to their specific needs (Bergman, 2001). This form of communicative learning, although rudimentary by nature, was the precursor to what we now know to be online learning. Radio broadcasts were later employed to deliver educational content, with the first educational broadcast license being issued to the Latter Day Saints' University of Salt Lake City in 1921 (Saettler, 1990).

Although this delivery model was adopted by several American universities and spread to parts of Europe and Latin America, it failed to gain widespread popularity in the United States, and the commercial driven medium of radio did not see it as a worthy investment when compared to more popular broadcasts (Moore & Kearsley, 2011). A more effective technology used to deliver educational content was the television. Moore and Kearsley detail its inception as a teaching tool as early as 1934 when the University of Iowa created over 400 educational programs to be delivered via television. By 1980, there were in excess of 150 educational

television stations broadcasting instructional programs throughout the nation to education audiences ranging from kindergarten to post-secondary students (Corporation for Public Broadcasting, 1981, p. 37).

Moore & Kearsley (2011) viewed teleconferencing as the bridge between radio/television and online learning as it was the first simultaneous two-way form of distance learning communication between educator and student. With the advent of satellite technology used for the purpose of telecommunication, the 1980's witnessed educators hosting live courses with individuals throughout the United States with interactive discussion and participation. It was not until the 1960's that we observed the incorporation of computer technology into the delivery model of courses, specifically in the area of higher learning, despite the common belief that educational institutions could not afford the technology (Bitzer, 1962; Suppes, 1964).

Suppes (1966) contested that due to the growth of computer aided instruction, "in a few more years millions of schoolchildren will have access to what Philip of Macedon's son Alexander enjoyed as a royal prerogative: the personal services of a tutor as well-informed and responsive as Aristotle" (p. 207). He also believed that the use of computer-driven instruction would benefit students' academic performance as described by Bloom's (1996) research that demonstrated the use of one-on-one tutoring leading to improved student achievement by two standard deviations when compared to group instruction. Suppes (1966) utilized computers as a tool, but he envisioned the limitless possibilities of computers in education and his research established a firm foundation for computer assisted learning.

Blitzer (1962) birthed PLATO, a timeshared computer system used to create educational courses and enabling electronic communication between users in the form of e-notes - the

grandfather of today's conferencing systems. Woolley (1994) exhorted PLATO with the following:

> Two decades before the World Wide Web came on the scene, the PLATO system pioneered online forums and message boards, email, chat rooms, instant messaging, remote screen sharing, and multiplayer games, leading to the emergence of what was perhaps the world's first online community (para. 1).

Originally created to support a classroom full of devices and students, in 1972 PLATO adopted a new generation of mainframes that would lead to the possibility of hosting up to one thousand users simultaneously. It was pioneers like Blitzer that led to the innovation of virtual schools such as Coastline Community College, the first higher education institute with no physical campus (Wooley, 1994). These increasing technologies inspired the development of the Internet, or, "an electronic communications network that connects computer networks and organizational computer facilities around the world" (Merriam-Webster, 2015).

With the mainstream development and rapid growth of the internet, Moore and Kearsley (2011) shared that the 1990's engaged the public in a cultural phenomenon where boundaries to communication were fading and global discourse was the norm. A group of students and researchers at the University of Illinois cultivated the first sophisticated web browser in 1993 called Mosaic (Moore & Kearsley, 2011). This browser partnered with the internet, a culmination of all prior technologies, enabled the concept of online learning to take flight. Keegan (1996) defined online learning as "a form of distance education whose central defining characteristic is the separation of teacher and learner" and Watson, Winograd, and Kalmon (2004) categorized online learning as "education in which instruction and content are delivered

primarily via the Internet" (p. 95). The continued development of online learning led to the creation of countless educational institutions devoted solely to online degree and diploma programs in the United States. Brick and mortar institutions also invested in the growing field of online education (Caruth & Caruth, 2012: Hyman, 2012; Lei & Gupta, 2010). Lei & Gupta (2010) explain that online learning caters to the culture of convenience present in the United States. This medium bridges the void between previously un-served students and allows them to engage in the learning process at times and in places that are conducive to their participation.

Perceived impact of online learning.

Although the term online learning may invoke an image of students engaged in learning from the comfort of a laptop on their couch at home, one survey showed that most K-12 students (86%) access their learning environment at their school; however, it should be noted that a shift from school-based to home-based online learning is upward trending due to the increased accessibility of technology (Vasquez & Straub, 2012; Zandberg, Lewis & Greene, 2008). In looking more purposefully at those students participating in online learning programs across the United States, one common theme exists, these students most commonly elect to participate versus being mandated to do so (Rauh, 2011). Although this awards freedom of choice to the parent, Rauh (2011) cautioned:

> There are many factors to consider when parents are deciding on a school for their children. However, parents ignore many of these factors completely – either out of ignorance of the factors, ignorance of options, some combination of both, or (most troubling) a lack of concern for either. (p. 3)

Those students who do not elect to participate in online programs are most often participants due to alternative placement mandates (Caroleo, 2014). Caroleo (2014) defined alternative placement as "education programs which offer exactly what the name says, alternative education options for students who are not successful in mainstream or traditional education settings" (p. 39). Well-designed online programs create learning opportunities for all students. An example of student participants who may greatly benefit from online learning would be students with disabilities. Students with disabilities benefit from online learning due to individualized instruction, flexible time and location options, and access to a variety of multimedia (Vasquez & Straub, 2012).

Whether elected or mandated, participation in online learning is growing each year (Wicks, 2010), and the potential impact on student achievement must be addressed. Toch (2010) predicted that by 2019, 50% of all high school students will take their full slate of courses online. Advocates of online learning contend that online courses promote equity. Schneider (2014) shared that access to information for students in low-income districts is often limited and they often experience less qualified teachers. Proponents of online learning say that these courses promote increased student exposure to higher levels of rigor with the support of highly qualified instructors (Schneider, 2014). With the growth of online learning "it is important to know the student population and consider learning goals, needs and school and home environments when implementing an initiative" (Donovan, Green & Hartley, 2010, p. 438).

Demographics.

Educational scholars (Dexter, 2011; Rauh 2011; National Center for Education Statistics & Educational Testing, 2012) differ in their views on the impact of demographic data on student

achievement when employing online learning settings. Dexter (2011) claimed that demographic information such as (a) gender, (b) race/ethnicity, (c) age, (d) grade level, (f) educational classification, and (g) socioeconomic status do not directly impact student achievement, whereas, the National Center for Education Statistics & Educational Testing, (2012) clearly stated to the contrary, "Students' performance varies by race/ethnicity, gender, and school location" (p. 15). This study suggests that the geographic location of a student's learning environment may impact their performance as measured by standardized assessments. Rauh (2011) suggested that students in higher poverty schools gain the most from participation in online learning programs. Barth (2013) echoed this view in a study of the Arkansas Virtual Academy School in which low-income students made more progress in math and literacy than their peers in traditional schools. Opinions regarding the impact of a student's demographic status on student achievement in an online learning environment differ greatly. One issue is: Does equality exist in regards to the accessibility of online learning environments?

Gibson, et al. (2015) shared that "students' environment and resources, both within their home and their community, play a part in their opportunities to utilize computer technology in their daily lives and to do so in such a way to improve educational outcomes" (p.172). This statement supports the idea that a student of a low socioeconomic demographic is at a disadvantage when it comes to the access and prior knowledge needed to be successful in an online learning environment. Despite the decreased exposure to technology, impoverished students are still finding great success in the form of academic achievement boosts in regards to online learning participation (Morgan, 2015). Morgan (2015), although acknowledging the increased student achievement, stated that "(online courses) can also hinder student learning and

prevent disadvantaged students from experiencing a classroom environment that benefits them most" (p.72).

Toch (2010) argued that educational programs that assist underprivileged youth experience increased levels of student achievement as a result of high degrees of contact between students and teachers, which increase the learning opportunities present within the environment. Although Toch recognizes the significance of technology within the classroom, he believes that the more disadvantaged the students are, the more they need a physical learning space they can identify as their school. The social and emotional support needed for so many disadvantaged youth is not present in an online learning program. Many of these students are products of dysfunctional homes and the school setting may be the only healthy location for them to cultivate social and emotional skills necessary for positive growth and development; therefore, a brick-and-mortar school may be the ideal learning environment for many economically disadvantaged students (Toch, 2010).

Standardized assessment.

Looking beyond the demographic composition of online learners and their reasoning for participation, researchers (Boyles, 2011; Heppen et al., 2012; Vonderwell & Boboc, 2013; McIntosh & Center on Education, 2011) studied outcomes of student assessment to form determinations in regards to the impact of an online learning environment, regardless of student demographic composition. A quantitative study performed by Heppen et al. (2012), reported, "as schools across the nation struggle to keep students on track and re-engage students who are off track, online learning has emerged as a promising and increasingly popular strategy" (p. 1). This statement is supported by assessment data, which shows positive growth on end of course

assessments in the area of mathematics over time for students participating in an online credit recovery program. With the continued implementation of online learning in Chicago Public Schools, the pass rate from 2011 to 2012 increased from 58% to 72% (Heppen et al., 2012).

Vonderwell and Boboc (2013) take a more cautious view of the impact of online learning in regards to student outcomes on standardized assessment. They do not deny the effect of the learning environment on student achievement, but are firm in the following: "Instructors need to identify effective assessment methods appropriate to online learning and understand the potential of technology tools for monitoring student learning and their own teaching" (p. 22); and, "Given the increasing complexity of requirements for a relevant curriculum preparing students for work in the 21st century world, assessment strategies need to balance out traditional and alternative approaches to evaluation of student performance" (p. 23). These statements support the following: Standardized assessment is a viable tool in evaluating the performance of online learners when planned and implemented with fidelity and considering all mitigating variables.

All potential variables must be considered when determining if student assessment is an accurate measure of the effectiveness of an online learning initiative. When considering both the positive and negative impacts of standardized assessment, McIntosh & Center on Education (2011) stated the following:

> Opponents of standardized testing would argue that standardized assessments, especially high-stakes assessments, have numerous negative effects on students without improving student achievement. They list negative effects such as narrowing of the curriculum and potentially increasing grade retention and dropout rates. However, others would argue that the standardized testing movement has increased academic standards and the

> expectations of high school graduates, most recently in expecting students to graduate with the knowledge and skills necessary for success in college or a career. These proponents would argue that testing is not the cause of grade retention and dropout rates, but rather an indicator that these students are receiving an inadequate K-12 education (p. 22).

Research in regards to online learning programs vary greatly in regards to the quality of instruction and program effectiveness. One 2011 study showed that students who participated in the Florida Virtual School outperformed their traditional peers on the state assessment for English and algebra courses (Chingos & Schwerdt, 2014), yet a similar study in Colorado showed that students who participated in online learning were at an increased risk of dropping out and underperformed their traditional peers on state assessments (Hubbard & Mitchell, 2011). This breathes life to a variety of questions which cannot be answered in this lit review, but instead lend themselves to the need for further research and exploration.

Graduation rates and student promotion.

One of the primary reasons for offering online course offerings to high school students in recent years has been the need to recover credits in order to fulfill graduation requirements (Clements, Pazzaglia, & Zweig, 2015). With the pressing demands on high school students and the rapid changes in the modern classroom setting, the need for "learning environments which center on the student" (Horzum, Kaymak, & Gungoren, 2015, p. 761) are growing exponentially. Examples of students in desperate need of an online learning program are ever present in today's educational landscape: The student, bullied by classmates, afraid for his safety as he makes the three mile walk to and from school to earn his remaining credit before graduation; the pregnant

fifteen-year-old with no way to pay for daycare and a lack of familial support; and the student working a night shift in order to support their siblings (Roblyer, 2006). These are all examples of struggles that are all too common for the youth of America, and online school personnel encounter many similar situations. No matter the reason for enrollment, a common goal is shared for all students and educational institutions; graduating from high school with the possibility of pursuing college and/or career options.

Rovai, Ponton, Wighting, and Baker (2007) found that the intrinsic motivation levels of students engaged in online learning are significantly greater than those of students learning in traditional settings. It is this level of motivation that keeps students enrolled in school with the dream of graduation still alive and well. In a study conducted by Cho and Herron (2015), they found significant differences in motivation levels of passing and non-passing students. Their findings showed a positive correlation between course completion and motivation levels for those students who set goals, planned ahead, and self-regulated. A trusting relationship is a necessary component of student success in online learning. Trust in the online learning environment is a large contributor to whether a student will remain enrolled and engaged in the course. Trust is also a key factor in preventing current students from dropping out. In turn, establishing trust is an essential ingredient for student success in an online program (Ghosh, Whipple & Bryan, 2001; O'Brien & Renner, 2002).

To the contrary, Allen and Seaman (2013) found in a survey of 2800 colleges and universities that 90% of those surveyed reported that course completion rates were lower in regards to online courses than their traditional counterparts. Bell and Federman (2013) also reported a higher number of e-learner dropouts when compared to those participating in face-to-

face courses. An explanation for the decreased completion rate of online courses is offered by Kim, Park and Cozart (2014) when they suggested that "the additional challenge posed by the lack of social interaction and less than immediate feedback from the instructor" (p. 174) may result in less than satisfactory performance. Smith (2005) shared that students are often thrust into online learning environments without the time management, self-learning skills, and understanding of their personal learning style and lack of intrinsic motivation.

Program implementation.

Lowther (2012) investigated the impact of Michigan's Freedom to Learn (FTL) 1:1 initiative. With the primary purpose of addressing student achievement through the placement of 20,000 laptop computers in partnership with professional development for teachers, Lowther utilizes a mixed methodology approach to her study. She determined, "teachers who have higher technical skills and hold positive beliefs and readiness are more likely to integrate computers into classroom instruction" (p. 23). In a study of 47 teachers and students participating in a 1:1 initiative in an urban middle school setting, Storz and Hoffman (2013) reinforced Lowther's research and go on to share that increased technology in the classroom setting enables the use of innovative and engaging instructional approaches which might otherwise not be present.

Cuban (2009) found that many teachers are hesitant to engage their students in online learning environments because they are fearful that students will depend too heavily on technology and lose their ability to problem solve. Teachers also exhibit apprehension due to the perceived notion that they could lose their employment due to a reduced need for instructors when moving to an online delivery model (Cuban, 2009). In moving toward effective program implementation, "teacher buy-in for technology immersion is critically important because

students' school experiences are largely dictated by their teachers" (Shapley, Sheehan, Maloney, & Carnikas-Walker, 2010, p.24). In order to create student-centered learning environments, teachers must be a part of the shift to online learning, or risk being left behind (Shapley, et al, 2010).

A key factor to consider when implementing an online learning initiative relates directly to the unique needs of online learners, specifically students with individual education plans (IEPs). If not addressed appropriately, the impact on these students has the potential to raise issues of a legal nature that may serve as problematic to the system initiating the program (Bathon, 2013). Regardless of the potential benefit to students, if the federally mandated needs of students are not met, then continued implementation may be greatly impeded.

Cost effectiveness.

