Spring 2-2017

Measuring the Outcome of At-Risk Students on Biology Standardized Tests When Using Different Instructional Strategies

Dana Burns
Lindenwood University

Measuring the Outcome of At-Risk Students on Biology Standardized Tests When Using Different Instructional Strategies

by

Dana Burns

A Dissertation submitted to the Education Faculty of Lindenwood University

in partial fulfillment of the requirements for the

degree of

Doctor of Education

School of Education

Measuring the Outcome of At-Risk Students on Biology Standardized Tests When Using Different Instructional Strategies

by

Dana Burns

This dissertation has been approved in partial fulfillment of the requirements for the degree of

Doctor of Education

at Lindenwood University by the School of Education

Dr. Beth Kania-Gosche, Dissertation Chair — 2-24-17 Date

Dr. Jackie Ramey, Committee Member — 2-24-17 Date

Dr. Francesco Giuseffi, Committee Member — Feb 24, 2017 Date

Declaration of Originality

I do hereby declare and attest to the fact that this is an original study based solely upon my own scholarly work here at Lindenwood University and that I have not submitted it for any other college or university course or degree here or elsewhere.

Full Legal Name: Dana Leigh Burns

Signature: Dana Burns Date: 2/24/17

Acknowledgements

I would like to thank the members of my committee for their time and guidance throughout this process. To Dr. Beth Kania-Gosche, thank you for your motivation and support. To Dr. Jackie Ramey and Dr. Giuseffi, I greatly appreciate your energy and insight along the way.

I am especially grateful to my husband for his support so I may accomplish my goal. To my mom, thank you for being a wonderful role model and always encouraging me to dream big. Finally, to my three children, I hope I to inspire you never give up and keep working hard at everything you do!

Abstract

Over the last two decades, online education has become a popular concept in universities as well as K-12 education. This generation of students has grown up using technology and has shown interest in incorporating technology into their learning. The idea of using technology in the classroom to enhance student learning and create higher achievement has become necessary for administrators, teachers, and policymakers. Although online education is a popular topic, there has been minimal research on the effectiveness of online and blended learning strategies compared to the student learning in a traditional K-12 classroom setting.

The purpose of this study was to investigate differences in standardized test scores from the Biology End of Course exam when at-risk students completed the course using three different educational models: online format, blended learning, and traditional face-to-face learning. Data was collected from over 1,000 students over a five year time period. Correlation analyzed data from standardized tests scores of eighth grade students was used to define students as "at-risk" for failing high school courses.

The results indicated a high correlation between eighth grade standardized test scores and Biology End of Course exam scores. These students were deemed "at-risk" for failing high school courses. Standardized test scores were measured for the at-risk students when those students completed Biology in the different models of learning. Results indicated significant differences existed among the learning models. Students had the highest test scores when completing Biology in the traditional face-to-face model. Further evaluation of subgroup populations indicated statistical differences in learning models for African-American populations, female students, and for male students.

Table of Contents

List of Tables

List of Figures

Chapter One: The Importance of Technology in the Classroom

The use of technology in the classroom has been a long debated topic, but within the last decade, this issue has become one of the most influential topics in education (Cook & Sonnenberg, 2014). The putative goal of technology in the K-12 classroom has been to increase individual instruction, provide students with self-paced lessons, credit-recovery, advanced classes, as well as provide students with skills to succeed in the 21st century. Online learning through virtual schools and blended learning environments has given the United States tools to rethink the current educational system. While some teachers have perceived negatives regarding technology, a blended model combines the benefits of face-to-face with the convenience of online education (The North American Council for Online Learning and the Partnership for 21st Century Skills, 2006, p. 2). No longer do schools need a credentialed teacher on site to teach one section of physics or other difficult to staff positions. A teacher can instruct online courses from anywhere in the country or even the world (Burian, Muhammad, Burian, & Maffei, 2012).

One of the main goals for our education system has been preparing students to succeed in the workforce, yet, 84% of employers agreed that K-12 schools are not properly preparing students for the workplace. Fifty-five percent of employers believed students lack basic professional aptitudes such as proper attendance, arriving at work on time and a strong work ethic (The North American Council for Online Learning and the Partnership for 21st Century Learning, 2006, p. 2). With more competition in an increasingly global society, several studies indicated young adults in the United States are falling behind their

international peers' academic assessments as well. In 2006, only 30% of United States students in fourth and eighth grade performed at grade-level in math (The North American Council for Online Learning and the Partnership for 21st Century Skills, 2006). According to results from the 2012 Program for the International Student Assessment (PISA), United States students' test scores have not shown much improvement over the last decade. Among the 65 countries that participated in the test, American students scored 30th in math, and 23rd in science (U.S. Department of Education, 2016). With the lack of success in many traditional classroom settings, web-based programs have gained greater attention.

Colleges and universities have invested heavily in online education over the past 15 years. In 2002, less than half of colleges and universities reported online education was critical to the long-term success of their institution. By 2012, 70% deemed online education one of the most critical components of their long-term strategy (Allen & Seaman, 2013). Almost every major university in the United States has implemented some form of online educational courses. During the 2009 school year, over 5.6 million students were enrolled in at least one online course and 30% of all college students took at least one higher learning course online (Seaman & Allen, 2010, p. 2). Figure 1 compared the increase in online and traditional college enrollment.

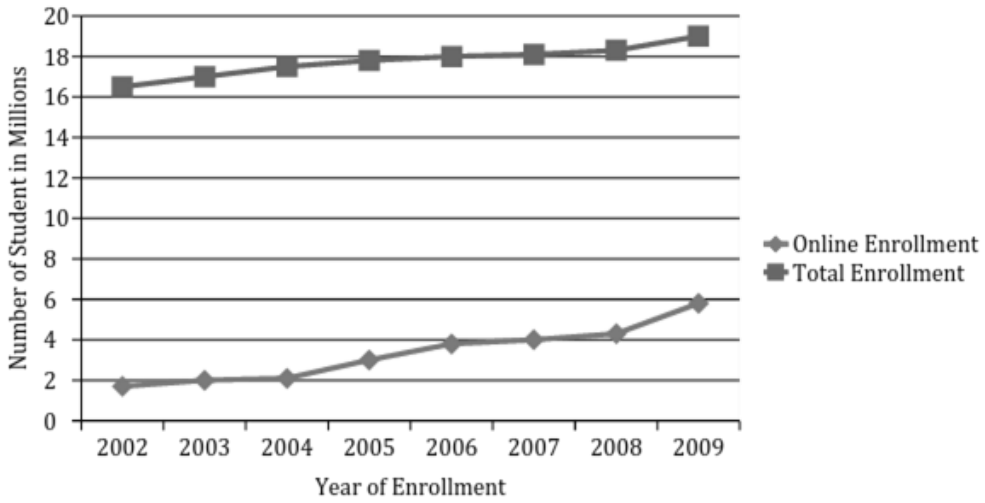

Figure 1. Student enrollment of post-secondary student institutions.
Note: Adapted from (Seaman & Allen, 2010, p. 8).

The rise of distance education has given many non-traditional college students the opportunity to complete classes post high school courses. Many non-traditional students have struggled in high school, have family obligations, and or other limitations that make traditional face-to-face courses difficult. Statistics have shown that people without post-secondary degrees have lower paying jobs and less successful careers. Therefore, online courses have increased opportunities to add more skilled labor in the United States (Xu & Jaggars, 2013).

Due to the demand from post-secondary students as well as employers around the country, K-12 schools have increased their interest in online learning. In 2009, more than 3 million students enrolled in an online or blended learning course (Horn & Staker, 2011). By 2010, 48 of the 50 states had students enrolled in online classes and over 1.5 million students were enrolled in an online class (Watson, Murin, Vashaw, Gemin, & Rapp, 2010, p. 6). Keeping Pace with

K-12, an estimated 3.8 million online courses were taken by students in 2015 (Gemin, Pape, Vashaw, & Watson, 2015).

There is little doubt that that the current generation of students has incorporated technology as part of their learning. Therefore, technology will continue to be a presence in classrooms across the country, and educators must determine the proper ways for it to be utilized. However, educators must use research to evaluate online and blended learning formats.

Statement of Problem

The generation of students known as Generation Z, were defined as people born in the 1990s through 2010. This group has been referred to as the "digital natives" (Grail Research, 2011). Most have used technology in their everyday lives since an early age and have become depended on it. A survey conducted in 2010 assessed teenagers on their preferred learning style. Forty-three percent responded they learn by reading material on the Internet, 38% liked a combination of print and online, and only 16% favored textbooks (Grail Research, 2011, pp. 5-6). Considering this data, the U.S. school system has failed to engage this generation of students with the current delivery models of information. This led to school districts spending money on hundreds of new programs every year (Grail Research, 2011, pp. 5-6).

Researchers have acknowledged the most prevalent change in education has been the expansion of online learning and the Internet. Data has also shown that students are engaged while using technology in the classroom (Kuehn, 2012). Yet, school districts have not found the most effective way to implement

technology. Technology costs, along with rising budget demands for other areas of education, have forced school administrators to make tough decisions on funding. Many K-12 schools do not have the financial resources to offer advanced classes or college preparation classes. Many schools, especially secondary schools, have struggled with resources for at risk-students who need credit recovery courses and are not on pace to graduate. Organizations such as Keeping Pace and International Association for K-12 Online Learning have been researching proposals for the United States government to invest more resources in online education to help alleviate financial burdens (Watson, Murin, Vashaw, Gemin, & Rapp, 2011).

Although many organizations have petitioned for more online courses, research has varied on the effectiveness of online learning especially for science, technology, engineering, and mathematic courses (STEM). These courses have large amounts of seat-time dedicated to hands-on activities that could potentially be replaced by online laboratory assignments (Randler & Hulde, 2007). Many educators have wondered about the effectiveness of online teaching and which delivery model has promoted the highest student achievement on standardized test scores in courses that have been traditionally heavily laboratory based, such as science. A 2010 meta-analysis found only seven rigorous studies had been conducted to measure the outcomes of fully online programs compared to traditional courses (Reichman, 2013).

Advocates for online learning concluded increased online coursework would increase graduation rates for at-risk students. Yet, one of the largest

obstacles in distant education has been the lack of successful completion of courses to gain educational credit. Ethnicity and gender have played a role in successful completion of online courses (Wladis, Conway, & Hachey, 2015). Data collected from over 2,000 community colleges compared ethnicity, gender, risk factors for success in STEM online coursework (Wladis, Conway, & Hachey, 2015). The study concluded Black students were underrepresented in online education, women were overrepresented, and students with risk factors such as no high school diploma were significantly more likely to enroll in distant education (Wladis, Hachey, & Conway, 2015). The largest growth in online enrollment has been the population of students who attend two-year colleges. Research has been contradictory regarding how the non-traditional students performed in online courses (Xu & Jaggars, 2013).

Online education has transformed the traditional thought processes of policymakers, administrators, teachers, parents, and students (Wicks, 2010). More research should be conducted to provide data of educational outcomes and the educational value of online courses compared to traditional educational courses (Pappano, 2013). Educators must also know the demographics of students who have been successful when taking online courses so they can make proper recommendations (Wladis, Conway, & Hachey, 2015).

Purpose of the Study

The purpose of this study was to investigate possible differences in student achievement, represented by test scores, when using three instructional models: online learning, blended learning, and face-to-face learning in a Missouri School

District. To begin the study, data were collected from eighth grade science Missouri Assessment Program (MAP) to classify students as at-risk. The MAP test assessed students' progress towards Show-Me Standards, the yearly indicators of mastering skills (Missouri Department of Elementary and Secondary Education [MODESE], 2016b). If a student had not met grade-level expectations in eighth grade, then that student was "at-risk" for not passing high school courses including Biology, thus not on course to graduate high school in four years. Biology, a science class typically taken by freshman, was a requirement for students to receive a high school diploma from the state of Missouri (MODESE, 2016b). After coursework was completed, the students took an End-of-Course Biology exam (EOC) that measured the level of course-level expectations (CLEs). For the purpose of this study, the high school involved in this study will be referred to as Washington High School within the Washington School District. Students within the district completed Biology using one of the three instructional models. This study analyzed data from 2009- 2015 to measure outcomes of student performance on the Missouri End of Course Exam, a standardized test administered across the state of the Missouri.

In 2015, Missouri school district accreditation and adequate yearly progress (AYP) were measured by Missouri School Improvement Program or MSIP-5. Attendance, graduation rate, and end of course exam scores were among factors included in the MSIP-5 calculation (MODESE, 2016b). If a school district did not meet AYP scores, the district was at risk for losing accreditation and federal government funding. District leaders have been searching for innovative

ways to meet these demands. Online learning was an option that provided opportunity.

According to the Project Tomorrow report, school districts have been implementing online courses to offer remediation, increase student engagement, and provide credit recovery courses that enabled students to earn needed graduation credits (Bolkan, 2014). It is critical that there is accountability and measurability as more online courses are implemented. The research and data presented in this study provided a guide for school administrators on the benefits of online courses and highlight areas of caution while deciding whether to implement online classes for credit recovery in subject-areas that have been traditionally hands-on courses and are accompanied by an end of course exam.

Rationale

Online learning has offered another option for students who are behind in credits and are at-risk of dropping out. About 9% or 1.2 million students drop out of high school each year (Archambault et al., 2010). Many schools have faced increased pressure from state and federal laws to improve student outcomes. Online credit recovery has become an integral part in increasing graduation rates because blended learning and online courses have allowed students to work at their own pace and provide flexibility to students to master the content (Legistlative Budget and Finance Committee, 2011). Fifty-four percent of administrators believed that the use of online and digital technology has increased students' career readiness. Career readiness, graduation rate, and proficiency of

standardized tests have all contributed to government funding for schools, which has been instrumental in their success (Bolkan, 2014).

A gap has existed in the current research because states have not required school districts to track or report the use of digital content in the classroom (Watson, Murin, Vashaw, Gemin, & Rapp, 2014). Therefore, there has been minimal research on the effectiveness of online teaching and which delivery model promoted the highest student achievement on standardized tests (Foundation for Excellence in Education, 2010). Science, technology, engineering, and mathematics (STEM) related job openings have been projected to double within the next 10 years, and studies show there will be a shortage of qualified workers (Wladis, Hachey, & Conway, 2015).

Numerous researchers agreed that quality online education could fundamentally change the United States' educational system and create high skilled employees who are needed by businesses. Online courses have provided opportunities for students who have struggled in the traditional school setting by providing the opportunity to finish high school requirements or earn post-secondary credit. Yet, these students are not successfully completing the course and are not earning degrees or certifications. Very little research has been conducted on how online science courses impact student achievement especially at the secondary level (Wladis, Hachey, & Conway, 2015).

Much of the current research on technology has been aimed at how to implement technology into the classroom with little focus on how well students have retained material learned through online platforms (Watson et al., 2014).

Several educational organizations including Keeping Pace and the Department of Education, agreed more research needs to be conducted on the effectiveness of learning online or through virtual schools. Teachers want to be provided with research and data that have indicated improved student learning before committing to more training on online and blended learning models (Wicks, 2010).

Several studies have been conducted to measure student outcome of online courses at the collegiate level but only a few large scaled studies have been conducted to measure student retention for a single online course at the high school level (Hughes, Zhou, & Petscher, 2015).

This study has provided needed research to help school districts make decisions based on quantitative data from student test scores after completion of a Biology course using one of three different models of learning: traditional setting, blended-learning, and online learning. Current research has helped teachers and administrators have a better understanding of how different instructional delivery models can meet the needs of students, particularly those at risk of dropping out of high school.

Research Question and Hypotheses

Q1. Do eighth grade Missouri Assessment Program test scores predict achievement on Biology End of Course exams in High School?

H1. There is a difference in achievement measured by the Biology End of Course exams for students identified as at-risk enrolled online, blended learning, or face-to-face instruction, for the years 2009 through 2015.

H2. There is a difference in achievement measured by the Biology End of Course exams for African American students identified as at-risk enrolled in online, blended learning, or face-to-face instruction, for the years 2009 through 2015.

H3. There is a difference in achievement measured by the Biology End of Course exams for male students identified as at-risk enrolled in online, blended learning, or face-to-face instruction, for the years 2009 through 2015.

H4. There is a difference in achievement measured by the Biology End of Course exams for female students identified as at-risk enrolled in online, blended learning, or face-to-face instruction, for the years 2009 through 2015.

