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Examining the Relationship Between Virtual School Size and Student Achievement

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Approval Page

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Abstract

Examining the Relationship Between Virtual School Size and Student Achievement. Sherrill Waddell, 2017: Applied Dissertation, Nova Southeastern University, Abraham S. Fischler College of Education. Keywords: virtual school, online school, school size, STAAR, z-test

The purpose of this study is to examine the relationship between virtual school size and student achievement in virtual schools in a southwestern state. Enrollment size and the following areas were studied in an attempt to determine student achievement: STAAR English Language Arts/Reading, STAAR Math, STAAR Science, and STAAR Social Studies testing scores in regards to race.

This quantitative study used nonexperimental research utilizing a distribution approach. The effect of virtual school size on student achievement in a southwestern state was examined. Specifically, student achievement was defined by student passing rates on individual tests of the STAAR examination. This research was conducted utilizing archival data from TEA for 2013-2016 school years.

The z-test results revealed in this study indicate students in the smaller schools performed significantly better across the three school years. The study analyzed enrollment size and STAAR English Language Arts/Reading in Grades 5 and 8, Math in Grades 5 and 8, English I, English II, and Algebra I testing scores relating to race. In all categories of both test category and race, students in smaller schools performed better than students in larger virtual schools. Notable trends were revealed in this study. First, small virtual schools outperform large virtual schools in academic achievement. Second, female students outnumber male students. Third, virtual schools are growing in demand. There was an increase in student population for all 3 school years and for all 4 virtual schools in this study.

Table of Contents

Figures

Chapter 1: Introduction

Virtual schools are a growing field in education. The growth reflects the spreading understanding that online courses and programs can serve a wide variety of students and needs (Watson & Gemin, 2009). The demand is continuing for expansion of online programs (Manzo, 2009). This past decade has seen a steady increase in the number of students selecting this form of instruction. With this growth comes the burden of establishing adequate school sizes in an effort to help students perform well both in their classes and on state testing. According to the Projections of Education Statistics to 2021 (Hussar & Bailey, 2013), total public and private elementary and secondary school enrollment was 55 million in Fall 2010, representing a 6% increase since Fall 1996. The International Association for K-12 Online Learning states that online learning in K-12 schools is growing explosively (Fast Facts about Online Learning, 2009). Sorting Through Online Learning Options (2009) states it is estimated that there are over one million K-12 enrollments in online courses across the country and the number of online courses and providers continues to grow at a steady rate each year (a staggering 30% annually), providing scores of options for today's students. The major appeal for many students in choosing this type of education is the flexibility that is offered from the comfort and safety of their home. Included are benefits of fewer distractions that interrupt instructional time, working at the student's own pace, and being able to travel without negative consequences in school. Online education has the potential to bring quality education to those students who may not be able to find it in a traditional classroom (Mills, 2011).

The purpose of No Child Left Behind (NCLB) Act of 2001 (Bush, 2001) was to ensure that all children have a fair, equal, and significant opportunity to obtain a high-

quality education and reach, at a minimum, proficiency on challenging state academic achievement standards and state academic assessments. The increased accountability associated with NCLB created a system that relies on the state test as an indicator of success (Leslie & Scherff, 2012). Individual states are responsible for assessing public school students on what they have learned and determining district and school accountability ratings. Thirty-three states and the District of Columbia have won flexibility on key provisions of the NCLB law (McNeil, 2012). These states proposed their own accountability systems, which included setting their own student-achievement goals, identifying struggling schools, and creating evaluation systems for teachers and building leaders (McNally, 2012).

Enrollment in K-12 online learning is growing at an exponential rate throughout the United States. Currently, all 50 states offer K-12 online learning (Kennedy & Archambault, 2012). Educational institutions need to understand how to best support their students throughout their educational careers and provide the best training to prepare a 21st century workforce (Hanasky, 2010). Virtual schools are not the answer for improving schools, but they are an important addition that augments the available resources for schools. Virtual schooling is more of a hybrid of public, charter, and home schooling, with ample dashes of tutoring and independent study thrown in, all turbocharged by Internet technology (Greenway & Vanourek, 2006).

Most states have some form of a virtual high school program (Journell, 2012). Some states run their own virtual education programs out of their departments of education, which districts can tap in to for little or no cost (Ash, 2009). To sustain and grow a state virtual school to meet and adjust to the academic needs across a state, reliable and sustainable funding should be provided (Thomas, 2008). Students in Florida

have benefited from the addition of virtual schools. Free from the geographic constraints and facilities costs of traditional schools, Florida Virtual Schools (FLVS) has grown rapidly, scaling up to match the considerable demand for the schools courses (Tucker, 2009). Savvy leadership, strong political support, and a series of well-timed decisions around growth have helped FLVS become the country's most successful virtual school, and perhaps one of its most important schools (Tucker, 2009).

For this southwestern state where the study was being conducted, the Education Code, Section 30A.051 (2)(A) states that commissioners shall provide high-quality education for students who are being educated through electronic courses provided through the state virtual school network (Texas Education Agency [TEA], 2017a). There are six virtual public schools in the southwestern state where the study took place. Due to accountability factors, only four schools were analyzed. The students who attended these schools were held to the same accountability standards as those in brick-and-mortar schools.

Enrollment requirements state that any student can attend as long as they were in a public school in this state the prior school year; have been placed in substitute or foster care in this state, regardless of whether the student was enrolled in a public school in this state in the preceding year; or is a dependent of a member of the U.S. military; was previously enrolled in high school in this state; or does not currently reside in this state due to a military deployment or transfer (TEA, 2017a). Virtual schools have different types of programs available for students to choose, but being part of a large or small school is important to parents and students alike. According to the state's Administrative Code, the maximum enrollment at a particular school shall not exceed the maximum number of students approved in the open-enrollment charter (Texas Administrative Code

[TAC], 2017a). The Technology Based Instruction section of the same Code states virtual schools need to ensure a maximum class size limit of 40 students in a single section of the courses in Grades 5 to 12, and ensure that the class size does not exceed the maximum allowed by law and a charter school's charter, as applicable, whichever is smaller.

Background and Justification

Those interested in virtual schools in the southwestern state where the study took place were affected by this type of schooling. There are six online public virtual schools that serve students in Grades 3-12 throughout the state. Only four of six of these schools were the subject of this study due to accountability factors. These schools operate through approved state-accredited public school districts and open-enrollment campus charters in this state (TEA, 2017a). There is a significant disproportion in enrollment size between virtual schools. There are a total of six public schools ranging in enrollment from 3 to 6,477 students (TEA, 2017a). School enrollment is the total number of students who are reported in membership at a school on a specific date set by TEA in October in a given year (TEA, 2017b). The top two public virtual schools with the largest enrollment both began in 2008 and are leading providers of K-12 virtual education for students located in the southwestern region of the United States, as well as across the United States. The next two virtual schools with the highest enrollment began in 2015. A fifth was established in 2013, and the school with the fewest students enrolled began in 2014. The following data for each school were obtained by using the school's Texas Academic Performance Reports (TAPR) for 2015-16 from the state education website (TEA, 2017c).

School 1 was established in the 2013-14 school year. It serves Grades 4-12 and has an enrollment of 379 students. The racial breakdown of students is 267 Caucasian, 52

Hispanic, 29 two or more races, 16 Asian, and 15 African American. The total professional staff for the campus is 15. There are 14 teachers and 1 campus administrator. The graduation rate is 100%. The accountability rating for this school is Met Standard. The school received distinction designations in Academic Achievement in English Language Arts/Reading, Academic Achievement in Science, and Academic Achievement in Social Studies.

School 2 was established in the 2008-09 school year. It served students in Grades 3-12 for 2013-2015 and currently serves students in Grades 3-8 for 2015-2016. School 2 was separated by grade levels and now serves Grades 3-8 while the newly created School 6 now serves students in Grades 9-12. The racial breakdown of students for School 6 is 1,587 Caucasian, 1,043 Hispanic, 447 African American, 125 Asian, 96 two or more races, 17 American Indian, and 9 Pacific Islander. The total professional staff for the campus is 17. There are 13.5 teachers and 3.5 campus administrators. The graduation rate is 82.2%. The accountability rating for this school is Improvement Required.

School 3 was established in the 2008-09 school year. It serves students in Grades 3-12 and has an enrollment of 5,106 students. The racial breakdown of students is 2,749 Caucasian, 1,396 Hispanic, 536 African American, 181 two or more races, 162 Asian, 62 American Indian, and 20 Pacific Islander. There is no professional staff information available. The graduation rate is 78%. The accountability rating for this school is Improvement Required.

School 4 was established in the 2015-16 school year. It serves students in Grades 3-12 and has an enrollment of 658 students. The educational levels are separated into three campuses elementary, middle, and high schools with the data presented in the next three paragraphs respectively.

School 4 elementary serves students in Grades 3-5 and has an enrollment of 118 students. The racial breakdown of students is 46 Caucasian, 36 Hispanic, 15 African American, 11 Asian, 9 two or more races, and 1 Pacific Islander. There is no professional staff or graduation rate information available for this campus. The accountability rating for this school is Met Standard. The school received distinction designations in Academic Achievement in English Language Arts/Reading, Top 25 Percent Closing Performance Gaps, and Postsecondary Readiness.

School 4 middle serves students in Grades 6-8 and has an enrollment of 239 students. The racial breakdown of students is 113 Caucasian, 69 Hispanic, 28 African American, 13 two or more, 12 Asian, 3 American Indian, and 1 Pacific Islander. There is no professional staff or graduation rate information available for this campus. The accountability rating for this school is Met Standard. The school received distinction designations in Academic Achievement in English Language Arts/Reading, Academic Achievement in Mathematics, Top 25 Percent: Closing Performance Gaps, and Postsecondary Readiness.

School 4 high serves students in Grades 9-12 and has an enrollment of 301 students. The racial breakdown of students is 173 Caucasian, 77 Hispanic, 25 African American, 11 Asian, 13 two or more races and 2 American Indian. There is no professional staff information available. The graduation rate is 100%. The accountability rating for this school is Met Standard. The school received distinction designations in Academic Achievement in English Language Arts/Reading, Academic Achievement in Mathematics, Academic Achievement in Science, Academic Achievement in Social Studies, Top 25 Percent Closing Performance Gaps, and Postsecondary Readiness.

School 5 was established in the 2014-15 school year. It serves Grades 9-10 and

has an enrollment of seven students. All seven students are Caucasian. The total professional staff for the campus is 2.9. There are 1.4 teachers, 1 professional support staff, and .5 campus administrator. There are no graduation rate data available. The accountability rating for this school is Not Rated. Inclusion of this school for this study is not feasible because of the accountability rating and individual testing results are reported on the state website.

School 6 was established in the 2015-16 school year. It serves Grades 9-12 and has an enrollment of 2,729 students. The racial breakdown of students is 1,468 Caucasian, 815 Hispanic, 287 African American, 82 two or more races, 46 Asian, 24 American Indian, and 7 Pacific Islander. The total professional staff for the campus is 16.5. There are 14 teachers and 2.5 campus administration. The graduation rate is 100%. The accountability rating for this school is Met Alternative Standard. Inclusion of School 6 for this study is not feasible because the school is being evaluated with alternative education accountability provisions.

Research Problem

The trend and demand for virtual education has grown nationwide (McNally, 2012). With an increase in students choosing this type of education, inevitably the demand for schools of this type of educational instruction has increased in number. The purpose of this study was to determine the extent of the relationship between virtual school size and student achievement in virtual schools in a southwestern state. For the purpose of this study, achievement was measured by student performance on state testing scores. The study used descriptive and inferential statistics to analyze enrollment size and STAAR English Language Arts/Reading in Grades 5 and 8, Math in Grades 5 and 8, English I, English II, and Algebra I testing scores in regard to race and gender.

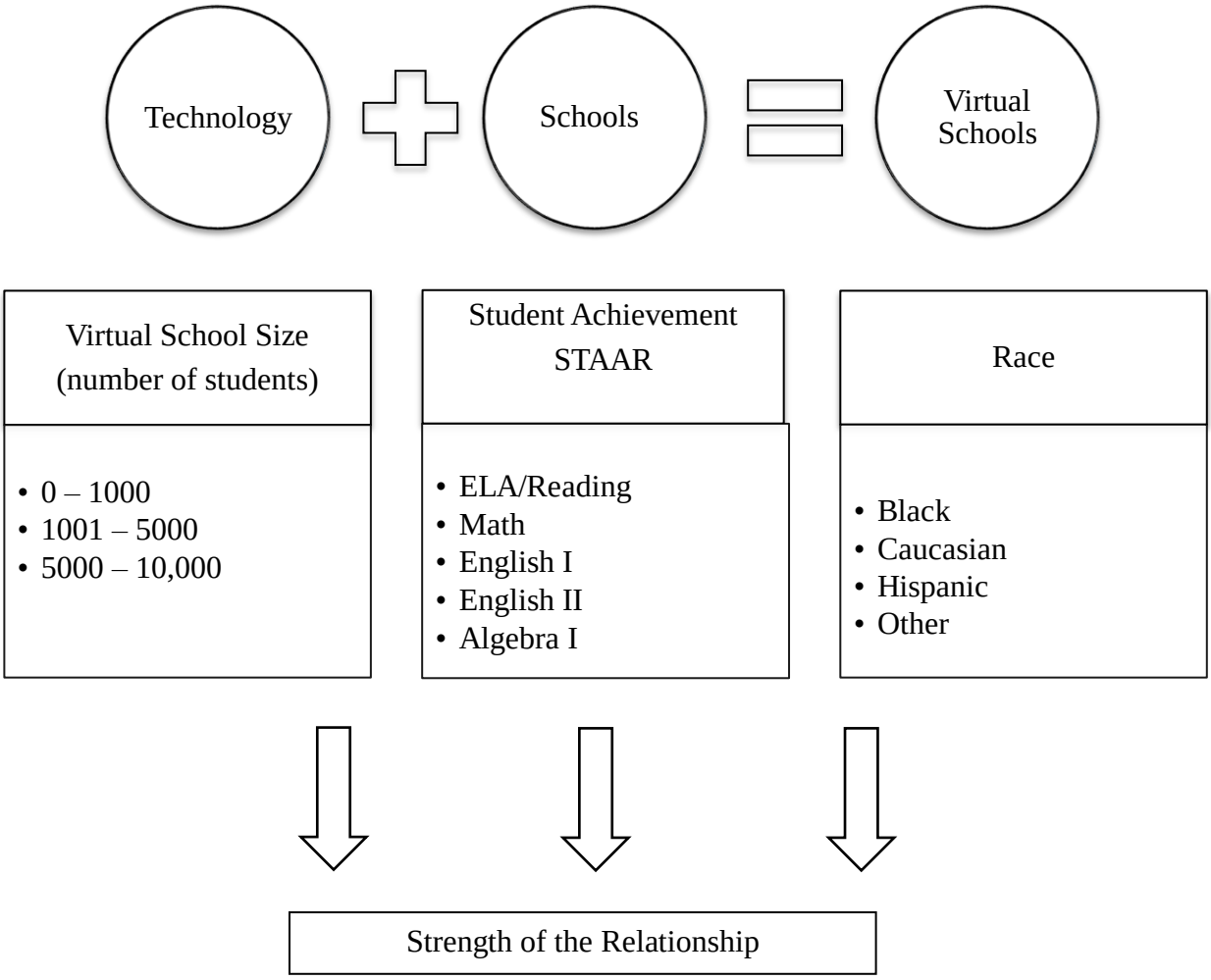

Figure 1. Conceptual framework: Examining the relationship between virtual school size and student achievement.