Although the potential impact on student achievement is a primary reason for implementing an online learning program, there are other factors that can be advantageous for the investing party. One such factor is the potential savings in regards to instructional costs. Schorr and McGriff (2012) outlined these savings, including reduced staffing, decreased consumption of materials and facility costs. Brown (2012) shared, "Many of the smaller districts, which offer fewer courses due to the size of their staffs and limited space on the schedule, turn to online learning to give students a richer selection of offerings" (p. 13). This presents online learning programs as a cost saving strategy, as it does not require the hiring of new staff to provide increased offerings. It is also possible for school systems to increase their Full-Time Employee (FTE) earnings with the adoption of online learners who are home based, and

therefore do not assume the traditional costs associated with educating students (Tonks, Weston, Wiley, & Barbour, 2013).

There are numerous school systems throughout the United States, such as a lab-model school called Rocketship in California, moving to hybrid learning environments in which technology is at the center (Simburg & Roza, 2012). Simburg and Roza (2012) described how twenty first century instruction can be structured through the use of computer labs to reduce the number of instructors needed within a school and/or district, which would provide new savings to the organization. With that said, online learning initiatives can be as cost effective or as costly as the district wants to make them due to the choices made by administration in regards to the technologies purchased and the infrastructure utilized to support them (Clausen, Britten & Ring 2008). To create effective implementation of an online learning program, there needs to be an increased emphasis on professional development of those teachers directly involved, resulting in increased cost (Clausen, Britten & Ring, 2008).

Although online learning continues to experience growth, the cost of implementation continues to serve as an obstacle to many districts (Clements et al, 2015). Cost will remain a limiting factor for some districts while others will experience cost savings which can add up to hundreds of thousands of dollars, which for a rural school system may account for a significant portion of their system's budget (Schorr & McGriff, 2012).

Student engagement.

The following three findings emerged while addressing student engagement in relation to online learning in the relevant research: (a) individualized instruction; (b) self-pacing and flexibility; and (c) increased course offerings (Brown, 2012; Bryans-Bongey, 2015; Gray &

DiLoreto, 2016; Effects from Student Engagement Online, 2014; Heppen et al., 2012; Schorr & McGriff, 2012). Online learning demonstrates "a deeper participation by students with a far higher degree of autonomy than found in the traditional, triadic recitation script of initiation-response-feedback" (Kennewell, Tanner, Jones, & Beauchamp, 2008, p.62). Kennewell et al. (2008) detailed the shift of pedagogy from teacher-driven to student centered as they describe the autonomous role of the online learner.

The responsibility for learning now rests on the shoulders of the student with the teacher acting as a facilitator in the online setting, as opposed to the traditional keeper of knowledge mentality of the twentieth century schoolhouse (Kennewell et al, 2008). Student engagement is a pivotal component to the success of the online learner. In understanding the engaged student, one must first know how to identify an engaged learner versus one who is disengaged. Bangert-Drowns and Pyke (2001) defined the engaged learner as a student who complies with minimal requirements for accomplishing school assignments. The disengaged learner is defined as one who exhibits "off task behavior… the use of assigned technology tools for purposes other than intended or specified for the learning activity" (Donovan, Green, & Hartley, 2010, p. 426).

Engaging in online learning is an exercise of trust (Wang, 2014). "The student must overcome the fear of potentially wasting time and money, disclosing sensitive information, and losing submitted work, and they must take such risks in the absence of face-to-face interactions" (Wang, 2014, p. 346). Horzum and Kaymak (2015) believe that the first step in engaging online learners and earning their trust is the provision of an appropriate orientation: "There is a positive relationship between readiness of online learning and interaction. This finding means that increase in readiness of students for online learning leads to increase in interaction in the

learning environment" (p.1795). In contrast, students who do not feel oriented to a program and lack trust in the delivery model may report a lack of motivation and low self-efficacy for learning. They may also experience negative emotions such as anxiety, frustration, and disinterest, which will ultimately lead to a lack of student engagement (Kim & Hodges, 2012).

Although there are those who believe that online education limits the opportunity for students to engage in meaningful learning experiences (Mbuva, 2014), it also believed that the provision of 1:1 initiatives through an online learning environment are "broadening choices for students, providing an effective alternative for students on IEPs, and helping students graduate who certainly would not without the opportunity to make up a course online" (Brown, 2012, p. 17). With the dire consequences of failing core academic courses in high school growing in prevalence, the importance of providing alternative pathways to graduation for high school students is paramount to the success of school systems throughout the U.S. (Heppen et al., 2012; Sorenson, 2012).

Student engagement can be measured both quantitatively and qualitatively; however, there is no mistaking the level of engagement when observing the eagerness of students in grades K-12 as they "hurtle toward their computer workstations" (Schorr & McGriff, 2012, p. 30). Despite increased participation, an engagement gap exists as detailed by Bryans-Bongey (2015), in a study that demonstrated increased engagement with girls than boys and with white and Asian students as opposed to other races. Therefore, while the focus of K-12 schools remains on student achievement as measured by standardized assessments, school systems must also consider the impact of student engagement on student outcomes.

Obstacles.

Researchers (Hawkins, Graham, & Barbour, 2012; Schaffhauser, 2011; Schorr & McGriff, 2012; Shoaf, 2011) present the most prevalent obstacles to the successful implementation of an online learning initiative: student comfort level, tech support, and student isolation. From obvious considerations such as the provision of technology and adequate support in the form of added bandwidth (Schaffhauser, 2011), to the more complex issue of student isolation (Hawkins et al., 2012), there are limiting factors which should be considered when launching an online learning environment. Schorr and McGriff (2012) suggested that there is also the potential to provide too much technology to students and their associated teachers.

Although the development of online learning has long been lauded as a benefit to today's education system, its potential is being challenged by a lack of quality control and oversight (Weston & Bain, 2010). Morgan (2015), stated that:

> Critics object to the rapid increase in online instruction at the K–12 level because few studies support its use. Additionally, students in many online programs perform less well academically than their counterparts who are enrolled in face-to-face classes. Although some online programs, such as the one at FLVS, produce excellent results, other programs yield dismal outcomes (p.73). . . . Because oversight and accountability are weak at many virtual schools, motivated students with strong literacy and technology skills are often the only students who do well (p.76).

A call for increased oversight and quality standards for online learning environments is garnering increased attention to ensure equity of delivery and learning for all who are engaged.

Schools that offer online programs, or have a desire to, recognize the potential benefits of program implementation, but limiting factors may mitigate their opportunity. Community support and access to technology resources are essential components of a successful online learning program (Holian, Alberg, Strahl, Burgette, & Cramer, 2014). Shapley et al. (2010) shared that "the enthusiastic support of community members, including elected members of the local school board and business people, may influence implementation through mechanisms such as the adoption of supportive policies or provision of financial resources" (p.25).

A common theme when discussing potential obstacles in regards to student achievement in online environments is clearly expressed by Shoaf (2011) when she wrote, "The challenge of offering the same depth and variation online as through traditional classroom instruction in the specialty areas—such as music, art, and gym—is difficult due to the traditional hands-on nature of the course material" (p. 193). This encourages exploration as to how online learning will address the need for physical interaction with content and material presented in classes that traditionally lend themselves to face-to-face interaction.

A void in the literature exists when considering the impact of online learning, specifically in regards to the impact of hybrid schools, or schools that combine face-to-face education with online instruction (Schorr & McGriff, 2012). This growing delivery model (Brown, 2012) presents a new arena for consideration in regards to research studies. The majority of the literature addresses the online versus face-to-face paradigm, but does not consider the merging of the two in great detail. Other considerations when exploring the efficacy of long-term implementation of asynchronous online learning initiatives are the need for consistent data trends

in regards to student performance on state assessments (Ramig, 2011), and the sustainability of programs in regards to funding and delivery models (Tonks et al., 2013).

Asynchronous Learning

Asynchronous learning takes many shapes and forms and is defined primarily by the person or organization implementing the Asynchronous Learning Network (ALN) (Hiltz & Goldman, 2005). For the purpose of this study, the use of a computer network to present or distribute educational content void of face-to-face interactions, or simultaneous online participation with an instructor (Coogle, & Floyd, 2015) defines the use of asynchronous online learning. According to Hiltz and Goldman (2005) the success of ALNs is contingent on accessibility to appropriate hardware, the nature of the course and the characteristics of the student(s). More than 90 percent of post-secondary United States institutions hold asynchronous online courses, but data of this nature has not been compiled at the K-12 level to date (Silva, 2013). The expanding use of technology innovations and computer use, partnered with the internet, have led to a global revolution in regards to how people deliver and receive knowledge (Irani & Chalak, 2016). Throughout this global change, educational institutions have been compensating for physical distance between instructor and learner through the adoption of online learning, and asynchronous online learning is one of the most cost effective and direct forms of content delivery to date (Irani & Chalak, 2016).

Conclusion

It is apparent that some form of voluntary or mandated online learning will be present in most schools in the near future and that the expectation is for increased technology interaction to result in increased student achievement (Bebell & O'Dwyer, 2010; Corry & Stella, 2012; Sener,

2010; Yuan-Hsuan Lee, Waxman, Jiun-Yu Wu, Michko, & Lin, 2013). Myhill (2006) supported this view in saying that "it may be that whole-class interactive teaching has become a meaningless term, with 'interaction' covering the whole range of discourse moves, including teacher-dominated procedures" (p. 21). Enrollment in online learning programs continues to skyrocket, and will likely continue its growth despite a lack of data indicating undisputed evidence that online learning is directly related to increased student achievement (Corry & Stella, 2012). Research indicates that the combination of face-to-face interaction with an online learning environment lends itself to the learning styles of a larger majority of students in the K-12 classroom (Means, Toyama, Murphy, Bakia, & Jones, 2010).

Those items within an online learning environment that are not disputed would be the (a) ability for students to learn at their own pace, (b) select different locations to do their work, and (c) select flexible times to complete assignments (Sorenson, 2012). Sorenson goes on to explain that these conditions are not always ideal for those students who (a) require face-to-face interaction, (b) communicate poorly online, (c) lack discipline and time management, and (d) lack a minimum level of technology skills. In summary, online learning is beneficial for students who have familiarity with technology and who are motivated to learn and graduate.

References

Allen, I. E., & Seaman, J. (2013). *Changing course: Ten years of tracing online education in the United States.* San Francisco, CA: Babson Survey Research Group and Quahog Research Group LLC

Bangert-Drowns, R. L., & Pyke, C. (2001). Student engagement with educational software: An exploration of literate thinking with electronic literature. *Journal of Educational Computing Research, 24*(3), 213-234.

Barth, P. 2013. Virtual schools: Where's the evidence. *Educational Leadership, 70*(6): 32–36.

Bathon, J. (2013). For districts, online testing has legal liabilities. *T H E Journal, 40*(7), 17-20.

Bangert-Drowns, R. L., & Pyke, C. (2001). Student engagement with educational software: An exploration of literate thinking with electronic literature. *Journal of Educational Computing Research, 24*(3), 213-234.

Bebell, D., & O'Dwyer, L. M. (2010). Educational Outcomes and Research from 1:1 Computing Settings. *Journal Of Technology, Learning, And Assessment, 9*(1). Retrieved from: http://ejournals.bc.edu/ojs/index.php/jtla/article/view/1606

Bell, B. S., & Federman, J. E. (2013). E-learning in postsecondary education. *The Future of Children,* 23, 165–185.

Bergman, H. F. (2001). The Silent University: The Society to Encourage Studies at Home, 1873-1897. *The New England Quarterly, 74*(3), 447-47.

Bitzer, D. L., Lichtenberger, W., & Braunfeld, P. G. (1962). PLATO II: A multiple-student, computer controlled, automatic teaching device. In J. E. Coulson (Ed.), *Programmed learning and computer-based instruction* (pp. 205-216). New York: John Wiley

Bloom, M. (1996). Transformative moments in education. *Holistic Educational Review, 9*(4), 44-47.

Boyles, P. C. (Fall 2011). Maximizing learning using online student assessment. *Online Journal of Distance Learning Administration, 14*(3). Retrieved from: https://www.learntechlib.org/p/52619

Broussard, J., Hebert, D., Welch, B., & VanMetre, S. (2014). Teaching today for tomorrow: A case study of one high school's 1:1 computer adoption. *Delta Kappa Gamma Bulletin, 80*(4), 37-45.

Brown, D. (2012). Rural districts bolster choices with online learning. *Learning & Leading with Technology*, *39*(6), 12-17.

Bryans-Bongey, S. (2015). Meeting the Holistic Needs of K-12 Online Learners: Designing Schools for the Future. *Internet Learning Journal*, *4*(2), 7-24.

Caroleo, M. (2014). An examination of the risks and benefits of alternative education. *Relational Child & Youth Care Practice, 27*(1), 35-46.

Caruth, G. D. & Caruth, D. L. (2012). Significant trends in online education. Journal of Online Education. Retrieved from: http://www.partedres.com/archieve/issue_1_2/3-per_14-09_volume_1_issue_2_page_21_35.pdf

Chingos, M. & Schwedt, G. (2014). *Virtual Schooling and Student Learning: Evidence from the Florida Virtual School.* Program on Education Policy and Governance Working Papers Series.

Cho, M., & Heron, M. L. (2015). Self-regulated learning: the role of motivation, emotion, and use of learning strategies in students' learning experiences in a self-paced online mathematics course. *Distance Education*, *36*(1), 80.

Clausen, J. M., Britten, J., & Ring, G. (2008). Envisioning Effective Laptop Initiatives. *Learning & Leading with Technology*, *36*(1), 18-22.

Clements, M., Pazzaglia, A. M., Zweig, J. (2015). Online course use in New York high schools: Results from a survey in the greater capital region. REL 2015-075. *Regional Educational Laboratory Northeast & Islands* Retrieved from: https://ies.ed.gov/ncee/edlabs/regions/northeast/pdf/REL_2015075.pdf

Coogle, C. C., & Floyd, K. k. (2015). Synchronous and Asynchronous Learning Environments of Rural Graduate Early Childhood Special Educators Utilizing Wimba© and Ecampus. *Journal of Online Learning & Teaching*, *11*(2), 173-187.

Corporation for Public Broadcasting. (1981). *Status report of public broadcasting.* Washington, DC: Corporation for Public Broadcasting.

Corry, M., and J. Stella. 2012. Developing a framework for research in online K-12 distance education. *The Quarterly Review of Distance Education*, *13*(3): 133–51.

Cuban, L. (2009). *Oversold and underused: Computers in the classroom*. Harvard University Press

Dexter, K. (2011). Addressing the high school dropout crisis: at-risk students and education 2020 online credit recovery. Retrieved from: http://www.academia.edu/26058255/ADDRESSING_THE_HIGH_SCHOOL_DROPOU

T_CRISIS_ATRISK_STUDENTS_AND_EDUCATION2020_ONLINE_CREDIT_RECOVERY

Donovan, L., Green, T., & Hartley, K. (2010). An Examination of One-to-One Computing in the Middle School: Does Increased Access Bring About Increased Student Engagement?. *Journal of Educational Computing Research,42*(4), 423-441.

Effects from Student Engagement Online. (2014). *ASHE Higher Education Report*, *40*(6), 67. doi:10.1002/aehe.20018

Gibson, P. p., Stringer, K., Cotten, S. R., Simoni, Z., O'Neal, L. J., & Howell-Moroney, M. (2014). Changing teachers, changing students? The impact of a teacher-focused intervention on students' computer usage, attitudes, and anxiety. *Computers & Education*, 71, 165-174.

Ghosh, A. K., Whipple, T. W., & Bryan, G. A. (2001). Student trust and its antecedents in higher education. *Journal of Higher Education,* 72, 322–340.