Definition of Terms

Asynchronous learning – Online communication between an instructor and student that does not occur in real time. Examples include email, message boards, blogs, and podcasts (International Association for K-12 Online Learning, 2011).

At-risk student – For the purpose of this study, an at-risk student is defined as a student that scored below grade level on eighth grade Missouri Assessment Program (MAP) test.

Blended learning or blended course – Learning that combines two modes of instruction. Students spend part of the time in face-to-face instruction and part of the time in online learning; also referred to as hybrid learning (International Association for K-12 Online Learning, 2011).

Brick and mortar school - Refers to a traditional school setting that is in a designated building with supervision (International Association for K-12 Online Learning, 2011).

Credit recovery - Refers to a student who is making up credit for a class that he/she previously failed or did not complete (International Association for K-12 Online Learning, 2011).

Course enrollments – The number of semester-long courses for which a student is enrolled (Watson, Gemin, Ryan, & Wicks, 2009).

Cyber school - An organization that offers full-time online education; also referred to as virtual school, eSchool, online (International Association for K-12 Online Learning, 2011).

Digital learning - Learning that is computer-based and may be online learning or blended learning (International Association for K-12 Online Learning, 2011).

Distance education - Learning in which the instructor and student are in separate locations. It may be asynchronous or synchronous learning (International Association for K-12 Online Learning, 2011).

Electronic learning (e-learning) - Educational content is delivered online; also referred to as online learning (International Association for K-12 Online Learning, 2011).

Face-to-face instruction – Learning that takes place when two or more people are in the same physical location (International Association for K-12 Online Learning, 2011).

Full-time online program – A student who is enrolled in a full course over the Internet (International Association for K-12 Online Learning, 2011).

Hybrid learning - Course that combines online and face-to-face instruction; also referred to as blended learning (International Association for K-12 Online Learning, 2011).

Learning management system (LMS) - The technology platform in which an instructor and students communicate in online education. It generally includes software to create and edit course material, communication tools, assessment tools, and several other tools to facilitate learning (International Association for K-12 Online Learning, 2011).

Online course – Course offered over the Internet (International Association for K-12 Online Learning, 2011).

Online learning – Web-based learning in which students and teachers can be in the same or distant locations. Online learning can be student-led or can be teacher-led instruction. Also referred to as cyber learning, virtual learning, and e-learning (International Association for K-12 Online Learning, 2011).

Online school – Organized entity that provides full-time or part-time educational classes offered over the Internet (International Association for K-12 Online Learning, 2011).

Seat-time – The amount of time a student must be present in a class to receive credit for the course; 7,830 minutes a year per course (MODESE, 2016b).

State virtual school – A virtual school established and ran by the state. It receives state funding to help provide resources for instruction (International Association for K-12 Online Learning, 2011).

Student enrollment – Used to count the number of students enrolled in year-long online courses (International Association for K-12 Online Learning, 2011).

Synchronous learning - Online learning in which students and instructors are communicating in real-time. Examples include instant messaging, webinars, and video conferencing (International Association for K-12 Online Learning, 2011).

Virtual school - Organized entity that provides online education. Also referred to as online school or cyber school (International Association for K-12 Online Learning, 2011).

Limitations and Assumptions

Research conducted on human subjects provided numerous limitations. In this study, standardized tests scores of students were compared. For the most accurate data collection and results, the researcher needed as many variables as possible for constancy. All students were enrolled in the same school district in the eighth grade. Students in the traditional and blended learning models attended the same high school brick-and-mortar school. The students who completed Biology online typically attended an alternative school setting.

Three different Biology teachers were involved in the traditional and blended learning models. Those three teachers remained the same over the six-

year period. The five teachers met every day to collaborate and kept the curriculum as constant as possible. All teachers gave students the same summative and formative assessments over the course of the year. Even with many factors held constant, individuals have their own teaching strategies and personalities.

The school district implemented a one-to-one technology program in 2011. This allowed for blended learning model. With the new technology, there was a learning curve and teachers became more comfortable with technology in the later years of the study. The students also had become more familiar and gained more experience with using a computer in the later years of the study. The quality of the online program and the blended learning model were not evaluated during the course of this study.

This study focused on students who were classified as at-risk. The study did not investigate why the students were struggling or looked at background information on the students. Standardized test scores were used to define at-risk which created the assumption that students were performing to the best of their ability on the test. The study also did not investigate student motivation, which plays a large role in the success of students who complete online courses.

The state of Missouri required the high school End of Course exams to be calculated in the student's overall course grade. This has helped hold students accountable, but it can be only assumed that test scores are an accurate reflection of the student's knowledge. The EOC test is preformed online for students involved in all three instructional models.

Another limitation is the fact that technology is continuing to evolve. The research and case studies presented use the most current data but by the time this paper was published, the technology has changed. The school district within this study implemented a new technology program for students and staff. The first few years had a learning curve and provided challenges to implement within the current curriculum.

Summary

School districts have been struggling to meet the needs of their students. As a result, K-12 students across the country have been falling behind academically when compared to their international peers. From 2000-2010, the United States spent more money on education than any previous decade but the achievement test scores have not reflected the increased financial support (Reichman, 2013). The immense technology advancements over the last 15 years have created promise in the educational world. Schools have been investing in technology to enhance instruction and improve students' scores on standardized tests (Bigony, 2010). Online and blended educational classes have aimed at engaging students but research was needed to measure outcomes of online learning. Distant learning has become more common but educational leaders need to make sure decisions to implement distant education is based on research.

Chapter Two presents research on the history of online education, defining online and blended education, reasons of growth online courses, types of online and blended programs, the cost of education, and research on the effectiveness of the different instructional learning models.

Chapter Two: The Literature Review

This chapter discusses the advancements in technology over the last 15 years and why technology has become an integral part of classroom learning. Data and research on the background of online learning are compared including why students are choosing to take online classes, the difficulties in tracking online data, creating the curriculum for the course, and different types of online programs. This chapter also discusses cost and funding of online programs, the demographics of students enrolled in online classes, and the quality of online classes. Finally, background information is presented on several online and blended classes that have been implemented in the state of Missouri.

History of Online Education

Many of today's youth have grown up searching the Internet, downloading applications and files, and blogging on websites. Communicating online has become natural to the "digital native" generation. This excitement and interest in technology created immense demand in online education opportunities. Online education, learning that takes place through computer software or web-based Internet technologies, has received publicity of late, yet it has been around for decades (Wicks, 2010, p. 9).

In 1963, two professors from the University of Illinois Urbana-Champaign, Suppas and Blitzer, envisioned that computer-aided learning would reform education and create a method to individualize education. They created the PLATO project. The PLATO platform was the first computer-based program used to enhance instruction and focus on improving literacy (Kidd, 2010).

Instruction consisted of repetition of completing practice problems known as the drill-and-practice model. Students used the program on a computer located within the classroom. Increased acceptance of online learning led to a range of topics including French and Organic Chemistry. The PLATO project evolved into two programs that are still widely used today: PLATO learning and NovaNet (Watson et al., 2010, pp. 50-51).

Online education within a school setting was slowly emerging through the 1970 and 1980s. By 1985, corporate America was benefiting from distance education. Companies began using online software to train new employees and offer career advancement for current employees (Allen & Seaman, 2011). With the introduction of the World Wide Web (WWW) in the 1990s, the efficiency of this practice grew. Companies could provide training for employees from remote locations and conduct conferences online. Results from surveys conducted on American businesses found 87% of corporations reported using online education to help train employees, a 73% increase in 10 years. Companies surveyed believed online training had a 60% faster learning curve, increased performance and created a large return on investments for each dollar spent (The North American Council for Online Learning and the Partnership for 21st Century Skills, 2006). Companies viewed online education as a way to cut travel and personnel costs while increasing the ability to interview and hire people from all over the country (Allen & Seaman, 2011).

In 1989, the University of Phoenix became the first university to offer distance education for undergraduate and graduate business courses through the

Internet. Distance learning courses provided online instruction for students who were at different locations from their instructors. John Sperling, who founded the university, wanted to appeal to working adults who did not have the time to sit in a traditional classroom (Anderson, 2014). In addition, online education provided University of Phoenix opportunities to reach students who were geographically too far from a college to attend classes physically. In its first year of conception, 12 students were enrolled with the university. Two years later, that number had risen to over 700 students taking distance online classes (University of Phoenix, 2016).

Also in the late 1980s, CALCampus, a Computer Assisted Learning Center located in Rhode Island, launched the first exclusively online curriculum. CALCampus course material was hypertext documents posted by a professor that could be viewed by students on a webpage. While some students could post homework to the website, most were required to mail a copy to their instructor (Morabito, 2015).

In 1994, Internet based email and the World Wide Web was becoming assessable to the public. CALCampus became the first school to offer real-time instruction via the Internet. This was a major improvement in distance education (Morabito, 2015). Although online education was in its early stages, many colleges and universities saw potential in the idea and began creating their own online classes (Allen & Seaman, 2011).

From the late 1990s to the early 2000s, computer equipment, software programs, and the Internet grew dramatically. Inventions such as the webcam and

internal microphones allowed instructors to record lessons and upload them to a website. Students and teachers communicated back and forth in real time (Morabito, 2015). The new technology created even more demand for online education as student programs became more efficient and user-friendly. The World Wide Web and electronic mail were accompanied by instant messaging, voice over Internet protocol, and interactive video conferencing (Cook & Sonnenberg, 2014). The increased demand continued to pressure institutions to offer online learning classes. "In the 2000-2001 school year, 90% of two-year and 89% of four-year colleges offered distance education courses" (Gaytan, 2007, p. 1).

Educational outcomes, or goals upon which learning programs are developed, have been driven by improvements and more widespread technology usage in higher education. This dramatically changed how instructors utilized technology (Kidd, 2010). Table 1 summarizes the focus and educational outcomes of online learning from 1975 to 2005.

By 2006, the focus of online education began to change. As the Internet continued to become more advanced, universities began to use the online market as a way to increase revenues for the university, expand educational reach to nontraditional students, and recover investments made to upgrade technology (Gaytan, 2007). Higher education institutions wanted to provide modern simulating opportunities while still reducing budgets and keeping tuition increases to a minimum (Burian et al., 2012). Skype, smartphones, and social media had become integral parts of online education (Cook & Sonnenberg, 2014).

Table 1

Historical Context of Online Learning

Era	Online Focus	Educational Outcome
1975-1985	Programming: Drill and Practice Method Computer-assisted Learning (CAL)	Using online programs to practice and solve problems.
1983-1990	Computer Based Training for Business Employees Multimedia (online text, images, video, etc.)	Learning was individualized but done in brick and mortar setting
1990-1995	Web Based Training	Training that could be done from remote location
1995-2005	e-learning, personalized learning plans	Flexible coursework for students from remote locations

Note: Adapted from (Kidd, 2010).

Some students were attracted to online courses because of the convenience of not having to attend classes at a designated time or place. Other students expressed an increased interest in online learning because they were in control of the pace of learning and believed the quality of instruction was comparable to a traditional school setting (Gaytan, 2007). By 2007, 20% of all college students were enrolled in at least one online class (University of Phoenix, 2016).

Online Education in Kindergarten Through 12th grade

With increased demand for online learning programs at the collegiate level, kindergarten through 12th grade (K-12) schools began to invest in the idea (Watson et al., 2009).

Early K-12 online programs were geared towards homebound students. School districts are mandated to provide educational services to all students, even

the ones who cannot attend the brick-and-mortar setting. Digital versatile discs (DVD) and compact disc read only memory (CD-ROMs) of subject material were sent to students and were completed at home (Keeping Pace with K-12 Digital Learning, 2015).

In 2000, 45,000 K-12 students were enrolled in online classes. From 2002 to 2005, the number of K-12 students enrolled in online classes increased by 65% (Watson et al., 2009). In 2007, surveys conducted by Sloan Consortium and Keeping Pace found that nearly 1,030,000 United States children in K-12 were involved with online or blended courses. That number had increased to three million K-12 students in 2009 (Watson et al., 2009, p. 19). That number continued to increase rapidly as districts across the country fully embraced online and blended learning.

In 2009, President Barack Obama showed support for online education and vowed $500 million towards the development of online courses and related material. By 2010, 50% of districts in the U.S. had created or joined an online learning environment. Authors of the book *Disrupting Class,* predicted that by 2019, half on all high school classes will be taught in some form of an online environment (Watson et al., 2010).

Educational researchers, Burian et al. (2012), studied technology and education and predicted online instruction would continue grow rapidly over the next 10 years and become an extremely critical in the learning process. Schools would become learning communities that facilitate student individual needs. Thirty percent of learning opportunities will be completed online while only 20%

will take place in a traditional classroom. Students will have individualized portfolios with custom learning goals that incorporate social networks and support groups. Twenty-first century learning programs will be adapted to students' lifestyle and prepare them for work commitments (Burian et al., 2012).

Defining Online Education in K-12

Online or distance education has been defined as "institutionally based formal education where the learning group is separated and where telecommunications technologies are used to unite the learning group" (Bigony, 2010, p. 390). Several organizations including the International Association for K-12 Online Learning (iNACOL) and Keeping Pace have begun trying to organize and track online data and policies. With the help of these online organizations, online learning programs have been separated into dimensions. The dimensions are illustrated in Table 2.

Table 2

Dimensions of Online Learning

Comprehensiveness:	Supplemental Course or Full-time School
Delivery:	Asynchronous or Synchronous
Reach:	District, Multi-district, State, or National
Type of Instruction:	Fully online, Blending, or Fully face-to-face

Note: Adapted from (Watson, Murin, Vashaw, Gemin, & Rapp, Keeping Pace with K-12 Online Learning, 2011, p. 10).

These dimensions of online education are important in understanding online education. The first dimension incorporates the amount of time the students was online either being supplemental courses or a full-time online program. Supplemental online classes are taken as an extra class while the

students still participated in a regular school setting. Supplemental online classes are taken on the student's own time away from school hours. While enrolled in full-time online programs, students take their entire course load online and do not attend a tradition school setting (Wicks, 2010).

The second dimension involved how the content is delivered: asynchronous and synchronous. Asynchronous was the more traditional online approach. Students and instructors worked independently and communicate with time delay. Common examples include courses from CD-ROMs, discussion boards, email, self-paced instruction, and web-based programs that required students to log-in to learning management site to obtain needed material (Watson et al., 2011).

With increased technology came synchronous learning. In this real-time interaction, students and instructors participated in video-conferencing, online chats, and two-way podcasts. This was the foundation behind virtual classrooms or cyber schools. Students and teachers do not have to be in the same physical location but still can interact in real-time (Christensen, Horn, & Staker, 2013).

The third dimension of online learning involved who the courses were created for and was referred to as the reach of the program. Online and blended programs range from nationwide to a single district. Some programs were designed in conjunction with several district sharing resources to create online programs. The reach or type of program will be discussed in more detail later in this chapter.

The fourth dimension of defining online education includes the type of instruction. Programs can range from fully online to blended online instruction to fully face-to-face. Table 3 defined the difference in the type of courses and how much technology was incorporated (Seaman & Allen, 2010).

Table 3

Type of Online Instruction

Percent of Content Delivered Online	Type of Course	Description
0%	Traditional / Face-to-Face	Course uses no online technology and all content is delivered by the instructor
1-29%	Web Facilitated	Course uses some technology to enhance the course. Instructor may use web page or Internet site to enhance the class.
30-79%	Blended / Hybrid	Course blends online and face-to-face delivery. Typically uses a LMS and has reduced face-to-face instruction.
80% or more	Online	Most or all of the content is delivered on a LMS or web-based program. Typically have no face-to-face meetings.

Note: Adapted from (Seaman & Allen, 2010, p. 5).

Fully online programs are commonly referred to by several terms including: cyber schools, e-learning, virtual school, web-based learning, e-school, and distance education. Distance education can be asynchronous or synchronous learning while cyber and virtual are associated with synchronous learning (International Association for K-12 Online Learning, 2011, p. 5).

Within fully online courses, students spend at least 80% of their time working on a computer-based program. Students submit assessments and assignments to the instructor over the Internet or a learning management system. Students are provided extra tutoring by the instruction or lab assistant. Students could be located in a school building or a distant location such

as their home. Several different online instruction models will be discussed later in this chapter (Watson et al., 2010).