Theoretical Framework

The theoretical framework used for this study is the economies of scale. In Principles of Economics (1961), Marshall referred to the advantages of production on a large scale as economies of skill, economies of machinery, and economies of supplies. This basic description includes three key economic concepts that directly or indirectly reduce the average cost per unit through an increase in overall production efficiency. Economies of scale are often cited in education literature as being one of the drivers for

the deployment of e-learning. They are used to support the notions that policy toward e-learning should promote scale efficiencies, that larger institutions will be better able to compete in the future, and that there should be substantial investment in the development of e-learning materials and online courses (Morris, 2008).

All virtual schools used in this study were managed by private companies that operate for a profit but are categorized as public schools through charter school agreements. In this study, the economies of scale theory was used to determine the extent of the relationship between virtual school size and student achievement in virtual schools in a southwestern state.

Deficiencies in the Evidence

For the purpose of this study, student achievement was determined by a student's ability to obtain a minimum passing score on statewide testing of general standards. Student preference in choosing which virtual school to attend can be based on several characteristics of the school, including school size. Few studies have been conducted to determine the overall effectiveness and impact on student achievement that occurs as a result of students in Grades 6 to 12 taking courses through an online platform (McNally, 2012). Though numerous studies have been performed on school size in this southwestern state, this researcher was not able to find any virtual school size studies for this state. Moreover, the research on virtual school size in general is limited.

There is controversy over whether small, medium, or large schools are the most effective. According to School Size and Its Relationship to Achievement and Behavior (2012), researchers have reported that although schools can be too small, most high schools are too big. Although a plethora of reforms has been suggested to improve U.S. high schools, in urban districts, the small school reform model is particularly popular

(Iatarola, Schwartz, Stiefel, & Chellman, 2008). Furthermore, technology has opened up new pathways for small schools to provide rigorous curriculum through online instruction (Wu, Hsu, & Hwang, 2008).

Conversely, large school benefits include being able to hire well-qualified teachers, more access to technology and facilities that may impact student achievement (Zoda, Slate, & Combs, 2011). These researchers examined Texas elementary brick-and-mortar school size and its effect on student performance in reading, writing, and math. They reported students enrolled in large schools demonstrated higher student achievement on the TAKS Reading, Math, and Writing examinations compared to students enrolled in small or very small elementary schools.

It could be debated whether or not size in a virtual school has an impact on student achievement or even whether it matters since students do not attend an actual building. Simonson (2004) states that a group made up mostly of administrators believes distance education courses do not require a classroom, one course can have dozens, even hundreds of students enrolled. While an abundance of research is available discussing relationships of brick-and-mortar school size and its effect on student achievement, there is a limited quantity of academic discussion and information available in regard to the virtual setting. This study of school size and its effect on student achievement in virtual schools was an attempt to add to the literature and bridge the chasm between the virtual and brick-and-mortar learning environments.

Audience

It is anticipated that the findings from this research study could be beneficial to policy makers, legislators, school governing boards, administrators, teachers, students, and parents.

Definition of Terms

Asynchronous learning does not take place at the same place or time.

Adequate Yearly Progress (AYP) measures academic performance in public schools, districts, and the state that are evaluated under NCLB. Districts, campuses, and the state are required to meet AYP criteria on three measures: reading/language arts, mathematics, and either graduation rate (for high schools and districts) or attendance rate (for elementary and middle/junior high schools) (TEA, 2017b).

Blended learning is defined as the thoughtful integration of face-to-face and online learning (Garrison & Vaughan, 2007).

E-Learning refers to a model of learning through computer network via the Internet or intranet with electronic learning medias as diverse as character, slide, animation, video and sound by using web technology to convey educational materials, including use of the Learning Management System to increase the capability of teaching, communication, monitoring and evaluation of student learning effectively (Vicheanpanya, 2014).

Enrollment is the total number of students who are reported in membership at a school on a specific date set by TEA in October in a given year (TEA, 2017b).

Learning Management Systems (LMS) are web-based systems that allow instructors and students to share instructional materials, make class announcements, submit and return course assignments, and communicate with each other online (Lonn & Teasley, 2009).

Online learning is teacher-led education that takes place over the Internet, with the teacher and student separated geographically, using a web-based educational delivery system that includes software to provide a structured learning environment (Watson,

Murin, Vashaw, Gemin, & Rapp, 2011).

Student Achievement is a group of elements for measuring student success. Student achievement is measured by high-stakes test scores, high school graduation and dropout rates, and the percentage of students who attend post-secondary educational institutions (Sable, 2016). For the purpose of this study, student achievement was measured only by test scores.

School Report Cards (SRC) combines accountability ratings, data from the Texas Academic Performance Reports, and financial information to give a broad view of campus performance. Available for each campus in Texas, the SRC is intended specifically to inform parents and guardians about a school's individual characteristics and its academic performance (TEA, 2017d).

Senate Bill 1031 (SB 1031) states the committee on public school accountability will conduct a study and review methods available to monitor each public school student, with emphasis on methods to monitor demonstrable growth in academic achievement. SB 1031 also requires end-of-course assessments be constructed so they allow for the measure of annual improvement. Furthermore, under SB 1031, TEA (2017e) may consider using an existing instrument to satisfy requirements around developing criterion-referenced or end-of-course assessments only if the existing instrument allows for the measure of annual improvement.

State of Texas Assessments of Academic Readiness (STAAR) program, which was implemented in spring 2012, includes annual assessments for reading and mathematics, Grades 3 to 8; writing in Grades 4 and 7; science in Grades 5 and 8; social studies in Grade 8; end-of-course (EOC) assessments for English I, English II, English III Algebra I, Algebra II, biology and U.S history (TEA, 2017f).

Synchronous learning takes place simultaneously through technology such as virtual classrooms. The virtual teacher assigns a day and time for the lesson and students attend remotely or in a blended learning environment. Students can be in different locations.

Texas Academic Performance Reports (TAPR), formerly known as the Academic Excellence Indicator System (AEIS) reports, pulls together a wide range of information annually on the performance of students in each school and district in Texas (TEA, 2017c). The reports also provide extensive information on staff, programs, and demographics for each school and district (TEA, 2017c).

Texas Assessment of Academic Skills (TAAS) test was the primary source of data for the Texas educational accountability system from 1994 through 2002 (Lorence, 2010). Enacted by the Texas State Legislature in spring 1990, the TAAS system of testing and test-driven curriculum is just such an accountability system (McNeil & Valenzuela, 2000).

Texas Assessment of Basic Skills (TABS) is the original test and it assessed students' skills in reading, writing, and mathematics for the first time in 1980 (Baenan, 1981).

Texas Assessment of Knowledge and Skills (TAKS) test was implemented in 2003 to measure the performance of Texas public high school students. Schools are rewarded for high performance based upon the student scores on the TAKS test, which is administered once per year (Jaska, Hogan, & Wen, 2009).

Texas Education Agency (TEA) is the Texas agency that provides leadership, guidance, and resources to help schools meet the educational needs of all students. Located in Austin, Texas, TEA is the administrative unit for primary and secondary

public education (TEA, 2017b).

Texas Essential Knowledge and Skills (TEKS) are the state standards for what students should know and be able to do (TEA, 2017h).

Texas Educational Assessment of Minimum Skills (TEAMS) is a criterion-referenced test administered to students in Grades 1, 3, 5, 7, 9, and 11 in Texas public schools and was mandated by the Texas legislature in 1984 to be instituted beginning with the school year 1985-86 (Mangino, 1986).

Purpose of the Study

The purpose of this study was to determine the extent of the relationship between virtual school size and student achievement in virtual schools in a southwestern state. For the purpose of this study, achievement was measured by student performance on state testing scores. The study used descriptive and inferential statistics to analyze enrollment size and STAAR English Language Arts/Reading in Grades 5 and 8, Math in Grades 5 and 8, English I, English II, and Algebra I testing scores in regard to race and gender.

Chapter 2: Literature Review

A Nation at Risk (1983) revealed the declining state of the educational system in America, as measured by high school student performance in the United States and other countries. This study was a unique form of lament when it was published. The structure, rhetorical tone, and fervor of the reports, with its suggestions of a nation fallen from grace, gripped by the national soul as though it were a sermon (Lanier, 2000). By utilizing momentum and transparency effects, this study exposed America's failing education system and the danger that lay ahead if immediate changes were not implemented. Twenty-five years later, A Nation Accountable (2008) reviewed progress made and determined that the United States remains a nation at risk but is now also a nation informed, accountable, and cognizant that much work needs to be done. Along with accountability and transparency, a notable variable that has changed the landscape of education systems across the world is the addition of virtual schools. The conceptual framework used for this study showed how virtual schools evolved in education with continuous technological developments.

More than 1 million public education students now take virtual courses, and as more districts and states initiate and expand online offerings, the numbers continue to grow (Dillon & Tucker, 2011). Indeed, virtual education has the potential not only to help solve many of the most pressing issues in K-12 education, but to do so in a cost effective manner (Dillon & Tucker, 2011).

The Fruition of Virtual Schools

The emergence of technology. Throughout the 20th century, technological advances changed daily life and society overall, especially in regard to education. Computers have evolved from machines that occupied a tremendous amount of space in

rooms to hand-held devices that are completely mobile today. A small group of University of California in Los Angeles (UCLA) researchers sent the first message between the first two nodes of the ARPAnet, the U.S. Department of Defense-funded network that eventually morphed into the modern Internet (*Meet the man who invented the instructions for the Internet*, 2012).

On October 3, 1969, for the first time, two computers at remote locations communicated with each other over the Internet. Connected by 350 miles of leased telephone line, the two machines, one at the UCLA and the other at Stanford Research Institute, attempted the simplest of messages: the word *login* transmitted one letter at a time (Beranek, 2007). It was in 1972 that the first real electronic mail was delivered. On January 1, 1983, Advanced Research Projects Agency Network (ARPANET) made its official transformation to Transmissions Control Protocol/Internet Protocol (TCP/IP) (Beranek, 2007). That is the official date of the formation of the Internet, the word that signifies the collection of all networks (Beranek, 2007).

The Internet changed dramatically in 1990 when Tim Berners-Lee invented the World Wide Web, an Internet-based hypermedia initiative for information sharing (Koprowski, 1999). The first programmable computer weighed 30 tons, contained 18,000 state-of-the-art vacuum tubes, and occupied 1,800 sq. ft. of space, but the behemoth's entire capacity today would occupy an integrated circuit the size of a lapel pin (Pospisil, 1999). Although John von Neumann generally is acknowledged as the father of the modern computer, two former University of Pennsylvania classmates have been less well known than those of von Neumann because ENIAC (electronic numerical integrator and computer) was created and operated under secrecy for the U.S. Army during World War II (Pospisil, 1999).

In 1973, more than 3 years before Steve Wozniak of Apple soldered together a circuit board that qualified as a computer in name only, researchers at Xerox's Palo Alto Research Center (PARC) flipped the switch on the Alto, the first computer ever designed and built for the dedicated use of a single person (Smith & Alexander, 1999). Xerox is widely recognized as a leader throughout the world in copy machines; they are not known for their contribution to computers. The scientists at PARC designed, built, and used a complete system of hardware and software that fundamentally altered the nature of computing itself (Smith & Alexander, 1999). An impressive lists of firsts came out of PARC, such as the first graphics-oriented monitor, the first hand-held mouse inputting device simple enough for a child, the first word processing program for non-expert users, the first local area communications network, the first object-oriented programming language, and the first laser printer (Smith & Alexander, 1999).

Within the next few years, several companies emerged creating varying brands of computers. Apple Computers, Inc. was founded on April 1, 1976, by Steve Jobs and Steve Wozniak, who brought to the new company a vision of changing the way they viewed computers. The college dropouts wanted to make computers small enough for people to have them in their homes or offices (Richardson & Terrell, 2008). Xerox scientists created technology that would one day be used in households around the world, but Xerox did not capitalize on its invention. Jobs and Wozniak started out building the Apple I in Jobs' garage and sold it without a monitor, keyboard, or casing, which they decided to add on in 1977 (Richardson & Terrell, 2008). IBM Corp. helped push the personal computer into the mainstream when it began selling its personal computer in 1981 (Golden, 1999). The Apple Macintosh made its debut in early 1984 with a $2,495 price tag (Guterl, 1984). Tandy had scored in the market with its TRS-80 Model 100, a

compact, lightweight computer with an integrated word processor and modem and in 1986, Toshiba unveiled a state-of-the-art portable line that became an immediate hit (Golden, 1999).

Computers have evolved from word processors, to desktops, to laptops, and eventually, hand-held devices. Software is all the information needed by computer hardware to perform a required task (Peters, 2016). It took word processers to the next level enabling machines to function more efficiently. It includes programs, libraries, and related data necessary to perform the tasks set before it (Peters, 2016). No longer does the student need to be confined to a desk and chair; they can now learn remotely, anywhere and anytime, with Wi-Fi and mobile devices.

Foundation of virtual school education. Virtual schools are growing exponentially and satisfying a demand in education for students' who require or desire instruction in an alternative setting. According to *The Journal of Teacher Education*, all 50 states offer K-12 online learning opportunities (Kennedy & Archambault, 2012). Some states such as Michigan, Alabama, New Mexico, and Idaho have passed legislative measures requiring K-12 students to complete at least one online learning experience by the time they graduate (Kennedy & Archambault, 2012). Capistrano Connections Academy, a charter school, authorized by the Capistrano Unified School District and managed by Connections Academy, is among a growing number of virtual schools offering full-time programs in which all courses are taken online (Butler, 2010). Some of the largest virtual schools throughout the country have low graduation rates and receive failing ranking on state accountability metrics, but they nonetheless flourish and grow, seemingly immune to sanctions that would be applied to traditional schools with similar ratings (Nespor & Voithofer, 2016). But to date, there is little research or publicly

available data on the outcomes for K-12 online learning (Dillon & Tucker, 2011).

Distance education began with correspondence courses, evolved further with radio and television, and has snowballed since personal computers and the Internet became mainstream in homes. In its infancy in the United States, distance education began with correspondence courses. In 1873, Anna Eliot Ticknor founded the Society to Encourage Studies at Home (Caruth & Caruth, 2013). Ticknor's Society established one of America's first correspondence schools, a distance learning option conducted through the mail that aimed at the education of women (Caruth & Caruth, 2013). Vincent's Chautauqua Literary and Scientific Circle was the first major correspondence school in the United States (Scott, 2005). William Rainey Harper, founding president of the University of Chicago, incorporated the key Chautauquan ideas of summer sessions, correspondence study, extension courses, and university press in his master plan in 1892 (Scott, 2005). In the late 1920s, the State University of Iowa offered perhaps the best program of that era, but the technical limitations of radio, the lack of well-defined target populations, and the failure to create an adequate faculty reward system eventually spelled doom for the system (Pittman, 1986).