Gray, J. A., & DiLoreto, M. (2016). The Effects of Student Engagement, Student Satisfaction, and Perceived Learning in Online Learning Environments. *International Journal Of Educational Leadership Preparation, 11*(1)

Hawkins, A., Graham, C. R., & Barbour, M. K. (2012). "Everybody Is Their Own Island": Teacher disconnection in a virtual school. *International Review of Research in Open and Distance Learning*, *13*(2), 123-144.

Heppen, J., Allensworth, E., Walters, K., Pareja, A., Kurki, A., Nomi, T., & Society for Research on Educational Effectiveness, (2012). Efficacy of online algebra I for credit recovery for

at-risk ninth grade students: Evidence from year 1. *Society for Research on Educational Effectiveness*.

Hiltz, S. R.. & Goldman, R. (2005). *Learning together online: research on asynchronous learning networks.* Mahwah, N.J. : Lawrance Eribaum Associates, 2005.

Holian, L., Alberg, M., Strahl, J. D., Burgette, J., Cramer, E. (2014). Online and Distance Learning in Southwest Tennessee: Implementation and Challenges. REL 2015-045. *Regional Educational Laboratory Appalachia*

Horzum, M. B., Kaymak, Z. D., & Gungoren, O. C. (2015). Structural Equation Modeling Towards Online Learning Readiness, Academic Motivations, and Perceived Learning. *Educational Sciences: Theory & Practice, 15*(3), 759.

Hubbard, B., & Mitchell, N. (2011). Troubling questions about online education. EdNews Colorado. Retrieved from http://www.chalkbeat.org/posts/co/2011/10/04/analysis-shows-half-of-online-students-leave-programs-within-a-year-but-funding-stays/

Hyman, P. (2012) *The year of the disruptive education: As college tuitions soar, various online models vie to educate college students worldwide—at no cost.* Communications of the ACM: 55(12) doi:10.1145/2380656.2380664

Irani, F., & Chalak, A. (2016). Interaction Analysis in an International Asynchronous Learning Envrionment. *Teaching English with Technology, 16*(4), 33-47.

Kennewell, S., Tanner, H., Jones, S., & Beauchamp, G. (2008). Analyzing the use of interactive technology to implement interactive teaching. *Journal of Computer Assisted Learning, 24*(1), 61-73.

Kim, C., Park, S. W., & Cozart, J. (2014). Affective and motivational factors of learning in online mathematics courses. *British Journal of Educational Technology,* 45, 171–185.

Johnson, J., Showalter, D., Klein, R., Lester, C. (2014). *Why rural matters 2013-2014: The condition of rural education in the 50 states.* Washington D.C.; Rural School and Community Trust.

Kim, C., & Hodges, C. B. (2012). Effects of an emotion control treatment on academic emotions, motivation and achievement in an online mathematics course. *Instructional Science,* 40, 173–192.

Lei, S. A., & Gupta, R. K. (2010). College distance education courses: Evaluating benefits and costs from institutional, faculty and students' perspective. Distance Education, 616-631.

Lowther, D. (2012). Do one-to-one initiatives bridge the way to 21st century knowledge and skills? *Journal of Educational Computing Research*, *46*(1), 1-30.

Lowther, D. (2012). Do One-to-one initiatives bridge the way to 21st century knowledge and skills? *Journal of Educational Computing Research*, *46*(1), 1-30.

Mbuva, J. M. (2014). Online Education: Progress and Prospects. *Journal of Business & Educational Leadership*, *5*(1), 91-101.

McIntosh, S., & Center on Education, P. (2011). *State high school tests: Changes in state policies and the impact of the college and career readiness movement.* Center on Education Policy. Retrieved from: http://www.cep-dc.org/displayTopics.cfm?DocumentTopicID=7

Means, B., Y. Toyama, R. Murphy, M. Bakia, & K. Jones. 2010. Evaluation of evidence-based practices in online learning a meta-analysis and review of online learning studies.

Merriam-Webster's collegiate dictionary (2015). Springfield, MA: Merriam-Webster Incorporated.

Moore, M. G., & Kearsley, G. (2011). *Distance education: A systems view of online learning*. Cengage Learning.

Morgan, H. (2015). Online Instruction and Virtual Schools for Middle and High School Students: Twenty-First-Century Fads or Progressive Teaching Methods for Today's Pupils?. *Clearing House: A Journal Of Educational Strategies, Issues And Ideas*, *88*(2), 72-76.

Myhill D. (2006) Talk, talk, talk: teaching and learning in whole class discourse. Research Papers in Education 21

National Center for Education Statistics. (2013). Elementary and secondary education. *Digest of Education Statistics*. Retrieved from https://nces.ed.gov/programs/digest/d13/

National Center for Education Statistics & Educational Testing, S. (2012). The nation's report card: Writing 2011. National Assessment of Educational Progress at Grades 8 and 12. NCES 2012-470. *National Center for Education Statistics*.

Nguyen, T. t. (2015). The Effectiveness of Online Learning: Beyond No Significant Difference and Future Horizons. *Journal of Online Learning & Teaching*, *11*(2), 309-319.

O'Brien, B. S., & Renner, A. L. (2002). Online student retention: Can it be done? In P. Barker & S. A. Rebelsky (Eds.), Proceedings of the world conference on educational multimedia, hypermedia and telecommunications (pp. 1479–1483). Waynesville, NC: Association for the Advancement of Computing in Education.

Ramig, R. (2014). One-to-one computing and learning: Has it lived up to its expectations? *Internet@Schools*, *21*(2), 6-8.

Rauh, J. (2011). The utility of online choice options: Do purely online schools increase the value to students? *Education Policy Analysis Archives*, *19*(34). Retrieved from http://www.redalyc.org/pdf/2750/275019735034.pdf

Roblyer, M. D. (2006). Virtually successful: Defeating the dropout problem through online school programs. *Phi Delta Kappan, 88*(1), 31–36.

Rovai, A. P., Ponton, M., Wighting, M., & Baker, J. (2007). A comparative analysis of student motivation in traditional classroom and e-learning courses. *International Journal on E-Learning*, *6*(3), 413-432.

Saettler, Paul (1990). *The evolution of American educational technology.* Englewood, Colorado: Libraries Unlimited, Inc.

Schaffhauser, D. (2011). High-stakes online testing. (Cover story). *T H E Journal*, *38*(6), 28-39.

Schneider, J. (2014). Cyber skepticism. *Phi Delta Kappan*, *95*(4), 80.

Schorr, J., & McGriff, D. (2012). Future schools: Blending face-to-face and online learning. *Education Digest: Essential Readings Condensed for Quick Review*, *77*(5), 30-37.

Sener, J. (2010). Why online education will attain full scale. *Journal of Asynchronous Learning Networks, 14*(4), 3-16.

Shapley, K.S., Sheehan, D., Maloney, C., & Caranikas-Walker, F. (2010). Evaluating the Implementation Fidelity of Technology Immersion and its Relationship with Student Achievement. *Journal of Technology, Learning, and Assessment, 9*(4).

Silva, J. (2013). Understanding the construction of the teaching discourse in an online environment. *International Education Studies,* 6(3), 143-155.

Sorenson, C. (2012). Learning online at the K-12 level: A parent/guardian perspective. *International Journal of Instructional Media 39*(4): 297–307.

Shapley, K.S., Sheehan, D., Maloney, C., & Caranikas-Walker, F. (2010). Evaluating the Implementation Fidelity of Technology Immersion and its Relationship with Student Achievement. Journal of Technology, Learning, and Assessment, 9(4).

Shoaf, L. M. (2011). Perceived advantages and disadvantages of an online charter school. *American Journal of Distance Education, 21*(4), 185-198.

Simburg, S., & Roza, M. (2012). *Innovating toward sustainability: How computer labs can enable new staffing structures, and new savings. Schools in crisis: Making ends meet*. University of Washington: Center on Reinventing Public Education.

Stephens, K.K., & Mottet, T.P. (2008). Interactivity in a web conference training context: Effects on trainers and trainees. *Communication Education, 57*(1), 88-104.

Skylar, A. (2009). A comparison of asynchronous online text-based lectures and synchronous interactive web conferencing lectures. *Issues in Teacher Education, 18,* 69-84.

Smith, P. J. (2005). Learning preferences and readiness for online learning. *Educational Psychology: An International Journal of Experimental Educational Psychology, 25*(1), 3-12.

Stetser, M. C., Stillwell, R., & National Center for Education Statistics (2014). Public high school four-year on-time graduation rates and event dropout rates: School years 2010-11

and 2011-12. First Look. NCES 2014-391. *National Center For Education Statistics*. Retrieved from http://nces.ed.gov/pubs2014/2014391.pdf

Storz, M. G., & Hoffman, A. R. (2013). Examining response to a one-to-one computer initiative: Student and teacher voices. *RMLE Online: Research in Middle Level Education, 36*(6)

Suppes, P. (1964). Modern learning theory and the elementary-school curriculum. American *Educational Research Journal,* 1, 79–93.

Suppes, P. (1966). The uses of computers in education. *Scientific American,* 215, 206–220.

Toch, T. (2010). In an era of online learning, schools still matter. *Phi Delta Kappan 91*(7), 72–73.

Tonks, D., Weston, S., Wiley, D., & Barbour, M. (2013). « Opening » a new kind of high school: The story of the open high school of Utah. *International Review of Research in Open & Distance Learning*, *14*(1), 255-271.

Vasquez, E., and C. Straub. (2012). Online instruction for K-12 special education: A review of the empirical literature. *Journal of Special Education Technology 27*(3), 31–40.

Vonderwell, S., & Boboc, M. (2013). Promoting formative assessment in online teaching and learning. *Techtrends: Linking Research & Practice to Improve Learning*, *57*(4), 22-27.

Wang, Y. D. (2014). Building student trust in online learning environments. *Distance Education*, *35*(3), 345.

Watson, J. F., Winograd, K., & Kalmon, S. (2009). Keeping pace with K–12 online learning: A snapshot of state-level policy and practice. Naperville, IL: Learning Point Associates.

Weston, M. E., & Bain, A. (2010). The end of techno-critique: the naked truth about 1:1 laptop initiatives and educational change. *The Journal of Technology, Learning and Assessment, 9*(6).

Wicks, M. (2010). A national primer on K–12 online learning, Version 2. Vienna, VA: *International Association for K-12 Online Learning.*

Woolley, D. R. (1994). PLATO: The Emergence of Online Community. Retrieved April 3, 2015, from http://www. thinkofit.com/plato/dwplato.htm

Yuan-Hsuan Lee1, j., Waxman, H. h., Jiun-Yu Wu1, j., Michko, G. g., & Lin, G. g. (2013). Revisit the Effect of Teaching and Learning with Technology. *Journal of Educational Technology & Society*, *16*(1), 133-146.

Zandberg, I., Lewis, L., & Greene, B. (2008). *Technology-based distance education courses for public elementary and secondary school students [electronic resource] : 2002-03 and 2004-05 / Izabella Zandberg, Laurie Lewis*. Washington, DC : U.S. Dept. of Education, National Center for Education Statistics, Institute of Education Sciences, 2008.

CHAPTER 2

ONLINE LEARNING IN A RURAL SCHOOL SETTING: AN EXAMINATION OF STUDENT ACHIEVEMENT DIFFERENCES

With online learning on the rise (Wicks, 2010) this dissertation examined the effectiveness of an asynchronous online learning program that used a computer network to present educational content void of face-to-face interactions or simultaneous online participation with an instructor (Coogle, & Floyd, 2015). A comparison was set up between a group of students who participated in an online learning experience and a group of students who participated in a traditional face-to-face learning experience. End of course assessments and national percentile ranks were used as dependent variables with the type of instruction (online or traditional), gender, and socioeconomic status as independent variables. Chapter 2 conveys the research design and theoretical framework employed to address the research questions. Participant selection criteria, instrumentation, data collection, data analysis, methods of validity, limitations, findings, and a summary discussion are also presented. Engaging a causal-comparative design, drawing from literature connected to the progression of online learning in today's society, a study of students engaged in asynchronous online learning in a rural Georgia school system was conducted over the period of one school year.

Purpose of the study.

There were research studies that supported (Brown, 2012; Heppen et al., 2012; Nguyen, 2015; Schorr & McGriff, 2012) and that argued against (Brown & Liedholm, 2002; Figlio, Rush & Linn, 2010; Xu & Jaggars, 2013) the use of online learning in the K-12 learning environment. However, online programs are growing at an exponential rate (Wicks, 2010). Nguyen (2015)

stated that, “the physical ‘brick and mortar’ classroom is starting to lose its monopoly as the place of learning… The Internet has made online learning possible, and many researchers and educators are interested in online learning” (p. 309). However remarkable the growth of online learning within the realm of K-12 education may be, the fact that the long-term ramifications of student participation are largely unknown calls for more research into the phenomenon (Nguyen, 2015). Because of this need for further research, the purpose of this dissertation was to examine student participation in an asynchronous, online, high school learning environment and discern its effect on student outcomes by looking at end of course assessments and national percentile rank in a small rural Georgia school system. The study provides data for the rural administrator, so that they may make an informed decision about the implementation of online learning within a rural school setting.

The following research questions guided the study:

1. How does the achievement of students participating in an asynchronous online learning environment compare to those peer students participating in a traditional learning environment as measured by End of Course assessments (EOCs)?

2. How does the achievement of students participating in an asynchronous online learning environment compare to those peer students participating in a traditional learning environment as measured by national percentile rank?

A quantitative study alone may not guarantee that conclusions drawn are 100% reliable (Anastassiou, 2001); however, this dissertation presents data which, when used with other pertinent data and studies, may provide the reader with informed conclusions. The anticipated benefit of this study is to provide information that will encourage system administrators to

pursue or decline online learning in their districts. It also has the potential to identify key pitfalls to avoid when establishing online learning environments.

Theoretical framework.

Numerous research studies (Ball, Ogletree, Asunda, Miller, & Jurkowski, 2014; Demir, 2006; Jacobsen, 1998; Less, 2003; Medlin, 2001; Mustafa & Al-Mothana, 2013) have employed Rogers' Diffusion of Innovation Theory in understanding the adoption of new classroom technology innovation, such as online learning, and its impact on student outcomes. This study utilized a quasi-experimental design, while embracing Rogers' Diffusion of Innovation Theory. Diffusion theory centers on the *conditions* that increase or decrease the likelihood that an innovative idea, product, or practice will be adopted by the membership of a given culture (Rogers, 1995). Rogers (1995) claimed the inclusion of four stages of innovation: (a) invention, (b) diffusion through the social system, (c) time, and (d) outcomes. He challenges the reader by asserting that innovation diffusion research attempts to identify and explain variables that influence the decision making process of those adopting a new medium, such as online learning. Rogers also explains the five categories of innovation adopters (innovators, early adopters, early majority, late majority and laggards). For the purpose of this study, the rural school system studied would be considered an early adopter when compared to its peers (Governor's Office of Student Achievement, 2016).