Blended online learning, also called hybrid learning, occurred when students have learned partially online and partially through face-to-face instruction. Many different models of blended learning exist including: face-to-face driver, rotation, online lab, and flex learning (Watson et al., 2010). Table 4 illustrates the most common blended learning models.

Table 4

Primary Models for Blended Learning

Blended Model	Description
Rotation Model	Students complete different activities in which at least one is online. Directed instruction, class project, worksheets, online labs, flipped classroom are some examples.
Flex Model	Students have an individualized where the teacher is a facilitator of learning.
A La Carte Model	Students take one or more courses completely online while also taking traditional courses in a brick and mortar setting.
Enriched Virtual Model	School-wide setting where each course is taken partially online and partially brick and mortar.

In the rotation model, a teacher delivers the curricula then students use computers, typically located in the room, to do guided practice at their own pace. Students who struggled with material use some time to catch up while other students use online programs to provide enrichment (Christensen et al., 2013). Students may spend one class period in a traditional setting with face-to-face instruction then the next class period online. The online lab model uses an online curriculum platform where teachers provide support and in-person

tutoring. Students complete courses online but are at their traditional location and under supervision (Christensen et al., 2013).

The flex model uses an online platform to complete courses, but teachers provide small-group and tutoring as needed. Students can spend some time in the classroom but also be at a distant location (Horn & Staker, 2011, pp. 4-6).

An increasing trend is the "A La Carte Model." Students take supplemental courses outside the school while still attending traditional school to take required courses. Keeping Pace K-12 estimated that in 2015 over 2.2 million students took supplemental online courses (Keeping Pace with K-12 Digital Learning, 2015).

Blended learning can significantly increase the school day or school year by offering flexibility of instruction. Classes can be taught in the morning, after school, or during the summer. Studies have shown that blended learning models increased instructional time without increasing the time school buildings are open. Students can communicate with teachers and other students both inside the classroom as well as outside (Watson et al., 2011).

Blended learning changed how the teacher approached student learning. Each student has a personalized instructional plan and worked on mastering each concept before continuing to the next subject. As a student worked online, the teacher has more free time to provide additional help to those who need it. Student response surveys on correctly implemented blended learning resulted in students feeling it enhanced personalization of learning (Watson et al., 2011).

Fully face-to-face delivery, referred to as traditional education, takes place in a brick and mortar setting. Brick and mortar refers to school building where K-12 educational classes are held. Students and teachers are required to meet for a specific amount of time referred to as seat-time. According to the U.S. National Center for Education Statistics, in 2009, 55.5 million students were enrolled in kindergarten through high school. Most of those students were enrolled in the over 98,000 public schools in the U.S. (U.S. Department of Education, 2011).

Reasons for Growth of Online Education

Almost half of the economic growth in the last 10 years in the United States was attributed to jobs in science, technology, engineering, and mathematics (STEM) fields. For college graduates in 2018, it has been predicted that there will be more than eight million STEM job openings and there will be a severe shortage of qualified workers (Wladis, Hachey, & Conway, 2015). Higher education has implemented technology to create more individualized learning plans and rapidly adapt curriculum for student learning, which research has shown to increase graduation rates (Battaglino, Haldeman, & Eleanor, 2012).

Over the last 10 years, online enrollments have exceeded students enrolling in traditional college classes. Community colleges have had the largest increase with nearly 60% of students enrolling in online courses. Nearly half of students graduating high school in the United States will attend a college community; furthermore, half of students who received a bachelor's degree in a STEM related field attended a community college (Wladis, Conway, & Hachey, 2015).

With job opportunities available and increased focus in STEM fields in higher education, K-12 staff have dedicated many resources to preparing students. According to a 2009 study by the National Center of Education Statistics, of the K-12 students enrolled in distance education, 74% were high-school students, 9% were middle school and only 4% were elementary students (Queen, Lewis, & Coopersmith, 2011, p. 4). Due to the vast majority of online courses being taken by high school students, much of the research on why students continue to enroll online was based on secondary schools (Queen, Lewis, & Coopersmith, 2011). In a study conducted by Project Tomorrow, students surveyed gave the following reasons for taking an online course (in order of highest to lowest percent): earn college credit, work at my own pace, class not offered at my school, complete high school requirements, get extra help in an subject area, fit my schedule, and easier for me to learn (Watson et al., 2009).

The survey echoed similar trends reported by school districts across the United States as to the different type of online education courses that students were enrolled in 2009-2010. Sixty-five percent of students that enrolled in distance classes were taking a core or elective class needed for graduation. Sixty-two percent were enrolled online for credit recovery, in which a student failed or missed a class. Forty-seven percent were in dual enrollment so the student could earn high school and college credit. Twenty-nine percent were taking Advancement Placement courses that were not offered at their high school. Twenty-seven percent were enrolled in career and technical education classes (Queen et al., 2011).

According to a study in 2012, two of the main reasons school districts offer online courses was to provide supplemental course offering and credit recovery (International Association for K-12 Online Learning, 2011). Many districts, especially rural, small schools, do not have the capability of offering advanced classes so students can enroll in those courses online. The College Board, which oversees advanced placement classes, estimated that in 2010 only 33.7% of schools offered advanced courses in English, science, math and social studies (International Association for K-12 Online Learning, 2011, p. 1).

While providing students with more course options was important, districts were heavily concerned with students who had fallen behind. Credit recovery refers to students who have taken a course but did not receive academic credit towards graduation due to poor performance in that class (Powell, Roberts, & Patrick, 2015). Students who fail classes become more at-risk of dropping out of high school before graduation. Nearly one third of public education students fail to graduate high school in four years. The number increases to one half of African Americans and Hispanics (Powell et al., 2015). In total, about 9% or 1.2 million students drop out of high school each year. Online learning can be a valuable tool for students who are behind in credits and can provide an option rather than dropping out of high school (Archambault et al., 2010, p. 2).

Many schools face increased pressure from state and federal laws to improve student outcomes. Online credit recovery has become an integral part in increasing graduation rates because blended learning and online courses allow student to work at their own pace and provided flexibility to students to master the

content (Legistlative Budget and Finance Committee, 2011). In 2010, nearly 84% of school districts offered credit recovery via online courses (Powell et al., 2015).

Demographics for Students Taking Online Classes

Non-traditional students have become the fastest growing segment enrolling in post-secondary degrees. Non-traditional referred to a student who may have delayed college enrollment, a single parent, part-time enrollment, no high school diploma, or are working full-time. According to the National Center for Education Statistics, 52% of public four-year students and 88% of public two-year college students have at least one non-traditional risk factor. Non-traditional students were significantly more likely to enroll in online courses than their peers (U.S. Department of Education, 2011).

A 2003 study found that historically Black colleges offered fewer online courses compared to other colleges and universities. In 2010, of the nearly 300,000 students enrolled in historically Black college and universities, 82% of students were not enrolled in any distant education courses, 15% enrolled in some, and only 4% were enrolled fully online (U.S. Department of Education, 2014, p. 24).

When focusing on enrollment within STEM related fields, minorities and women were typically underrepresented in traditional programs at most colleges and universities. Yet, women were overrepresented in enrollments of online STEM courses as compared to the number enrolled in face-to-face courses. Black and Hispanic men were underrepresented in online STEM courses at both two-year and four-year institutions (Wladis, Hachey, & Conway, 2015).

Data for demographics of students in K-12 enrolled in online courses was limited. Many programs have not divided online data into subcategories for tracking and it has not been a requirement for school districts to report how students obtained graduation credits. In 2009, iNACOL surveyed 31 online providers. Of the 31 programs, only six kept data on ethnic demographics, and nine programs kept gender data. The six online programs represented an approximated 82,000 students whereas the nationwide demographics represented 45 million students. Table 5 compares online ethnic demographics to nationwide K-12 demographics. Due to the shortage of data, caution is needed when drawing conclusion towards ethnic trends (Watson et al., 2009, pp. 35-36).

Table 5

Survey Results From Ethnic Demographics on Online Programs Compared to Nationwide Demographics

Ethnic background	Six online programs	Nationwide K-12 demographics
White, non-Hispanic	59.4%	56.5%
Hispanic/Latino	16.1%	20.5%
African American	14.4%	17.1%
Asian	3.3%	4.7%
Native American	0.5%	1.2%
Other	6.6%	Not available

Note: Adapted from (Watson, Gemin, Ryan, & Wicks, 2009, p. 36).

Of the nine online surveyed on gender demographics, 43.3% were male and 56.7 % were female. The national K-12 average was 51.4% male and 48.6% female (Watson et al., 2009, pp. 35-36).

A 2007 study conducted by the U.S. Department of Education National Center of Education Statistics focused on the location of K-12 students enrolled in

online programs. Urban school district located slightly outside large cities contained the most students enrolled in online courses. Table 6 summarized the finding based on city size (Picciano & Seaman, 2010, p. 7).

Table 6

Location of School Districts Using Online Programs

City Size	Percent of Students	Definition
Large City	1.4%	City having a population greater than 250,000.
Mid-Size City	4.9%	City having a population less than 250,000.
Urban Fringe of a Large City	21.0%	Census designated area or territory within a large city
Urban Fringe of a Mid-Size City	15.3%	Census designated area or territory within a mid-sized city
Large Town	0.8%	Census designated place with a population greater than 25,000.
Small Town	11.5%	Census designated place with a population less than 25,000 and greater than 2,500.
Rural	45.1%	Any census designated area that is not within a core statistical area, large or mid-sized city.

Note: Adapted from (Picciano & Seaman, 2010, p. 7).

The state of Washington was one of the first to create an accountability system for online learning. In 2013, over 23,000 students within the state enrolled in K-12 online courses. Female students were slightly over-represented as well as white students. Eighty percent of students taking online courses were high school students and 25% were taking courses in math and science. Fifteen percent were using the online courses as credit recovery (Nelson & St. Pierre, 2014).

Comparing Success of Online and Traditional Programs

Research on high schools in American has deemed there to be a "graduation crisis" (Powell et al., 2015). Graduation rates in 2014 from public high school was 84% but ranged from 61% in the District of Columbia to 90% in

Iowa. Missouri was slightly higher than average at 87% (National Center for Education Statistics, 2014, p. 1). Nearly half of African American and Hispanic students failed to graduate and less than that have the skills needed for success in college or the work force. In 2014 the average graduation rate for Hispanic students was 76% and only 68% for African Americans (Powell et al., 2015, p.8). With increasing total U.S. population numbers of minorities, it has been predicted that Asian, Hispanic, and Black students enrolling in college will double from 2000 to 2050, with most enrolling in community colleges (Wladis, Conway, & Hachey, 2015).

The social costs of students dropping out of high school include increased public assistance, loss of taxes, lower productivity, and increased crime. Over 80% of incarcerated individuals do not have a high school diploma. Due to this, states have been funding ways to improve graduation rates without much success over the last 15 years (Montgomery & Hirth, 2011, p. 253). Strategies such as ninth grade transition programs, individualized instruction, common-cohorts based on interest, academic and social supports, and implementing technology have been researched and implemented in all 50 states (Montgomery & Hirth, 2011).

The state of Florida has been leading the trend of online learning and established the country's first virtual school. Florida State University conducted one of the first studies on the effectiveness of online courses in the secondary setting. The study compared the likelihood a student earned a C or better in a face-to-face or an online courses for 20 subject areas. For most subgroups,

students received higher grades on the online course than in the traditional face-to-face setting. Students who scored low on the Florida Comprehensive Assessment Test (FCAT), less than 3 on a five-point scale, in the prior year generally had better results online (Hughes et al., 2015). Special education students also scored higher on the online courses than students who took the course face-to-face. Students who were taking a class for credit recovery in ninth grade had greater success when taking that class online as opposed to face-to-face. The demographics of students within the study choosing to take online courses were more likely to be White than Black or Hispanic (Hughes et al., 2015). Table 7 summarizes demographics of students.

Table 7

Demographics for Students Taking Online Courses in Florida

2010-11	Face-to-Face Only	One or More Online	Difference (online minus face-to-face)
White Students	44.2%	53.8%	9.6%
Black Students	23.6%	17.5%	-6.1%
Hispanic Students	26.9%	21.3%	-5.6%
Eligible for free or reduced lunch	48.6%	26.3%	-22.3%
Special Education Student	12.0	5.9	-6.1%

Note: Adapted from (Hughes, Zhou, & Petscher, 2015).

The results indicated additional research needs to be conducted to measure the quality of the online and face-to-face as measured by a standardized test to measure quality of the course material (Hughes et al., 2015).

While Florida focused on effectiveness measured by the grade the student earned in the course, the state of Washington focused on standardized tests to

gauge effectiveness of online courses. Washington state tracked test scores on state assessment tests, Measurements of Student Progress (MSP), and End-of-Course exams (EOC). Students who took online courses scored below students who took the traditional method on every test: fourth grade math, seventh grade math, fourth grade reading, seventh grade reading, and 10th grade reading (Nelson & St. Pierre, 2014). High school students who took online courses were more likely to earn a D or F and less likely to earn an A or B, than students who took the course face to face. Of students who enrolled in online courses for credit recovery, 63% earned at least some credit. Algebra had the lowest credit recovery success rate with only 41% of students enrolled in the course actually earning credit (Nelson & St. Pierre, 2014).

Total online enrollment in postsecondary institutions for the fall of 2011 was almost seven million students. Nearly half of all distant learners at postsecondary institutions were enrolled in community colleges. Data collected from 2,000 students majoring in STEM related fields at community colleges focused on learning outcomes of students. "Success" for this study was measured by students who completed the face-to-face or online course (Wladis, Conway, & Hachey, 2015). Women were more likely to drop out of online courses as opposed to face-to-face STEM related courses. The study also found students older than 24 had a higher success rate of online courses than face-to-face. Finally, the study found non-White students success rate about equal among online and face-to-face environments (Wladis, Conway, & Hachey, 2015).

In a study that tracked online learning from 2007-2012, 88% of chief academic officers in schools offering online courses agreed that students who were disciplined about their schoolwork had a better success rate of online courses. In 2012, nearly 75% were concerned with low retention rates of students enrolled in online programs and this was their largest concern with online programs (Allen & Seaman, 2013).

One of the most extensive studies of online education tracked more than 50,000 students at community colleges in Virginia. Findings concluded that withdrawal rates of online programs were nearly double compared to face-to-face courses. Regardless of the content area and demographics, students who took an online and face-to-face course performed more poorly in the online course. Performance gaps of White and minority students were larger in the online course than in the face-to-face courses. Finally, students labeled "at-risk" had the highest withdrawal rates and low overall performance (Reichman, 2013).

A study on blended learning of a statistics class offered by Carnegie Mellon University, found no significant difference in learning outcomes of students who took the course in the blended format and the traditional format (Reichman, 2013). The research is still inconclusive and varies greatly among age group studies.

Quality and Curriculum of Online Education

The quality of education received through online education has been a heavily debated topic. Since 2007, iNACOL has been compiling research and reviewed literature to create online learning and teaching standards. The goal of

the online standards was to align online material with state and federal curriculum. Online programs should also create engaging learning experiences that allowed students to master curriculum similar to the goal of face-to-face curriculum (International Association for K-12 Online Learning, 2011, p. 7).

Curriculum is broken into three categories: intended curriculum, assessed curriculum, and enacted curriculum. Intended curriculum is the set of objectives that are identified prior to the lesson. Assessed curriculum is measured by formative and summative assessments. Enacted curriculum is the daily material that gets carried out by the teacher (Ornstein, Pajak, & Ornstein, 2015).

Additional curriculum descriptors include the following: hidden, null, written, implicit, adopted, and received curriculum. The intended curriculum is developed by the federal government, state and school districts, and teachers. The Obama administration challenge grant program, Race to The Top, awarded 4.5 billion dollars for states who implemented National Standards known as Common Core. Common Core Standards outlined grade level competencies to be implemented by the states as the intended curriculum (Miller, 2010).

State and local government played a greater role in creating the assessed curriculum or how students would be considered successful. States, including Missouri, implemented Grade Level Expectations (GLEs) and learning standards in conjunction with the Common Core Standards. States also created graduation requirements, seat time for students, and standardized tests associated with the GLEs. State regulation dictated accreditation protocols, compliance with funded

programs, and special education programs (Weiss, Knapp, Hollweg, & Burrill, 2001).