Distance education at Nova Southeastern University (NSU) began in 1972 with the use of the telephone and airplanes (Kontos, 1995). Coastline Community College opened in fall 1976 and served as a model for the community-based college beyond walls movement (Lusken & Small, 1980). NSU is constantly striving to expand the concept of the classroom and fulfill the mission of the university, which includes serving the educational needs of employed professionals, regardless of their schedules and distance from the central campus (Kontos, 1995). In 1983, graduate education programs were offered through interactive electronic telecommunications (Kontos, 1995). Facilitated

classrooms, using a combination of audio teleconferencing discussions, individual phone calls, and a local facilitator provided a new instructional mode at NSU beginning in 1991 (Kontos, 1995).

The first incarnation of what everyone thinks of as K-12 virtual school appears to have been launched in the summer of 1995, with the CyberSchool Project in Eugene, Oregon (Greenway & Vanourek 2006). Since then, there are two educational organizations that currently dominate the market for virtual public schools in the United States, K12, Inc. and Connections Education. Experts say, for-profit providers of online courses, long seen as an option for home-schoolers and a potential rival to public schools, are breaking into the public education mainstream as more schools mix face-to-face classes and online courses to expand their curricular offerings (Gustke, 2010). Online charter schools are unique among K-12 online learning options for students as they are full-time, public schools that combine online learning with traditional and home schooling practices (Waters, Barbour, & Menchaca, 2014). They are often chartered by a state agency, supported in full or in part with state funds and most often managed by a private educational management company (Waters et al., 2014).

K12 Inc., a technology-based education company, is the largest provider of proprietary curriculum and online education programs for students in kindergarten through high school in the United States (de Gyor, 2010). K12 Inc. enrolls more public school students than any other private education management organization in the United States (Miron & Urschel 2012). K12 Inc. provides its high quality, award-winning curriculum, and academic services to online schools, traditional classrooms, blended school programs, and directly to families (de Gyor, 2010). K12 Inc., the nation's largest provider of online pre-collegiate education, was launched in 2000 and went public 7

years later after raising about $140 million in revenue (Flanigan, 2012). In partnership with charter schools and school districts, K12 Inc. operates online public schools in 25 states and the District of Columbia (de Gyor, 2010). FLVS, which has provided supplemental, credit-recovery, and accelerated classes for high school students since 1997, has contracted with Florida Connections Academy, a commercial provider, to offer K-8 programs to districts (Manzo, 2009).

Online learning can be either distance learning or blended learning, with both supported by a new, robust instructional approach that takes advantage of the best elements of both settings (Watson, 2008). Districts and schools throughout the country are doing what they can for students to the help them achieve academic success. Some districts are creating a virtual school within a brick-and-mortar school. The brick-and-mortar building could provide services such as administration, on-site teachers, cafeteria, gym classes, classrooms, other non-academic coursework, and support.

While some schools call this method of teaching blended, others call it hybrid, and others do not bother naming it; they are just implementing an approach that they believe is helping their students (Watson, 2008). Online learning is growing rapidly as states and districts are creating new online schools, and existing programs are adding new courses and students. Traditional schools have educated many students throughout the United States, but there are students who have needed an avenue for a different type of education. The growth reflects the spreading understanding that online courses and programs can serve a wide variety of students and needs (Watson, 2008).

Virtual School Environment

Virtual schools deliver instruction using a radically different approach than conventional public schools (Gill et al., 2015). One benefit of virtual schools is that

students can access their courses 24 hours a day, 7 days a week from any remote location through technology. Virtual schools are publicly funded schools of choice that eschew physical school buildings and use technology to deliver education to students in their homes (Gill et al., 2015). Virtual schools have created nontraditional learning environments where students visit to receive additional support. Some virtual schools have blended learning, which is the thoughtful integration of face-to-face and online learning. Virtual schools also offer more blended learning opportunities that allow students to drop into learning centers, community centers or school-owned facilities for remediation, face-to-face instruction, or to access their lessons in a computer lab (Holmes, 2013). Blended learning should be viewed as a pedagogical approach that combines the effectiveness and socialization opportunities of the classroom with the technologically enhanced active learning possibilities of the online environment (Watson, 2008). These schools typically provide students with computers, software, and network-based resources, while also providing access to teachers via email, telephone, web, and teleconference (Gill et al., 2015).

According to the commissioner's rules regarding technology in this state, virtual schools must follow the same laws and rules that apply to traditional schools unless otherwise indicated (TAC, 2017b). These schools have the basic administrative format as the traditional public school. All schools must have a main office located in one of the cities located in the state. The teachers work from home and connect with the students who learn from their home through computer and phone. Schools Open Doors to New eLearning Rules (2012) states some students are intimidated at first by virtual learning and do not always realize there is a live teacher on the other side. The teachers are required to be state-certified in the content area and grade level they are teaching. These

teachers must be trained in best practices to deliver online instruction (TAC, 2017b). Teachers also may interact with students throughout the year in learning experiences, face-to-face tutoring, and state testing.

Teacher efficacy is an important tool in creating effective schools where all children are challenged and learn (Deskins, 2010). The virtual teacher is an advocate for the virtual student. The relationship between these two is critical for student success. The effective teacher‘s classroom management system is predicated on the readiness of students to succeed where students are motivated to learn, strive to meet the teacher‘s behavioral expectations, and are cognizant of the benefits of academic achievement (Caballero, 2010). This variable is applicable in both virtual and brick-and-mortar schools. One path to improving a student’s emotional connection to his/her studies and improving the capacity to cope with the curriculum complexity and achievement is through the medium of the student-teacher relationship (Whannell & Allen, 2011).

Another important key to the success of any virtual school program is the quality of leadership. Leadership styles differ, and there is no single style that fits all virtual school programs (Hickmon, 2015). Effective leaders guide, manage, and monitor school progress, this holds true for both traditional and virtual schools. According to Neti (2011), managers of virtual teams find themselves struggling with communication issues, trust, work control, productivity, and accountability (as cited in Anderson, 2012). Furthermore, Anderson (2012) stated the problem is that due to virtual employees being dispersed geographically, managers are having difficulty developing trust and communicating performance and developmental feedback.

Students who attend this type of school might not have the opportunity to go to the main office building for support. Therefore, all of the assistance must come from a

distance. This support is in place before it is needed. Some typical avenues of instruction in a virtual school are students have the choice of attending asynchronous or synchronous lessons or both and watching a video recording of the concept taught. These designs encourage students to engage in dialogue for learning, leading to the use of asynchronous or synchronous tools and teachers transforming into facilitators of discussions for co-construction of learning (Lopez, 2006). The Internet and other computer technologies can deliver online content using audio, live interactive video, and prerecorded video formats (Coy & Hirschmann, 2014). These educational platforms or online classrooms use software called Learning Management Systems (LMS), also known as educational management systems to deliver instruction. LMS are web-based systems that allow instructors and students to share instructional materials, make class announcements, submit and return course assignments, and communicate with each other online (Lonn & Teasley, 2009). The virtual classroom is an asynchronous based online learning environment that delivers course materials to learners and provides collaboration and interaction using an asynchronous based forum as the main platform to support the learners' independent study (Subramaniam & Kandasamy, 2011). A classroom lecture at Capistrano Connections Academy in Southern California involves booting up the home computer, logging on to a web site, and observing a teacher conducting a PowerPoint presentation of that day's lesson entirely online (Butler, 2010). It also provides a learning environment with learning tools, learning materials, opportunities for contextual and collaborative discussions, and individual learning and assessment (Subramaniam & Kandasamy, 2011). Through microphone headsets, students can watch on their home computers, respond to the teacher's questions, and take part in classroom discussions (Butler, 2010).

Students have also gained increased access to mobile devices throughout recent years, and educators have actively looked for ways to capitalize on this trend (Barbour, Grzebyk, & Eye, 2014). Mobile learning has exploded onto the educational scene with students connecting to the Internet continuously through their mobile devices mostly through using mobile apps (Hickmon, 2015). This emerging technology has made learning on the go more accessible to students. They no longer need to be confined at home in front of a computer screen; they can easily access coursework anywhere and anytime on a mobile phone. Apps are enabling people to gather information from wherever they are by assessing them through a number of mobile devices (e.g., tablets, iPad, iPod, eBooks, etc.), which have a great impact on education. (Hickmon, 2015).

Students also have the opportunity to communicate on the phone with instructors and departments established to help meet students' needs. In the online classroom, students can receive one-to-one attention in an environment where classroom distractions are eliminated, and content delivery is optimized with engaging tasks (Coy & Hirschmann, 2014). There are also various pathways of interaction between students such as social networking and discussion boards posts that foster student interaction. Promoting social interaction within a virtual program enables students to connect in an otherwise isolating environment (Wolfinger, 2016). Requirements and struggles may vary in virtual schools as compared to brick-and-mortar, but having students successfully complete the school year is the ultimate goal of every educational institution.

According to Texas Connections Academy @ Houston (TCAH, 2017), students are offered a challenging curriculum developed by leading education experts, instruction from state certified teachers experienced in online instruction, and support from trained counselors, the principal, and the administrative staff. In virtual schools, students view

daily plans, lessons, and progress (Millet, 2012). Students are required to attend online classes that are set up as a PowerPoint presentation with chat room tools and webcams (Millet, 2012). Training sessions in the virtual learning environment provide parents with information regarding what the online school can do for parents and their children and how they can use it (Vernon, 2013). According to K12 (2017b), there are opportunities for interaction with student peers such as clubs, competitions and showcases, leadership development opportunities, college and career workshops, and online summer camps.

In addition to K12 lesson assessments and unit tests, students in K12 public virtual schools must participate in state standardized testing, just as students in brick-and-mortar public schools in the state must do (K12, 2017a). Likewise, students who are enrolled in all other public virtual schools in this southwestern state are mandated to attend state testing in their area.

Student Achievement: Implications for Research

There is a notable discrepancy between the research findings of information available regarding school size for virtual schools and the traditional brick-and-mortar school. Using assessment data to improve student achievement and instruction is at the heart of effective schools (Osorio, 2013). The salient conclusion is that school size is important to schools' AYP outcomes because the number of students enrolled can either exacerbate or mitigate circumstances that either pose academic risks for schools or that influence formulas for calculating AYP (Thompson, 2011). Little evidence exists to support the connection between imposed pressure on schools due to the implementation of high stakes testing and increased student achievement (Gilmore, 2009).

Student achievement requires districts to (a) clearly define the academic knowledge and skills to achieve success in school and life, and (b) clearly define the life

skills necessary to be a successful contributor in and outside of the school environment (Mart, 2011). The results of tests administered to students in each state in the nation include ramifications for each school and district (Gilmore, 2009).

There is a plethora of material at hand for brick-and-mortar schools as it pertains to size and student achievement. Little research had been collected on the virtual schools, most notably because they only just emerged on the educational stage in the last few decades. Ash (2012) states research on how successful virtual schools are is mixed, it says, with a majority of it finding higher dropout rates and lower test scores for full-time online students than for their counterparts in brick-and-mortar schools.

Accountability

Over the last decade, accountability reform has been at the forefront of the domestic policy agenda. Both virtual education advocates and education policymakers should learn from nearly two decades of experience with charter schooling, another reform movement predicated on innovation and change within public education (Dillon & Tucker, 2011). Public virtual schools in the United States operate under state accountability systems that vary by state and are meant to measure individual school performance against criteria determined by state policy makers (Watson & Pape, 2015). The purpose of these systems is to hold each school accountable for increasing student performance (Watson & Pape, 2015). Public schools, including virtual schools, are held to a standards-based accountability system and are required to follow federal and state requirements to receive funding (Wilson, 2010). According to The Accountability Illusion (2017), states submit accountability plans to the U.S. Department of Education (USDOE) detailing the rule and policies to be used in tracking the AYP of schools towards these goals. Each state is responsible for constructing an accountability system

and attaching consequences for student performance (The Accountability Illusion, 2017). All virtual public schools in this southwestern state are held accountable for teaching grade level standards by state certified teachers and educating students.

In this southwestern state, the Performance Reporting Division of the Texas Education Agency is responsible for compiling and analyzing data to develop and report meaningful accountability ratings that help Texas Public schools meet the educational needs of all students (TEA, 2017c).

Performance-Based Monitoring (PBM) staff develops the Performance-Based Monitoring Analysis System (PBMAS), an automated data system that reports annually on the performance of school districts and charter schools in selected program areas (bilingual education/English as a second language, career and technical education, special education, and certain Title programs under the NCLB).

From the data contained in the PBMAS as well as certain State Performance Plan (SPP) federally required district determination elements, PBM staff produces annual PBMAS district reports. School Improvement staff monitors and supports intervention activities within this data-driven and performance-based system using a continuous improvement model. Activities targeted to improve student performance and program effectiveness reflect an emphasis on data integrity and analysis, needs assessment, improvement planning, and progress reporting. If noncompliance, student performance, or program effectiveness concerns are identified, school districts are required to participate in these activities and may also be subject to additional sanctions and interventions, including on-site reviews (TEA, 2017c).

The TAPR pulls together a wide range of information annually on the performance of students in each school and district in Texas (TEA, 2017c). The report

also provides extensive information on staff, programs, and demographics for each school and district (TEA, 2017e). Texas Administrative Code Chapter 97, Planning and Accountability, Subchapter EE, Accreditation Status, Standards, and Sanctions states how accreditation statuses will be determined and assigned to school districts (TEA, 2017b). It also defines the accreditation statuses of Accredited, Accredited-Warned, Accredited-Probation, and Not Accredited-Revoked (TEA, 2017e).

The SRC combines accountability ratings, data from the TAPR and financial information to give a broad view of campus performance (TEA, 2017d). Available for each campus in Texas, the SRC is intended specifically to inform parents and guardians about a school's individual characteristics and its academic performance (TEA, 2017d).

State Standardized Testing Background

Students in this southwestern state are taught according to the TEKS, the state standards for what students should know and can do for that grade level (TEA, 2017h). Common educational practice in the United States is teaching to the test. Texas' student assessment program is designed to measure the extent to which a student has learned and is able to apply the defined knowledge and skills at each tested grade or course level (TEA, 2017e). Texas has offered a statewide summative student assessment since 1980. It has become clear that a single system does not accurately measure all schools (Watson & Pape, 2015). The following information reveals standardized testing is continually evolving to meet state, district, school, and student's needs to monitor growth as expected student educational outcomes become increasingly more rigorous (see Table 1).

In 1980, the original test was called the TABS and it assessed students' skills in reading, writing, and mathematics. During the spring, Texas tested all of its ninth graders for the first time as part of a legislatively-mandated competency program (Baenen, 1981).

Table 1

Standardized Testing Timeline in a Southwestern State

School years	Acronym	Name of test
1980-1984	TABS	Texas Assessment of Basic Skills
1985-1993	TEAMS	Texas Educational Assessment in Minimum Skills
1994-2002	TAAS	Texas Assessment of Academic Skills
2003-2011	TAKS	Texas Assessment of Knowledge and Skills
2012 – present	STAAR	State of Texas Assessments Academic Readiness

Beginning with the 1985-86 school year, TEAMS, a criterion-referenced test administered to students in Grades 1, 3, 5, 7, 9, and 11 in Texas public schools, was mandated by the Texas legislature (Mangino, 1986). The TEAMS test consists of multiple choice items designed to assess student learning associated with explicit TEAMS objectives (Texas Educational Assessment of Minimum Skills [TEA], 1987). Tabulated results are provided and analyzed, including comparisons with national scores on a norm-referenced test and aggregations by ethnic group (TEA, 1987). Data are also provided concerning students for whom remedial instruction would be provided due to failure to attain the standard for mastery established by the State Board of Education (TEA, 1987).