An innovation is an idea, practice, or object that is perceived as new by individuals or a social system (Rogers, 2003). Five factors that affect the characteristics of an innovation exist. *Relative advantage* is the degree to which the innovation is better than what it is replacing. *Compatibility* is the degree to which the innovation meets the values and needs of those

exploring adoption. *Complexity* is the perceived degree of difficulty of the adoption of the innovation. *Trialability* is the degree to which the innovation can be experimented prior to adoption. *Observability* is the degree to which outcomes of adopting the innovation are observable to the adopters (Rogers, 2003). This study, through four-way ANOVA, identified which elements in Rogers' (2003) diffusion of innovation theory are more likely to influence the adoption and diffusion of asynchronous online learning in a rural Georgia school system.

Methodology

This dissertation is grounded in a post-positivist paradigm (Scharff, 2013; Creswell, 2014) in which a causal-comparative design is employed to determine the impact of online learning on student achievement while acknowledging that there are external variables which may impact the experiment. A dualist/objectivist epistemology is adhered to which simply states that the investigator and the investigated are independent of one another, thus lending itself to objective observation leading to discovery of reality (Martin, 2010). As it relates to this study, the observer was not a participant, nor contributor, to the online learning environment, and thus, remained objective in the interpretation and reporting of all findings.

Research design.

The overall design of my research adopted a quantitative approach, meaning that I used a formal, objective, systematic process where data were utilized to address the extent to which the use of an online high school learning environment correlates to student outcomes on end of course assessments and national percentile rank in a small rural Georgia school system (Bettany-Saltikov & Whittaker, 2014). The design of the study was ex post facto, causal comparative because no random assignment of the treatment group took place. This causal-comparative

design's primary purpose was to investigate causal relationship when traditional experimental designs are not possible (Isaac & Michael, 1971). In this instance, the presumed causal condition (asynchronous online learning) had already occurred and the potential for extraneous variables are considered. Existing differences between groups being compared are controlled and causal conclusions are made with caution (Isaac & Michael, 1971; Kerlinger, 1964; Tuckman, 1972; Van Dalen, 1962). To assess the impact of the course delivery model on student achievement with regard to assessment, historical data on standardized assessments, in the form of End of Course Milestones, were analyzed using the method of factorial analysis of variance (ANOVA) in order to draw conclusions on the effectiveness of asynchronous online learning implementation in a rural Georgia school system.

The following steps were followed in identifying, collecting and analyzing data: (a) selection of study site; (b) identification of pre-existing treatment and control groups; (c) statistical analysis of treatment and control group prior academic performance (GPA) using Welch's t-test after removal of participants not meeting established criteria; (d) retrieval of EOC test score and national percentile data (dependent variables) from SLDS, Department of Education Portal, and Infinite Campus as facilitated by local system data specialists; (e) a four-way ANOVA was conducted in language arts, mathematics, science and social studies to compare the main effects of online learning and the interaction effect between gender, race, and socioeconomic status on test scores and then the model is repeated for national percentile rankings; (f) higher order independent variable interactions with no significance were then removed in order to simplify both models and focus on the independent variable of interest, online learning.

Setting.

The rural northwest Georgia school system where this study was conducted comprised of one high school with an overall student population of 1,125 at the time of the study. The school system is one of three rural public school systems in the state of Georgia to have an online learning academy where the primary delivery model is asynchronous online learning (Governor's Office of Student Achievement, 2016). Being that only three systems out of the eighty-eight rural school systems in Georgia contain an online learning academy, this school system is considered an early adopter of online learning (Governor's Office of Student Achievement, 2016).

The online learning academy in the school system studied utilizes an asynchronous online delivery platform called Odysseyware. Odysseyware is a for-profit platform delivering asynchronous online content through courses meeting all Georgia state curriculum standards. Students navigate units of standards-based content void of face-to-face interaction or simultaneous teacher participation. This online platform delivers student-driven instruction through stand-alone curriculum and competency based learning models. For more than a decade, Odysseyware has delivered eLearning solutions to thousands of schools and districts across the U.S. (Odysseware, 2017). Students navigate units within assigned courses, participating in engaging curriculum focused on a variety of content delivery mediums, including video, audio and text.

The site was selected for the study based on its identification as a rural school system, its adoption of online learning, and its diverse student population. A further breakdown of the demographics of this population is presented in Table 1.

Table 1

Demographics of the Rural Northwest Georgia School Studied

Variable	Category	Total	Percentage
Gender	Female	543	52%
	Male	582	48%
Race	Asian	24	2%
	Black	68	6%
	Hispanic	338	30%
	Multiracial	20	2%
	White	675	60%
Socioeconomic Status	Economically Disadvantaged	585	52%
	Not Economically Disadvantaged	540	48%
Cohort	2016 (Seniors)	256	23%
	2017 (Juniors)	279	25%
	2018 (Sophomores)	302	27%
	2019 (Freshmen)	288	26%

There was a roughly even distribution of male (52%) and female (48%) students, and the majority of students were White (60%). Approximately half of the students were identified as socioeconomically disadvantaged (52.0%) with overall student participation distributed across all four cohorts with the 2018 (Sophomore) cohort having the largest population at 27% and the 2016 (Senior) cohort having the smallest population at 23%.

Participant selection criteria.

A quasi-experimental design was employed, as the sample group was not randomly assigned, but pre-determined based on student participation in the academic setting (Sampath, 2005). The treatment group was identified through consecutive sampling (Sampath, 2005), where all accessible students were included in the study. This is to say that all asynchronous learners meeting selection criteria present in the school system were included in the study. Although the

treatment group was not randomized, the causal variable (asynchronous online learning) was delivered equitably to all parties in the treatment group via the Odysseyware platform. Odysseyware is an asynchronous online learning platform that is aligned to Common Core curriculum standards. Students participated in both the treatment and control groups within the same time constraints. The selection of this site and study population was made based on the historical context of online learning in the school system (Governor's Office of Student Achievement, 2016) with an emerging online learning environment and the existence of both an experimental and control group.

The treatment group participated in online learning delivered through Odysseyware. The delivery of instruction was driven by an asynchronous online learning model where courses do not take place in "real time," but are time-driven based on assigned tasks and agreed upon deadlines (Coogle & Floyd, 2015). Students within the treatment group worked at their own pace while still meeting assigned benchmarks throughout the course and not exceeding the time allotted for control group (traditional learners). All instruction to the treatment group was delivered asynchronously and students worked independently of one another.

All online learners, with the exception of those placed for discipline reasons and those students repeating a course, were included in the study. Students placed in an asynchronous online learning setting for discipline reasons as a form of alternative school were excluded from the treatment group due to their lack of choice in their educational setting (Robison, Jaggers, Rhodes, Blackmon, & Church, 2017). Students who were repeating a course for the purpose of credit recovery were excluded as they would be taking the End of Course assessment for a second time, which could provide them with an unfair advantage when participating on the EOC

(Fong, Jaquet, Finkelstein & Society for Research on Education Effectiveness, 2016). Three hundred and sixty-two online learners participated in the treatment group (107 students in language arts, 59 students in mathematics, 47 students in science, and 149 students in social studies). All online learners are enrolled in the same rural Georgia school system and participate as a part of the system online learning academy.

Comparisons are drawn to the general high school population (control group) in those same core content areas (407 students in language arts, 319 students in mathematics, 354 students in science, and 389 students in social studies) participating in a general education setting void of asynchronous online learning. Students participating within each content area are independent of one another. In Tables 2-5, demographics for the treatment and control are provided.

Table 2

Demographics of the Language Arts Dataset

Variable	Category	Online	Face-to-face	Total
Gender	Female	49	196	245
	Male	58	211	269
Race	Asian	3	11	14
	Black	10	21	31
	Hispanic	36	129	165
	Multiracial	2	6	8
	White	56	239	295
Socioeconomic Status	Economically Disadvantaged	65	197	262
	Not Economically Disadvantaged	42	210	252
Cohort	2016 (Seniors)	6	20	26
	2017 (Juniors)	45	209	254
	2018 (Sophomores)	3	4	7
	2019 (Freshmen)	53	184	227

Table 3

Demographics of the Mathematics Dataset

Variable	Category	Online	Face-to-face	Total
Gender	Female	27	158	185
	Male	32	161	193
Race	Asian	1	9	10
	Black	6	20	20
	Hispanic	20	104	124
	Multiracial	0	4	4
	White	32	182	214
Socioeconomic Status	Economically Disadvantaged	27	145	172
	Not Economically Disadvantaged	32	174	206
Cohort	2016 (Seniors)	1	5	6
	2017 (Juniors)	2	11	13
	2018 (Sophomores)	14	87	101
	2019 (Freshmen)	42	216	258

Table 4

Demographics of the Science Dataset

Variable	Category	Online	Face-to-face	Total
Gender	Female	20	172	192
	Male	27	182	209
Race	Asian	1	13	14
	Black	4	14	18
	Hispanic	14	104	118
	Multiracial	0	4	4
	White	29	218	247
Socioeconomic Status	Economically Disadvantaged	26	153	179
	Not Economically Disadvantaged	21	201	222
Cohort	2016 (Seniors)	0	0	0
	2017 (Juniors)	2	4	6
	2018 (Sophomores)	12	134	146
	2019 (Freshmen)	33	216	249

Table 5

Demographics of the Social Studies Dataset

Variable	Category	Online	Face-to-face	Total
Gender	Female	75	191	266
	Male	74	198	272
Race	Asian	4	10	14
	Black	13	24	37
	Hispanic	39	109	158
	Multiracial	4	12	16
	White	79	233	312
Socioeconomic Status	Economically Disadvantaged	71	200	271
	Not Economically Disadvantaged	78	189	267
Cohort	2016 (Seniors)	97	179	276
	2017 (Juniors)	49	208	257
	2018 (Sophomores)	3	1	4
	2019 (Freshmen)	0	0	0

After removing students placed in an asynchronous online learning environment for discipline reasons and those placed for the purpose of recovering core course credit, Welch's t-test was conducted to compare entry grade point average (GPA), or the cumulative average of grades earned to date, between those included in the treatment (online learning) and control (traditional learning) groups (Welch, 1938). Although there is evidence of a non-normal distribution, unequal group size, and unequal variance, Welch's t-test remains robust for large samples such as the one in this study (Welch, 1938; Zimmerman & Zumbo, 1993). At the 5% level of significance, there was no significant difference in the GPA of online learners (M = 84.29, SD = 11.59) and traditional learners (M = 85.26, SD = 10.27); $t(452) = 1.41$, $p = .158$.

These results suggest that the prior academic performance of the treatment and control groups are similar.

In summary, this observational study focused on a rural high school located in northwest Georgia containing a pre-existing treatment and control group in regards to the delivery of asynchronous online learning. Students participating in the treatment and control group exhibit the pre-condition of similar academic performance based on prior year's GPA, which is an indicator of future academic success (Caldarella & McKee, 2016)**.**

Instrumentation and data collection.

The primary data sources of this study consisted of End of Course assessments (EOCs) and national percentile ranks as displayed in the State Longitudinal Data System (SLDS), Department of Education Portal and local data collection system (Infinite Campus). End of Course Assessments are a part of the Georgia Milestones state standardized assessment program (Georgia Department of Education, 2016).

Debuted in 2014, Georgia EOC Milestones are the primary standardized assessment delivered to all students in grades 9 - 12. These assessments are delivered in eight content areas and are grouped for the purpose of this study as follows: language arts (Ninth Grade Literature & American Literature); mathematics (Algebra I & Algebra II); science (Biology & Physical Science); and social studies (U.S. History, & Economics). Students earn a test score on a scale of 0 - 100 on each content area test, and these scores are considered accurate predictors of future performance on subsequent EOCs (Georgia Department of Education, 2016). This score translates to a classification of beginning learner, developing learner, proficient learner and distinguished learner and is used to compare student performance with peers throughout the state

of Georgia. For the purpose of this study, only those in grades 9 - 12 are considered due to the presence of asynchronous online learning in these grade levels. National Percentile ranks are produced as a result of select test items on the EOCs that are nationally normalized (Georgia Department of Education, 2016). These percentile rankings are used to compare a student to their peers across similar assessments nation-wide. For instance, a student scoring at the 90th percentile is assumed to perform as well as, or better than, 90 % of his peers across the nation. Because only select items are included in the determination of percentile rank, it is possible that two students receiving an identical test score may have differing percentile rankings (Georgia Department of Education, 2016). EOC's were administered at the conclusion of the academic school year with the exception of Economics, which was completed at the end of the fall semester.

These data were collected through the submission and retrieval of End of Course Milestone results and national percentile rank rates as displayed in the aforementioned platforms. These efforts were coordinated between the system testing director and data specialists at the system level. Data were managed and organized in each of the platforms at the conclusion of the 2015 - 2016 school year and were reviewed and documented for the purpose of the study. The data collected (EOC & National Percentile Rankings for traditional and online learners) are used to formulate conclusions and recommendations for the advancement or deceleration of online learning in the public educational landscape.

Data analysis.

Analysis of Variance (ANOVA) was chosen as the most appropriate analysis for this study. Both research questions aim to compare the means of two categorical groups (online or

traditional). ANOVA is specifically a test that allows the comparison of means between categorical groups, and can additionally simultaneously control for demographic variables such as gender and socioeconomic status (Crawley, 2013). Although ANOVA traditionally has an assumption that data is normally distributed, ANOVA is considered generally robust to violations of this assumption (Glass et al. 1972, Harwell et al. 1992, Lix et al. 1996). An ANOVA is not very sensitive to moderate deviations from normality as when you take a large number of samples from a population, the means of those samples are approximately normally distributed even when the population is not normal (Glass et al. 1972, Harwell et al. 1992, Lix et al. 1996). Additionally, ANOVA has an assumption of homogeneity of variance as the *F* statistic is robust to the assumption as long as group sizes are equal, or if unequal, the samples are large enough that the *F* statistic is considered too conservative. This analysis will be using a four-way ANOVA and non-parametric equivalent tests do not exist. As such, normality and homogeneity will be examined graphically using a q-q plot and a scatter plot of predicted values versus residuals respectively, and will be used in combination with the statistical results of the ANOVA to comment on the chance of spurious results (Crawley, 2013).

A q-q plot is a graphical technique used for determining if two data sets come from populations with a common distribution. If the data is normally distributed, the points in the q-q normal plot lie on a straight diagonal line. If the points deviate from a straight diagonal line then the observer can comment on the degree of non-normality and the existence of extreme outliers based on the shape of the plotted data (Crawley, 2013). A scatter plot of predicted values versus residuals is a plot used to detect non-linearity, unequal error variances, and outliers. If the data represents equal variance, points should be equally distributed around the horizontal zero line. If

there is significant deviation from the zero line and a lack of balance and/or shape, the data may indicate increased potential for increased error and the observer should caution the reader in their interpretation (Crawley, 2013).

The four-way ANOVA was used to analyze the independent variables of online learning, socioeconomic status, race, and gender. In this study, EOC test scores and national percentile ranking are the dependent variables. Online learning status (online vs. traditional), socioeconomic status (economically disadvantaged vs. non-economically disadvantaged), gender (Male vs. Female) and race (White, Hispanic or Other) are the independent variables. This results in a 2x2x2x3 factorial ANOVA design. An interaction effect occurs when the effect of one independent variable on the dependent variable varies by the level of the other independent variable (Stevens, 2008). For the purpose of this study, the ANOVA will reveal whether the effect of online learning interacts with socioeconomic status, race, or gender. A four-way ANOVA is performed for each content area (English Language Arts, Mathematics, Science and Social Studies) and repeated for both dependent variables (test score and national percentile ranking). Higher order independent variable interactions (3-way and 4-way) with no significance were then removed in order to simplify both models and focus on the interactions involving the independent variable of interest, online learning (Crawley, 2013). The assumption of independence of observation is met since no relationship exists between each student participant by content area (Crawley, 2013). That is, within each content area, every student participant is independent of other participants and duplication does not occur.