Local school districts and teachers played the greatest role in enacted curriculum by deciding which instructional material to use for subject-specific concepts such as textbook, websites, and laboratory activities. Commercial publishers have become a huge influence on decisions made by school districts. For profit companies have produced and sold instructional material including online management systems for decades, thus making the K-12 instructional material a 3.3 billion dollar industry (Weiss et al., 2001).

FuelEducation, a popular for-profit online education provider, has aligned its online lessons with the intended curriculum of Common Core Standards and independent State Standards. The company employed curriculum specialists who have continuously updated and aligned material to specific standards requested by school districts (Fueleducation, 2016).

Many online organizations have adopted the work of the Southern Regional Education Board's Quality Online Course Standards. "National Standards for Quality Online Courses are designed to provide states, districts, online programs and other organizations with a set of quality guidelines for online course content, instructional design, technology, student assessment and course management" (International Association for K-12 Online Learning, 2011, p. 3). In 2011, iNACOL published Version Two of the National Standards for Quality Online Courses. The standards were broken down into five categories: content, instructional design, student assessment, technology, and course evaluation.

iNACOL has also developed the National Standards for Quality Online Teaching which helped states and districts provide guidelines for how an online class should be taught. This helped insure students are getting a highly qualified education (International Association for K-12 Online Learning, 2011).

Although national standards for online programs have been developed, many questions about the quality of online education still exist. Many concerns have been raised in regards to academic honesty and student work. For example, the *New York Times* published an article that the New York City public schools were cheating the system with questionable online practices to help students graduate. Online courses offered to students were not as rigorous as courses taken in the traditional setting (Picciano & Seaman, 2010). On the other side, the Department of Education (DOE) released a meta-analysis on the effectiveness on online learning and found that students enrolled in online classes performed better than students in traditional classes. The DOE confirmed that there is a lack of data and much more research needs to be conducted on the effectiveness of online learning (Wicks, 2010, p. 38)

Type or Reach of Online Programs

In 2011, all 50 states offered some form of online or blending learning environment. It was estimated that over 2.2 million students enrolled in online courses with around 35% of those courses in science and math (Keeping Pace with K-12 Digital Learning, 2015). Each state's virtual school was developed and funded differently. In order to help define and track different programs, Keeping Pace developed several major categories of online schools: state virtual schools,

multi-district full time schools, single district programs, consortium programs, and programs run by postsecondary institutions. This provided needed information for government agencies and lawmakers to start to design distance education policy. It has been a slow process to implement needed policies (Watson et al., 2011). Table 8 described the major categories of online programs.

Table 8

Types of Online Programs

Category	Organization or authority	Full-time / Part-time	Funding	Geographical reach	Examples of leaders in the field
State virtual school	State education agency	Full-time or part-time	State funding, course fees, grants	Statewide	Florida Virtual School, Idaho Digital Learning
Multi-district	Charter school or district	Full-time	State funding formula	Regional or statewide	Oregon Connections Academy, Insight School of Washington
Single-district	District	Full-time or part-time	District funding	Single-district	Riverside, CA; Broward, FL;
Consortium	Variable	Part-time	Course fees, school membership fee	Statewide or national	Virtual High School Global, Wisconsin eSchool Network
Post-Secondary	University or college	Full-time or part-time	Course fees	National	University of Nebraska Independent Study HS

Note: (Watson, Murin, Vashaw, Gemin, & Rapp, Keeping Pace with K-12 Online Learning, 2011, p. 10).

Virtual schools. State virtual schools have remained the major contributor to online learning. Thirty-nine states have a virtual state school, but they vary in size. During the 2014-2015 school year, over 462,000 students were taking 815,000 online courses through virtual schools. Of those students 46% were full-time virtual high school students (Keeping Pace with K-12 Digital Learning, 2015). State virtual schools are created by a state-level agency and receive funding by federal grants, state appropriation and charging course fees. They have also received private funding and grant money from community sources. "Virtual schools" are any distance learning K-12 programs that use web-based technology and services (Clark & Berge, 2005). State virtual schools have not replaced traditional schools but provided students with additional opportunities to take advanced courses, credit recovery, and help with scheduling conflicts (Watson et al., 2011).

In a 2011 study conducted by the Pennsylvania House Resolution, the approach and philosophy of state virtual schools widely varied. Common initiatives among the virtual schools were supplemental courses for advancement and recovery, alignment of virtual school's curriculum to academic standards, requiring teachers to complete online training programs, requiring teachers to have a valid teaching license, state funding, diplomas, and requiring students to participate in state assessments (Legistlative Budget and Finance Committee, 2011).

At the time of this writing, the frontrunners in state virtual schools included: Florida Virtual Schools (FLVS), Michigan Virtual Schools, and Idaho

Digital Learning Academy. Florida was the country's largest public online provider and offers both full and part-time enrollment. In 2010-2011, FLVS had 259,928 course enrollments (students enrolled in a semester long course), which was a 22% increase from the previous school year (Watson et al., 2011). Florida also had the highest state funding at $87 million in 2008-2009 school year (Legistlative Budget and Finance Committee, 2011, pp. 7-9).

Multi-district full-time online programs. The second major type of online program is multi-district full-time schools. As of 2011, 27 states had at least one multi-district online school. Most are run by charter schools. Charter schools are public organizations that follow many of the same regulations that traditional schools do, but have a unique mission. They have more flexibility and a greater ability to include technology in their curriculum (Watson et al., 2011, pp. 21-25).

Many traditional school districts have partnered together to offer multi-district programs. Most have been affiliated with national education management organizations such as Connections Academy or K12 Inc., which have helped provide course material, software and teacher training. Multi-district online schools typically enrolled students from a general geographical location but are not always held to accountability standards of public and charter schools. Financial support was provided by state funds, student tuition fees, or by grants from either government or private sources (Watson et al., 2011, pp. 21-25).

District-level online programs. The fastest growing sector of online learning has been district-level online education. Single districts create online or blended learning programs to meet the needs of the student it serves within the district lines. The popular trend among single district online programs has been to combine online learning with face-to-face instruction to create blended learning environments (Keeping Pace with K-12 Digital Learning, 2015). Data for most districts is unavailable because schools are not required to report the number of students enrolled in such classes. Originally, these programs were primarily targeted towards high school students and focus on credit recovery and at-risk students. Many district have begun to expand blended class offerings by providing students with laptops or tablets. Single-district programs are funded primarily by the district and do not vary from funding for students in traditional classes (Watson et al., 2011, pp. 19-20).

Consortium programs. Consortium online programs do not fit into the category of virtual schools, multi-district, or single district programs. These online learning programs are an association for two or more school districts that worked together to improve and expand learning options for students (Keeping Pace with K-12 Digital Learning, 2015). They received funding from various organizations, including some government funding, but many times the school district will pay fees for the student to enroll in coursework (Watson et al., 2011, pp. 25-26). Sloan Consortium surveyed school districts to find the major providers of online and blended learning; results are shown in Table 9.

Table 9

Providers of Online Content

Online Instructional Provider	Fully Online	Blended Learning
Postsecondary Institution	47.4%	38.2%
State Virtual School in residing state	34.1%	11.2%
Independent Vendor	31.8%	25.8%
School district – teachers within the district	26.6%	52.8%
Education service with the state	24.9%	18.0%
Another local school district	22.0%	29.2%
State virtual school in another state	13.3%	3.4%
Cyber charter school within the district	9.8%	6.7%
Districts or schools in another state	5.2%	3.4%
Other	2.3%	1.1%

Note: Adapted from (Picciano & Seaman, 2010, p. 13).

The highest online providers for fully online courses at 47.1% were classes provided by postsecondary institutions. Thirty-four percent of school districts relied on state virtual schools to provide online classes. In districts that utilized the blended education model, 52.8% relied on staff within the district, 38.2% of classes were provided by postsecondary institutions, and 29.2% were provided by another local school district (Picciano & Seaman, 2010, pp. 12-13).

Many post-secondary programs have created courses that offer students dual credit so high school students received high school and college credit. One example of an industry leader is the University of Missouri-Columbia High School, which offered distance-learning classes to 700 full-time students. It also provided over 8,000 supplemental course enrollments. Fees are paid by the student and typically range from $200-$250 per course. Universities are the largest provider of online classes to high school students (Watson et al., 2011, pp. 25-26). University online highs schools often attract high performing students

and the most common classes students enrolled in were advanced placement (Keeping Pace with K-12 Digital Learning, 2015).

Cost and Funding of Online Learning

According to the Constitution of the United States, K-12 educational responsibilities are an obligation of the states and not the federal government. The federal government has provided some funding for education. In 1965, the federal government enacted the Elementary and Secondary Education Act (ESEA), which provided limited funds to school programs for low-income families. In 2001, the reauthorization of ESEA was No Child Left Behind (NCLB). The goal of NCLB was to close the achievement gap in race and socioeconomics (U.S. Department of Education, 2005). The U.S. Department of Education's Budget Service and National Statistics (NCES) reported that the United States was among the top countries in the world when it comes to spending money on education. The United States was ahead of every civilized country in academic spending, except for Switzerland and Norway. Vietnam considered 79% of its students to be economically disadvantaged but still outscored US students in math on the Program for International Student Assessment (PISA) test and spent less in federal education funding (Layton, 2013, p. 4).

Although the federal government provides some school funding, a large majority of funding comes from the state and local level. In 2004-2005, 83 cents out of every dollar spent on education came from the state and local levels. Total expenditures for elementary and secondary education has steadily risen from

$248.9 billion in 1990-91 school year to $536 billion in 2004-2005. This is a 105% increase in 15 years (U.S. Department of Education, 2005, p. 2).

Most of government funding has been calculated and recorded in per pupil spending. The average per pupil expenditure (APPE) has been used to decades to report how much was spent to educate each student. Included in the APPE was teacher salaries, administrative costs, instructional material, and infrastructure, along with all ancillary services provided by the school. To calculate APPE, school districts total overall costs and then divide it by the number of students that attended the school (Watson et al., 2014). According to the 2009 Annual Local Government Finance Statement, APPE in the US was $10,499; $1,159 dollars came from federal sources, $5,725 came from state sources, and $5,367 came from local sources. The state of New York had the highest APPE spending $18,126 while Utah had the lowest at $6,356 APPE (U.S. Department of Education, 2009, para. 6).

Traditional schools have developed a standard system of funding. Educators and policymakers have heavily debated how to fund online and blended schools. Historically, funding for the public education system was not associated with a specific school or specific students. Government funds a school district with stringent regulations on how the money can be spent. It is difficult, if not impossible, to transfer funds from one category to another (Hill, 2011, pp. 2-3). For example, funds to pay building facilities cannot be used to pay for new programs, such as software or technology training. The biggest obstacle in online funding has been current state policy and regulations that do not

allow school districts to invest in innovative technology using funds from other categories (Hill, 2011, pp. 2-3).

Many states have developed funding methods for online courses that are similar to funding for traditional schools but have reduced money associated with capital funds associated with building maintenance. During the 2008-2009 school year, costs of funding state virtual schools ranged from $325,000 in Connecticut to $87.3 million in Florida. The average cost for state run virtual schools was $9,558,702 (Legislative Budget and Finance Committee, 2011, pp. 7-10). Although virtual schools received some federal and state funding, 73% of school charged tuition to cover school expenses. Tuition costs ranged from $85 per course enrollment in Michigan to $1,200 per course enrollment in Missouri (Legistlative Budget and Finance Committee, 2011, pp. 7-10). With the help of lawmakers, Florida's Virtual School (FLVS) has had great success funding its online school. In 2002, legislation enacted the public school choice. This allowed FLVS to count as a school option for students and allowed course completion and performance to replace seat time. FLVS lost funding for every student who does not complete their courses (Watson et al., 2011).

Educational funding has faced severe reduction in the last several years. This has hurt online education efforts as well. Some virtual schools such as North Carolina Virtual School, experienced 368.5% growth in 2010 and a 20% growth in 2011. Many states had decreases in course enrollments due to changes in funding costs. Missouri Virtual School had an 82% decline in 2010 and 5% in 2011 (Watson et al., 2011, pp. 28-31). According to research on barriers to online

and blended education, 58% of school district administrators responded cost as top reason for slow implementation (Picciano & Seaman, 2010). North Carolina Virtual School experienced 367% growth in 2010 and 20% growth in 2011 due to a drop in funding of courses in the traditional setting so students enrolled online (Watson et al., 2011).

Where is the money spent? According to the Thomas B. Fordham Institute, the National Average for per-pupil cost in a traditional brick-and-mortar educational setting was $10,000 in 2010, although costs varied dramatically across the country (Battaglino et al., 2012). Similar to predicted cost of per pupil in a traditional school, several variables come into play in the estimated the costs of online education.

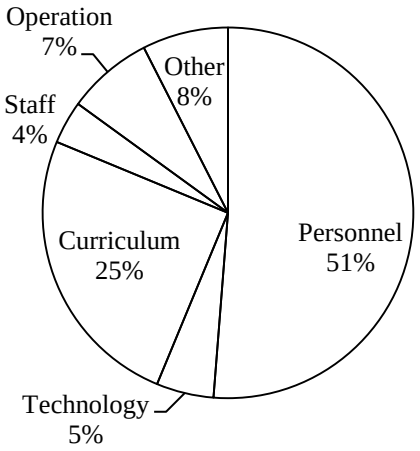

Figure 2. Allocation of budget. Adapted from Watson, Murin, Vashaw, Gemin, & Rapp, Keeping Pace with K-12 Online Learning, 2011, p. 34.

According to iNACOL, the national average in 2011 for online school per pupil expenditure was $6,500. Of a typical budget, 41% was spent on personnel such as salary and benefits for teachers, 20% was spent on materials and books

for curriculum and instruction, 27% was allocated for technology and infrastructure and 6% was spent on school operations and support services (Watson et al., 2011, pp. 32-34).

Due to the different online models, cost structure has widely varied. The cost of online education can be divided into two categories: virtual schools or blended learning environment. The virtual school model allowed all instruction to be completed online. Students could enroll in full-time programs or be considered part-time students. Part-time students typically add a supplemental course but still attended a traditional brick-and-mortar school (Allen & Seaman, 2013). In blended online schools, students attended traditional classes but educators use technology as a tool to increase the effectiveness of instruction. The main areas that will be examined for both models are costs associated with the following: personnel; curriculum and instruction materials; technology and infrastructure; and school operations and support services (Watson et al., 2011).

Personnel costs. Personnel costs in the traditional school setting can range anywhere from 50-80% of a district's budget. Online schools vary in the amount of money spent on laborers depending on student-teacher ratio, number of full-time teachers, state-licensed employees, and certified principals. In the virtual school model, personnel costs average $2,600 per student, with 15% variation either way. Virtual schools with lower labor costs saved money by increasing the student-teacher ratio. This was especially common among elementary schools that often required a parent or guardian to be a facilitator (Battaglino et al., 2012, pp. 34-35).

Another factor in calculating labor costs was employment of part-time or paraprofessionals that have reduced salaries. For example, a school may have an "online learning center" with computer rooms available for students that were facilitated by a paraprofessional rather than a certified full time teacher. Virtual schools also have been able to reduce costs by employing less administrators, but many need additional IT staff (Anderson, Augenblick, DeCescre, & Jill, 2006).

In the blended learning model, labor costs are $5,500 per pupil with a 10-15% variation. The two main differences in costs from a traditional school setting and a blended learning environment are the type of staff employed to supervise computer-based learning and the time spent in computer-facilitated learning. Some blended learning models employed paraprofessional or online supervisors to monitor computer instruction while certified teachers are used in face-to-face content delivery. Blended learning environments spend more on technology to purchases devices and broadband services to access the Internet and store data (Battaglino et al., 2012, pp. 5-7).

Curriculum and instruction costs. The main curriculum and instruction material for traditional schools are considered textbooks, workbooks, and videos. Most of the instructional costs are tied to the teachers who created the lessons for the students. Online content has a much broader spectrum of curricular materials used as learning tools. Electronic book (E-books) can be used as a supplemental resource or can replace conventional textbooks. Other instructional material includes virtual labs for science classes, online journal articles, online workbooks, webcasts, and other media both print and digital (Anderson et al., 2006). Many

schools also used data integration and management tools, which can consume the majority of the curricular budget. Virtual schools have spent millions of dollars so companies can create coursework and design a learning management system (Battaglino et al., 2012).