From 1994 through 2002, the TAAS test was the major source of data for the Texas educational accountability system (Lorence, 2010). Enacted by the Texas State Legislature in spring 1990, the TAAS system of testing and test-driven curriculum is just such an accountability system (McNeil & Valenzuela, 2000). It differs from earlier test systems in being increasingly tied to teacher and principal tenure and pay (McNeil & Valenzuela, 2000).

In 2003, the TAKS test was implemented to measure the performance of Texas public high school students. Schools are rewarded for high performance based upon the student scores on the TAKS test, which is administered once per year (Jaska et al., 2009). The state education agency reported that the 76th Legislature also passed bills ending social promotion along with the development of the more rigorous TAKS testing program (Chadwick, 2009). Under the new law, students in Grade 3 would be required to pass reading before being promoted, in Grades 5 and 8, passing scores in both reading and math would be required before advancing to the next grade, in the 11th grade, students must pass reading, writing, math, science, and social studies in order to receive their diploma (Chadwick, 2009).

In the spring of 2012, Texas students began taking the STARR exams (TEA, 2017f). The STAAR tests are directly aligned to the state's curriculum, the TEKS (TEA, 2017f). By focusing on the TEKS that are most critical to assess, STAAR measured the academic performance of students as they progress from elementary to middle to high school (TEA, 2017f).

Factors That Contribute to School Size

Enrollment. Students enroll in virtual schools as an alternative schooling option that will support their educational goals. Due to the effectiveness of this format, enrollment has consistently risen within the last decade. Actual K-12 online learning enrollment numbers are somewhat difficult to come by because there currently is no single entity that tracks students because of the wide variety of ways in which students can engage in this form of schooling (Glass & Welner, 2011; Watson et al., 2011). Research on student achievement has indicated that online instruction is as effective as face-to-face instruction (Means, Toyama, Murphy, Bakia, & Jones, 2010).

Virtual schools offer flexibility to students that the traditional brick-and-mortar cannot, such as students may work on their schooling at night while they train and compete in competitive sports during the day. This type of schooling also offers students anonymity, which may benefit students struggling with social issues, health concerns, and others, by removing visual labels that are present in face-to-face learning environments. Often, students who are shy or easily intimidated are dominated by quick thinking students who want to control the class. Students enrolled in an online class can dismiss that feeling of fear of domination and feel comfortable about participating in discussions (McGhee, 2010).

Withdrawals. Although there is an increase in the number of students opting for virtual education, there is a consistent rate in the number of students withdrawing from this setting. About 6,209 students nationwide in Grades 3-11 were served through state online learning programs in the 2011-12 instructional year, representing a 17% increase over the previous year (Watson et al., 2011). Florida Virtual School examines all relative data and utilizes them in attempts to minimize student withdrawals. In 2006, there were 20,000 more enrollments than the year before, and the withdrawals were reduced considerably. Total middle school withdrawals went from 34.1% to 19.9%, and total high school withdrawals decreased from 42.8% to 36.9% (Final Report, 2007). The challenge associated with virtual schools is getting and keeping students engaged.

Students withdraw from schools for a variety of reasons, be it a brick-and-mortar or virtual school. Students leave schools due to a move or a better schooling option, but students who withdraw and do not enter another school are considered truant or dropout. Reported challenges include issues with student engagement and motivation, hiring and training of qualified teachers and support staff, providing students with the necessary

skills in order for them to be successful in an online environment, decreasing student mobility, improving parental support, and providing additional resources, including access to technology (Archambault, et. al., 2010). School systems do not adequately assess schools with high rates of student mobility or a high number of students who enter as over age or under credited (Watson & Pape, 2015).

Academic success or failure is explained by the interactions of a multiplicity of sources. Often these sources contain elements beyond what is within the control of the school, including issues of affect, cognition, culture, language, and individual differences (Holmes, 2013). Virtual schools have the opportunity to reduce the overall withdrawal rate in instructing students who are not performing well in the traditional setting.

The world of K-12 publicly funded virtual learning is where education is not limited to the confines of a brick-and-mortar building, and students have the flexibility to work when they want and where they want (Much, 2013). Once virtual schools have students registered, it is hard work keeping them engaged or even enrolled. These circumstances may include but are not limited to teen pregnancy, disciplinary suspensions or expulsions, or to students who need to enter the work force to help sustain or support their families (Mills, 2011). Some students' needs were not met in the traditional format; therefore, virtual education for some is just another avenue to escape the demands and rigor of the classroom. The attitude of taking the path of least resistance may have taken hold in earlier grades for some students (Barbour & Siko, 2012). Research into improving virtual schooling for at-risk students may be ineffective or counterproductive by reinforcing rather than reducing those attributes (Barbour & Siko, 2012).

School size. One avenue for increasing enrollment and minimizing withdrawals is

considering the effects of school size as it relates to student achievement. Though school district officials may choose to reach the goal of success for all students differently, school leaders must continue to examine and identify the characteristics of a successful educational system in America (Lenear, 2013). Learning can no longer be confined to the years spent in school or the hours spent in the classroom: It must be life-long, life-wide, and available on demand (Dede, 2011). School size is a multifaceted topic with varied findings. Some studies indicate beneficial implications of smaller schools where others reveal size is not an important component in student achievement. Conversely, others find consistent evidence to support the idea that bigger is better.

School size is mandated by the governing state education agency and regulated at the district level of education. Determining school size is a complex formula that takes into account funding, resources, available trained staff, students' needs, and other variables. Goldstein and Blatchford (1998) state possibly more has been written about the effects of class size on performance than on any other single topic in education, yet there is still no clear consensus about the extent to which classes or schools of different sizes promote the learning of students. Decisions about school size involve complex analyses. Until policymakers, educators, and advocates pay as much attention to quality as they do to expansion, virtual education will not be ready for a lead role in education reform (Dillon & Tucker, 2011). With this complex and varied information, more research needs to be done by evaluating the impact of school size on virtual school success. This study was an attempt to add to the literature and reveal whether or not a relationship exists between virtual school size and student achievement. An abundant amount of the literature declares the virtual school is education's remedy for oversized schools, but there is little research about schools' size effect on student achievement as it pertains to

virtual schools. This researcher was not successful in finding studies especially aimed at this topic for this educational level.

Classroom quality and school characteristics predicted youth functioning regardless of school type, reshaping the research and policy debate with renewed focus on classroom quality and school size instead of grade organization (Holas & Huston, 2012).

The Matthew Project is based on the work of Friedkin and Necochea (1988), who found that school performance benefited from smaller school size in impoverished California communities and from larger school size in affluent communities (Howley, Strange, & Bickel, 2000). In 1999, equity effects of size on achievement were also tested by computing the correlation between supplemental education services and achievement in groups of larger and smaller schools and districts (Howley et al., 2000). Strong evidence of an interaction effect of school size was found in Ohio, Georgia, and Texas, such that academic achievement benefited from smaller schools in more impoverished communities and from larger schools in more affluent communities (Howley et al., 2000). A weaker interactive effect was found in Montana, which maintains many small schools (Howley et al., 2000). Across all four states, a strong equity effect was found at all grade levels, whereby small size reduced the negative influence of poverty on school and district performance (Howley et al., 2000). Strong evidence of an interaction effect of district size was found only in Ohio (Howley et al., 2000). The Matthew Project studies indicate that a one-best, everywhere optimal, school size is a figment of the imagination (Howley et al., 2000).

Argument for Small Schools

Small schools are hampered as a result of severely constrained resources, among

which are personnel, money, infrastructure, and time; these factors limit the ability of small public institutions to fully adopt widely approved online best practices (Lovvorn, Barth, Morris, & Timmerman, 2009). Sergiovanni (1995) argued that, even if small schools do cost slightly more per student than do large schools, small schools could still be more efficient if they were more productive (Slate & Jones, 2005). Support for Sergiovani's argument comes from research showing that increases in per student costs, not decreases, are associated with increased academic achievement (Slate & Jones, 2005). Another concern surrounding small schools is their ability to increase achievement by creating a more communal climate (Weiss, Carolan, & Baker-Smith, 2010).

Carbaugh (2017) states hierarchical linear modeling revealed that small schools had higher math achievement scores compared to medium or larger schools. Many districts consolidate schools to keep costs down. Another argument for small schools is that larger size schools with higher student transience and misbehavior predict higher levels of criminal incidents (Chen, 2008).

Argument for Large Schools

The strongest argument for large schools is funding; it helps districts maintain costs while educating a large number of students. While performance does not change much as size increases in rural areas, input variables do change a lot: the schools in the top quartile have, on average, a class size that is about double the class size in schools in the lowest quartile (Coupé, Olefir, & Alonso, 2016). The demographics of the type of school, be it urban or rural, affect achievement scores. According to Riew (1996), given the magnitude of the resources involved and the rapid growth of their amounts, inquiry into scale economies in public education has not received adequate treatment by researchers. In the cities, the relation between size and test scores is much clearer, larger

schools go together with substantially better mean and median test scores, a higher percentage of high scoring students, and a lower percentage of low scoring students (Coupe et al., 2016).

Schools keep getting larger and larger. The rate of consolidation has slowed in recent years, but at least a few districts consolidate every year in many states (Duncombe & Yinger, (2010). Most state governments have policies that influence school district consolidation (Duncombe & Yinger, (2010).

Strengths and Weaknesses of Prior Studies

As the above studies indicate, school size is a complex and complicated topic. There are varied findings as to whether small or large schools benefit students most. The negative influence of size was quite weak in affluent settings and comparatively strong in impoverished ones. A small number of rigorous studies linked school size with academic performance (e.g., Lee & Smith 1997), with many suggesting that engagement is the proximate mechanism of this benefit (Weiss et al., 2010).

Both size and mission matter, which is an important consideration for policymakers as they continue to seek ways to improve the educational outcomes of high school students. The pursuit of a singularly focused policy, such as creating small school without consideration of mission, will not produce the most cost-effective outcome. A more realistic approach would be to pursue a mix of schools regarding both size and mission, understanding that the optimal size of both themed and comprehensive schools is larger than the average size of existing schools (Stiefel, Schwartz, Iatorola, & Chellman, 2008).

This study augmented literature concerning class size effects in virtual public schools. There is an abundance of literature on virtual education in higher education and

size research in brick-and-mortar schools. This research bridges the chasm that currently exists in school size and virtual schools. The critical variable that differed in this study was the target population that included students in K-12 public virtual schools who are mandated to attend school. The literature that is currently available for virtual schools and school size predominately consists of higher education virtual schools, of which many are privately funded. Additionally, school size studies consist primarily of information about traditional brick-and-mortar schools.

Advocates for virtual education say that it has the power to transform an archaic K-12 system of schooling. Instead of blackboards, schoolhouses, and 6-hour school day, interactive technology personalizes learning to meet each student's needs, ensures all students have access to quality teaching, extends learning opportunities to all hours of the day and all days of the week, and innovates and improves over time (Dillon & Tucker, 2011). There are technological advances that happen daily that may impact the future of virtual schools. Including new technologies such as these into the curriculum could entice more students into attending virtual schools.

Chapter Summary

Given the complexity of the classroom environment, the effects of school size on student achievement cannot be isolated from the various other elements that influence students such as teacher practices (Englehart, 2011). Most of the consequences of school size reduction are positive, but the move is not always smooth. The increase in staff and the need for classroom space has stressed already fragile school systems disproportionately affected by serving the most low-income English-language learners and students of color (Graue, Hatch, Rao, & Oen, 2007). Even though virtual schools are not confined by actual spatial requirements and constraints, they are obligated to follow

state regulation regarding size according to the state education agency. Smaller sizes and a space within the learning management system for teachers and students to talk beyond instructional exchanges could help both groups foster a greater sense of immediacy and connectedness (Hawkins, Barbour, & Graham, 2011). As has been noted, it is evident from current research that school size impacts student achievement in the brick-and-mortar schools.

This quantitative study used deductive reasoning to reveal the effectiveness of virtual schools. Additionally, it used nonexperimental research with a correlational approach and an explanatory design. It is essential that studies of this type are conducted so individuals, schools, districts, states, and federal programs can make decisions based on the viability of virtual schools.

Research Questions

The following research questions were addressed to determine the extent of the relationship between virtual school size and student achievement in virtual schools in a southwestern state. For the purpose of this study, achievement was measured by student performance on state testing scores. The study used descriptive and inferential statistics to analyze enrollment size and STAAR English Language Arts/Reading in Grades 5 and 8, Math in Grades 5 and 8, English I, English II, and Algebra I testing scores relating to race and gender.

Research Question 1. What is the relationship between virtual school size and students' academic achievement in English Language Arts/Reading in Grades 5 and 8?

RQ1a. What is the relationship between virtual school size and students' academic success in ELA when race is concerned?

RQ1b. What is the relationship between virtual school size and students'

academic success in ELA when gender is concerned?

Research Question 2. What is the relationship between virtual school size and students' academic achievement in Math in Grades 5 and 8?

RQ2a. What is the relationship between virtual school size and students' academic success in Math when race is concerned?

RQ2b. What is the relationship between virtual school size and students' academic success in Math when gender is concerned?

Research Question 3. What is the relationship between virtual school size and students' academic achievement in English I?

RQ3a. What is the relationship between virtual school size and students' academic success in English I when race is concerned?

RQ3b. What is the relationship between virtual school size and students' academic success in English I when gender is concerned?

Research Question 4. What is the relationship between virtual school size and students' academic achievement in English II?

RQ4a. What is the relationship between virtual school size and students' academic success in English II when race is concerned?

RQ4b. What is the relationship between virtual school size and students' academic success in English II when gender is concerned?

Research Question 5. What is the relationship between virtual school size and students' academic achievement in Algebra I?

RQ5a. What is the relationship between virtual school size and students' academic success in Algebra I when race is concerned?

RQ5b. What is the relationship between virtual school size and students'

academic success in Algebra I when gender is concerned?

Chapter 3: Methodology

This chapter provides information regarding the epistemological and philosophical assumptions of the study, including the participants, instruments, procedures, design, and data analyses. The primary goal of this study was to expand the body of research on how virtual school size is related to student achievement.

Participants

The data for this research project were collected from the state education website. The target population was students who attended virtual schools in a southwestern state in the 2013-2016 school years. Students testing in Grades 5 and 8 for Math and Reading and students testing in Grades 9 to 12 for English I, English II, and Algebra I comprised the target population. Four public virtual schools ranging in enrollment from 108 to 6,477 students in a southwestern state housed the target population (TEA, 2017d).

According to the state's TAPR, the racial breakdown of students was categorized as African American, Hispanic, White, American Indian, Asian, Pacific Islander, and two or more races. For the purposes of this research study, the following racial categories were used: Black, Caucasian, Hispanic, American Indian, Asian, Pacific Islander, and two or more races. The data for each school were obtained by retrieving the school's TAPR for the 2013-16 school years from the state education website (see Table 2).

For the 2015-16 school year, all virtual schools reported students enrolled. Table 2 reveals the total number of enrolled students in the four virtual schools that were researched in this study. Schools 5 and 6 were omitted from the study because they were evaluated using an alternative accountability rating. School 4 enrollment numbers were tabulated by combining elementary, middle, and high school data from the TAPR report for the year.