In summary, after the identification of an appropriate treatment and control group, a four-way ANOVA was selected as the most appropriate form of analysis due to it’s focus on specified

interactions between independent variables (Crawley, 2013). ANOVA is equally valid and produces equivalent results to multiple regression models and is commonly used when a researcher is interested a specific interaction (Crawley, 2013). Two four-way ANOVA models were repeated across all four content areas (English language arts, mathematics, science and social studies) for the dependent variables of test score and national percentile ranking. Higher order independent variable interactions were then removed due to non-significance and the model was simplified for the purpose of reporting results that are relevant to the research questions.

Methods for validity.

Tests themselves are not valid or invalid. Instead, we validate the use of a test score (College Board, 2016;). Test validity is defined as "an integrated evaluative judgment of the degree to which empirical evidence and theoretical rationale support the adequacy and appropriateness of inferences and actions based on test scores and other modes of assessment" (Messick, 1989, p. 13). In order to garner maximum levels of external and content validity for the study, the researcher utilized End of Course Assessments as the primary source of data. EOCs are nationally normalized assessments, which adhere to national common core standards of curriculum (Georgia Department of Education, 2016). Each student in the control and treatment group takes an identical assessment. This standardization increases the validity of the performance data yielded from the assessment (Messick, 1989). As previously stated, normality and homogeneity will be examined graphically using a q-q plot and a scatter plot of predicted values versus residuals respectively, and will be used in combination with the statistical results of the ANOVA to comment on the chance of spurious results (Crawley 2013).

Results

The results of student participation in asynchronous online learning as compared to their traditional counterparts, measured by EOC test scores and national percentile ranking, are presented in this section. Results from 362 online learners and 1,469 traditional learners are reported and analyzed using four-way ANOVA. Data is broken into the four content areas of language arts, mathematics, science and social studies.

Language arts.

Data from 514 participants were obtained to set up the comparison between asynchronous online learning students and traditional learning students in regards to language arts performance. Of this sample, 107 students participated in online learning and 407 students participated in traditional learning (Table 6). A further breakdown of the demographics of this population is presented in Table 2. There was a balanced distribution of both male (52.3%) and female (47.7%) students, with the majority of students being White (57.4%). Approximately half of the students were identified as socioeconomically disadvantaged (51.0%) and the vast majority of students were from the 2017 (49.4% Juniors) and 2019 (44.2% Freshmen) cohorts.

Table 6 presents descriptive statistics of the two outcome variables of this analysis, test score and percentile, for the language arts dataset. The mean raw test score was 75.97 (*SD* = 11.04) and the mean percentile was 60.88 (*SD* = 25.68) for all students and the breakdown of online and traditional learner outcomes is also included in Table 5.

A four-way ANOVA was conducted to compare the main effects of online learning and the interaction effect between gender, race, and socioeconomic status on test scores and national percentile rankings. Due to low participation of Asian and Multiracial students, race was simplified to a variable with three categories (White, Hispanic and Other). This was done in order to control for the possibility of a single participant misrepresenting mean data for a given population (Tabachnick & Fidell, 2007). Hispanic students remain as a subgroup per the request of the school district participating in the study. The district has observed rapid growth with this demographic and their academic performance is an area of concern.

Table 6

Mean and SD of Language Arts Performance Metrics for Control and Treatment Groups

Variable	*N*	*M*	*SD*
Test Score (All Students)	514	75.97	11.04
Test Score (Traditional)	407	78.70	9.20
Test Score (Online)	107	65.38	11.08
Percentile (All Students)	514	60.88	25.68
Percentile (Traditional)	407	66.47	22.71
Percentile (Online)	107	39.61	25.27

Cohorts were not included in the analysis as there was minimal participation in the 2016 and 2018 cohorts and no intuitive way to group these nominal variables.

ANOVA results for the language arts *test* (EOC) score is presented in Table 7. Comparisons of mean test scores for each variable level is presented in Table 8. Based on these findings we can conclude that students taking language arts online have significantly lower test scores than students using traditional learning methods ($F(1, 507) = 56.60$, $p < .001$).

Table 7

ANOVA Results for Language Arts Test Score.

Variable	*SS*	*df*	*MS*	*F*	p
Online Status	4738.282	1	4738.28	56.60	< 0.001*
Gender	623.46	1	623.46	7.44	.007*
Race	1064.33	2	532.17	6.35	.002*
SES	450.37	1	450.37	5.38	.02*
Online Status-Gender	65.59	1	65.59	0.78	.37
Online Status-Race	312.48	2	156.24	1.86	.15
Online Status-SES	134.77	1	134.77	1.61	.20
Error	42186.26	504	83.70		
Total	3028849.00	514			

*$p < .05$

Table 8

Comparisons of Mean Language Arts Test Scores for Traditional and Online Delivery

Variable	Level	*M*	*SD*
Online Status	Traditional	78.75	9.20
	Online	65.38	11.08

Students who participated in online learning had a mean language arts score of 65.38, whereas students who participated in traditional learning had a mean language arts score of 78.75. There was no significant interaction between method of learning language arts and any demographic variable indicating that this effect was consistent across all races, genders and socioeconomic statuses.

A q-q plot of residuals is presented in Figure 1 and appears to generally follow a linear line. A scatter plot of predicted values versus residuals is presented in Figure 2 and the residuals appear to have similar variance across the sample with no systematic relationships obvious

between residuals and predicted values. Therefore, it is accepted that the assumptions of the ANOVA were met and results are statistically valid.

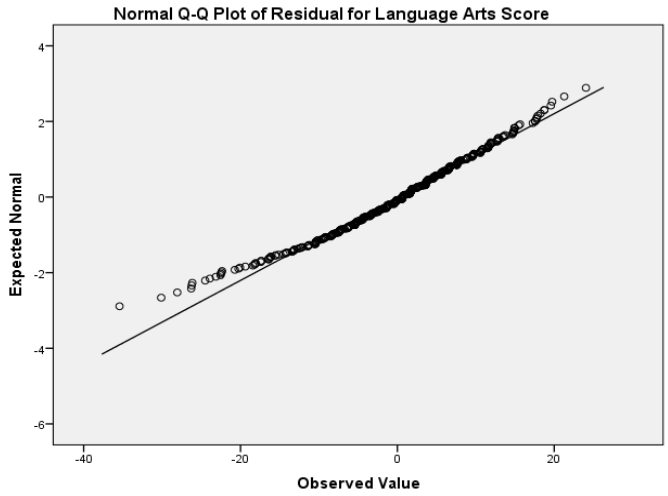

Figure 1. Q-Q Plot of residuals for the ANOVA on language arts score.

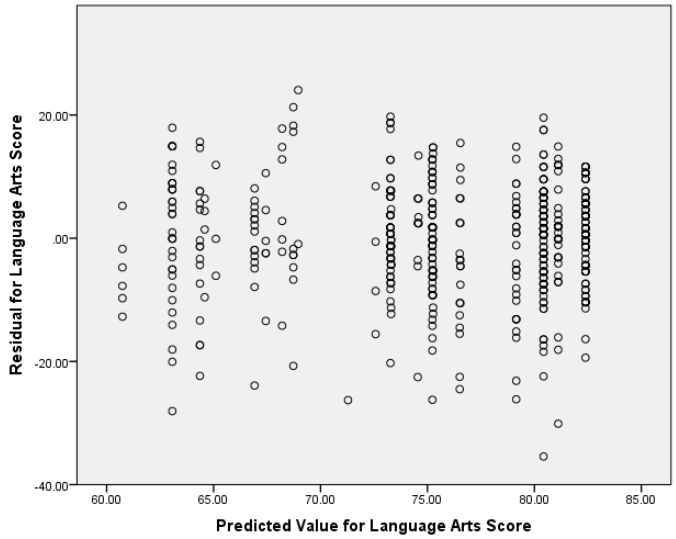

Figure 2. Predicted values vs residuals for language arts score.

ANOVA results for *percentile* language arts score are presented in Table 9. Comparisons of mean percentiles for each variable level is presented in Table 10.

Table 9

ANOVA Results for Language Arts Percentile

Variable	*SS*	*df*	*MS*	*F*	*p*
Online Status	22072.09	1	22072.09	43.48	< 0.001*
Gender	628.78	1	628.78	1.23	.26
Race	3010.35	2	1505.17	2.96	.05
SES	3012.84	1	3012.84	5.93	.01*
Online Status-Gender	74.40	1	74.40	0.14	.70
Online Status-Race	1803.65	2	901.83	1.77	.17
Online Status-SES	289.96	1	289.96	0.57	.45
Error	255823.14	504	507.58		
Total	2243206.00	514			

*$p < .05$

Table 10

Comparisons of Mean Language Arts Percentiles for Traditional and Online Delivery

Variable	Level	*M*	*SD*
Online Status	Traditional	66.47	22.71
	Online	39.61	25.27

Based on these findings we can conclude that students taking language arts online have significantly lower percentile rankings than students using traditional learning methods (F (1, 504) = 43.48, $p < .001$), and similar to language arts test scores, there is no interaction between taking the course online or any demographic variable. As previously, a q-q plot and predicted values versus residuals is presented in Figures 3 and 4 respectively. As before, there are no concerns with violations of either the assumption of normality or homogeneity, although there is a negative trend in the latter indicating some model misspecification, specifically that low percentiles are over predicted and higher percentiles are under predicted.

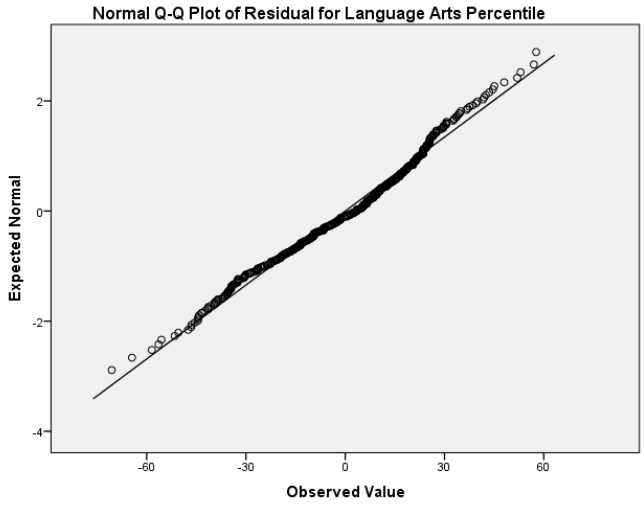

Figure 3. Q-Q Plot of language arts percentile residuals.

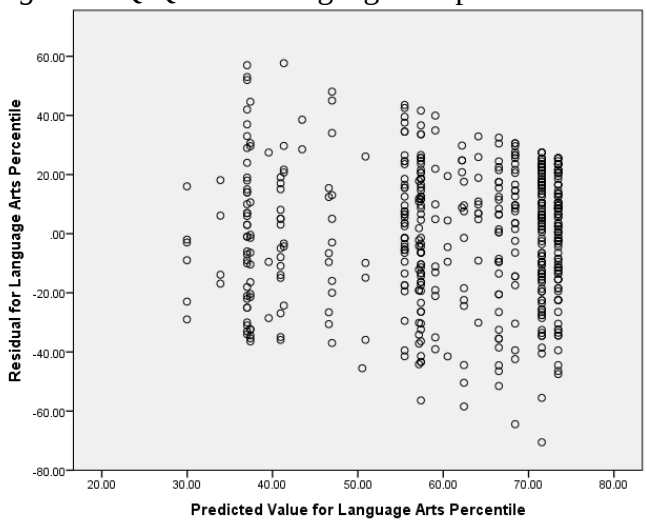

Figure 4. Residuals vs predicted values for the language arts percentile ANOVA.

In summary, those students taking language arts courses online received significantly lower test scores and percentile rankings than their traditional counterparts. No significant interactions existed between online status and gender/race/socioeconomic status for both test score and percentile ranking. Assumptions of normality and homogeneity were met; therefore the results are considered statistically valid.

Mathematics.

Data for 378 participants were obtained for the comparison between asynchronous online learning and traditional learning in regards to mathematics performance. Table 11 presents the number of students who participated in online learning (15.6%) and traditional learning (84.4%). A breakdown of the demographics of this population is also presented in Table 3. There was a roughly evenly distribution of both male (51.1%) and female (48.9%) students and once again the majority of students were White (57.4%). Slightly less than half of the students were identified as socioeconomically disadvantaged (45.5%) and the vast majority of students were from the 2018 (26.7% Sophomore) and 2019 (68.3% Freshmen) cohorts.

Table 11

Mean and SD of Mathematics Performance Metrics for Control and Treatment Groups

Variable	*N*	*M*	*SD*
Test Score (All Students)	378	76.03	11.72
Test Score (Traditional)	319	78.49	10.53
Test Score (Online)	59	62.71	8.47
Percentile (All Students)	378	70.48	28.24
Percentile (Traditional)	319	76.71	23.28
Percentile (Online)	59	36.80	29.06

A four-way ANOVA was once again conducted to compare the main effects of online learning and the interaction effect between gender, race, and socioeconomic status on test scores and national percentile rankings. As with previous analyses, race was simplified to a variable with three categories; White, Hispanic and Other.

ANOVA results for test score is presented in Table 12. Comparisons of mean test scores for variables meeting levels of significance are presented in Table 13.

Table 12

ANOVA Results for Mathematics Test Score

Variable	*SS*	*df*	*MS*	*F*	*p*
Online Status	6162.79	1	6162.79	61.43	< .001*
Gender	96.32	1	96.32	0.96	.32
Race	518.64	2	259.32	2.58	.07
SES	20.73	1	20.73	0.20	.65
Online Status*Gender	7.58	1	7.58	0.07	.78
Online Status*Race	344.86	2	172.43	1.71	.18
Online Status*SES	28.43	1	28.43	0.28	.59
Error	36914.30	368	100.31		
Total	2236867.00	378			

*p < .05

Table 13

Comparisons of Mean Mathematics Test Scores for Traditional and Online Delivery

Variable	Level	*M*	*SD*
Online Status	Traditional	78.49	10.53
	Online	62.71	8.47

Based on these findings we can conclude that students taking mathematics online have significantly lower test scores than students using traditional learning methods (F (1, 368) = 61.43, p < .001). There was, however, no significant interaction between online learning and any demographic variable indicating that this effect is consistent across genders, races and socioeconomic status.

A q-q plot and residuals versus predicted values scatter plot is also presented in Figures 5 and 6. The q-q plot appears close to linear, however there does appear to be heterogeneity of variances in the residuals versus predicted values plot as indicated by the greater spread of

residuals for higher predicted values. This may mean that statistical findings for mathematics score are questionable although the effect does not appear severe.