A learning management system (LMS) referred to a website or software package that allowed students and instructors to communicate synchronous and asynchronous. This meant students could communicate with instructors in real-time by webinars, text chat or audio discussion. Students could also communicate asynchronous by email and web discussions. A LMS could be developed by the teachers but has often been third-party software. LMS teachers maintain large portions of the content include Blackboard and Moodle. Examples of LMS created and maintained by for-profit companies include E2020 and K-12 Learning (Wicks, 2010).

The course is divided into units and lessons. Instructors have the responsibility to choose lessons that align to their state standards. Students log-in to the website and the LMS would provide students with personalized course work such as quizzes and assessments. Multiple-choice assessments are automatically graded by the software and reported to the instructor. Student activity can also be tracked for attendance and participation (Wicks, 2010, p. 22).

Blended models spend less money than virtual schools on online content because students used less computer-based software. Many blended schools rely on teachers to develop online course material instead of hiring a company to create the material. Content acquisition for virtual schools is estimated at $800

per pupil and $400 for blended learning environments (Battaglino et al., 2012, p. 8).

Technology and infrastructure costs. The next area of cost is technology and infrastructure. The big difference in online education and traditional school setting is online education spends more money on technology and much less on infrastructure. Brick and mortar schools spend an average of $200 per pupil on technology, which amounts to very little of the overall budget (U.S. Department of Education, 2005, p. 3). Virtual schools spend approximately $7,200 per student, which includes computers for teachers, storage for data, server space, and connectivity as well as other teaching devices such as web cameras. Students are typically at distant locations so the school does not need an actual building (Anderson et al., 2006,p. 10). Some virtual schools have created a common meeting place called a school office. This allows teachers a place to meet and work together, students a place to have face-to-face interaction, and administrators a physical work site. This increases the infrastructure costs but it still much less expensive than operating a school building (Watson et al., 2011).

While traditional schools spend on average about $200 per students per year on technology, districts that adopted blended learning programs spend approximately $500 per student per year, but this varies widely depending on the infrastructure where students take classes. Many blended learning environments rotate days in the computer lab and classroom so it reduces the amount of classroom space needed (Battaglino et al., 2012, p. 9).

School Operations and Student-Support Service Costs

Traditional school districts spend 15-25% of the budget on school operations. This includes non-instructional costs such as transportation, custodians, food service, counseling, and special education. Virtual schools can save money on certain school operations but replace some of those costs with school outreach programs to recruit students across many districts. Virtual schools still have to meet state requirements for special education service, which can require teachers to make home visits (Legistlative Budget and Finance Committee, 2011). Blended schools often find innovative ways to reallocate resources such as rotating the time students are in the traditional education setting with time spent in online learning programs. By having students meet with a teacher one period and in a computer lab the next period, regulations on seat-time requirements are being met (Battaglino et al., 2012).

Challenges in Online Learning

One of the major concerns with online and blended education is the lack of data. Tracking information about online learning in the K-12 population has been a difficult task mainly due to the lack of consistency across the online learning community. Different school districts have utilized different vocabulary when referring to online learning and many do not differ between virtual learning and blended learning (Wicks, 2010). Government regulations have not determined a way to consistently report if a student was enrolled in a full-time virtual school as opposed to taking a blended course through their high school (Watson et al., 2010).

Along with the lack of a universal definition of what "online" means in the educational setting, there has been inconsistency in how data was collected. School districts have not been required to report data in a common format so differences are found even within the same state. Some districts use course enrollment meaning they count the number students enrolled in a course. One student could be enrolled in numerous courses. Other districts used student enrollment and count the number of students enrolled in online courses even if a student was taking more than one course. Few institutions reported students enrolled in blended learning opportunities (Watson et al., 2010, p. 13).

The next several years present several challenges to school administrators. Schools will continue to include online learning in their course offerings but currently there has been a lack quality assurance in the classes offered. Online standards of learning are a major obstacle still to be overcome. Keeping the Pace and iNACOL are hoping that educational leaders continue to push the national common core standards. This would demand the creation of online quality standards across state lines (Watson et al., 2009).

Another concern with online education is government policies and funding. States have different policies on their approach to online learning. School personnel are working with political leaders that have very little background information on online learning and how technology can enhance learning (Watson et al., 2014). Currently, there are rules on the number of online or blended-learning courses a student can take to receive credit. Many states also have seat-time or attendance requirements that pose many obstacles for fully

online programs. Students are required to be in "class" for a designated amount of time to receive credit for the course. State requirements also lead to difficulties in funding formulas. State and local governments provide funding based on per pupil expenditures and often does not account for online or blending learning (Anderson et al., 2006).

Another challenge of online education has been the lack of specialized teacher training. A 2010 study by Going Virtual! concluded that 86% of teachers have received some training regarding online learning. The type of training ranged from ongoing training session through the school to graduate courses through a university. Yet, many teachers feel more professional development time will be needed. They have many concerns that how they are using the technology in the classroom does not provide the highest quality of learning for students. Many school districts have fiscal problems with funding and therefore have difficulties providing more training for their employees (Dawley, Rice, & Hinck, 2010, pp. 11-13).

Online Programs in Missouri

Missouri's virtual school. In 2007, the Missouri State Board of Education established Section 161.670, which established a Missouri Virtual School to serve students kindergarten through 12th that reside in the state. If a student enrolls in the state virtual school, it will provide information to the district in which the student resides, including if the student discontinues the program. The full-time student can complete the equivalent of six credits per term. Missouri's virtual school must meet the standards of adequate yearly progress (AYP), annual

performance report (APR), school improvement program (MSIP), teacher certification and curriculum standards (MODESE, 2016b).

Missouri Virtual Instruction Program (MoVip) is regulated by the Missouri Department of Elementary and Secondary Education (DESE). MoVIP provides course instruction in a virtual or distant setting and offers a variety of online learning tools. MoVIP's mission is "to offer Missouri students equal access to a wide range of high quality courses, flexibility in scheduling, and interactive online learning that is neither time nor place dependent" (Missouri Virtual Instruction Program, 2016, para. 2).

MoVIP supports school districts by offering an expanded course selection for districts who cannot offer a class due to low enrollment number or budget constraints. It provides flexibility for students who have scheduling conflicts or cannot attend school due to a medical condition. It allows students to earn more credit and prepare for college. It also helps provide resources and recovery courses for struggling students. In 2016, MoVip offered 172 classes in grades K-12 including remedial or foundation courses, foreign language, advanced placement and practical art classes (Missouri Virtual Instruction Program, 2016).

MoVip did not offer diplomas so credit earned was reflected on the student's transcript at the residential school district. If a student does not respond to course material or submit assignments for 21e days, the student was dropped from the class. The grade received was communicated to the school district and reflected on the student's permanent record (Missouri Virtual Instruction Program, 2016).

State policies towards Missouri's virtual schools have been slow to change. In traditional settings, students are required to spend a certain amount of time in each class to receive credit for that class. In 2009, Missouri became one of a handful of states to eliminate the seat-time requirement for virtual school classes. Bill SB291 allowed Missouri students more flexibility to complete online classes (MODESE, 2011).

MoVip was created in 2006 to serve both full and part-time student in K-12. Most of the students who enrolled in the program were in high school. Funding in 2008-2009 was $5.8 million and over 15,000 students from across the state enrolled in the various courses. In 2009-2010 that funding dropped to $4.8 in the virtual school and mid-year funding was eliminated due to budget constraints. MoVIP was forced to charge students tuition for the spring semester and enrollment declined 82% to only 2,900 students. Enrollment continued to fall in 2010-2011 to 1,335 students (Watson et al., 2011, p. 116).

In 2009, Missouri's funding of virtual schools was similar to funding of students in the traditional setting. The district that enrolled the student received 15% of its state funding and the virtual school receives 85% of the state funding. In 2011, state funding was eliminated and MoVIP went to a tuition-based program. The cooperating school district may pay the student's tuition or it is the responsibility of the student to pay. Medically fragile students may apply for free tuition that the state would cover. Average costs for online classes are $300-$350 per semester course. This also decreased the amount of students enrolling in Missouri's virtual school program (Watson et al., 2011, p. 117).

MU High School. The University of Missouri-Columbia High School (MU High School) provides online distance learning classes through the University of Missouri. Student work through the curriculum at their own pace and were graded by performance evaluations. Exams were administered in a face-to-face environment. MU High is accredited by AdanceED so students can receive graduation credit from their home school or through MU High (University of Missouri, 2014).

In 2010-2011, MU High School had 700 full-time students and had 8,458 supplemental course enrollments. Most tuition costs were the responsibility of the student and ranged from $160 - $185 per course per semester. The price for a student enrolled full-time for four year was approximately $2,500 (Watson et al., 2011, p. 117).

Missouri Multi-District Full-Time School

MO Learning Center. MO Learning Center, a nontraditional school settings offering online courses, located on the fringe of St. Louis, Missouri, opened several locations in 2001. In 2015, MO Learning Center served 800 students from six school districts including within the metropolitan area of this study. MO Learning has focused on helping at-risk students who have considered dropping out of high school or students that are not have succeeded in traditional high schools. As of 2014, 4,500 received their high school diploma through the MO Learning Center program (ACE Learning Center, 2016).

MO Learning provides computer-based instruction using the PLATO Learning platform. PLATO Learning is a leading provider of online education. It

offers a wide range of programs from credit recovery to advanced placement. PLATO works with the school to create personalized and engaging lessons (EdTech Times Staff, 2012). Students master learning goals in a given subject matter before moving on to the next objective. Certified teachers provide support and instruction as needed. The home district of where the student was a resident pays for the student to attend the distant learning program (ACE Learning Center, 2016).

Summary

Technology has provided many innovative solutions for the United States educational system including more options for advance learning, credit recovery, and individualized learning. It has also given creative opportunities for school districts that are struggling with budget constraints to reduce overhead. As blended and online learning have become more common in K-12 schools, accountability and quality standards have been slow to keep pace. Research has been contradictory in determining if students have received as good or better instruction than using face-to-face instruction alone. Lawmakers have been slow to introduce funding methods that created equal opportunity for students to access the technology resources. Finally, school administrators need more research data to make informed decision about implementing technology. School officials want to feel comfortable that students will be successful when taking online courses.

Chapter Three will include the methodology used to determine if students were at-risk for failing high school courses. It will also illustrate how the analysis will compare standardized test scores on the Biology End of Course exam of the

three different learning models: traditional face-to-face, blended, and online learning. The procedure and design of the experiment will be discussed as well as the role of the researcher, the privacy of participants, and the method of data collection.

Chapter Three: Methodology

The increase in technology and the growth of online education has created the need to evaluate its effectiveness in the classroom. This study was designed to determine if a correlation existed between struggling eighth grade students and those same students in high school. Then using the at-risk student population, the study measured the outcome on students' standardized End of Course Biology exam scores when using three different instructional models: online learning, blended learning and a traditional setting. The School Improvement Plan for this district focused on many aspects that play a pertinent role in this study. This chapter describes the research design, research procedure, participants of the study, protection of human subjects, data analysis, and limitations of the study.

The Research Site

The school district included in this study, referred to as U.S. School District, was chosen for this study because it parallels many of the highly researched educational topics of the last five years. No Child Left Behind has increased focus on closing the achievement gap of minority students. Technology has been viewed as one element to assist in bridging the gap. Research conducted by Picciano and Seaman concluded that 21% of total students enrolled in online courses are in urban districts on the fringe on a large city (Seaman & Allen, 2010). U.S. School District boarders a large Midwest City. It has an extremely diverse population, has struggled with growing poverty concerns, and pressure to meet state requirement for accreditation. The school district has allocated

voluminous financial resources to provide technology opportunities for its students. It has become a state leader in technology integration.

In 2015, the district had an enrollment of 5,528 students from preschool through 12th grade. The district had seven elementary schools, two middle schools, and one high school. The district had a diverse student population: 51% Caucasian, 33% African-American, 9% Hispanic, 4% Asian, and 3% multi-race. Students represented 59 countries and spoke over 40 languages. Table 10 summarized facts provided from the Missouri Department of Education regarding the district (MODESE, 2016b).

Table 10

Enrollment Statistics of U.S. School District

Year	2009	2010	2011	2012	2013	2014	2015
Total Enrollment	5,446	5,509	5,518	5,502	5,563	5,650	5,562
White Students	61.8%	59.6%	57.3%	56.3%	54.9%	52.4%	50.8%
Black Students	27.6%	30%	31.5%	31.2%	31.6%	33.1%	33.3%
Hispanic	5.8%	6%	6.5%	7.1%	7.7%	8.0%	8.8%
Free and Reduced Lunch	36.1	40.6%	42.9%	44.1%	47.2%	49.1%	48.8%

The school district has one high school, U.S. High School. The following statistics were provided by the high annual yearly progress and the report card given by the Missouri Department of Education. One of the school goals for the high school has been to increase test scores for all subgroups. Subgroups noted in Table 11 outperformed state averages on End of Course exams in 2016 (MODESE, 2016b).

Table 11

Enrollment Statistics of Subgroups for U.S. High School

Year	2009	2010	2011	2012	2013	2014	2015
Total Enrollment	1,802	1,789	1,819	1,785	1,784	1,785	1,785
White Students	64.5%	63.2%	61.6%	61.8%	61.3%	59.4%	56.3%
Black Students	27.4%	28.8%	30.0%	29.2%	29.1%	30.7%	32.9%
Hispanic					5.2%	5.2%	5.8%
Free and Reduced Lunch	29.1%	33.3%	35.4%	35.5%	39.3%	42.6%	43.5%

The school district has seen a change in socioeconomics over the last seven years. The number of students receiving free and reduced lunch has increased approximately 2% every year since 2009. This has been higher than the Missouri state average of free and reduced lunch, which increased from 43.7% in 2009 to 51.7% in 2015 (MODESE, 2016b). U.S. High School has had an influx of temporary housing and homeless families. The school district continued to research innovative ways to meet the needs of its students even with large population shifts. This has been another reason the district introduced online learning into the classroom. Many students have transferred into the district and are behind grade level. Online credit recovery has been a popular and cost inefficient way to move students toward graduation requirements (Powell et al., 2015).

U.S. High School has focused the last five years on increasing its science, technology, engineering, and mathematics (STEM) course offerings. The science department has spent ample professional development time researching best practices in education. Areas of research included using technology to close the

achievement gap, aligned course content to state standards, and how to motivate at-risk students. U.S. High provided a valuable research site to study the effects of technology implemented in Biology courses.

U.S. High School has implemented several technology-based programs for at-risk students. One option was online credit recovery offered through an independent vendor in conjunction with traditional high school courses. Students enrolled in online courses that were completed on-site outside the regular school hours, typically before or after school. Another option was in collaboration with the MO Learning Center, which provided a multidistrict online learning center. Students had the opportunity to take high school courses and work towards graduation requirements. The courses were funded by the students' local school district and End of Course exam scores were reported back to the high school in which the student was registered. Students involved in the online instructional model of this study were enrolled in the MO Learning Center (ACE Learning Center, 2016).

The main areas of focus over the last five years for U.S. High School were using data to improve proficiency at state exams, closing the achievement gap for minority students, and incorporating technology into the classroom. In 2015, U.S. School District employed over 400 teachers and over 100 at the high school. Teachers at the high school received over 80 hour of professional development per year. Table 12 summarized levels of experience of teachers at the high school (MODESE, 2016b).

Table 12

High School Teacher Information

Year	2012	2013	2014	2015
Tenured Teachers	85	84	87	85
Non-Tenured Teachers	56	57	59	60
Average Year of Teacher Experience	13.6	14.4	14.0	14.6

Along with diversity and highly qualified teachers, U.S. High has received state and national recognition for promoting student achievement. Table 13 summarized annual major components of performance data for the years in the study for U.S. High School (MODESE, 2016b).

Table 13

Performance Data for U.S. High School

Year	2009	2010	2011	2012	2013	2014	2015
Average ACT	22.1	21.5	21.6	22.5	22.1	22.1	22.2
Dropout Rate	2.5	2.5	2.1	2.3	2.1	2.4	2.6
Entering a 4-Year College	39.5	32.2	34.0	37.1	46.9	39.2	40.1

Table 14 summarized data from 2015 and 2016 from the Biology test for all the students who completed the test in the state of Missouri and U.S. High School (MODESE, 2016b).

In 2012, this district approved a 1-to-1 initiative called iLearn.PSD. Each student was issued a laptop computer for use at school and at home. This allowed them daily access to a digital learning environment and the learning management system. iLearn.PSD incorporated the learning management system known as "Moodle."