Table 2

2013-16 Total Number of Students Enrolled in Virtual Schools in a Southwestern State

Virtual school	2013-2014	2014-2015	2015-2016
School 1	108	246	379
School 2	5,999	6,477	3,324
School 3	3,887	4,443	5,106
School 4	125	185	658

Note. The above data were retrieved from TEA (2017d), TAPR for the individual schools for 2013-2016.

Table 3

School 1 Number of Enrolled Students and Percentage by Grade Level and Year

School year & grade level	2013-2014		2014-2015		2015-2016	
	Number	Percentage	Number	Percentage	Number	Percentage
Grade 4	0	0.0%	0	0%	10	2.6%
Grade 5	0	0.0%	11	4.5%	14	3.7%
Grade 6	14	13.0%	19	7.7%	24	6.3%
Grade 7	18	16.7%	33	13.4%	50	13.2%
Grade 8	24	22.2%	44	17.9%	52	13.7%
Grade 9	21	19.4%	41	16.7%	61	16.1%
Grade 10	17	15.7%	44	17.9%	60	15.8%
Grade 11	14	13.0%	32	13.0%	62	16.4%
Grade 12	0	0.0%	22	8.9%	46	12.1%

Note. The above data were retrieved from TEA (2017d), TAPR for school 1.

Table 3 reveals the number of students enrolled in School 1 for the 2013-16 school years. As indicated above, School 1 was established in 2013-14 school year. This school has the second fewest number of students enrolled for every year that was evaluated.

Table 4 reveals the number of students enrolled in School 2 for the 2013-16 school years. School 2 was established in 2008-2009 school year. This school has the highest number of students enrolled for 2013-14 and 2014-2015 school years.

Table 5 reveals the number of students enrolled in School 3 for the 2013-16

school years. School 3 was established in 2008-2009 school year. This school has the highest number of students enrolled for 2015-2016 school year. This school has the second highest number of students enrolled for the three school years that were studied.

Table 6 reveals the number of students enrolled in School 4 for the 2013-16 school years. School 4 was established in 2013-14 school year. This school has the third fewest number of students enrolled for every year that was evaluated. Data for this virtual school was reported separately by school level into the TAPR system. For the purpose of this study, the information was compiled into one school to reveal the total number of students enrolled.

Table 4

School 2 Number of Enrolled Students and Percentage by Grade Level and Year

School year & grade level	2013-2014		2014-2015		2015-2016	
	Number	Percentage	Number	Percentage	Number	Percentage
Grade 2	0	0.0%	1	0.0%	0	0.0%
Grade 3	235	3.9%	228	3.5%	213	6.4%
Grade 4	301	5.0%	381	5.9%	358	10.8%
Grade 5	516	8.6%	499	7.7%	395	11.9%
Grade 6	573	9.6%	612	9.4%	603	18.1%
Grade 7	873	14.6%	769	11.9%	811	24.4%
Grade 8	982	16.4%	1,068	16.5%	944	28.4%
Grade 9	1,070	17.8%	1,072	16.6%	0	0.0%
Grade 10	669	11.2%	832	12.8%	0	0.0%
Grade 11	524	8.7%	671	10.4%	0	0.0%
Grade 12	256	4.3%	344	5.3%	0	0.0%

Note. The above data were retrieved from TEA (2017d), TAPR for school 2.

Table 5

School 3 Number of Enrolled Students and Percentage by Grade Level and Year

School year & grade level	2013-2014		2014-2015		2015-2016	
	Number	Percentage	Number	Percentage	Number	Percentage
Grade 3	136	3.5%	149	3.4%	153	3.0%
Grade 4	212	5.5%	204	4.6%	203	4.0%
Grade 5	282	7.3%	249	5.6%	269	5.3%
Grade 6	337	8.7%	345	7.8%	351	6.9%
Grade 7	487	12.5%	393	8.8%	456	8.9%
Grade 8	645	16.6%	577	13.0%	586	11.5%
Grade 9	572	14.7%	723	16.3%	966	18.9%
Grade 10	746	19.2%	797	17.9%	841	16.5%
Grade 11	299	7.7%	674	15.2%	794	15.6%
Grade 12	171	4.4%	332	7.5%	487	9.5%

Note. The above data were retrieved from TEA (2017d), TAPR for school 3.

Table 6

School 4 Number of Enrolled Students and Percentage by Grade Level and Year

School year & grade level	2013-2014		2014-2015		2015-2016	
	Number	Percentage	Number	Percentage	Number	Percentage
Grade 3	5	3.96%	1	.54%	23	3.50%
Grade 4	4	3.17%	13	7.03%	43	6.53%
Grade 5	5	3.96%	3	1.62%	52	7.90%
Grade 6	6	4.76%	7	3.78%	61	9.27%
Grade 7	17	13.29%	20	10.81%	82	12.46%
Grade 8	13	11.11%	20	10.81%	96	14.59%
Grade 9	27	21.43%	41	22.16%	80	12.16%
Grade 10	19	15.08%	38	20.54%	93	14.13%
Grade 11	13	10.32%	27	14.59%	83	12.61%
Grade 12	16	12.70%	15	8.11%	45	6.84%

Note. The above data were retrieved from TEA (2017d), TAPR for school 4.

Instruments

The state assessments continue to be based on the TEKS, the standards designed

to prepare students to succeed in college and careers and to compete globally (TEA, 2017h). However, consistent with a growing national consensus regarding the need to provide a more clearly articulated K-16 education program that focuses on fewer skills and addresses those skills in a deeper manner, the TEA is implementing a new assessment model for the STAAR tests for elementary, middle, and high school (TEA, 2017f). The source of data for this study is results from the STAAR.

According to the education agency for this state (2017e), Texas provides annual academic accountability ratings to its public school districts, charters and schools. The ratings are based largely on performance on state standardized tests and graduation rates. The ratings examine student achievement, student progress, efforts to close the achievement gap and postsecondary readiness. The state accountability system assigns one of three academic ratings to each district and campus: Met Standard, Met Alternative Standard, or Improvement Required. Below is a description of individual tests for the STAAR testing program that were used in this study according to TEA (2017e).

Math Grades 5 & 8.

***Reporting Category 1: Numerical representations and relationships*.** The student will demonstrate an understanding of how to represent and manipulate numbers and expressions.

***Reporting Category 2: Computations and algebraic relationships*.** The student will demonstrate an understanding of how to perform operations and represent algebraic relationships.

***Reporting Category 3: Geometry and measurement*.** The student will demonstrate an understanding of how to represent and apply geometry and measurement concepts.

Reading Grades 5 and 8.

***Reporting Category 1: Understanding and analysis across genres*.** The student will demonstrate an ability to understand and analyze a variety of written texts across reading genres.

***Reporting Category 2: Understanding and analysis of literary texts*.** The student will demonstrate an ability to understand and analyze literary texts.

***Reporting Category 3: Understanding and analysis of informational texts*.** The student will demonstrate an ability to understand and analyze informational texts.

STAAR Algebra I Assessment Mathematical Process Standards.

These student expectations will not be listed under a separate reporting category. Instead, they will be incorporated into test questions across reporting categories since the application of mathematical process standards is part of each knowledge statement.

Reporting Category 1: Number and algebraic methods. *The* student will demonstrate an understanding of how to use algebraic methods to manipulate numbers, expressions, and equations.

Reporting Category 2: Describing and graphing linear functions, equations, and inequalities. The student will demonstrate an understanding of how to describe and graph linear functions, equations, and inequalities.

***Reporting Category 3: Writing and solving linear functions, equations, and inequalities*.** The student will demonstrate an understanding of how to write and solve linear functions, equations, and inequalities.

***Reporting Category 4: Quadratic functions and equations*.** The student will demonstrate an understanding of how to describe, write, and solve quadratic functions and equations.

Reporting Category 5: Exponential functions and equations. The student will demonstrate an understanding of how to describe and write exponential functions and equations.

English I.

Reporting Category 1: Understanding and analysis across genres. The student will demonstrate the ability to understand and analyze a variety of written texts across reading genres.

***Reporting Category 2: Understanding and analysis of literary texts*.** The student will demonstrate an ability to understand and analyze literary texts.

***Reporting Category 3: Understanding and analysis of informational texts*.** The student will demonstrate an ability to understand and analyze informational texts.

***Reporting Category 4: Composition*.** The student will demonstrate an ability to compose a variety of written texts with a clear, controlling idea; coherent organization; sufficient development; and effective use of language and conventions.

***Reporting Category 5: Revision*.** The student will demonstrate an ability to revise a variety of written texts.

***Reporting Category 6: Editing*.** The student will demonstrate an ability to edit a variety of texts.

Reliability

Test reliability is the degree to which student testing results remain stable and consistent over a period of time. State assessment test scores are privileged over other data sources and accepted without question because of the presupposition that they are based on objective mathematics, but they should be examined as critically as any other product in the marketplace (Lowe, 2012).

The STAAR assessments should be administered on the state-assigned days listed on the student assessment testing calendar. All district and campus personnel who participate in state-mandated testing or handle secure test materials must meet the eligibility requirements detailed in this supplement and the appropriate test administration materials, be trained, and sign a security oath. Testing personnel are required to receive annual training in test security and administration procedures and are responsible for complying with state assessment requirements. By signing the Oath of Test Security and Confidentiality, participants affirm that they have been trained, understand their obligation to properly implement the program, acknowledge their responsibility to report any suspected testing irregularity to the campus or district coordinator, principal, or TEA, and are aware of the range of penalties that may result from a violation of test security and confidentiality (TEA, 2017e).

Test administrators must actively monitor, distribute, and properly handle secure test materials appropriately. These guidelines are mandated for both virtual schools and brick-and-mortar schools. When a person completes the agreement to enroll in a virtual school, part of the agreement states that all students are expected to participate in state testing at one of the testing sites. The state testing site may be located within a 2-hour (or less) driving range from the student's residence. It is the parent's responsibility to make travel arrangements to get the student to state testing for all testing days. An adult is required to walk the student into and out of the test site and show their identification each test day (TCAH, 2017).

Test administration is taken as seriously in a virtual school as in a brick-and-mortar facility. The procedure is the same as in a typical school building but testing may take place in a civic building or hotel conference room. Teachers must be trained to

administer the test in the same manner and students are held to the same strict testing rules and procedures.

Validity

Validity refers to the degree to which evidence and theory support the interpretations of test scores entailed by proposed uses of tests (Murphy, 2012). Further clarified, in the current consensus definition, the term validity indicates to what extent an interpretation of a test score is justifiable (Borsboom, 2012). TEA (2017f) states the STAAR progress measure classifies the progress that students have already achieved and does not predict future performance. Rather, student scores from the previous year and the current year are compared to calculate the amount of improvement or growth the student has already made (TEA, 2017f).

Scale scores and performance levels convey information about how a student performed in the current year. Progress measures provide additional information by communicating how much the student has improved from the previous year to the current year. When used together, this information provides a more complete picture of the student's achievement (TEA, 2017e).

Under TEC §39.036, TEA is required to develop a vertical scale for assessing student performance in Grades 3 to 8 for reading and mathematics. A vertical scale allows for a student's scale scores to be compared across different grades for the same subject area. The changes in the student's vertical scale scores indicate the academic progress the student has made over time. The assessments for which vertical scales were developed are STAAR Grades 3 to 8, mathematics and reading in English (TEA, 2017e).

According to TEA (2017f), the following categories are used to determine student performance on the STAAR test in Grades 3 to 8: Level I: Unsatisfactory Academic

Performance, Level II: Satisfactory Academic Performance, and Level III: Advanced Academic Performance. The same scoring categories are used to determine student performance on the STAAR end of course tests in Grades 9 to 12. For the purpose of this study, STAAR Percent at Phase-in Satisfactory Standard or Above All Grades from school years 2013-2014 and 2014-2015 school years was used. In 2015-2016 the category was changed to STAAR Percent at Level II Satisfactory Standard or Above All Grades. This scoring category was analyzed along with enrollment numbers in each school to look for a relationship or trend.

Procedures

Design. This quantitative study used nonexperimental research utilizing correlational approach with an explanatory design. In quantitative research, the investigator identifies a research problem based on trends in the field or on the need to explain why something occurs (Creswell, 2013). Describing a trend means that the research problem can be answered best by a study in which the researcher seeks to establish the overall tendency of responses from individuals and to note how this tendency varies among people (Creswell, 2013). Nonexperimental research, when reported accurately, makes a tremendous contribution because it can be used for conducting research when experimentation is not feasible or desired (Reio, 2016). Explanatory designs consist of a simple association between two variables (Creswell, 2013). The relationship between virtual school size and student achievement in Texas is being examined in this correlational quantitative research design. Specifically, student achievement was defined by student passing rates on individual tests of the STAAR examination. This research was conducted utilizing archival data from TEA for the 2013-2016 school years. Archival data are usually utilized in non-experimental designs to help

determine differences among dependent variables (Johnson & Christensen, 2014). No intervention will be implemented in this study and the data were collected all at once. In using this nonexperimental research design, independent variables are not manipulated, control for extraneous variables is limited, and identifying cause and effect relationships is difficult (Johnson & Christensen, 2014).

Data analysis. The data were compiled and analyzed using Statistical Package for Social Science (SPSS) 23. Using this statistical program, descriptive statistical analyses were performed utilizing retrieval data from the state education system on the four virtual schools to obtain a clear understanding of the population. Measures of central tendency including means and dispersion including standard deviations were computed. Pearson's Product Moment Correlation analyses were conducted in order to assess the strength, directionality, linear aspect or lack of, and range of the relationship between school size and student achievement.

In correlational studies, independent variables are known as predictor variables and dependent variables are called criterion variables. By explaining a relation among variables, the researcher is interested in determining whether or not one or more variables might influence another variable (Creswell, 2013). The variables that were analyzed are school size representing the predictor variable and student performance results on STAAR English/Language Arts and Math representing the criterion variables.

Furthermore, the criterion variables were aggregated by gender and ethnic categories of Black, Caucasian, Hispanic, American Indian, Asian, Pacific Islander, and two or more races. Using inferential statistics, the relationship between student achievement and the virtual school size variable, the Pearson's Product Moment Correlation was utilized.

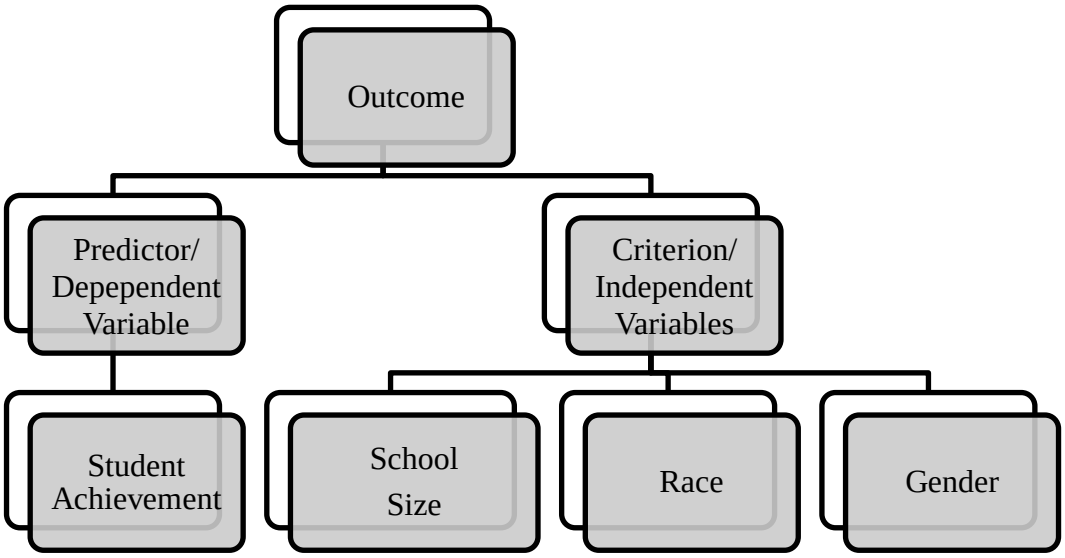

Figure 2. Predictor variables and criterion variables revealing outcome.