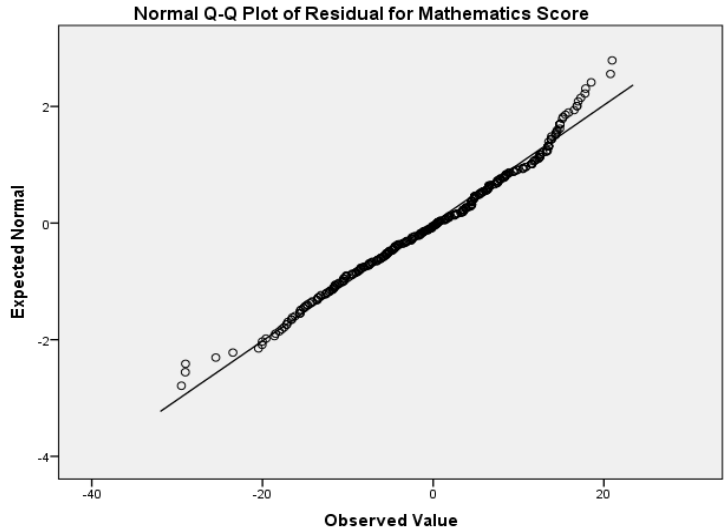

Figure 5. Q-Q Plot of mathematics score ANOVA.

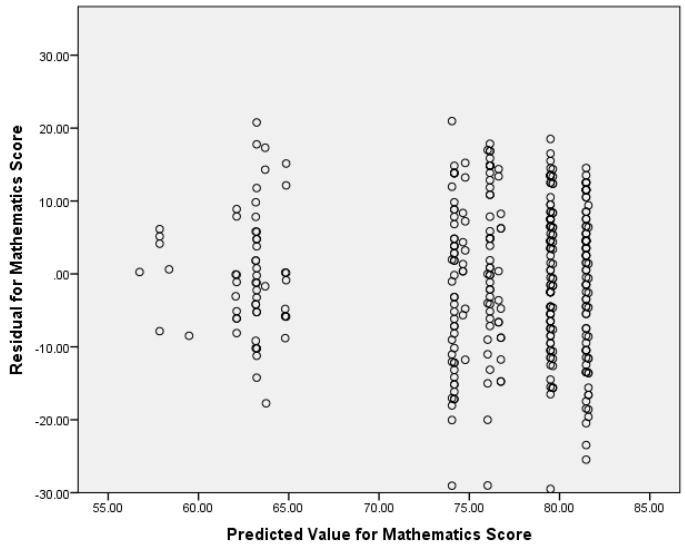

Figure 6. Plot of residuals vs predicted values for mathematics score.

ANOVA results for percentile mathematics score is presented in Table 14. Comparisons of mean percentiles for each variable level is presented in Table 15. Based on these findings we can conclude that students taking mathematics online have significantly lower percentiles than

students using traditional learning methods (F (1, 368) = 60.74, p < .001). There was a significant interaction between the effect of online learning and socioeconomic status (F (1, 368) = 6.14, p = .01) and Table 16 presents further details on this interaction.

Table 14

ANOVA Results for Mathematics Percentile

Variable	*SS*	*df*	*MS*	*F*	*p*
Online Status	33985.10	1	33985.10	60.74	< .001*
Gender	65.94	1	65.94	0.11	.73
Race	4266.11	2	2133.05	3.81	.02*
SES	1831.42	1	1831.42	3.27	.07
Online Status-Gender	187.13	1	187.13	0.33	.56
Online Status-Race	1997.60	2	998.80	1.78	.16
Online Status-SES	3439.90	1	3439.90	6.14	.01*
Error	205890.93	368	559.48		
Total	2178178.00	378			

*p < .05

Table 15

Comparisons of Mean Mathematics Percentiles for Delivery Type and SES

Variable	Level	*M*	*SD*
Online Status	Traditional	76.71	23.28
	Online	36.80	29.06
SES	Economically Disadvantaged	63.87	29.59
	Not Economically Disadvantaged	75.99	25.86

Based on Table 16, it would appear that students labeled socioeconomically disadvantaged perform lower regardless of learning method, and this effect is lower for online learning than traditional learning. As with previous results, a q-q plot and residuals versus predicted values is presented in Figures 7 and 8. Both figures have some cause for concern as Figure 7 indicates that residuals may be distributed non-normally and Figure 8 shows some

model misspecification although residuals appear mostly homogenous, so results for this analysis should be treated with suspicion.

Table 16

Interaction between Online Status and Socioeconomic Status for Mathematics Percentiles

Variable	Level	*M*	*SE*
Interaction	Traditional: Econ. Disadvantaged	74.41	2.12
	Traditional: Not Econ. Disadvantaged	78.6	1.74
	Online: Econ. Disadvantaged	32.25	3.67
	Online: Not Econ. Disadvantaged	49.00	6.02

As with previous results, a q-q plot and residuals versus predicted values is presented in Figures 7 and 8. Both figures have some cause for concern as Figure 7 indicates that residuals may be distributed non-normally and Figure 8 shows some model misspecification although residuals appear mostly homogenous, so results for this analysis should be treated with suspicion.

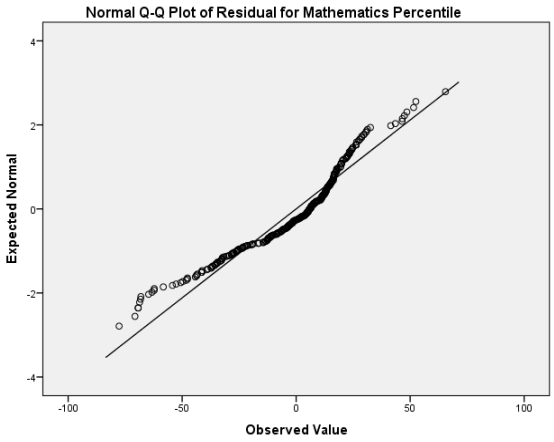

Figure 7. Q-Q plot of residuals for mathematics percentile.

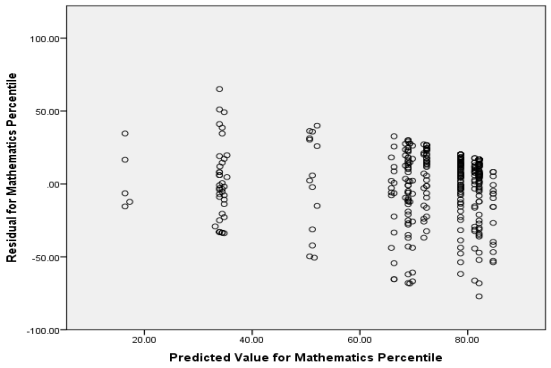

Figure 8. Residuals vs predicted values for mathematics percentile.

In summary, those students taking mathematics courses online received significantly lower test scores and percentile rankings than their traditional counterparts. No significant interactions existed between online status and gender/race/socioeconomic status for test score; however, a significant interaction occurred between online status and socioeconomic status for percentile ranking. This interaction indicated a significant difference in the means between economically disadvantaged students taking mathematics courses online vs. non-economically disadvantaged students taking courses online; whereas the same difference was not exhibited in traditional learners. Assumptions of normality were met for both test score and percentile ranking; however, scatterplots of predicted vs. residual values demonstrated some model misspecification for both test score and percentile ranking. This indicates heterogeneity of variances, and could lead to an increased chance of error. Findings for mathematics should be interpreted with caution.

Science.

A total of 401 students' data were obtained for the comparison on asynchronous online learning and traditional learning in regards to science performance. Subject participants in online and traditional learning is presented in Table 17. As with previous analyses, a significantly

higher percentage of students participated in traditional learning (88.3%) than online learning (11.7%).

A breakdown of the demographics of this population is presented in Table 4. Again, as with previous analyses, there was a roughly even distribution of both male (52.1%) and female (47.9%) students, and once again the majority of students were White (61.6%). Slightly less than half of the students were identified as socioeconomically disadvantaged (454.6%) and the vast majority of students were from the 2018 (36.4%) and 2019 (62.1%) cohorts. No students were included from the 2016 cohort.

Table 17

Mean and SD of Science Performance Metrics for Control and Treatment Groups

Variable	*N*	*M*	*SD*
Test Score (All Students)	401	75.63	11.52
Test Score (Traditional)	354	77.61	10.35
Test Score (Online)	47	60.66	8.60
Percentile (All Students)	401	65.77	27.79
Percentile (Traditional)	354	70.14	24.93
Percentile (Online)	47	32.83	26.30

A four-way ANOVA was conducted to compare the main effects of online learning and the interaction effect between gender, race, and socioeconomic status on test scores and national percentile rankings. A with previous analyses, race was simplified to a variable with three categories; White, Hispanic and Other.

ANOVA results for science test score is presented in Table 18. Comparisons of mean test scores for each significant variable level is presented in Table 19. Based on these findings we can conclude that students taking science online have significantly lower test scores than

students using traditional learning methods (F (1, 391) = 62.84, p < .001). There was also no significant interaction between gender, race or socioeconomic status and taking science online.

Q-Q plots and residuals versus predicted values are presented in Figures 9 and 10. The q-q plot appears to be roughly linear, but there is some heterogeneity, indicated by the cone shape of the data, in the residuals versus predicted values plot and a similar negative trend to previous analyses.

Table 18

ANOVA Results for Science Test Score

Variable	*SS*	*df*	*MS*	*F*	*p*
Online Status	6250.68	1	6250.68	62.84	< .001*
Gender	4.688	1	4.688	0.04	.82
Race	124.97	2	62.48	0.26	.53
SES	340.40	1	640.48	3.42	.06
Online Status-Gender	191.77	1	191.77	1.92	.16
Online Status-Race	316.32	2	158.16	1.59	.20
Online Status-SES	143.37	1	143.37	1.44	.23
Error	38891.37	391	99.46		
Total	2346596.00	401			

*p < .05

Table 19

Comparisons of Mean Science Test Scores for Traditional and Online Delivery

Variable	Level	*M*	*SD*
Online Status	Traditional	77.61	10.35
	Online	60.66	8.60

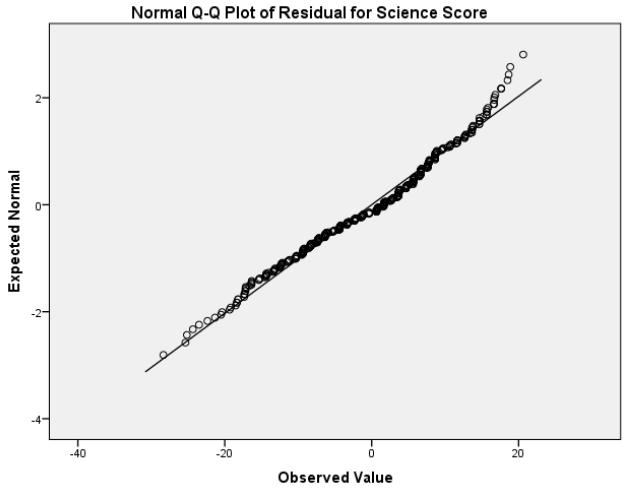

Figure 9. Q-Q Plot for science test score.

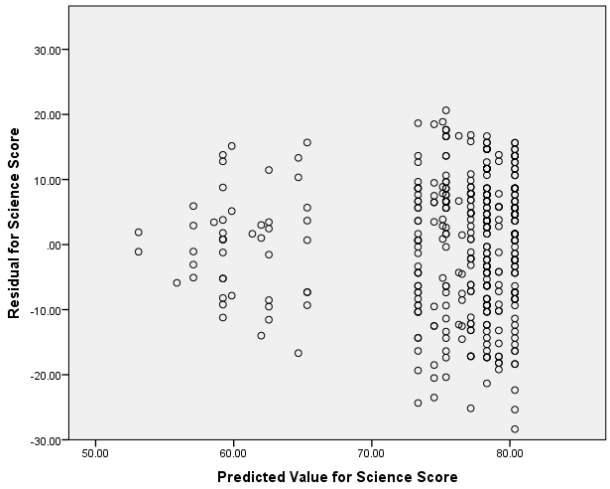

Figure 10. Predicted values vs residuals for science score.

ANOVA results for percentile science score is presented in Table 20. Comparisons of mean percentiles for each significant variable level is presented in Table 21. Based on these findings we can conclude that students taking science online have significantly lower percentiles than students using traditional learning methods ($F (1, 391) = 53.78$, $p < 0.001$). There was also no significant interaction between any demographic variable and online course status.

Table 20

ANOVA Results for Science Percentile

Variable	*SS*	*df*	*MS*	*F*	*p*
Online Status	33074.65	1	33074.65	53.78	< 0.001*
Gender	510.20	1	510.20	0.83	0.36
Race	2185.80	2	1092.90	1.77	0.17
SES	404.52	1	404.52	0.65	0.41
Online Status*Gender	26.20	1	26.20	0.04	0.83
Online Status*Race	76.78	2	368.39	0.59	0.55
Online Status*SES	381.11	1	381.11	0.62	0.43
Error	240454.19	391	614.97		
Total	2043622.00	401			

$p < .05$

Table 21

Comparisons of Mean Science Percentiles for Traditional and Online Delivery

Variable	Level	*M*	*SD*
Online Status	Traditional	70.14	24.93
	Online	32.83	26.30

As in previous analyses, q-q plots and residuals versus predicted values figures are presented in Figures 11 and 12. Both plots appear to demonstrate non-linear relationships suggesting the data is both non-normal and that there is heterogeneity so results should be treated with caution.

In summary, those students taking science courses online received significantly lower test scores and percentile rankings than their traditional counterparts. No significant interactions existed between online status and gender/race/socioeconomic status for test score or percentile ranking. Assumptions of normality were met for test score; however, non-normality is exhibited with test score, and scatterplots of predicted vs. residual values demonstrated some model misspecification for both test score and percentile ranking. This indicates heterogeneity of

variances, and could lead to an increased chance of error. Findings for science should be interpreted with caution.

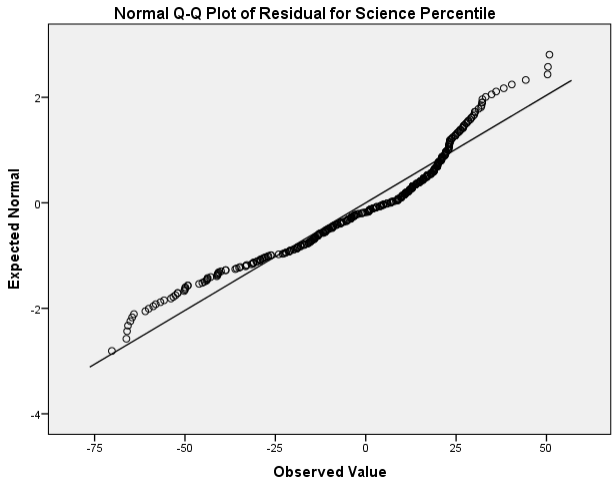

Figure 11. Q-Q plot of residuals for science percentile.

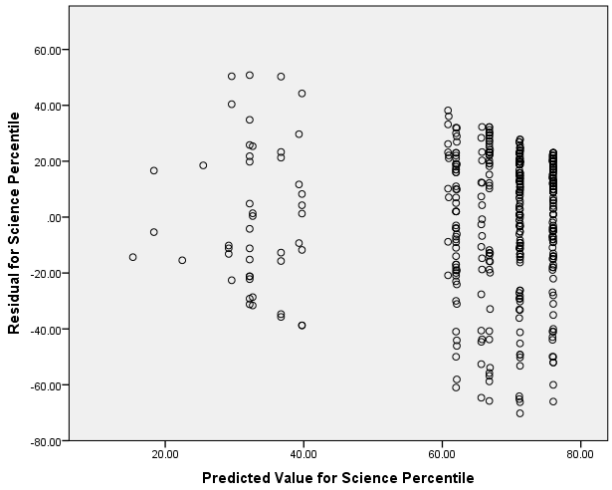

Figure 12. Residuals vs predicted values for science percentile.