Table 14

Biology End of Course Exam Data

Year	2015 MO State Ave.	2015 US High Ave.	2016 MO State Ave.	2016 US High Ave.
% Scoring Below Basis	6.4	Less than 1	Less than 1	Less than 1
% Scoring Basic	26.8	17.7	21.8	10.7
% Scoring Proficient	45.8	49.0	49.3	38.7
% Scoring Advanced	21.0	31.5	25.0	47.3

iLearn.PSD allowed more teachers to implement a blended learning environment and provided students with increased exposure to technology tools. Teachers and staff were responsible for developing and maintaining course content on the learning management system. Teachers also received training on how to incorporating technology into the classroom.

Developing the Intervention

In 1996, the state of Missouri established the Missouri's Department of Education created the Show-Me Standards. These standards provided a guide for independent school districts to create challenging curriculums. To evaluate student progress the state implemented the Missouri Assessment Program (MAP), standardized tests completed by students in grades three through eight and End of Course exams in certain courses. Students' scores on these standardized tests and graduation rate are an integral part accreditation process for the school district. Sub-group scores also factor in the annual yearly progress score for accreditation. Therefore, schools are continuously searching for cost effective strategies to

improve student achievement. This study was aimed to measure the effectiveness of online education.

Upon completing the MAP test, students received a scale score and then categorized into level of performance based on their based on their score. Table 15 summarizes eighth grade level indicators, skill level, and scale score. Students who scored below basic or basic are considered below grade level expectations (MODESE, 2016a).

Table 15

Grade Level Indicators

Grade 8 - Descriptors	Scale Score
Below Basic Students can identify simple terms and vocabulary. They can read simple graphs and make simple comparisons.	540-670
Basic Students can identify an example of terms and vocabulary. They can recognize simple hypothesis, trends in data, and influence in science.	671-702
Proficient Student can classify terms and vocabulary. Recognize and calculate averages, understand the importance of constants and variables in an experiment. Understand the discoveries that help advance science.	703-734
Advanced Students can explain terms and vocabulary. Construct a complete graph, evaluate experimental design, create a testable question and a hypothesis. Awareness of influences the have lead to increase in science and technology.	735-895

Note: Adapted from MODESE, 2016, Retrieved from https://dese.mo.gov/search-mo-gov/eoc%2Bindicators

The state of Missouri also created the Missouri Learning Standards to define skills and knowledge for students to be successful after high school. These standards combined the Show-Me Standards and the Grade Level Expectations

(GLEs) to provide clear expectations for students to meet goals. To measure progress, End of Course (EOCs) exams were developed to provide teachers with specific feedback on students' progress of the Missouri Learning Standards for certain high school courses. Consistent with MAP scores, students received a scale score, which categorized their level of performance. Table 16 summarizes learning goals, achievement indicators, and scale scores. Students who score basic or below basic did not meet the academic requirement for that course (MODESE, 2016a).

Table 16

Achievement Indicators for Biology End of Course Exam

Achievement-Level Descriptors	Scale Score
Below Basic Students can identify simple terms and vocabulary. They can read simple graphs and make simple comparisons.	100-177
Basic Students can identify an example of terms and vocabulary. They can recognize simple hypothesis, trends in data, and influence in science.	177-199
Proficient Student can classify terms and vocabulary. Recognize and calculate averages, understand the importance of constants and variables in an experiment. Understand the discoveries that help advance science.	200-224
Advanced Students can explain terms and vocabulary. Construct a complete graph, evaluate experimental design, create a testable question and a hypothesis. Awareness of influences the have lead to increase in science and technology.	225-250

Note: Adapted from MODESE, 2016, Retrieved from https://dese.mo.gov/search-mo-gov/eoc%2Bindicators.

Research has indicated students who fail classes especially as a freshman are less likely to graduate within four years (Neild, Balfanz, & Herzog, 2007). This study wanted to determine if a correlation existed between scores on middle school exam scores and high school science assessments. If a correlation exists, below proficiency MAP score could be one indicator to predict struggling students in later academic years.

Students who scored basic or below basic on the MAP in eighth grade, which was a scale score of below 200 were considered to be at-risk. At-risk students for the purpose of this study is defined as students predicted to struggle with high school grade level material, have higher probability of failing courses, and not on path to graduate in four years.

All students across the state of Missouri were required to complete Biology prior to graduation. The district began to pilot blended learning instruction with several volunteer Biology teachers. The teachers involved in the research taught some sections blended and taught some sections the traditional face-to-face method. Students were randomly placed in the traditional or blended learning models. All Biology students were given the same summative and formative assessments throughout the year.

Students in the online model selected or were recommended by the administration to take biology in the online format. The state standards and Course Level Exceptions for Biology were consistent over the course of the study. Upon completion of Biology, students were given the Biology End of Course (EOC) exam, a requirement by the state of Missouri. The study only collected

scores for students who were at-risk from the beginning of the course. Data was combined for each of the three learning models over the course of the seven-year period.

Participants

Participants were located in a metropolitan city in the Midwest, and surrounding suburbs. Students' ages ranged from 14 to 18 and were enrolled in grades nine through 12. Around 2,000 students completed both the eighth grade science MAP test and the Biology EOC in within the school district from 2009-2015. U.S. School District's data coordinator randomly assigned all students a number from 1-2,000 for the purpose of maintaining student identification anonymous for the study. MODESE collected data on socioeconomics, ethnicity, gender, and MAP and EOC scores. U.S. School District collected data on which instructional model students completed Biology.

A sample of the population was taken to complete the correlation analysis. The demographics of the sample varied and included all ethnic and socioeconomic backgrounds. From the population that completed the eighth MAP test, 210 were labeled at-risk. Some trends in the data indicated more males than females completed Biology online over the course of the study. Less minority students completed Biology online than nonminority students. More students completed Biology in the traditional face-to-face model than in the blended or online models. About 40% of students qualified for free or reduced lunch. All students were from the same school district and completed similar coursework in preparation for high school.

Data Collection and Analysis Procedures

MODESE administered and collected data on all standardized tests. Eighth grade students' MAP test scores and Biology EOC test scores were reported to the school district each year from 2009 to 2015.

From the students who completed both MAP and the Biology EOC during this time period, samples of 73 students were randomly selected from the total population of both at-risk and students on grade level. All students that were selected completed Biology with the same teachers over a five-year period. The research question of this study stated, Do eighth grade Missouri Assessment Program test scores predict achievement on Biology End of Course exams in High School? A correlation between the eighth grade MAP and the Biology EOC would provide a statistical relationship between variables. The Pearson product moment correlation coefficient (PPMC) was conducted to measure strength and direction of a linear relationship between quantitative variable, eight-grade MAP scores and Biology End of Course exams (Bluman, 2013). A positive correlation between low eighth-grade MAP scores and low Biology EOC scores indicated students whom were below grade level expectations in eighth-grade would continue to struggle in high school. Most students within the school district in this study completed Biology in ninth grade.

The effectiveness of each model of instruction was measured by the Biology EOC data collected during the years of 2009-2015. Over those years, 210 students were classified at-risk and were randomly assigned a learning model for their Biology course: blended and traditional face-to-face. Students were

assigned or selected to take Biology in the online format. Data was disaggregated based on gender and demographics to provide analysis for the hypothesis of the study.

The first null hypothesis stated: There is no difference in achievement measured by Biology End of Course exams for students identified as at-risk enrolled in online, blended learning, or face-to-face instruction, for the years 2009 through 2015. An analysis of variance (ANOVA) was used to test the mean of EOC scores from randomly selected students for each of the three learning model simultaneously. The independent variable was type of instruction: online learning, blended learning, or traditional face-to-face learning. The dependent variable was the standardized EOC test score of the student. Significant test value means that there was a high probability that the learning model impacted test scores. Statistical analysis was then completed to indicate between which models represented a difference in test scores.

The second null hypothesis stated: There is no difference in achievement measured by Biology End-of-Course exams for African American students identified as at-risk enrolled in online, blended learning, or face-to-face instruction, for the years 2009 through 2015. The same statistical analyses were conducted with this subgroup. Around 43% of the participants in the student were African American. This was slightly higher the African American population within the high school. This sub-group was selected because there has been increased focus on closing the achievement gap in our educational system and many district are turning to technology to provide additional opportunities. Yet,

much research stated African Americans have been less likely to enroll in online courses (Wladis, Hachey, & Conway, 2015). Research predicted the number of minority students applying to college to double in the next 20 years (Wladis, Conway, & Hachey, 2015). African-American students are twice as likely to drop out of high school than their counterparts (National Center for Education Statistics, 2014). Understanding which model was most beneficial to African American students will provide valuable data to districts with large population of minority students.

The third null hypothesis stated: There is no difference in achievement measured by Biology End-of-Course exams for male students identified as at-risk enrolled in online, blended learning, or face-to-face instruction, for the years 2009 through 2015. The same statistical analyses were conducted with this subgroup. Previous surveys conducted on male students found males prefer courses that involved technology. Males have historically been identified as at-risk at higher rates than females (Watson et al., 2011). Nearly one-third of high school students are not on track to graduate in four years. One of the main reasons students enroll in online courses has been credit recovery to move towards graduation (Powell et al., 2015). Data from this study will provide information on how males perform in different learning models.

The fourth null hypothesis stated: There is no difference in achievement measured by Biology End-of-Course exams for female students identified as at-risk enrolled in online, blended learning, or face-to-face instruction, for the years 2009 through 2015. The same statistical analyses were conducted with this

subgroup. According to research by Wladis, Hachey and Conway (2015), females have been the fastest going segment of students enrolling in online education for various reasons. Post-secondary institutions have been using flexibility of online courses to attract females into STEM majors (Wladis, Hachey, & Conway, 2015).

Protection of Human Subjects

The superintendent of the school district gave the researcher permission to view and analyze state test scores for the district. All data used was secondary and collected by MODESE and released to the U.S. School District. The district coordinator assigned random identification number to students so the data collected remained anonymous. Demographic variables were included in the dataset. Biology sections that completed the EOC were coded by MODESE. U.S. High School recorded which sections completed the course by which learning model. The researcher received IRB approval to conduct the study.

Summary

The study was designed to measure the effectiveness of different learning models based on their standardized test scores from Biology. Within the school district of study, students completed both the eighth-grade MAP and the Biology End of Course exam. From the total population of students that completed both the MAP and the Biology EOC, 210 students were identified as at-risk based on PPMC correlation coefficient from the eighth grade scores. An ANOVA test with Post Hoc Test was used to compare mean scores from each learning model on overall at-risk students, African-American at-risk students, and male and female

at-risk students. Chapter Four will discuss the results of the statistical analysis completed to support the research question and hypotheses of this study.

Chapter Four: Results

Although online programs are being implemented at a faster rate than ever before, a gap in research existed in the performance of students on standardized tests using different learning models that incorporate technology especially for high school Biology. The purpose of this study was to measure the effectiveness of different learning models on the standardized test scores of at-risk students. This chapter includes the results from the Pearson-P correlation and the ANOVA tests. The results provided valuable insight into the effectiveness of different learning models of education and how technology plays a role in the current educational classroom.

Research Question

Do eighth grade Missouri Assessment Program test scores predict achievement on Biology End of Course exams in high school?

All students in Missouri are given the Missouri Progress Assessment (MAP) in eighth-grade in three subject areas: English, math, and science. Based on their scale score they are categorized into a level of performance.

Table 17

Descriptive Statistics for Eighth Grade Missouri Assessment

Statistics	Eighth Grade MAP
n	73
Mean	681.5
Median	686.0
Sample Variance (s^2):	253.7
Sample Standard Deviation (s):	15.9
Population Variance (σ^2):	250.2
Population Standard Deviation (σ):	15.8

Table 17 indicated the correlation between scale score and level of performance (MODESE, 2016b).

Scale score from the students' standardized test was randomly collected from 73 students of the total population the completed both the MAP and the EOC. The scale score was compared to see if correlation existed between eighth grade MAP performance and Biology EOC performance.

The mean score for the eighth grade MAP students were M=681.5, SD=15.9. Table 18 described the grade level descriptors of expectations for students. The scale denoted the level of performance on the test. The mean score indicated students were scoring in the basic level of the grade level. Districts strive for all students to score in the proficient or advanced grade level indicator.

Table 18

Level for Performance of Eighth Grade MAP

Level of Performance	Scale Score
Below Basic (below grade level)	540-670
Basic (below grade level)	671-702
Proficient	703-734
Advanced	735-895

The eighth grade students then moved on to high school and completed Biology using one of the learning models. Then students were required to take a Missouri standardized test, the Biology End of Course exam. Table 19 indicated statistics for the students on the Biology EOC.

Table 19

Descriptive Statistics for Biology End of Course Exam

Statistics	Biology EOC
n	73
Mean	205.2
Median	205.0
Sample Variance (s^2):	161.5
Sample Standard Deviation (s):	12.7
Population Variance (σ^2):	159.3
Population Standard Deviation (σ):	12.6

The scores for the End of Course Biology exam were M=205.2, SD=12.7. Seventy-three Biology students indicated their scale score was slightly above the baseline for scoring proficiency in the course. Table 20 defines the grade level descriptors of expectations for students upon the completion of Biology. The scale denoted the level of performance on the test.

Table 20

Level of Performance on Biology End of Course Exam

Level of Performance	Scale Score
Below Basic (below course level)	100-170
Basic (below course level)	177-199
Proficient	200-224
Advanced	225-250

School districts strive for all students to score in the proficient or advanced categories of achievement. In high schools within the state of Missouri, annual yearly progress evaluations are determined, in part, by how students score on the End of Course exams (MODESE, 2016b).

A correlation coefficient was conducted to explore a possible relationship between eighth grade MAP and Biology EOC.

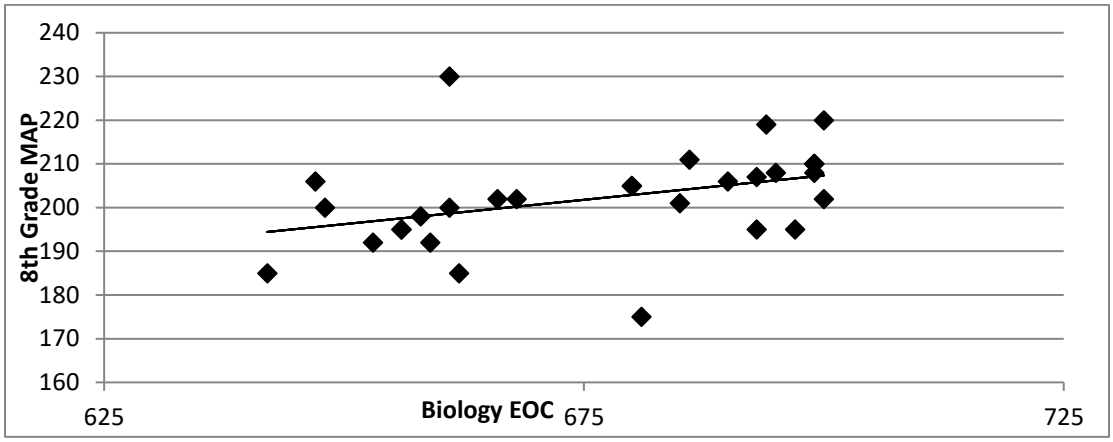

Figure 3. Correlation of eighth grade MAP and biology EOC.

The analysis revealed that the eighth grade MAP and Biology EOC were strongly correlated, $r(73) = .436$, $p < 0.0007$. A p-value of less than .05 indicated a correlation between the variables. This indicated that a low eighth grade MAP score also indicated a low EOC score.

Null Hypothesis 1

There is no difference in achievement measured by Biology End of Course exams for students identified as at-risk enrolled in online, blended learning, or face-to-face instruction, for the years 2009 through 2015. An ANOVA with Post Hoc Test was completed comparing the Biology End of Course exam for students who completed the class. Table 21 summarized the statistical descriptors for each of the learning models.

Table 21

Models of Learning Statistical Descriptors

Groups	*Count*	*Sum*	*Mean*	*Variance*
Online	10	1918	191.8	138.62
Blended	26	5148	198	87.12
Traditional	56	11502	205.39	140.60

The ANOVA test revealed significant differences between the classes. Students had the highest mean score when completing the course in the traditional face-to-face method and lowest mean score when taking Biology online. Table 22 displayed the statistical analysis for the ANOVA test for the different learning models.