Chapter 4: Results

Introduction

This chapter presents the statistical analyses that were conducted in this research study. Specifically researched were data sets from the state educational agency website for 2013-2014, 2014-2015, and 2015-2016 school years to look for existing trends. The dependent variable was academic achievement of student performance results on STAAR English/Language Arts, Math, English I, English II and Algebra I. The independent variables were school size, race, and gender.

Demographic Characteristics

The racial breakdown of students is categorized as Black, Hispanic, White, American Indian, Asian, Pacific Islander, and Two or more races. For the purposes of this research study, the following racial categories were used: Black, Hispanic, Caucasian, Asian, and Two or more races. The categories of American Indian and Pacific Islander were not used because there was not enough representation amongst the schools for these groups. Gender is categorized by male and female. No other demographic information was included in this study.

Table 7

2013-16 Total Racial Distribution of Students Enrolled in Virtual Schools in a Southwestern State

Virtual school	Black	Caucasian	Hispanic	American Indian	Asian	Pacific Islander	Two or more races
School 1	41	529	87	1	27	2	46
School 2	1863	8252	4514	85	438	28	620
School 3	1495	7280	3590	131	412	63	475
School 4	98	508	272	5	43	3	39

Note. The above data were retrieved from TEA (2017d), TAPR for the individual schools for 2013-2014.

Table 7 shows the total racial distribution of students enrolled in Southwestern state virtual schools in 2013-14.

Table 8

2013-14 Racial Distribution of Students Enrolled in Virtual Schools in a Southwestern State

Virtual school	Black	Caucasian	Hispanic	American Indian	Asian	Pacific Islander	Two or more races
School 1	12	82	5	0	3	1	5
School 2	694	3278	1585	28	132	8	274
School 3	442	2087	1035	33	119	16	155
School 4	12	71	37	0	4	0	1

Note. The above data were retrieved from TEA (2017d), TAPR for the individual schools for 2013-2014.

Table 8 shows the racial distribution of students enrolled in Southwestern state virtual schools in 2013-14.

Table 9

2014-15 Racial Distribution of Students Enrolled in Virtual Schools in a Southwestern State

Virtual school	Black	Caucasian	Hispanic	American Indian	Asian	Pacific Islander	Two or more races
School 1	14	180	30	1	8	1	12
School 2	722	3387	1886	40	181	11	250
School 3	517	2444	1159	36	131	17	139
School 4	18	105	53	0	5	1	3

Note. The above data were retrieved from TEA (2017d), TAPR for the individual schools for 2014-2015.

Table 9 shows the racial distribution of students enrolled in Southwestern state virtual schools in 2014-15.

Table 10 shows the racial distribution of students enrolled in Southwestern state virtual schools in 2015-16.

Table 10

2015-16 Racial Distribution of Students Enrolled in Virtual Schools in a Southwestern State

Virtual school	Black	Caucasian	Hispanic	American Indian	Asian	Pacific Islander	Two or more races
School 1	15	267	52	0	16	0	29
School 2	447	1587	1043	17	125	9	96
School 3	536	2749	1396	62	162	20	181
School 4	68	332	182	5	34	2	35

Note. The above data were retrieved from TEA (2017d), TAPR for the individual schools for 2015-2016.

Table 11

2013-2014 School 1 STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades

Test	Black	Caucasian	Hispanic	American Indian	Asian	Pacific Islander	Two or more races
Read 5							
Math 5							
Read 8		92					
Math 8		78					
English I		80					
English II		82					
Alg. I		91					

Note. The above data were retrieved from TEA (2017d), TAPR for the individual schools for 2013-2014.

Table 11 shows the STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades in 2013-14 for School 1.

Table 12

2014-2015 School 1 STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades

Test	Black	Caucasian	Hispanic	American Indian	Asian	Pacific Islander	Two or more races
Read 5		100					
Math 5							
Read 8		97					
Math 8							
English I		79					
English II		97					
Alg. I		92					

Note. The above data were retrieved from TEA (2017d), TAPR for the individual schools for 2015-2016.

Table 12 shows the STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades in 2014-15 for School 1.

Table 13

2015-2016 School 1 STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades

Test	Black	Caucasian	Hispanic	American Indian	Asian	Pacific Islander	Two or more races
Read 5		100					
Math 5		100					
Read 8		100	100				
Math 8		96	80				86
English I		95					100
English II		94	100				100
Alg. I		95	86				

Note. The above data were retrieved from TEA (2017d), TAPR for the individual schools for 2015-2016.

Table 13 shows the STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades in 2015-16 for School 1.

Table 14

2013-2014 School 2 STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades

Test	Black	Caucasian	Hispanic	American Indian	Asian	Pacific Islander	Two or more races
Read 5	67	77	80		88		53
Math 5	40	69	58		88		47
Read 8	88	89	86		100		97
Math 8	66	71	74		90		79
English I	65	67	65		100		68
English II	59	72	68		92		69
Alg. I	63	69	63		100		93

Note. The above data were retrieved from TEA (2017d), TAPR for the individual schools for 2013-2014.

Table 14 shows the STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades in 2013-14 for School 2.

Table 15

2014-2015 School 2 STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades

Test	Black	Caucasian	Hispanic	American Indian	Asian	Pacific Islander	Two or more races
Read 5	74	85	82		87		91
Math 5							
Read 8	89	88	88		96		83
Math 8							
English I	55	73	74		88		73
English II	62	75	77		90		76
Alg. I	46	67	64	100	75		68

Note. The above data were retrieved from TEA (2017d), TAPR for the individual schools for 2014-2015.

Table 15 shows the STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades in 2014-15 for School 2.

Table 16

2015-2016 School 2 STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades

Test	Black	Caucasian	Hispanic	American Indian	Asian	Pacific Islander	Two or more races
Read 5	53	73	67		80		63
Math 5	37	57	49		100		38
Read 8	76	81	82		92		76
Math 8	35	49	48		88		76
English I	90	84	90				
English II		93	100				
Alg. I	63	83	89				

Note. The above data were retrieved from TEA (2017d), TAPR for the individual schools for 2015-2016.

Table 16 shows the STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades in 2015-16 for School 2.

Table 17

2013-2014 School 3 STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades

Test	Black	Caucasian	Hispanic	American Indian	Asian	Pacific Islander	Two or more races
Read 5	75	91	90		100		100
Math 5	54	80	66		100		
Read 8	95	97	96		100		100
Math 8	67	90	83		100		100
English I	60	73	63		100		94
English II	73	77	67		100		77
Alg. I	61	72	61		93		85

Note. The above data were retrieved from TEA (2017d), TAPR for the individual schools for 2013-2014.

Table 17 shows the STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades in 2013-14 for School 3.

Table 18

2014-2015 School 3 STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades

Test	Black	Caucasian	Hispanic	American Indian	Asian	Pacific Islander	Two or more races
Read 5	79	87	100		92		
Math 5							
Read 8	89	95	91		100		88
Math 8							
English I	75	74	72		92		75
English II	64	79	74	83	92		75
Alg. I	73	75	61		100		63

Note. The above data were retrieved from TEA (2017d), TAPR for the individual schools for 2014-2015.

Table 18 shows the STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades in 2014-15 for School 3.

Table 19

2015-2016 School 3 STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades

Test	Black	Caucasian	Hispanic	American Indian	Asian	Pacific Islander	Two or more races
Read 5	80	91	82		100		100
Math 5	44	81	65		100		100
Read 8	91	95	96		100		88
Math 8	59	79	79		100		59
English I	65	71	71		100		80
English II	68	78	78		100		90
Alg. I	50	67	59		95		53

Note. The above data were retrieved from TEA (2017d), TAPR for the individual schools for 2015-2016.

Table 19 shows the STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades in 2015-16 for School 3.

Table 20

2013-2014 School 4 STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades

Test	Black	Caucasian	Hispanic	American Indian	Asian	Pacific Islander	Two or more races
Read 5							
Math 5							
Read 8		100					
Math 8		86					
English I							
English II							
Alg. I							

Note. The above data were retrieved from TEA (2017d), TAPR for the individual schools for 2013-2014.

Table 20 shows the STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades in 2013-14 for School 4.

Table 21

2014-2015 School 4 STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades

Test	Black	Caucasian	Hispanic	American Indian	Asian	Pacific Islander	Two or more races
Read 5		100	100				
Math 5							
Read 8		100	100				
Math 8							
English I		94	83				
English II		93	100				
Alg. I		80	63				

Note. The above data were retrieved from TEA (2017d), TAPR for the individual schools for 2014-2015.

Table 21 shows the STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades in 2014-15 for School 4.

Table 22

2015-2016 School 4 STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades

Test	Black	Caucasian	Hispanic	American Indian	Asian	Pacific Islander	Two or more races
Read 5	100	100	100	90			
Math 5	100	94	80				
Read 8							
Math 8							
English I	100	97	100		100		
English II	100	97	78				
Alg. I	100	97	100				

Note. The above data were retrieved from TEA (2017d), TAPR for the individual schools for 2015-2016.

Table 22 shows the STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades in 2015-16 for School 4.

Table 23

2013-16 Total Gender Distribution of Students in Virtual Schools in a Southwestern State

Virtual school	Male	Female
School 1	278	455
School 2	7045	8755
School 3	5427	8016
School 4	443	746

Note. The above data were retrieved from TEA (2017g) website for the individual schools for 2014-2015.

Table 23 shows the total gender distribution of students enrolled in Southwestern state virtual schools in 2013-16.

Table 24

2013-14 Gender Distribution of Students Enrolled in Virtual Schools in a Southwestern State

Virtual school	Male	Female
School 1	50	58
School 2	2662	3337
School 3	1624	2266
School 4	40	84

Note. The above data were retrieved from TEA (2017g) website for the individual schools for 2013-2014.

Table 24 shows the gender distribution of students enrolled in Southwestern state virtual schools in 2013-14.

Table 25

2014-15 Gender Distribution of Students Enrolled in Virtual Schools in a Southwestern State

Virtual school	Male	Female
School 1	93	153
School 2	2770	3707
School 3	1790	2654
School 4	149	258

Note. The above data were retrieved from TEA (2017g) website for the individual schools for 2014-2015.

Table 25 shows the gender distribution of students enrolled in Southwestern state virtual schools in 2014-15.

Table 26

2015-16 Gender Distribution of Students Enrolled in Virtual Schools in a Southwestern State

Virtual school	Male	Female
School 1	135	244
School 2	1613	1711
School 3	2013	3096
School 4	254	404

Note. The above data were retrieved from TEA (2017g) website for the individual schools for 2015-2016.

Table 26 shows the gender distribution of students enrolled in Southwestern state virtual schools in 2015-16.

Data Analysis

The study initially purported to analyze data with a correlational approach. Upon consulting a statistician, the recommended approach was to group schools likewise in size and change the statistical method to analyze the data. The remaining information in this section follows the statistician's recommendations.

In order to test the research questions, the achievement percentages shown in Tables 7-22 and the student sample sizes shown in Tables 8, 9, and 10 were averaged across the three school years studied within each ethnic group. Data on achievement within the two smaller schools was limited, so, to increase the power of the comparisons, virtual school size was operationalized by grouping together the two schools with over 3,000 students enrolled, and by grouping together the two schools with under 1,000 students enrolled. The average achievement percentages representing all 3 years were again averaged across the two smaller schools and across the two larger schools within each racial group. The average number of students representing all 3 years were summed across the two smaller schools and across the two larger schools within each racial group. Finally, the achievement percentages were averaged across all racial groups, and the numbers of students represented were summed across all racial groups to create overall achievement data representing all racial groups and all school years.

Achievement percentages were not available for all years within each racial group, so only the average number of students represented by the existing percentages was used in the calculations. For example, achievement percentages were only available for Black students in School 4 during the 2015-2016 school year, and no data were available on Black students in School 1 during any of the 3 years. Therefore, the small school achievement percentages for Black students across all years were represented by School 4 achievement percentages for Black students in the 2015-2016 school year, and the associated sample size was represented by the 68 Black students attending School 4 during the 2015-2016 school year.

Once achievement data had been compiled according to the protocols detailed above, z-tests were computed to compare the achievement percentages between the

smaller versus the larger schools within each racial group and across all racial groups combined. The overall results to address the main components of the research questions are presented in Table 27.

Table 27

Comparison of Large Versus Small School STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades for 2013-2016

Test	Large Schools		Small Schools		*z*	*p* <
	%	*N*	*%*	*N*		
Read 5	82.3	9646	100.0	628	-11.5	0.001
Math 5	66.7	9075	92.3	849	-15.4	0.001
Read 8	91.1	9646	98.9	369	-5.3	0.001
Math 8	74.6	9062	84.2	327	-3.9	0.001
English I	77.7	9712	96.1	643	-11.1	0.001
English II	78.7	9799	96.3	661	-10.9	0.001
Alg. I	72.5	9712	91.3	560	-9.8	0.001

Parallel analyses were computed within each racial group, and are presented in Tables 28 through 32.