Social studies.

A total of 538 students' data were obtained for the comparison on asynchronous online learning and traditional learning in regards to social studies performance. Table 22 presents the

number of students in each method of learning, and as previous there is a much larger percentage of students participating in the traditional learning (72.3%) than the online learning (27.7%).

Table 22

Mean and SD of Social Studies Performance Metrics for Control and Treatment Groups

Variable	*N*	*M*	*SD*
Test Score (All Students)	538	73.92	12.64
Test Score (Traditional)	389	76.62	12.08
Test Score (Online)	149	66.87	11.27
Percentile (All Students)	538	51.50	29.50
Percentile (Traditional)	389	56.31	27.65
Percentile (Online)	149	38.95	30.57

A breakdown of the demographics of this population is presented in Table 5. As with previous analyses, there was a roughly evenly distribution of both male (50.6%) and female (49.4%) students, and once again the majority of students were White (58.0%). Slightly more than half of the students were identified as socioeconomically disadvantaged (50.4%) and the vast majority of students were from the 2016 (51.3%) and 2017 (47.8%) cohorts. This dataset did not include any students from the 2019 cohort.

A four-way ANOVA was conducted to compare the main effects of online learning and the interaction effect between gender, race, and socioeconomic status on test scores and national percentile rankings. As with previous analyses, race was simplified to a variable with three categories; White, Hispanic and Other.

ANOVA results for social studies test scores is presented in Table 23. Comparisons of mean test scores for each significant variable level is presented in Table 24. Based on these findings we can conclude that students taking social studies online have significantly lower test scores than students using traditional learning methods ($F (1, 528) = 36.45$, $p < 0.001$).

Table 23

ANOVA Results for Social Studies Tests Scores

Variable	*SS*	*df*	*MS*	*F*	*p*
Online Status	4464.93	1	4464.93	36.45	< 0.001*
Gender	659.44	1	629.44	5.14	0.02*
Race	1856.42	2	928.21	7.57	0.001*
SES	2233.63	1	2233.63	18.23	< 0.001*
Online Status-Gender	0.24	1	0.24	0.00	0.96
Online Status-Race	223.30	2	111.65	0.91	0.40
Online Status-SES	71.03	1	71.03	0.58	0.44
Error	64664.82	528	122.47		
Total	3025646.00	538			

$p < .05$

Table 24

Comparisons of Mean Social Studies Test Scores for Traditional and Online Delivery

Variable	Level	Mean	Standard Deviation
Online Status	Traditional	76.62	12.08
	Online	66.87	11.27

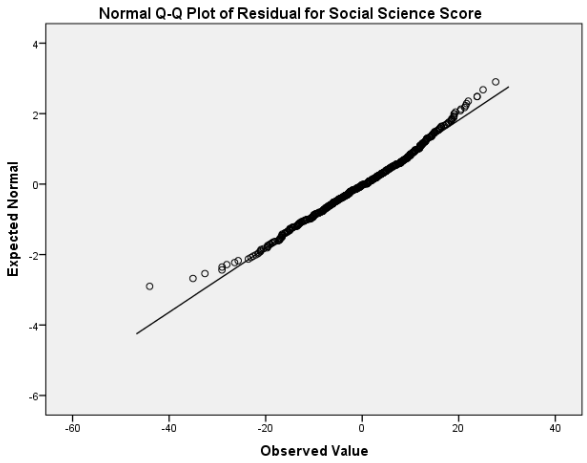

Figure 13. Q-Q plot of social science score.

There was also no interaction between gender, race or socioeconomic status and receiving the course online. Q-Q plots and residuals versus predicted values are presented in

Figures 13 and 14. There appears to be some more minor issues with heterogeneity as compared to previous analyses.

ANOVA results for percentile social studies score is presented in Table 25. Comparisons of mean percentiles for each significant variable is presented in Table 26. Based on these findings we can conclude that students taking social sciences online have significantly lower percentiles than students using traditional learning methods (F (1, 528) = 18.86, $p < .001$). There was no significant interaction between gender, race, or socioeconomic status and receiving the social sciences course online.

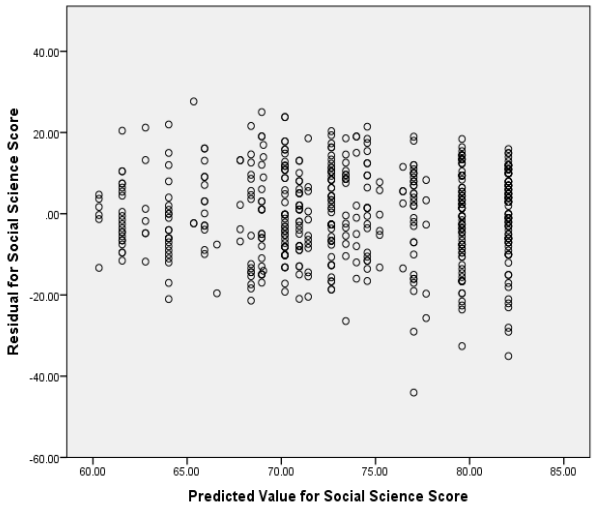

Figure 14. Residuals vs. predicted values for social studies score.

Table 25

ANOVA Results for Social Studies Percentile

Variable	SS	df	MS	F	p
Online Status	12895.00	1	12895.00	18.86	< .001*
Gender	2492.63	1	2492.63	3.64	.06*
Race	17408.94	2	8704.47	12.73	< .001*
SES	13892.13	1	13892.13	20.32	< .001*
Online Status-Gender	5.79	1	5.79	0.00	.92
Online Status-Race	239.54	2	119.77	0.17	.83
Online Status-SES	1103.84	1	1103.84	1.61	.20
Error	360857.82	528	683.44		
Total	1894370.00	538			

$p < .05$

Table 26

Comparisons of Mean Social Studies Percentiles for Traditional and Online Delivery

Variable	Level	Mean	Standard Deviation
Online Status	Traditional	56.31	27.65
	Online	38.95	30.57

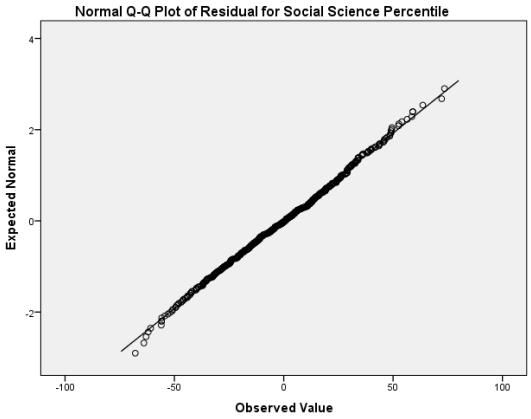

Figure 15. Q-Q plot for social studies percentile.

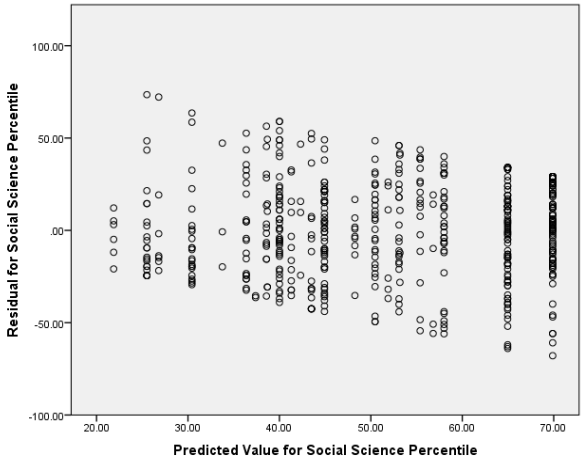

Figure 16. Predicted values vs. residuals for social studies percentile.

In summary, those students taking social studies courses online received significantly lower test scores and percentile rankings than their traditional counterparts. No significant

interactions existed between online status and gender/race/socioeconomic status for test score or percentile ranking. Assumptions of normality were met for both test score and percentile ranking and scatterplots indicated homogeneity of variance despite a slight negative trend, indicating that results were statistically valid.

Summary.

The research questions of this analysis were:

(a) How does the achievement of students participating in an asynchronous online learning environment compare to those peer students participating in a traditional learning environment as measured by End of Course assessments?

(b) How does the achievement of students participating in an asynchronous online learning environment compare to those peer students participating in a traditional learning environment as measured by national percentile rank?

Across all four subjects (language arts, mathematics, science, and social studies) and both metrics of performance (tests scores in end of course assessments and national percentile ranking) students participating in asynchronous online learning environments performed lower than students in traditional learning environments. This result was unaffected by student gender, race or socioeconomic status with the exception of mathematics percentile score where socioeconomic disadvantaged students performed even lower using online courses than students who were not socioeconomically disadvantaged.

Therefore, this analysis concludes that for this set of students, there is *not* evidence of online learning having equitable outcomes to traditional learning environments. All analyses

showed that students who participated in online learning had significantly lower outcomes than students who participated in traditional learning.

Discussion

The primary purpose of this study was to provide pertinent data to rural school administrators and policy makers so that they may make informed decisions in regards to the potential adoption of asynchronous online learning within a rural school setting. Using four-way ANOVA, this study showed no evidence that online learning had equitable outcomes when compared to traditional learning environments. This study utilized Rogers' Diffusion of Innovation Theory, which is based on the conditions that increase or decrease the likelihood that an innovative idea, product, or practice will be adopted by the membership of a given culture (Rogers, 1995).

An innovation is an idea, practice, or object that is perceived as new by individuals or a social system (Rogers, 2003). Five factors that affect the characteristics of an innovation exist, as previously described in this chapter: relative advantage; compatibility; complexity; trialability and observability (Rogers, 2003). This study, through four-way ANOVA, identified relative advantage, and observability as those most likely to influence the adoption and diffusion of asynchronous online learning in a rural Georgia school system. The study showed no evidence that online learning had equitable outcomes when compared to traditional learning environments; therefore, the relative advantage of adopting the innovation of online learning is negated in regards to student achievement; however, there are other advantages to be considered. The results of this study do not preclude the use of online learning in a rural school district. As a school administrator, accessibility for students in need of an alternate means of education may

necessitate the use of online learning. After all, low student achievement, is better than no student achievement. Therefore, the relative advantage of adopting online learning must be considered in regards to those variables that are most important to maximizing accessibility and student achievement. The accessibility of state-wide data, as illustrated in this study, and the potential for further studies in growing online learning environments provides increased observability for those making adoption decisions. This means that a rural administrator at any school in Georgia would have equitable access to data outputs in their own district as they pertain to EOCs and percentile rank.

Although Bergman (2001), Suppes (1966), and Bloom (1996) cited increased student achievement as the rationale for the implementation of online learning, the results of the current study are in disagreement with this literature as the analyses showed all learners participating in online learning to perform lower than students in traditional learning settings. There could be several reasons for this occurrence, one of which could be that students who are still in school require the interaction of a teacher to explain concepts to them. Students may require visual and auditory stimuli to perform optimally.

Lei & Gupta (2010) explained that online learning bridges the void between previously un-served students and allows them to engage in the learning process at times and in places that are conducive to their participation. For example, students with disabilities benefit from online learning due to individualized instruction, flexible time and location options and access to a variety of multimedia (Vasquez & Straub, 2012). Online learning in this regard is very helpful, yet, with regards to the results of this study, students participating in online learning might not show the same level of performance when compared to traditional learning settings. Well-

designed online programs create learning opportunities for all students. Whether elected or mandated, participation in online learning is growing each year (Wicks, 2010), and the potential impact on student achievement must be addressed. The results of this study are important, as it can be used to argue the effectiveness of online learning in this regard. As online learning does assist learners who are unable to receive education otherwise, these results may assist the improvement of online learning to get it up to par with traditional learning results.

Toch (2010) predicted that by 2019 fifty percent of all high school students will take all of their courses online. With the growth of online learning "it is important to know the student population and consider learning goals, needs and school and home environments when implementing an initiative" (Donovan et al., 2010, p. 438). The factors mentioned by Donovan et al. are of high importance, and will ultimately determine the success or failure of online learning. Online learning provides a constant standard, but with regards to the results, may not be the optimal learning environment for all students.

Dexter (2011) claimed that demographic information such as gender, race or ethnicity, age, grade level, educational classification and socioeconomic status do not directly impact student achievement, whereas, the National Center for Education Statistics & Educational Testing, (2012) clearly stated to the contrary, "Students' performance varies by race or ethnicity, gender, and school location" (p. 15). The results of this study agree with the latter in regards to the interaction between online status and socioeconomic status. Rauh (2011) suggested that students in higher poverty schools gain the most from participation in online learning programs. Barth (2013) echoed this view in a study of the Arkansas Virtual Academy School in which low-income students made more progress in math and literacy than their peers in traditional schools.

The results of the current study, however, show that socioeconomically disadvantaged learners performed lower than students who were found not to be disadvantaged in three of the four subjects analyzed, with regards to online and traditional learning methods. Other factors should be considered with regards to the underperformance of socioeconomically disadvantaged students.

There were several other factors mentioned in the literature with regards to the performance of socioeconomically disadvantaged learners, although some researchers still argue the success of online learning for these learners. The results of the current study showed that socioeconomically disadvantaged students performed significantly worse in online math courses, and may add merit to Toch's (2010) statement, who argued that the social and emotional support needed for disadvantaged youth is not present in an online learning program. Toch (2010) argued that educational programs that assist underprivileged youth experienced increased levels of student achievement as a result of high degrees of contact between students and teachers, which increase the learning opportunities present within the environment. Although Toch (2010) recognizes the significance of technology within the classroom, he believes that the more disadvantaged the students are, the more they need a physical learning space they can identify as their school.

Boyles (2011) attributed the growth of online learning in the K-12 landscape primarily with regards to the need for institutions to remain competitive with one another. Through the use of qualitative survey data, as gathered from online educators, he postulated that online assessment is a valuable tool in gauging student progress. The results are in disagreement, as it

showed that learners in online learning settings consistently performed lower than students in traditional learning settings.

Although there are those who believe that online education limits the opportunity for students to engage in meaningful learning experiences (Mbuva, 2014), it is also believed that the provision of an online learning environment provided more options to students (Brown, 2012). With the dire consequences of failing core academic courses in high school growing in prevalence, the importance of providing alternative pathways to graduation for high school students are paramount to the success of school systems throughout the US (Heppen et al., 2012, Sorenson, 2012). This dissertation found that online learning at this particular high school still needs to be upgraded and improved in order to meet the standards of traditional learning settings.

Implication of the findings.

This dissertation aimed to provide pertinent data to rural school administrators and policy makers so that they will be able to make informed decisions with regards to the potential adoption of asynchronous online learning in a rural school setting. The study showed no evidence that online learning had equitable outcomes when compared to traditional learning environments; the results of this study will help educational leaders make informed decisions with regards to online learning. That is, students may need more assistance and motivation in order to benefit from online instruction.

The results of this study contribute to the body of research investigating online learning. Although it will probably not result in the exclusion of online learning in the current educational climate, it may help school boards and principals to be more cautious in the design and expected outcomes for online programs: before extensive financial resources are invested. The results may

also assist to identify key expectations, and which students may benefit most from online learning environments. The main effects of this study demonstrate that there is cause for concern when implementing online learning in schools with high poverty due to the significant interaction between online learning and socioeconomic status; however, for many schools, online learning may be the only means to meet the needs of all learners.