Table 22

Analysis of Variance in Learning Models of At-Risk Students

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	2098.26	2	1049.13	8.368	0.0005	3.099
Within Groups	11158.96	89	125.38			
Total	13257.22	91				

A p-value of less than .05 indicated a significant difference in the mean scores. A Scheffe Test was performed to provide a more focused analysis between groups.

Table 23

Scheffe Test for Different Learning Models

	Fs	Fcrit	Significant
Online vs. Blended	2.21	6.20	No
Online vs. Traditional	12.50	6.20	Yes
Blended vs. Traditional	7.74	6.20	Yes

There was a significant difference between the students who took Biology online and students who took Biology in the traditional setting. A significant difference also existed between students who took the blended course and the traditional Biology course. The mean scores were the highest for the traditional model and the lowest for the online model. There was enough evidence to reject the null hypothesis that there is no difference in test scores between the different models.

Null Hypothesis 2

There is no difference in achievement measured by Biology End of Course exams for African American students identified as at-risk enrolled in online, blended learning, or face-to-face instruction, for the years 2009 through 2015. An ANOVA with Post Hoc Test was completed comparing the Biology End of Course exam for students who completed the class. Table 24 summarized the statistical descriptors for each of the learning models.

Table 24

Models of Learning Statistical Descriptors of Black At-Risk Students

Groups	*Count*	*Sum*	*Mean*	*Variance*
Online	7	1272	181.71	151.57
Blended	18	3584	199.11	125.51
Traditional	21	4299	204.71	121.31

The ANOVA test revealed significant differences between the classes. Black students had the highest mean score when completing the course in the traditional face-to-face method and lowest mean score when taking Biology

online. Table 25 displayed the statistical analysis for the ANOVA test for the different learning models.

Table 25

Analysis of Variance in Learning Models of Black At-Risk Students

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	2777.48	2	1388.74	10.918	0.0001	3.214
Within Groups	5469.49	43	127.19			
Total	8246.97	45				

The p-value of less than .05 revealed significant differences between the classes. The Scheffe Test was performed to provide a more focused analysis between groups.

Table 26

Scheffe Test for Different Learning Models of Black At-Risk Students

	Fs	Fcrit	Significant
Online vs. Blended	11.99	6.429	Yes
Online vs. Traditional	21.83	6.429	Yes
Blended vs. Traditional	2.39	6.429	No

Significant difference existed between the traditional face-to-face model and the online as well as the online and the blended model. There was no significant difference in the blended and traditional learning models. There was enough evidence to reject the null hypothesis that there is no difference in test scores between the different models.

Null Hypothesis 3

There is no difference in achievement measured by Biology End of Course exams for male students identified as at-risk enrolled in online, blended learning, or face-to-face instruction, for the years 2009 through 2015. An ANOVA with Post Hoc Test was completed comparing the Biology End of Course exam for students who completed the class. Table 27 described the statistical descriptors of male students.

Table 27

Models of Learning Statistical Descriptors of Male At-Risk Students

Groups	*Count*	*Sum*	*Mean*	*Variance*
Online	17	3202	188.35	219.36
Blended	23	4565	198.47	80.71
Traditional	28	5853	209.03	136.48

The mean score was the highest when males completed Biology in the traditional model and lowest when completed online. An ANOVA was completed to test if significant differences existed between models. Table 28 summarized the data.

Table 28

Analysis of Variance in Learning Models of Male At-Risk Students

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	4639.53	2	2319.76	16.809	0.0000	3.138
Within Groups	8970.58	65	138.00			
Total	13610.11	67				

The p-value of the ANOVA test revealed significant differences between the models. A Scheffe Test was performed to provide a more focused analysis between groups. Table 29 summarized the results of the test.

Table 29

Scheffe Test for Different Learning Models of Male At-Risk Students

	Fs	Fcrit	Significant
Online vs. Blended	7.26	6.276	Yes
Online vs. Traditional	32.78	6.276	Yes
Blended vs. Traditional	10.19	6.276	Yes

Differences existed between the models. Male students performed the highest on the EOC test when completing the course in the traditional face-to-face model as compared to the online and blended model. There was enough evidence to reject the null hypothesis that there is no difference in test scores between the different models.

Null Hypothesis 4

There is no difference in achievement measured by Biology End of Course exams for female students identified as at-risk enrolled in online, blended learning, or face-to-face instruction, for the years 2009 through 2015. An ANOVA with Post Hoc Test was completed comparing the Biology End of Course Exam for students who completed the class.

Table 30

Models of Learning Statistical Descriptors of Female At-Risk Students

Groups	*Count*	*Sum*	*Mean*	*Variance*
Online	6	1110	185	74.8
Blended	19	3835	201.84	92.14
Traditional	28	5649	201.75	122.41

The mean score when completing the course in the blended format was the highest for at-risk females. This is the only subgroup that the traditional model did not have the highest mean. Table 31 summarized the results from the ANOVA test.

Table 31

Analysis of Variance in Learning Models of Female At-Risk Students

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	1499.54	2	749.77	7.023	0.0021	3.183
Within Groups	5337.77	50	106.75			
Total	6837.32	52				

The ANOVA p-value was less than .05, which revealed significant differences between the classes. A Scheffe's Test was performed to provide a more focused analysis between groups. Table 32 summarized the results from the test.

Table 32

Scheffe Test for Different Learning Models of Female At-Risk Students

	Fs	Fcrit	Significant
Online vs. Blended	12.11	6.365	Yes
Online vs. Traditional	12.98	6.365	Yes
Blended vs. Traditional	0.000	6.365	No

A significant difference existed between the online and blended models as well as online and traditional. No significant difference existed between the blended and the traditional models. There was enough evidence to reject the null hypothesis that there is no difference in test scores between the different models.

Summary

The study analyzed how students performed on standardized test after completing Biology in one of three different models. At-risk students had the highest mean score when completing Biology using the traditional face-to-face method. When completing the ANOVA tests significant difference existed in between the models in all the subgroups. Table 33 summarized the results for the analysis to which significant difference existed.

Table 33

Significant Difference in Test Scores

	At-Risk	African American	Males	Females
Traditional vs. Blended	Yes	No	Yes	No
Traditional vs. Online	Yes	Yes	Yes	Yes
Blended vs. Online	No	Yes	Yes	Yes

The results indicated students had the highest EOC scores when completing Biology in the traditional method and lowest test scores when completing Biology online.

The results from this study will contribute to the lack of research on effects of how at-risk students perform on standardized tests using different learning models in Biology. Chapter Five will interpret the results and provide recommendations for educational leaders.

Chapter Five: Discussion and Reflection

The purpose of this study was to measure the outcome of student achievement when students completed three different types of learning models: a traditional learning model, a blended learning model, and an online learning model. Data analysis identified students as at-risk, defined for the purpose of this study, as students who scored below the basic level of proficiency on their eighth grade MAP test. The correlation was conducted using eighth grade MAP and Biology EOC standardized test scores. The study determined there was a high correlation between eighth grade MAP and the Biology EOC exam scores.

The correlation coefficient confirmed the theory that based on standardized test scores students struggling in eighth grade would continue to struggle with educational content in ninth grade. To help determine if there was a model of learning that would be more beneficial for that particular segment of the population, an analysis of variance was conducted to examine significant differences between the learning models for at-risk students. The results indicated statistical differences on the EOC between the groups.

Further analysis was completed to investigate how subgroups divided by gender and ethnicity scored on standardized tests. An ANOVA was performed to identify statistical differences among the sub-categories for students completing Biology in the different instructional models.

Triangulation of Results

Research question. The researcher analyzed data to identify if a correlation existed among test scores of students over multiple years. The data

indicated a strong correlation between eighth grade MAP scores and Biology End of Course exam scores. In the school district of study, Biology is typically a freshman course. Students who were behind grade level expectations in eighth grade may have made academic growth towards proficiency levels but continue to underachieve as measured by standardized tests administered in high school. The implications of a strong correlation confirmed the idea that at-risk students will not dramatically improve their achievement levels without intense intervention prior and during their high school years. Students who are underperforming academically in middle school do not have the educational skills to be successful in high school. This supported much of the current research including the vast amount of how to successful implement invention strategies for struggling high school students.

Null Hypothesis 1. Null Hypothesis 1 of the study measured statistical outcomes of the at-risk students when they completed Biology in three different models: fully online, blended learning, and the traditional face-to-face method. There was enough evidence to reject the null hypothesis, which stated that no difference existed between the learning models for at-risk students. The Sheffe post-hoc concluded significant difference existed between students taking Biology in the online model and the traditional face-to-face method. The results also indicated a statistically difference between the blended and traditional face-to-face learning model.

The research on effectiveness of online learning has varied greatly especially for STEM subject areas. Many studies have found that student

achievement has not dramatically improved with students completing courses online. Very few of those studies have measured achievement based on standardized test scores. There are many reasons why students may not be performing at higher levels in the online and blended courses. In 2014, more than half of the children in the public school system fall below the poverty line. Of those, 30% do not have access have sufficient access for broadband at home. Low-income students have less access to technology and are less likely to own their own device. Without readily available access to technology students have less confidence and can get overwhelmed with completing work through online applications (Darling-Hammond, Zielezinski, & Goldman, 2014). A valuable socioeconomic piece of data for this study was 50% of their students in this school district fell below the poverty line and 30% of the students in the studied sample qualified for free and reduced lunch.

Other factors that contributed to students being less successful when they completed courses online aligned with why they were classified as at-risk in eighth grade in the first place. Students with low motivation need the right blend of the face-to-face time and technology. Research has found at-risk students benefit from relationships built with educators and need the consistent reinforcement from that relationship (Darling-Hammond et al., 2014).

The data from the study showed that all subgroups have higher test scores from the traditional face-to-face learning models. Research conducted on why students are less successful in online learning models found students felt a weaker connection with the school when not there every day and therefore less motivated

to strive for higher critical thinking opportunities. Students also were negatively affected by the absence of peer interaction (Gilbert, 2015).

One of the largest on-going problems with online courses at the collegiate level is non-completion of a course. Studies have shown that non-traditional students, those that are working full-time jobs outside of school, have children themselves, have been placed in alternative setting due to drug and alcohol addiction, etc., are more attracted to online courses but yet cannot overcome distractions to complete the courses (Wladis, Conway, & Hachey, 2015). These students can highly benefit from teachers and counselors supporting their journey.

The results indicated no statistically difference between at-risk students who completed the course in a blended format and an online learning model. Some of the data in this study was collected starting in 2009 when the school district was beginning to implement a new technology program. By 2012, the program was fully implemented. As teachers gained more knowledge and became better educated with the technology, it would be predicted that the blended learning test scores would continue to increase. At-risk students, as do all students, need well-designed interactive programs that engage student learning. The learning, training and implementing of technology could impact student scores.

Null Hypothesis 2. There was enough evidence to reject the null hypothesis, which stated that no difference exists between the learning models for Black students. Data concluded that a significant difference existed between Black students taking Biology in the online model and the traditional face-to-face

method. It was the largest significant difference in student test scores of any of the subgroups. This was one of two subgroups that did not have a significant difference in the traditional and the blended learning models.

Current research on demographics of students specified African American students are less likely to complete courses online. A 2010 study by the Department of Education found historical Black universities have the lowest participation in online courses of any subgroups (U.S. Department of Education, 2011). The school district had approximately 50% African American students but only 30% of the students who completed Biology online were minorities.

Null Hypothesis 3. There was enough evidence to reject the null hypothesis, which stated that no difference exists between the learning models for male students. Data concluded that significant difference existed between all three of the learning models.

The largest significant difference from all the sub-groups existed between online and traditional face-to-face models for males. Although male students seem to be enthusiastic regarding technology especially such things as video games, the results were expected. Most of the current research stated males were less successful and score lower grades in online courses. Research on gender and technology found males struggled more with self-regulated learning, self-monitoring, goal setting and long range planning. Males also had more difficulty with time management and organization (Yukselturk & Bulut, 2009). Those are critical skills for online learning because students need to self-pace and self-motivate to ensure success. Males self-reported enjoying courses more when

technology was included than when it was not include (Yukselturk & Bulut, 2009).

The study supported previous research completed by Florida State University that students, including male students, did not score higher on the online learning model (Hughes, Zhou, & Petscher, 2015). It is possible adding technology-based activities could become a motivational factor for student achievement by increasing student engagement. Male students who engage in online learning would highly benefit from coaches who would help pace and monitor the learning environment.

Null Hypothesis 4. There was enough evidence to reject the null hypothesis, which stated that no difference exists between the learning models for at-risk female students. Data concluded that significant difference existed between females who completed Biology online and traditional face-to-face model. Significant difference also existed between the online and the blended learning model. Only 26% of the students who completed the course online for this study were female. This may be due to fewer females being categorized as at-risk in eighth grade as opposed to male students. Table 34 compared male to female ANOVA test scores.

Table 34

Significant Difference in Learning Models of Males and Females

	Males	Females
Traditional vs. Blended	Yes	No
Traditional vs. Online	Yes	Yes
Blended vs. Online	Yes	Yes

Research stated that females are the fastest growing segment of online learning because of the flexibility online course could provide. Although females have accounted for the fast growing segment for online courses, they are still struggling with underachieving on standardized tests with increased technology in the course. As in all groups of students, self-regulation, cognitive ability, and behavior played a role in the success of the learning model. Yet, the study found that females had comparable scores when completing the course in the blended and the traditional models.

Implications of Research

At-risk students who completed the Biology course in the traditional fact-to-face model scored higher on the End of Course exam than those students who completed the course in a blended or online format. Although overall scores were higher, both African-American and female students did not have statistical differences in scores for traditional and blended learning models. The results indicated there is a place for technology in the classroom even in a heavily activity-based, hands-on content area such as Biology. Also indicated from the

study was school districts need to be purposeful in implementing technology into the curriculum especially science. Many districts have been turning to online courses to help at-risk students earn credits towards graduation. The results from the study support the conclusion that students are more likely to meet course level expectations when the curriculum administered by a qualified teacher. Students benefited from strong relationships with educators that motivated them to think critically. District officials need to monitor the implementation of online learning carefully so students are not missing a quality education.

Studies show this generation of students must be savvy with using technology to compete in the workforce; therefore, essential that it is used in high school courses. U.S. High School, the school involved in this study, was in the beginning stages of implementing a technology program when the study began. Several teachers volunteered to implement blended learning models in which students completed at least 40% of their activities and coursework using some form of technology. Some examples of technology included Internet searches, Web-quest, word processing, online learning management system, and third party online tools. The online model included students completing all their assignments and assessments through a computer program generated by an educational research group.

Over the course of this five-year study, teachers received training and became more comfortable with using high quality technology in the classroom. If this study were to continue, it would be predicted that test scores in the blended learning model would continue to improve. Technology has created a necessary

tool that has helped enrich curriculum. Correctly implemented technology is interactive, inspires creative, and allows students to explore topics in greater complexity. Research indicated that students who lack educational motivation were more engaged and encountered less behavioral problems when technology was correctly implemented into the coursework (Darling-Hammond et al., 2014).

The results from this study indicated that even an online science course developed by top corporations in the profession does not replace engaging teachers that created thought provoking lessons. Technology has been a tool that has allowed individualized learning and student engagement. Without proper teacher education and training, online courses can become computerized worksheets that do not provide clear learning objectives. High school students, especially at-risk students, need adequate face-to-face learning time with qualified teachers that have well adapted curriculum. Technology can assist the learning of the students, but data suggested that students retain more information and higher levels of learning with increased instructional time as opposed to completing assignments online.

The outcome of the study matched several studies including one completed by the state of Washington. That study indicated students who completed reading and math courses online scored lower on standardized test than their counterparts in grades four, seven and ten (Nelson & St. Pierre, 2014). The results also matched the results from Carnegie Melon University that found a difference in outcomes for students who completed courses using the blended learning model and for those who competed course in the traditional face-to-face

model (The North American Council for Online Learning and the Partnership for 21st Century Skills, 2006; Reichman, 2013).

Districts around the country are under pressure to improve high graduation rates as well as standardized test scores. The data collected from this study provided teachers, administrators, parents, and school stakeholders' valid information on retention of materials for a year-long science course. Caution needs to be taken when implementing online courses to make sure student learning and course rigor will not be compromised. Students who lack fundamental skills for success in school and are already behind grade level in middle school have less success when taking classes online.