Table 28

Comparison of Large Versus Small School STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades for 2013-2016 for Black students

Test	Large Schools		Small Schools		*z*	*p* <
	%	*N*	*%*	*N*		
Read 5	71.3	1119	100.0	68	-5.2	0.001
Math 5	43.8	1060	100.0	68	-9.0	0.001
Read 8	88.0	1119				
Math 8	56.8	1060				
English I	68.3	1119	100.0	68	-5.5	0.001
English II	65.2	1206	100.0	68	-5.9	0.001
Alg. I	59.3	1119	100.0	68	-6.7	0.001

Table 29

Comparison of Large Versus Small School STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades for 2013-2016 for Caucasian students

Test	Large Schools		Small Schools		*z*	*p* <
	%	*N*	*%*	*N*		
Read 5	84.0	5177	100.0	442	-9.1	0.001
Math 5	71.8	4851	97.0	599	-13.4	0.001
Read 8	90.8	5177	97.8	264	-3.9	0.001
Math 8	72.3	4851	86.7	246	-5.0	0.001
English I	73.7	5177	89.0	395	-6.8	0.001
English II	79.0	5177	92.6	395	-6.5	0.001
Alg. I	72.2	5177	91.0	322	-7.4	0.001

Table 30

Comparison of Large Versus Small School STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades for 2013-2016 for Hispanic students

Test	Large Schools		Small Schools		*z*	*p* <
	%	*N*	*%*	*N*		
Read 5	83.5	2701	100.0	118	-4.8	0.001
Math 5	59.5	2530	80.0	182	-5.5	0.001
Read 8	89.8	2701	100.0	105	-3.4	0.001
Math 8	71.0	2530	80.0	52	-1.4	NS
English I	72.5	2701	91.5	118	-4.6	0.001
English II	77.3	2701	92.7	170	-4.7	0.001
Alg. I	66.2	2701	83.0	170	-4.5	0.001

Table 31

Comparison of Large Versus Small School STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades for 2013-2016 for Asian students

Test	Large Schools		Small Schools		*z*	*p* <
	%	*N*	*%*	*N*		
Read 5	91.2	283				
Math 5	97.0	269				
Read 8	98.0	283				
Math 8	94.5	269				
English I	96.0	294	100.0	34	-1.2	NS
English II	94.8	294				
Alg. I	92.6	294				

Table 32

Comparison of Large Versus Small School STAAR Percentage at Phase-in Satisfactory Standard or Above All Grades for 2013-2016 Multi-Racial Students

Test	Large Schools		Small Schools		*z*	*p* <
	%	*N*	*%*	*N*		
Read 5	81.4	365				
Math 5	61.7	366				
Read 8	88.7	365				
Math 8	78.5	353	86.0	29	-1.0	NS
English I	78.0	420	100.0	29	-2.8	0.01
English II	77.4	420	100.0	29	-2.9	0.01
Alg. I	72.4	420				

Chapter 5: Discussion

Introduction

To recapitulate, the purpose of this study was to expand the body of knowledge regarding virtual school size and student achievement concerning race and gender. Examining the extent of the relationship between virtual school size and student achievement in virtual schools in a southwestern state was the primary focus.

Summary of Findings

In general, the students in the smaller schools performed significantly better across the 3 school years ($p < .001$). There were a few exceptions. Tables 28, 31 and 32 reflect the fact that even after combining the two smaller schools, sufficient data were sometimes not available for comparisons between the larger and smaller schools. In addition, it is possible that the non-significant results shown in Tables 30, 31 and 32 are due to the small number of students representing the smaller virtual schools.

Research Question What is the relationship between virtual school size and students' academic achievement in STAAR English Language Arts/Reading in Grades 5 and 8, Math in Grades 5 and 8, English I, English II, and Algebra I testing scores relating to race. In all testing categories, students performed better in small virtual schools compared to large virtual schools.

RQ1a. What is the relationship between virtual school size and students' academic success in STAAR English Language Arts/Reading in Grades 5 and 8, Math in Grades 5 and 8, English I, English II, and Algebra I when race is concerned? In all testing categories, students performed better in small virtual schools compared to large virtual schools in all racial categories.

RQ1b. What is the relationship between virtual school size and students'

academic success in STAAR English Language Arts/Reading in Grades 5 and 8, Math in Grades 5 and 8, English I, English II, and Algebra I when gender is concerned? Conducting a statistical analysis concerning student achievement and gender was not possible as the student achievement data were only aggregated by racial categories. It was determined that there are more females than males in all schools represented.

Interpretation of Findings

It was unanticipated to find the results unilaterally revealing small virtual schools outperforming their counterpart of larger virtual schools in all categories. Notable trends were revealed in this study. First, small virtual schools outperform large virtual schools in academic achievement. Second, female students outnumber male students. Third, virtual schools are growing in demand. There was an increase in student population for all 3 school years and for all 4 virtual schools in this study.

Context of Findings

The results of this study align with prior studies that indicate small schools surpass large schools. Carbaugh (2017) states small school benefits consist of ease in developing student to student relationships, staff familiarity with each other and the students, teachers accepting more responsibility for student learning, a stronger sense of community, and encouragement of better teaching; all of which indirectly impact student achievement and affect (Leithwood & Jantzi, 2009). As mentioned in the literature review, the Matthew Project (Friedkin, & Necochea, 1988) found that school performance benefited from smaller school size in impoverished California communities. This study did not take into consideration poverty or economically disadvantaged categories.

Implications of Findings

The intent of this study was to examine the relationship between virtual school size and student achievement. Despite the limited sample size of four virtual schools, it is evident from the results small virtual schools are outperforming large virtual schools. As expressed earlier in the chapter, virtual schools are growing in the number of students enrolled each year. Virtual education has the potential not only to help solve many of the most pressing issues in K-12 education, but to do so in a cost-effective manner (Dillon & Tucker, 2011). More than 1 million public-education students now take online courses, and as more districts and states initiate and expand online offerings, the numbers continue to grow (Dillon & Tucker, 2011). Further research and practice could verify whether or not the trends found in this study are isolated to this specific state or if they are regional or nationwide.

The strongest argument for large schools is funding; it helps districts maintain costs while educating a large number of students. Classroom quality and school characteristics predicted youth functioning regardless of school type, reshaping the research and policy debate with renewed focus on classroom quality and school size instead of grade organization (Holas & Huston, 2012). This study helps to support the notion that small schools are better than large schools. Even though districts could save money by investing in large schools, small schools could benefit concerning student achievement outcomes.

Limitations of the Study

This study was limited to virtual schools in a single southwestern state. At present, there are only six public virtual schools in the state, and only four were used to ensure the integrity of the study. Schools 5 and 6 were omitted from the study because

they were evaluated using an alternative accountability rating. The data collected were specific to the state and may not be representative of other states. Other mitigating factors of socioeconomic status, English language learners status, special education rate, mobility rate, dropout rate, class size, instructional expenditure per pupil, or attendance rate exhibiting interaction effects can be used to predict student achievement (Riggen, 2013). They were not evaluated in this study. Assessment results can be most helpful if considered as one component of an evaluation system (TEA, 2017e). Data collected for this study were solely retrieved from the state education website using assessment results and other reporting criteria from archival data for the 2013-2016 school years. According to TEA (2017e), standardized assessments are a valuable tool for evaluating programs. However, any assessment can furnish only one part of the picture (TEA, 2017e). The STAAR end of course assessments are not able to identify, let alone measure, every factor that contributes to the success or failure of a program (TEA, 2017e).

Furthermore, all data collected were retrieved from the state's education website. In large-scale assessments, such as state-wide testing programs, there are many steps involved in the measurement and reporting of student achievement (Wu, 2010). There may be sources of inaccuracies in each of the steps (Wu, 2010). The accuracy of reporting is dependent on individual virtual schools.

Future Research Directions

The debate regarding school size will continue in the years to come, especially as virtual schools grow. There is little research or publicly available data on the outcomes from K-12 online learning (Dillon & Tucker, 2011). Thus far, this researcher was not able to obtain any relevant literature based on virtual school size and its relationship to student achievement for public virtual schools in the K-12 sector. Further research

regarding virtual school size and academic achievement could include not only a single state, but include regions or an in-depth study of the entire country. Also, this study only analyzed data according to student achievement results and race. Gender data were observed based on the number of each category. Future research studies could include other important factors such as graduation rates, economically disadvantaged students, and student-to-teacher ratios. Future research could explore other types of research including a comparison study reviewing the academic achievements in virtual schools to brick and mortar schools that could assist lawmakers and legislatures in decisions regarding funding.

Summary

The results revealed in this study indicate students in the smaller schools performed significantly better across the three school years. The study analyzed enrollment size and STAAR English Language Arts/Reading in Grades 5 and 8, Math in Grades 5 and 8, English I, English II, and Algebra I testing scores relating to race. In all categories of both test category and race, students in smaller schools performed better than students in larger virtual schools. Notable trends were revealed in this study. First, small virtual schools outperform large virtual schools in academic achievement. Second, female students outnumber male students. Third, virtual schools are growing in demand. There was an increase in student population for all 3 school years and for all 4 virtual schools in this study.

References

A nation accountable: Twenty-five years after "A nation at risk." (2008). Washington, DC: U.S. Department of Education.

A nation at risk: The imperative for educational reform. (1983). *American Education*, *19*(5), 2–3.

The accountability illusion: Texas. (2009). Washington, DC: Thomas B. Fordham Foundation & Institute.

Anderson, R. L. (2012). An analysis of dyadic relationships between administrators and employees working virtually in higher education (Doctoral dissertation). (Order No. 3528444). Available from ProQuest Dissertations & Theses Global.

Archambault, L., Diamond, D., Brown, R., Cavanaugh, C., Coffey, M., Foures-Aalbu, D., . . . Zygouris-Coe, V. (2010). *Research Committee Issues Brief: An Exploration of At-Risk Learners and Online Education*. International Association for K-12 Online Learning.

Ash, K. (2009). Expert's debate cost savings of virtual education. *Education Week*, *28(*28), 20-23.

Ash, K. (2012). Virtual education lacks accountability, NSBA report argues. *Education Week*, *31*(32), 10.

Baenen, N. R. (1981). How competent is competent? Does the state or local district know best? Non-Journal Abstract.

Barbour, M. K., Grzebyk, T. Q., & Eye, J. (2014). Any time, any place, any pace-really? Examining mobile learning in a virtual school environment. *Turkish Online Journal of Distance Education*, *15*(1), 114–127.

Barbour, M. K., & Siko, J. P. (2012). Virtual schooling through the eyes of an at-risk

student: A case study. *European Journal of Open, Distance and E-Learning*, 1.

Beranek, L. L. (2007). Who really invented the internet? *Sound and Vibration*, *41*(1), 6–12.

Borsboom, D. (2012). Whose consensus is it anyway? Scientific versus legalistic conceptions of validity. *Measurement: Interdisciplinary Research and Perspectives*, *10*(1), 38–414.

Bush, G. W. (2001). No child left behind. ED Pubs, Education. Jessup, MD. Retrieved from http://www.ed.gov/pubs/edpubs/html.

Butler, K. (2010). Logging on to learn. *District Administration*, *46*(3), 43–44.

Caballero, J. A. R. (2010*). The effects of the teacher-student relationship, teacher expectancy, and culturally-relevant pedagogy on student academic achievement* (Doctoral dissertation). (Order No. 3474274). Available from Education Database. (897551383).

Carbaugh, E., (2017). Albamarle County Schools. *Effects of School Size on Student Outcomes: A Brief Overview of Research*. Retrieved from http://esblogin.k12albemarle.org/attachments/4e78e3a8-d449-42a0-a1aa-e48869e4d1de.pdf

Caruth, G. D., & Caruth, D. L. (2013). Distance education in the United States: From correspondence courses to the internet. *Turkish Online Journal of Distance Education*, *14*(2), 141–149.

Chadwick, M. (2009). *Examining the relationships between math achievement and the resiliency of high school seniors* (Doctoral dissertation). (Order No. 3447681). Available from Education Database.

Chen, G. (2008). Communities, students, schools, and school crime: A confirmatory

study of crime in U.S. high schools. *Urban Education*, *43*(3), 301.

Coupé, T., Olefir, A., & Alonso, J. D. (2016). Class size, school size and the size of the school network. *Education Economics*, *24*(3), 329–351.

Coy, K., & Hirschmann, K. R. (2014). Maximizing student success in online virtual schools. *Perspectives on Language and Literacy*, *40*(1), 17–21.

Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches*. Thousand Oaks, CA: Sage Publications.

Deacon, L. (2017). Statistical editor.

Dede, C. (2011). Emerging technologies, ubiquitous learning, and educational transformation. In Author(s), *European conference on technology enhanced learning* (pp. 1–8). Berlin: Springer.

de Gyor, H. J. (2010). An interview with Henrik de Gyor, K12 Inc. *Digit Asset Management Journal of Digital Asset Management*. doi:10.1057/dam.2010.15

Deskins, T. (2010). *Determining teacher expectations in an urban school environment its implications for affecting student achievement* (Doctoral dissertation). Order No. 3474289). Available from ProQuest Central; ProQuest Dissertations & Theses Global.

Dillon, E., & Tucker, B. (2011). Lessons for online learning: Charter schools' successes and mistakes have a lot to teach virtual educators. *Education Next*, *11*(2), 50–57.

Duncombe, W. D., & Yinger, J. M. (2010). School district consolidation: The benefits and costs. *School Administrator*, *67*(5), 10–17.

Englehart, J. M. (2011). Why class size effects cannot stand alone: Insights from a qualitative exploration. *Learning Environments Research*, *14*(2), 109–121. http://dx.doi.org.ezproxylocal.library.nova.edu/10.1007/s10984-011-9085-z

Fast facts about online learning. (2009). International Association for K-12 Online Learning. Retrieved from http://www.inacol.org/resource/fast-facts-about-online-learning/

Final report: A comprehensive assessment of Florida virtual school. (2007). Center for Educational Performance and Accountability. *Florida Tax Watch*. Retrieved from http://www.inacol.org/resource/final-report-a-comprehensive-assessment-of-florida-virtual-school/

Flanigan, R.L. (2012). Publicly traded ed. companies are rare. *Education Week, 31*(21), 1. Retrieved from http://www.edweek.org/ew/articles/2012/02/22/21pubtrade_ep.h31.html

Friedkin, N. E., & Necochea, J. (1988). School system size and performance: A contingency perspective. *Educational Evaluation and Policy Analysis*, *10*(3), 237–249.

Garrison, R. D., & Vaughan, N. D. (2007). *Blended learning in higher education: Framework, principles, and guidelines.* San Francisco, CA: Jossey-Bass, Inc.

Gill, B., Walsh, L., Wulsin, C. S., Matulewicz, H., Severn, V., Grau, E., ... Kerwin, T. (2015). *Inside online charter schools. A report of the national study of online charter schools*. Mathematica Policy Research.

Gilmore, J. M. (2009). *The role of the principal in affecting student achievement* (Doctoral dissertation) (Order No. 3357421). Available from Education Database. (304917572).

Glass, G. V., & Welner, K. G. (2011). *Online K-12 schooling in the U.S.: Uncertain private ventures in need of public regulation.* Boulder, CO: National Education Policy Center. Retrieved from http://flaglerlive.com/wp-

content/uploads/onlineschooling.pdf

Golden, P. (1999). The development of the IBM ThinkPad, part I: Big blue's big adventure. *Electronic Business, 25*(1), 69–76.

Goldstein, H., & Blatchford, P. (1998). Class size and educational achievement: A review of methodology with particular reference to study design. *British Educational Research Journal, 24*(3), 255–268.

Graue, E., Hatch, K., Rao, K., & Oen, D. (2007). The wisdom of class-size reduction. *American Educational Research Journal*, *44*(3), 670–700.

Greenway, R., & Vanourek, G. (2006). The virtual revolution: Understanding online schools. *Education Next, 6*(2), 34–41.

Gustke, C. (2010). Virtual ed. biz seeks mainstream. *Education Week, 29*(36), 1.

Guterl, F. (1984). Design case history: Apple's Macintosh. *IEEE Spectrum, 21*(12), 34.

Hanasky, W. (2010). *Virtual programs and their impact on Appalachian Ohio high schools* (Doctoral dissertation). (Order No. 3420369). Available from ProQuest Central: ProQuest Dissertations & Theses Global. (749230473).

Hawkins, A., Barbour, M. K., & Graham, C. R. (2011). Strictly business: Teacher perceptions of interaction in virtual schooling. *Journal of Distance Education (Online), 25*(2), 1–15.

Hickmon, S. A. (2015). *Skill sets, dispositions, and administrative behaviors of K–12 school administrators operating in a virtual learning environment* (Doctoral dissertation). (Order No. 10297466). Available from ProQuest Dissertations & Theses Global. (1846968099).