The results of the study showed constant lower performance from students in the online learning setting, and this may be very helpful to online learning program developers in order to develop more effective interfaces. It should be noted; however, that the system studied has a high rate of graduation (17% above the state average), and this may be attributed to the accessibility of education to students that cannot perform in traditional settings. Removal of an online learning environment could negatively impact the graduation rate in consideration to student accessibility. Online learning will still be helpful to learners who are not able to go to a school, and the improvement of online learning programs are therefore of utmost importance. Several researchers stated the benefits of online learning, and therefore online learning as a successful learning alternative cannot be dismissed so easily.

The results of this study are important, as it was very clear that students in traditional learning settings constantly outperformed online learners. The results could assist in the development of alternative means of studying, which do not include independent learning. Students may benefit from semi-structured learning settings, working online, but as part of a team. Schools may implement a supervisor and schedule as well as a location for these learners. The implications of an educational agency void of online learning should also be noted. If the asynchronous online learning environment in the system studied were not present, the increased

potential for student dropouts would exist in addition to the placement of students who are not successful in the traditional environment would be returned to that setting. This could result in increased class sizes, additional staffing needs, and avoidable distractions to the traditional learning model.

Recommendations for future research.

The population of the current study only included a single rural high school in Georgia. Therefore, the results are for the benefit of the district personnel and possibly other districts in Georgia that have similar programs. Further research including a larger population from which to sample including students from other countries may yield interesting and possibly different results.

The populations/samples used for this study only included select students from a single institution and only included courses that could be taught in both traditional and online formats. In order to gather more comprehensive data, future studies should include additional academic and demographic variables wherever possible in order to expand the scope of the study. Also, the addition of schools from other rural settings around the United States should be included in future models.

Further studies could also include the dropout rates of students participating in online learning in comparison with learners in traditional learning settings. The results of such a study would provide further information for institutions who are contemplating the inclusion of online learning programs. Dropout rates are a significant problem currently, and more research on the effect of online learning may assist in lowering dropout rates.

Cost effectiveness of online learning implementation is an additional area requiring further study. With the extensive needs of increased bandwidth, technology access, etc., it will be an important consideration in the decision making process of asynchronous online learning implementation. Further studies could also include the potential tradeoffs if a system does not pursue asynchronous online learning, such as the need for increased staffing, lack of accessibility to curriculum, transportation and facility costs, and so on.

Lastly, further studies should focus on the factors that influence socioeconomically disadvantaged students in learning. Studying these students over time in a longitudinal study may assist in the identification of those factors that most influence student achievement. By identifying these factors programs could be designed to assist socioeconomically disadvantaged students. The ideal circumstances for learning for socioeconomically disadvantaged students are still unknown, and further research on this matter will assist educational leaders to develop more effective programs for these students.

Limitations

The primary limitation to the current study was the ability to draw comparisons to the general education population. The asynchronous online learning environment that comprised the sample population being studied was clearly defined as an asynchronous online learning delivery model; however, the comparison group was not as clearly identified. It is not known if blended learning existed within the general education setting or at what rate students participated in online learning within the traditional learning environment. These variables could have potentially influenced data outcomes.

The results of this study must be observed with consideration to the delivery platform. With the use of Odysseyware, an asynchronous online learning platform, it is difficult to say that the rigor of the online curriculum is identical to that of the traditional learning model. Both models are aligned to national standards; however, the asynchronous environment is not able to differentiate for the learner and adapt as needed for the individual needs of the learner. This can be viewed as a potential reason for the lower performance of online learners versus their traditional counterparts as observed in this study.

The sample used was from a single institution and only included courses that could be taught in both traditional and online formats. In order to gather more comprehensive data, future studies should include additional academic and demographic variables wherever possible to expand the scope of the study. Also, the addition of schools from other rural settings around the United States should be included in future models. Course completion and program matriculation as measured by the study demand the highest possible levels of validity as they provide a more concise short and long-term indicator of the impact of online vs. face-to-face instruction.

Conclusion

The purpose of this quantitative study was to provide pertinent data to rural school administrators and policy makers so that they will be able to make informed decisions with regards to the potential adoption of asynchronous online learning in a rural school setting. The findings showed that students participating in asynchronous online learning environments performed lower than students in traditional learning environments for all four subjects included

and both metrics of performance. No evidence was found that online learning had equitable outcomes when compared to traditional learning environments.

The literature showed that some researchers favored online learning and that some researchers stated the obstacles it entailed. Students with disabilities benefit from online learning due to individualized instruction, flexible time and location options, and access to a variety of multimedia (Vasquez & Straub, 2012). Toch (2010) stated that the more disadvantaged the students are, the more they need a physical learning space they can identify as their school. Several recommendations are made for future research, including a larger sample population, and the inclusion of other variables of interests like dropout rates.

If the study were repeated, the researcher would expand the scope of the quasi-experimental design by including additional rural school systems with asynchronous online learning environments. The researcher would also include additional dependent variables, such as course grades, to assess the impact of the independent variable (asynchronous online learning) on student achievement. This would provide additional pertinent data and either confirm or contest the results of the current study.

Finally, rural school administrators must consider whether to implement online learning environments within their districts. The results from this dissertation will aid them in making informed decisions with regards to the adoption of asynchronous online learning, but student achievement is only one factor to consider in such an important decision. Accessibility, cost-effectiveness, and student engagement are just some of the considerations for the rural administrator. In order for a district to not only adopt an innovation, but also to have it diffuse through the social system (Rogers, 1995), the rural administrator will have to be both an

advocate and pioneer in its implementation. With the void in literature, specifically in regards to K-12 asynchronous online learning, in order for further research to exist, school and district leaders will have to be bold in their adoption of asynchronous online learning. They must weigh the benefits of adoption, and determine if they will settle for the status-quo, or if they will be a pioneer in the realm of online learning, and learn from those who have gone before them, while blazing a trail for future educational leaders to follow.

References

Ball, J., Ogletree, R., Asunda, P., Miller, K., & Jurkowski, E. (2014). Diffusion of innovation elements that influence the adoption and diffusion of distance education in health. *American Journal of Health Studies*, *29*(3), 240-246.

Barth, P. 2013. Virtual schools: Where's the evidence. *Educational Leadership, 70*(6), 32–36.

Bergman, H. F. (2001). The Silent University: The Society to Encourage Studies at Home, 1873-1897. *The New England Quarterly, 74*(3), 447-47.

Bettany-Saltikov, J., & Whittaker, V. J. (2014). Selecting the most appropriate inferential statistical test for your quantitative research study. *Journal of Clinical Nursing*, *23*(11/12), 1520-1531. doi:10.1111/jocn.12343

Bloom, M. (1996). Transformative moments in education. *Holistic Educational Review, 9*(4), 44-47.

Boyles, P. C. (Fall 2011). Maximizing learning using online student assessment. *Online Journal of Distance Learning Administration, 14*(3),

Brown, B. W., & Liedholm, C. E. (2002). Can web courses replace the classroom in principles of microeconomics? *The American Economic Review, 92*(2), 444–448

Brown, D. (2012). Rural districts bolster choices with online learning. *Learning & Leading with Technology*, *39*(6), 12-17.

Caldera, P. & McKee, T., (2016). Middle school predictors of high school performance: a case study of dropout risk indicators. *Education, 136*(4), 515-529.

College Board (2016). Validity. Retrieved January 1, 2017 from https://research.collegeboard.org/services/aces/validity/handbook/test-validity.

Coogle, C. C., & Floyd, K. k. (2015). Synchronous and Asynchronous Learning Environments of Rural Graduate Early Childhood Special Educators Utilizing Wimba© and Ecampus. *Journal of Online Learning & Teaching*, *11*(2), 173-187.

Crawley, M. J. (2013*). The R book* 2nd Edition. USA. John Wiley & Sons.

Creswell, J. (2014). *Research design: qualitative, quantitative, and mixed method approaches*. Thousand Oaks, CA: Sage Publications.

Demir, K. (2006). Rogers' theory of the diffusion of Innovations and online course registration. *Educational Administration: Theory & Practice*, 47, 386-392.

Dexter, K. (2011). Addressing the high school dropout crisis: at-risk students and education 2020 online credit recovery.

Donovan, L., Green, T., & Hartley, K. (2010). An examination of one-to-one computing in the middle school: Does increased access bring about increased student engagement?. *Journal of Educational Computing Research*, *42*(4), 423-441.

Figlio, D. N., Rush, M., & Yin, L. (2010). *Is it live or is it internet? Experimental estimates of the effects of online instruction on student learning.* National Bureau of Economic Research.

Fong, A., Jaquet, K., Finkelstein, N., & Society for Research on Educational Effectiveness (2016). Who repeats algebra, and how does initial performance relate to improvement when the course is repeated?. *Society for Research on Educational Effectiveness.* ERIC

Georgia Department of Education (2016). *Georgia Milestones.* Retrieved from http://www.gadoe.org/milestone.

Glass, G. V., Peckham, P. D., & Sanders, J. R. (1972). Consequences of failure to meet assumptions underlying the fixed effects analyses of variance and covariance. *Review of educational research*, *42*(3), 237-288.

Governor's Office of Student Achievement (2016). Georgia school districts by locale and type. Retrieved from https://gosa.georgia.gov/sites/gosa.georgia.gov/files/APPENDIX%20B%20Districts%20by%20Locale%20Type.pdf.

Harwell, M. R., Rubinstein, E. N., Hayes, W. S., & Olds, C. C. (1992). Summarizing Monte Carlo results in methodological research: The one-and two-factor fixed effects ANOVA cases. *Journal of Educational and Behavioral Statistics*, *17*(4), 315-339.

Heppen, J., Allensworth, E., Walters, K., Pareja, A., Kurki, A., Nomi, T., & Society for Research on Educational Effectiveness, (2012). Efficacy of online algebra I for credit recovery for at-risk ninth grade students: Evidence from year 1. *Society for Research on Educational Effectiveness*.

Isaac, S. & Micahel, W.B. (1971). Handbook in research and evaluation. San Diego, CA: Robert R. Knapp.

Jacobsen, M. (1998). Adoption patterns and characteristics of faculty who integrate computer technology for teaching and learning in higher education. (Doctoral dissertation, The University of Calgary, 1998). ProQuest Digital Dissertations. (UMI No. AAT NQ34679).

Kerlinger, F.N. (1964). Foundations of behavioral research. New York: Holt, Rinehart, & Winstron.

Lei, S. A., & Gupta, R. K. (2010). College distance education courses: Evaluating benefits and costs from institutional, faculty and students' perspective. Distance Education, 616-631.

Less, K.H. (2003). Faculty adoption of computer technology for instruction in the North Carolina Community College System (Doctoral dissertation, East Tennessee State University, 2003). ProQuest Digital Dissertations. (UMI No. AAT 3097072).

Lix, L. M., Keselman, J. C., & Keselman, H. J. (1996). Consequences of assumption violations revisited: A quantitative review of alternatives to the one-way analysis of variance F test. *Review of educational research*, *66*(4), 579-619.

Martin, R. M. (2010). *Epistemology : a beginner's guide*. Oxford : Oneworld, 2010.

Mbuva, J. M. (2014). Online Education: Progress and Prospects. *Journal of Business & Educational Leadership, 5*(1), 91-101.

Medlin, B.D. (2001). *The factors that may influence a faculty member's decision to adopt electronic technologies in instruction* (Doctoral dissertation, Virginia Polytechnic Institute and State University, 2001). ProQuest Digital Dissertations. (UMI No. AAT 3095210).

Messick, S. (1989). Validity. In R. L. Linn (Ed.), *Educational Measurement*, 3rd ed. (pp. 13-103). New York: Macmillan.

Mustafa, J., & Al-Mothana, G. (2013). Using the diffusion of innovation theory to explain the degree of English teachers' adoption of interactive whiteboards in the modern systems school in Jordan: A case study. *Contemporary Educational Technology*, *4*(2), 138-149.

National Center for Education Statistics & Educational Testing, S. (2012). *The nation's report card: Writing 2011*. National Assessment of Educational Progress at Grades 8 and 12. NCES 2012-470. National Center for Education Statistics.

Nguyen, T. t. (2015). The effectiveness of online learning: Beyond no significant difference and future horizons. *Journal of Online Learning & Teaching*, *11*(2), 309-319.

Oddysseware (2017). About Oddysseyware: Impacting students through education and innovation is the core of Odysseware, our people and our solutions. Retrieved from https://www.odysseyware.com/about

Rauh, J. (2011). The utility of online choice options: Do purely online schools increase the value to students? *Education Policy Analysis Archives*, *19*(34).

Robison, S. Jaggers, J., Rhodes, J., Blackmon, B.J., & Church, W. (2017). Correlates of educational success: Predictors of school dropout and graduation for urban students in the Deep South. *Children and Youth Services Review*, *7*(3), *37*-46.

Rogers E.M. (2003). *Diffusion of innovations (5th Edition)*. Simon and Schuster. ISBN 978-0-7432-5823-4.

Rogers, E.M. (1995). *Diffusion of innovations (4th edition)*. The Free Press. New York.

Sampath, S. (2005). *Sampling theory and methods*. Harrow, U.K: Alpha Science International.

Scharff, R. (2013). Being post-positivist . . . or just talking about it?. *Foundations of Science*, *18*(2), 393. doi:10.1007/s10699-011-9249-4

Schorr, J., & McGriff, D. (2012). Future schools: Blending face-to-face and online learning. *Education Digest: Essential Readings Condensed for Quick Review*, *77*(5), 30-37.

Sorenson, C. (2012). Learning online at the K-12 level: A parent/guardian perspective. *International Journal of Instructional Media, 39*(4), 297–307.

Stevens, J. (2008). *Intermediate statistics: A modern approach.* New York: Routledge.

Suppes, P. (1966). The uses of computers in education. *Scientific American,* 215, 206–220.

Tabachnick, B.G., & Fidell, L.S. (2007). *Experimental designs using ANOVA.* Australia ; Belmost, CA : Thomson/Brooks/Cole, c2007.

Toch, T. (2010). In an era of online learning, schools still matter. *Phi Delta Kappan 91*(7), 72–73.

Tuckman, B.W. (1972). *Conducting educational research.* New York: Harcourt, Brace, Jovanovich.

Van Dalen, D.B. (!962). *Understanding educational research: An introduction.* New York: McGraw Hill.

Vasquez, E., & C. Straub. (2012). Online instruction for K-12 special education: A review of the empirical literature. *Journal of Special Education Technology, 27*(3), 31–40.

Welch, B.L. (1938). The significance of the difference between two means when population variances are unequal. *Biometrika,* 38, 330-336.

Wicks, M. (2010). *A national primer on K–12 online learning,version 2*. Vienna, VA: *International Association for K-12 Online Learning.*

Xu, D., & Jaggars, S. (2013). Adaptability to online learning: Differences across types of students and academic subject areas. Retrieved from http://academiccommons.columbia.edu/catalog/ac:157286

Zimmerman, D., & Zumbo, B. (1993). Rank transformations and the power of the student t-test and Welch t-test for non-normal populations. *Journal of Exploratory Psychology, 47,* 523-539.