Recommendations to the Program

The study results indicated low eighth grade MAP scores could predict non-proficient Biology EOC scores. The hypotheses of the study were established to measure which learning model would be most beneficial for at-risk students when completing a rigorous, activity-based class such as Biology. The results found students had higher achievement on standardized tests when completing the course in the traditional face-to-face model. Many students who struggle with academic material need a teacher to guide their learning heavily.

Recommendations to other educational professionals include building a strong curriculum with highly qualified teachers. STEM related courses, such as Biology, need students to be engaged with hands-on activities that can be enriched with technology. The type and quality of technology implemented into the classroom is critical to the success of student learning. Teachers need to be

taught how to use technology in the classroom so students are gaining greater depth of knowledge. If the use of technology is not effective, it can result in lost instructional time for the students.

Student personality and learning style should also be a priority for school personnel. Many at-risk students are not motivated to complete assignments without being prompted. Some students rely on the relationship built between teacher and student to motivate them to be successful. A blended learning model could provide flexibility for at-risk students while providing support needed to motivate them to complete coursework. It could also provide opportunities for schools to move students towards earning graduation credit in a cost effective manner.

Implementing online material would be an excellent way to provide acceleration to struggling students. Online learning has many possibilities by providing students extended learning at home and away from the classroom teacher. By combining classroom face-to-face instruction and high quality online instruction, students would be provided with vast learning opportunities.

Recommendations for Future Research

The data collected for this study was collected starting in 2009. The school was just beginning to implement a new technology initiative at that time. In 2012, the school provided all its students with a laptop device. As teachers become more educated with technology in the classroom, it would be valuable to analyze data from the next five years to investigate the outcomes of the blended learning model.

Another research study that would have meaningful results is using reading level of students to categorize them as at-risk. Students who are not reading on grade level face many other challenges in school.

Another recommendation for future study is evaluating why Black students are underperforming while completing the course online compared to other subgroups. It would provide educators extensive data to help service our minority students.

A large part of any educational study that is difficult to measure is student motivation. Some students may be close to dropping out of school and completing course online would be measured as success. Research suggested huge societal costs for students who do not finish high school (Neild, Balfanz, & Herzog, 2007). More research needs to be conducted on online courses and student motivation in high school.

Research is needed on loss of instructional time due to student distraction while using computers. It is difficult for teachers to monitor what students are doing while using their computers. This generation of students has trouble disconnecting from technology. They feel the need to be connected by social media (Grail Research, 2011). Online and blended learning models have to overcome loss of instruction time while students are not fully focused. More research also needs to be conducted on the use of technology in blended learning models and which instructional strategies provide students with the highest achievement.

Another future study would be to compare the cost of students retaking courses in the face-to-face model and retaking the course in the online model. Many schools are facing budget limitations and a major motivation for districts is the cost of online education. A valuable study would investigate how students perform when retaking a course.

Discussion

Technology has become an integral part of our society and the lives of this generation of students. Young adults are highly engaged technology as a daily part through activities such as social media to typing a paper for school. At the time of this writing, high schools are facing many challenges from increased high school dropout rates, especially for minority students, to losing school accreditation. School districts are hoping to build on student excitement and capitalize on the many benefits technology can provide. This researcher believes many districts are wishing that technology could become the educational fix that everyone in education is searching to find.

This study focused on student standardized test scores for students after completing Biology. This researcher believes the blended learning model provides opportunities for students and teachers to create a learning environment that can be personalized and engaging for students.

One of the largest barriers to overcome with technology integration into the classroom is student distraction by non-curriculum material. High school students are often distracted by Internet, social media, and video games on their computers. Teachers have to manage student behavior when they have a device

in front of them while trying to engage them in learning. This can be very difficult for students to stay on task, especially for those who are already struggling. One way to help combat the problem is for teacher education programs to include online learning as part of their program.

As an educational leader, this study will influence how the researcher views online Biology courses especially for struggling students. Online courses provide many benefits to students but as an educator, the researcher wants to ensure rigor is not lost. At-risk students benefit from strong relationships with school personnel to help keep them motivated and on target to earn a high school diploma. Enrollment in distant learning and online courses has increased so quickly that research has been slow to catch up. The educational community must do its due diligence on how online courses impact student learning.

Conclusion

School districts are facing many challenges when trying to meet the needs of students, especially those at the highest risk of dropping out of school. The fast growing trend in education is the increasing use of technology and the rise in online learning. School districts around the country have been implementing technology into classrooms, and online enrollments have grown exponentially over the last 10 years. The data from this study provides meaningful explanations to educators that students retain more information and preform higher on standardized tests with more face time with educators. This is especially true for minority students that did exceptionally poor on the standardized test after completing Biology online. Technology is an irreplaceable tool for the classroom

but extreme caution should be taken to make sure it is implemented correctly and in conjunction with a rigorous meaningful curriculum.

References

ACE Learning Center. (2016). *Fast facts about ACE*. Retrieved April 11, 2016, from ACE Learning Centers: http://acelearningcenters.org/all-about-ace/fast-facts-about-ace/

Allen, E., & Seaman, J. (2011). *Going the distance: Online education in the United States.* Oakland, CA: Babson Survey Reserach Group.

Allen, E., & Seaman, J. (2013). *Changing course: Ten years of tracking online education in the United States.* Oakland, CA: Babson Survey Research Group.

Anderson, A., Augenblick, J., DeCescre, D., & Jill, C. (2006). *20/20 costs and funding of virtual schools: An examination of the costs to start, operate, and grow virtual schools and a disscussion of funding options for states interested in supporting virtual school programs.* Denver, CO: Augenblick, Palaich, & Associates.

Anderson, N. (2014, August 25). *The Washington Post.* Retrieved April 1, 2016, from The Washington Post: https://www.washingtonpost.com/national/john-g-sperling-university-of-phoenix-founder-dies-at-age-93/2014/08/25/ff96e384-2c58-11e4-994d-202962a9150c_story.html

Archambault, L., Diamond, D., Coffey, M., Foures-Aalbu, D., Richardson, J., Zygouris-Coe, V.,…Cavanaugh, C. (2010). *Research committee issues brief: An exploration of at-risk learners and online education.* Vienna: iNACOL.

Battaglino, T. B., Haldeman, M., & Eleanor, L. (2012). *Creating sound policy for*

digital learning. Washington, DC: Thomas B. Fordham Institute.

Bigony, L. (2010). Can you go the distance? Attending the virtual classroom. *Orthopaedic Nursing , 29*(6), 390-392.

Bluman, A. (2013). *Elementary statistics: A step by step approach.* New York, NY: McGraw Hill.

Bolkan, J. (2014, June 11). Report: 83% of high schools offer online courses. Retreived from https://thejournal.com/articles/2014/06/11/Report-83-Percent -of-High-Schools-Offer-Online_Courses.aspx?p=1

Burian, P., Muhammad, B., Burian, P., & Maffei, F. (2012). The manifest destiny of education: Past, present, and beyond the boundaries of tradition. *Contemporary Issues in Education Research, 5*(4), 301-314.

Christensen, C., Horn, M., & Staker, H. (2013). *Is K-12 blended learning disruptive? An introduction of the theory of hybrids.* Redwood City, CA: Clayton Christensen Institute.

Clark, T., & Berge, Z. (2005). Virtual schools and elearning: Planning for success. *19th Annual Conference on Distance Teaching and Learning* (pp. 1-5). The Annual Conference on Distance Teaching and Learning. San Francisco, CA.

Cook, C., & Sonnenberg, C. (2014). Technology and online education: Models for change. *Contemporary Issues in Education Research, 7*(3), 171-188.

Darling-Hammond, L., Zielezinski, M., & Goldman, S. (2014). *Using technology to support at-risk students' learning.* Stanford, CA: Stanford Center for Opportunity Policy in Education.

Dawley, L., Rice, K., & Hinck, G. (2010). *Going virtual! 2010.* Biose, ID: Boise State University.

EdTech Times Staff. (2012, March 12). *edtechtimes.* Retrieved 2012, from PLATO Learning: https://edtechtime.com/2012/03/12/plato-learning-announces-k-12-online-courses/

Foundation for Excellence in Education. (2010). *Digital learning now!* Tallahasse, FL: Foundation for Excellence in Education.

Fueleducation. (2016). *Common Core State Standards*. Retrieved April 5, 2016, from fueleducation.com: http://www.getfueled.com/solutions/common-core-state-standards

Gaytan, J. (2007). Visions shaping the future of online education: Understanding its historical evolution, implications, and assumptions. *Online Journal of Distant Learning, 11*.

Gemin, B., Pape, L., Vashaw, L., & Watson, J. (2015). Keeping pace with k-12 digital learning. *An Annual Review of Policy and Practice.* Durango, CO: Evergreen Education Group.

Gilbert, B. (2015). Online learning revealing the benefits and challenges. (Master's thesis). Retrived from http://fisherpub.sjfc.edu/cgi/viewcontent.cgi? article= 1304 &context=education_ETD_masters

Grail Research. (2011). *Consumers of tomorrow insights and observations about generation z.* Boston, MA: Grail Research.

Hill, P. (2011). *Creating sound policy for digital learning.* Washington DC: Thomas Fordham Institute.

Horn, M., & Staker, H. (2011). *The Rise of K-12 Blended Learning.* Boston, MA: Innosight Institute.

Hughes, J., Zhou, C., & Petscher, Y. (2015). *Comparing success reate for general and credit recovery courses onlin and face to face: Results for Florida high school courses.* Institute of Education Sciences. Washington, DC: U.S. Department of Education.

International Association for K-12 Online Learning. (2011). *The online learning definitions project.* Vienna: International Association for K-12 Online Learning.

Keeping Pace with K-12 Digital Learning. (2015). *Keeping pace with k-12 digital learning: An annual review of policy and practice.* Durango, CO: Evergreen Educational Group.

Kidd, T. (2010). *Online education and adult learning: New frontiers for teaching practices.* Hershey, PA: Information Science Reference.

Kuehn, L. (2012, Winter). The "voracious appetitie" of online learning. *Our Schools, Our Selves*, pp. 95-104.

Layton, L. (2013, December 3). U.S. students lag around average on international science, math and reading test. *The Washington Post*. Retreived from http://www.post-gazette.com/news/nation/2013/12/04/U-S-students-lag-around-average-on-science-math-and-reading-test/stories/201312040068

Legistlative Budget and Finance Committee. (2011). *Cost and funding models of A state-led virtual learning program.* Harrisburg, PA: Pennsylvania General Assembly Joint Committee.

Miller, C. (2010). National curriculum standards: What's really going on? *The Dallas Morning News.* Retrieved from http://www.dallasnews.com/news/education/2010/02/01/national-curriculum-standards

Missouri Department of Elementary and Secondary Education. (2011). *Virtual instruction program.* Jefferson City, MO: Department of Elementary and Secondary Education.

Missouri Department of Elementary and Secondary Education. (2016a). *Teachers*. Retrieved Dec 15, 2016, from Missouri Learning Standards: http://www.missourilearningstandards.com/the-standards-are-working/

Missouri Department of Elementary and Secondary Education. (2016b). *Missouri Department of Elementary and Secondary Education*. Retrieved March 18, 2016, from http://www.dese.mo.gov

Missouri Virtual Instruction Program. (2016). *Frequently Asked Questions*. Retrieved April 11, 2016, from http://www.movip.org

Montgomery, G., & Hirth, M. (2011). *Freshman transition for at-risk students: Living with hurt.* Thousand Oaks, CA: SAGE.

Morabito, M. (2015). *Orgins.* Retrieved April 1, 2016, from CALCampus: http://www.calcampus.com/calc.htm

National Center for Education Statistics. (2014). *Public Hish school 4-year adjusted cohort graduation rate (ACGR)*. Retrieved April 5, 2016, from Common Core of Data (CCD): http://nces.ed.gov/cce/table/ ACGR_ RE_and _characteristics_2013-2014.asp

Neild, R. C., Balfanz, R., & Herzog, L. (2007, October). An early warning

system. *Educational Leadership*, 28-33.

Nelson, K., & St. Pierre, L. (2014). *Online learning annual report 2013-14.* Olympia, WA: Superintendent of Public Instruction.

Ornstein, A., Pajak, E., & Ornstein, S. (2015). *Contemporary issues in curriculum* (6th ed.). New York, NY: Pearson.

Pappano, L. (2013). *How Online Learning is Reinventing College.* Christain Science Monitor. Retreived from http://www.csmonitor.com/USA/ Society/2013/0602/How-online-learning-is-reinventing-college

Picciano, A., & Seaman, J. (2010). *Class connections: High school reform and the role of online learning.* Oakland, CA: Babson Survey Research Group.

Powell, A., Roberts, V., & Patrick, S. (2015). *Using online learning for credit recovery: Getting back on track to graduation.* Durango, CO: International Association for K-12 Online Learning.

Queen, B., Lewis, L., & Coopersmith, J. (2011). *Distance education courses for public elementary and secondary school students: 2009-2010.* Washington DC: U.S. Department of Education.

Randler, C., & Hulde, M. (2007). Hands-on verus teacher-centered experiments in soil ecology. *Research in Science and Technological Education, 25*(3), 329-338.

Reichman, H. (2013). Online Education and the "Cost Disease". *Academe, 99*, 37-41.

Seaman, J., & Allen, E. (2010). *Class differences: Online education in the*

United States. Babson Park, MA:Sloan Survey.

The North American Council for Online Learning and the Partnership for 21st Century Skills. (2006). *Virtual schools and 21st century skills.* Vienna, VA: North American Council for Online Learning.

U.S. Department of Education. (2005). *10 facts about k-12 education funding.* Washington, DC: U.S. Department of Education.

U.S. Department of Education. (2011). *Postsecondary awards in science, technology, engineering, and mathematics (STEM) in postsecondary education.* Retrieved April 5, 2016, from U.S. Department of Education: http://nces.ed.gov/pubs2011/2011226.pdf

U.S. Department of Education. (2014). *Enrollment in distance education courses, by state: Fall 2012.* Washington, DC: U.S. Department of Education. National Center for Education Statistics.

University of Missouri. (2014). *Mizzou college of education k-12 online MU high school*. Retrieved 2011, from http://mizzouk12online.missouri.edu

University of Phoenix. (2016). *Unversity of Phoenix*. Retrieved April 20, 2016, from http://www.phoenix.edu

U.S. Department of Education. (2009). *10 facts about k-12 education funding.* Washington, DC: Author.

U.S. Department of Education. (2016, March 9). *Institute of Education Sciences*. Retrieved March 9, 2016, from National Center for Educational Statistics: https://nces.ed.gov/surveys/pisa/

Watson, J., Gemin, B., Ryan, M., & Wicks, M. (2009). *Keeping pace with k-12*

digital learning. Boulder, CO: Evergreen Learning Group.

Watson, J., Murin, A., Vashaw, L., Gemin, B., & Rapp, C. (2010). *Keeping pace with k-12 online learning.* Boulder, CO: Evergreen Education Group.

Watson, J., Murin, A., Vashaw, L., Gemin, B., & Rapp, C. (2011). *Keeping pace with k-12 online learning.* Boulder, CO: Evergreen Education Group

Watson, J., Murin, A., Vashaw, L., Gemin, B., & Rapp, C. (2014). *Keeping pace with k-12 digital learning.* Durango, CO: Evergreen Education Group.

Weiss, I. R., Knapp, M. S., Hollweg, K. S., & Burrill, G. (2001). Investigating the influence of standards: A framework for research in mathematics, science, and technology education. Washington, DC: National Academic Press.

Wicks, M. (2010). *A national primer on k-12 online learning.* Durango, CO: International Association for K-12 ONline Learning.

Wladis, C., Conway, K. M., & Hachey, A. C. (2015). The online stem classroom-who succeeds? An exploration of the impact of ethnicity, gender, and non-traditional student characterics in the community college context. (SAGE, Ed.) *Commity College Review*, *43*(2), 142-163.

Wladis, C., Hachey, A., & Conway, K. (2015). The representation of minority, female, and non-traditional stem majors in the online environment at community colleges: A nationally representative study. *Community College Review*, *43*(1), 89-114.

Xu, D., & Jaggars, S. S. (2013). *Adaptability to online learning: difference*

across types of students and academic subject areas. New York, NY: Community College Research Center.

Yukselturk, E., & Bulut, S. (2009). Gender differences in self-regulated online learning environment. *Educational Technology & Society*, 12-22.