Holas, I., & Huston, A. C. (2012). Are middle schools harmful? The role of transition timing, classroom quality and school characteristics. *Journal of Youth and*

Adolescence, *41*(3), 333–345.

Holmes, K. E. (2013). *Influences of parental expectations and involvement on academic success* (Doctoral dissertation). Retrieved from http://csus-dspace.calstate.edu/handle/10211.9/2116

Howley, C., Strange, M., & Bickel, R. (2000). Research about school size and school performance in impoverished communities. ERIC digest ERIC/CRESS, P.O. Box 1348, Charleston, WV 25325-1348.

Hussar, W. J., & Bailey, T. M. (2013) Projection of education statistics to 2021. Retrieved from http://nces.ed.gov/pubs2013/2013008.pdf

Iatarola, P., Schwartz, A. E., Stiefel, L., & Chellman, C. C. (2008). Small schools, large districts: Small-school reform and New York City's students. *Teachers College Record, 110*(9), 1837–1878.

Jaska, P., Hogan, P., & Wen, Z. (2009). Academic accountability in Texas public schools: 2003-2007. *Contemporary Issues in Education Research, 2*(4), 59–64.

Johnson, B., & Christensen, L. (2014). *Educational research: Quantitative, qualitative, and mixed approaches*. Thousand Oaks, CA: Sage.

Journell, W. (2012). Walk, don't run to online learning. *Phi Delta Kappan, 93*(7), 46–50.

K12 online public school FAQ. (2017a). Retrieved from http://www.k12.com/faqs/online-public-school.html

K12 student activities and support. (2017b). Retrieved from http://www.k12.com/k12-schools/student-activities-support.html

Kennedy, K., & Archambault, L. (2012) Offering Preservice Teachers Field Experiences in K-12 Online Learning A National Survey of Teacher Education Programs. *Journal of Teacher Education 63*(3), 185–200. Retrieved from

http://journals.sagepub.com/doi/abs/10.1177/0022487111433651

Kontos, G. (1995). Presented from International Conference on Technology and Education. *Employing the power of technology to change the concept of the classroom*. Orlando, FL. 4.

Koprowski, G. (1999). A brief history of web advertising. *Forbes*, 8–15.

Lanier, K. O. (2000). Annual Meeting of the American Educational Research Association. *"Hearken to the sound of the trumpet." "A nation at risk" as an American Jeremiad.* 5.

Lee, V. E., & Smith, J. B. (1997). High school size: Which works best and for whom? *Educational Evaluation and Policy Analysis, 19*(3), 205–227. http://dx.doi.org.ezproxylocal.library.nova.edu/10.2307/1164463

Leithwood, K., & Jantzi, D. (2009). A review of empirical evidence about school size effects: A policy perspective. *Review of Educational Research*. 79(1), 464-490.

Lenear, B. C. (2013). *School district size and academic performance: A multi-year study* (Doctoral dissertation). (Order No. 3575108). Available from ProQuest Dissertations & Theses Global: Social Sciences.

Leslie, S. R., & Scherff, L. (2012). NCLB 10 years later. *English Education, 44*(2), 91–101. Retrieved from http://www.ncte.org/library/NCTEFiles/Resources/Journals/EE/0442-jan2012/EE0442Opening2.pdf

Lonn, S., & Teasley, S. D. (2009). Saving time or innovating practice: Investigating perceptions and uses of learning management systems. *Computers & Education, 53*(3), 686–694.

Lopez, W. J. (2006). *Teaching in a hybrid online high school environment: A case study of five school teachers* (Doctoral dissertation). (Order No. 3213346). Available

from ProQuest Dissertations & Theses Global.

Lorence, J. (2010). Trait validity and reliability of TAAS reading scores: 1994-1999. *Educational Research Quarterly, 34*(2), 18–59.

Lovvorn, A. S., Barth, M. M., Morris, F. R., & Timmerman, J. E. (2009). Lessons learned from lessons learned: The fit between online education "best practices" and small school reality. *Online Journal of Distance Learning Administration, 12*(4), 15.

Lowe, R. (2012). "…But the light's better here," he said: Mischance, misapplication and misdirection in data-driven applications (Doctoral dissertation). (Order No. 3543593). Available from ProQuest Dissertations & Theses Global: Social Sciences.

Luskin, B. J., & Small, J. (1980). *Coastline community college: An idea beyond tradition.*

Mangino, E. (1986). *The TEAMS report 1986. Texas educational assessment of minimum skills*(56). (No. AISD-ORE-85.59).

Manzo, K. K. (2009). Fla. budget threatens online ed. mandate. *Education Week, 28*(30), 1, 12–13.

Marshall, A. (1961). *Principles of economics*. New York, NY: Macmillan for the Royal Economic Society.

Mart, D. T. (2011). *Perceived district-level leadership influences upon student achievement* (Doctoral dissertation). Available from ERIC. (1037909929; ED533503).

McGhee, R. M. H. (2010). *Asynchronous interaction, online technologies self-efficacy and self-regulated learning as predictors of academic achievement in an online class* (Doctoral dissertation). (Order No. 3453755). Available from ProQuest Education Journals.

McMillen, B., Zhang, G., Cobb, C., Williamson, G., Kaase, K., Williams, J., & Feifs, H. (2000). School size and its relationship to achievement and behavior. *Public Schools of North Carolina, Division of Accountability Services, Evaluation Section*.

McNally, S. R. (2012). *The effectiveness of Florida virtual school in terms of cost and student achievement in a selected Florida school district* (Doctoral dissertation). (Order No. 3569631). Available from ProQuest Dissertations & Theses Global: Social Sciences.

McNeil, L., & Valenzuela, A. (2000). *The harmful impact of the TAAS system of testing in Texas: Beneath the accountability rhetoric* (Research Report). (2).

McNeil, M. (2012). Ed. dept. gears up to manage NCLB waiver oversight. *Education Week*, *32*(2), 16–17.

Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2010). *Evaluation of evidence-based practices in online learning: A meta-analysis and review of online-learning studies.* Washington, DC: U.S. Department of Education.

Meet the man who invented the instructions for the internet. (2012). Retrieved from https://www.wired.com/2012/05/steve-crocker/

Millet, J.A. (2012). Virtual learning in k-12 education: Successful instructional practices and school strategies (Doctoral dissertation). (Order No. 3497822). Available from ProQuest Central; ProQuest Dissertations & Theses Global.

Mills, C. R., (2011). *Online & virtual education [electronic resource]: its effectiveness impact on high school mathematics and science students* (Doctoral dissertation). Retrieved from http://scholarworks.montana.edu/xmlui/handle/1/1880

Miron, G., & Urschel, J. L. (2012*). Understanding and improving full-time virtual*

schools: A study of student characteristics, school finance, and school performance in schools operated by K12 Inc. [with appendices]. Boulder, CO: National Education Policy Center.

Morris, D. (2008). Economies of scale and scope in E-learning. *Studies in Higher Education*, 33(3), 331–343.

Much, M. (2013). At home K-12 online education gaining a foothold nationally K12 Herndon, Virginia. *Investor's Business Daily*.

Murphy, K. R. (2012). Validity for what? The peril of overclarifying. *Measurement: Interdisciplinary Research and Perspectives, 10*(1), 3.

Nespor, J., & Voithofer, R. (2016). Failure irrelevant: Virtual schools and accountability-immunity. *Teachers College Record, 118*(7) 1–28.

Osorio, P. E. (2013). *Effective school practices which foster academic success for English language learners: Perceptions of elementary school principals and teachers* (Doctoral dissertation). (Order No. 3570997). Available from ProQuest Dissertations & Theses Global.

Peters, D. M. (2016). Software, hard impact. *Industrial Heating*, *8*(6), 6.

Pittman, V. V. (1986). International Conference on the History of Adult Education. *Pioneering instructional radio in the U.S.: Five years of frustration at the University of Iowa*, 1925-1930. Oxford, England.

Pospisil, V. (1999). Who invented the computer? *Industry Week*, *248*(13), 14.

Reio, T. G. (2016). Nonexperimental research: Strengths, weaknesses and issues of precision. *European Journal of Training and Development*, *40*(8), 15.

Richardson, A., & Terrell, E. (2008). Business Reference Services. This Month in Business History. The Apple Computer Inc. The Library of Congress,

Researchers. Retrieved from https://www.loc.gov/rr/business/businesshistory/April/apple.html

Riew, J. (1996). *Economies of scale in high school operation. The Review of Economics and Statistics, 48*(3), 280–287.

Riggen, V. (2013). *School size and student achievement* (Doctoral dissertation). (Order No. 3589555). Available from ProQuest Dissertations & Theses Global: Social Sciences.

Sable, M. E. (2016). *A mixed method examination of student achievement indicators* (Doctoral dissertation). (Order No. 10014927). Available from ProQuest Dissertations & Theses Global.

Schools open doors to new eLearning rules, ideas. (2012). *Education Week, 32*(2), 16.

Scott, J. C. (2005). The Chautauqua vision of liberal education. *History of Education, 34*(1), 41–59.

Sergiovanni, T. J. (1995). Small schools, great expectations. *Educational Leadership, 53*(3), 48.

Simonson, M. (2004). Class size: Where is the research? *Distance Learning, 1*(4), 56.

Slate, J. R., & Jones, C. H. (2005). Effects of school size: A review of the literature with recommendations. *Essays in Education, 13*(1), 1–24.

Smith, D. K., & Alexander, R. C. (1999). Fumbling the future: How Xerox invented, then ignored, the first personal computer. iUniverse. Lincoln, NE.

Sorting through online learning options: A guide for parents. (2009). Vienna, VA: International Association for K-12 Online Learning.

STAAR Vertical Technical Report. (2013). State of Texas Assessments of Academic Readiness. TEA.

Stiefel, L., Schwartz, A. E., Iatorola, P., & Chellman, C. C. (2008). Mission matters: The Cost of Small High Schools Revisited. IESP Working Paper# 08-03. Institute for Education and Social Policy, New York University.

Subramaniam, N. K., & Kandasamy, M. (2011). The virtual classroom: A catalyst for institutional transformation. *Australasian Journal of Educational Technology, 27*(8), 25.

Texas Administrative Code. (2017a). Chapter 70. Technology-Based Instruction. Subchapter AA. Commissioner's Rules Concerning the Texas Virtual School Network. §70.1011. Texas Virtual School Network Online School Program Requirements. (e)(14) (TxVSN) Retrieved from http://ritter.tea.state.tx.us/rules/tac/chapter070/ch070aa.html

Texas Administrative Code. (2017b). Chapter 100. Charters. Subchapter AA. Commissioner's Rules Concerning Open-Enrollment Charter Schools. Division 1. General Provisions. §100.1207. Student Admission (f) Maximum enrollment. Retrieved from: http://ritter.tea.state.tx.us/rules/tac/chapter100/ch100aa.html#division6

Texas educational assessment of minimum skills. (1987). Student performance results for 1985 and 1986.

Texas Connections Academy @ Houston. (2017). Retrieved from http://www.connectionsacademy.com/texas-virtual-school

Texas Educational Agency. (2017a). Texas virtual schools program-Online schools network. Retrieved from https://tea.texas.gov/Academics/Learning_Support_and_Programs/Texas_Virtual_School_Network/Texas_Virtual_School_Network_-_Online_Schools_Program/

Texas Educational Agency. (2017b). Texas Education Agency Glossary of Acronyms. Retrieved from http://tea.texas.gov/About_TEA/Glossary_of_Acronyms/

Texas Educational Agency. (2017c). Performance reporting division. Retrieved from http://tea.texas.gov/accountability/

Texas Educational Agency. (2017d). School report cards. Retrieved from http://tea.texas.gov/perfreport/src/index.html

Texas Educational Agency. (2017e). Student testing and accountability. Retrieved from http://tea.texas.gov/Student_Testing_and_Accountability/Testing/

Texas Educational Agency. (2017f). State of Texas assessments of academic readiness. Retrieved from http://tea.texas.gov/student.assessment/staar/

Texas Educational Agency. (2017g). Student enrollment reports. Retrieved from https://rptsvr1.tea.texas.gov/adhocrpt/adste.html

Texas Educational Agency. (2017h). Texas essential knowledge and skills. Retrieved from http://tea.texas.gov/curriculum/teks/

Thomas, W. R. (2008). *Making the critical transition to stable funding for state virtual schools*. Atlanta: GA: Southern Regional Education Board.

Thompson, S. M. (2011). *School size, school poverty and school-level mobility: Interactive threats to school outcomes* (Doctoral dissertation). (Order No. 3447911). Available from Education Database.

Tucker, B. (2009). Florida's online option. *Education Next, 9*(3), 12–18.

Vernon, N. (2013). *The study of success of individuals with exceptional needs in Tennessee virtual academy in grades 5-8* (Doctoral dissertation). (Order No. 3611440). Available from ProQuest Dissertations & Theses Global.

Vicheanpanya, J. (2014). E-learning management system model for Thai society.

International Journal of Information and Education Technology, *4*(1), 67.

Waters, L. H., Barbour, M. K., & Menchaca, M. P. (2014). The nature of online charter schools: Evolution and emerging concerns. *Educational Technology & Society*, *17*(4), 379–389.

Watson, J. (2008). *Blended learning: The convergence of online and face-to-face education. Promising practices in online learning.* Vienna, VA: North American Council for Online Learning.

Watson, J., & Gemin, B. (2009). *Management and operations of online programs: Ensuring quality and accountability. Promising practices in online learning.* Vienna, VA: International Association for K-12 Online Learning.

Watson, J., Murin, A., Vashaw, L., Gemin, B., & Rapp, C. (2011). *Keeping pace with K-12 online learning: An annual review of policy and practice.* Durango, CO: Evergreen Education Group.

Watson, J., & Pape, L. (2015). *School accountability in the digital age. Keeping pace with K-12 digital learning. Policy brief.* Vienna, VA: Evergreen Education Group.

Weiss, C. C., Carolan, B. V., & Baker-Smith, E. (2010). Big school, small school: (re)testing assumptions about high school size, school engagement and mathematics achievement. *Journal of Youth and Adolescence*, *39*(2), 163–176.

Whannell, R., & Allen, W. (2011). High school dropouts returning to study: The influence of the teacher and family during secondary school. *Australian Journal of Teacher Education*, *36*(9), 22–35.

Wilson, C. (2010). *An examination of assessment scores between students who attend public schools and students who were homeschooled prior to entering a virtual charter school* (Doctoral dissertation). (Order No. 3405772). Available from

Education Database; ProQuest Dissertations & Theses.

Wolfinger, S. (2016). *An exploratory case study of middle school student academic achievement in a fully online virtual school* (Doctoral dissertation). (Order No. 10129096). Available from ProQuest Dissertations & Theses.

Wu, H., Hsu, Y., & Hwang, F. (2008). Factors affecting teachers' adoption of technology in classrooms: Does school size matter? *International Journal of Science and Mathematics Education, 6*(1), 63–85.

Wu, M. (2010). Measurement, sampling, and equating errors in large-scale assessments. *Educational Measurement, Issues and Practice*, *29*(4), 15.

Zoda, P., Slate, J. R., & Combs, J. P. (2011). Public school size and Hispanic student achievement in Texas: A 5-year analysis. *Educational Research for Policy and Practice, 10*(3), 171–188.