# DIFFERENCES IN MAP PERFORMANCE OF ONLINE AND SEATED FIFTH-GRADE STUDENTS IN MISSOURI ELEMENTARY SCHOOLS

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The undersigned, approved by the Department Chair of Graduate Studies in Education, have examined a dissertation entitled:

DIFFERENCES IN MAP PERFORMANCE OF ONLINE AND SEATED FIFTH-GRADE STUDENTS IN MISSOURI ELEMENTARY SCHOOLS

Presented by Nathan Carter a candidate for the degree of Doctor of Education

and hereby certify that in their opinion it is worthy of acceptance.

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# DIFFERENCES IN MAP PERFORMANCE OF ONLINE AND SEATED FIFTH-GRADE STUDENTS IN MISSOURI ELEMENTARY SCHOOLS

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A Dissertation
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The Faculty of the Graduate Education Department
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Doctor of Education

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By

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## ACKNOWLEDGMENTS

In our first doctoral class we were given the task of describing the journey from that point to dissertation defense. As a group we described the dissertation journey in several different ways: climbing a mountain, becoming a new parent, and moving to a foreign country were a few of the highlights. As this journey ends I cannot help but describe my journey as the completion of a triathlon. There were many points where I simply felt like giving up, but with the help of a great support system I kept going.

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"Let us not become weary in doing good, for at the right time we will reap a harvest if we do not give up." Galatians 6:9 (NIV)

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## ABSTRACT

Michael Simonson's equivalency theory provided support for this study. Simonson's equivalency theory is built around the idea that while there should be different learning experiences for online and seated students, those learning experiences should be equivalent. Equivalency theory includes equivalency, learning experiences, appropriate application, students, and student outcomes. The independent variable used in this study was whether fifth graders were online students or seated students; online students are generally defined as students enrolled in an approved Missouri Course Access and Virtual School Program (MOCAP) provider course. The dependent variable used in this study was student achievement/outcomes as measured by fifth-grade MAP assessment scores. This study used the percentage of students who scored proficient and advanced on fifth-grade ELA, Math, and Science MAP assessments. An ex post facto quantitative causal-comparative methodology was used to complete the study. Student achievement scores were analyzed from the 2020-2021 school year. This study was guided by three main research questions. What is the difference in fifth-grade proficient and advanced English Language Arts MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year? What is the difference in fifth-grade proficient and advanced Math MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year? What is the difference in fifth-grade proficient and advanced Science MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year? In the areas of Math and Science, full-time virtual students had statistically significantly lower performance than full-time seated

students. In the area of ELA, full-time virtual student and full-time seated student performance differences were not statistically significant.

# CHAPTER ONE

## INTRODUCTION

"The Internet is unquestionably one of the most important driving forces of change in the contemporary world" (Warf, 2019, p.77). Taking advantage of this driving force, Missouri has taken steps to provide Missouri's elementary students with different and unique educational opportunities. One way of delivering on this is through online or virtual courses. Online courses and cyber schools have quickly grown in popularity (Borup et al., 2019; Chapman, 2018; Hornbeck et al., 2019; Mann et al., 2021; Molnar et al., 2019). In Missouri, online courses are accessible to all Missouri students through the state's online school, Missouri Course Access and Virtual School Program (MOCAP).

Missouri Virtual Instruction Program was established in 2007 as Missouri's designed online school. Renamed Missouri Course Access and Virtual School Program, it provides, provides every student in the state the opportunity to take courses taught by Missouri-certified teachers from an internet-connected device 24 hours a day, seven days a week. Missouri Course Access and Virtual School Program's mission is to "offer Missouri students equal access to a wide range of high-quality courses and interactive online learning that is neither time nor place dependent" (MOCAP, para. 1 n.d.)

Enrollment in MOCAP courses has been up and down since its establishment. At the time of this study, 623 course enrollments were the lowest, while 1,872 course enrollments were the highest. In addition, 764 students represented the course enrollment of 1,872. With 764 students taking 1,872 course enrollments, students in Missouri took an average of 3.4 online courses per enrolled student during the highest enrolled school

year. The average online courses per enrolled student for states studied during the corresponding school year was 1.2; Missouri students exceeded the average, but Missouri students had the highest average for online courses per enrolled student of any state studied. English Language Arts (ELA), Math, Science, and Social Studies accounted for just under half of all enrollments during the highest enrollment school year (Digital Learning Collaborative, 2019).

With the increase in online educational program availability at the elementary level, parental and student response to the global pandemic caused by COVID-19 online course enrollment has the potential to rise. As the popularity and availability of online educational programs continue to increase, quality research is needed to determine the effectiveness of online education for elementary students (Arnesen et al., 2019; Darmiany & Maulyda, 2022; Iswan & Sari, 2022; Mann et al., 2021; Molnar et al., 2019; Shagiakhmetova et al., 2022). Results from this research project have the potential to guide future educational policy and practice within the online education sector. In addition, the researcher sought to see if statistically significant academic achievement differences existed between full-time online and full-time seated students at the elementary level. In addition, the availability of online learning for elementary students in Missouri is in its early stages. This study can help determine the appropriate place for online education for Missouri elementary students. Finally, a causal-comparative methodology was used for this study. Chapter One includes a brief description of the theoretical framework used in this study, a problem statement, the purpose of the study, research questions, hypothesis, significance of the study, definitions of terms, limitations and delimitations, assumptions, and design controls.

## Theoretical Framework

Michael Simonson's (1995) equivalency theory provided the support for this study. Simonson's equivalency theory is built around the idea that while there should be different learning experiences for online and seated students, those learning experiences should be equivalent (Simonson et al., 1999). Equivalency theory includes equivalency, learning experiences, appropriate application, students, and student outcomes. Distance education has existed in different forms since the 1840s, but the theoretical base for distance education was left unfilled through the 1970s (Simonson, 2019). Simonson's (1995) equivalency theory was built upon previous theories. Central to equivalency theory is the belief that distance and local students should have equivalent learning experiences, and students with equivalent learning experiences should have equivalent learning outcomes. Since distance learners are experiencing a different environment than local learners, they should experience different learning experiences. Designers of distance learning experiences should consider the unique needs of their students; as a result of these considerations, distance learners might access other learning activities, resources, and other strategies than those of their local counterparts. Distance learning experiences should not be identical but equivalent to local students' outcomes (Simonson et al., 2011, 2015).

Simonson's (1995) equivalency theory guided this study. Literature centered around the performance of seated and online students, student experience in online and seated courses, and how government policy has impacted online and seated education. Examining learning outcomes is needed to determine if online and seated elementary students have equivalent learning outcomes. Achievement levels on standardized tests are

one way to determine learning outcomes in Missouri. Missouri Assessment Program (MAP) is the standardized test used at the elementary level. Missouri Assessment Program tests are written based on approved Missouri Learning Standards. Missouri Learning Standards are approved by the Missouri Department of Elementary and Secondary Education (MODESE), an extension of the state government.

**Problem Statement**

As of 2020, virtual state schools were operational in 21 states. Of those 21 states, North Dakota, South Carolina, and Missouri were the only states to offer virtual options for K-12 students (Digital Learning Collaborative, 2019; The Foundation for Blended and Online Learning, 2018). Missouri Course Access and Virtual School Program, established in 2007, is Missouri's state virtual school. Through this online school, students from across the state have access to high-quality online classes that meet students' individual needs and courses that might not be available through their local school districts.

As the popularity of online educational opportunities has grown, research on the impact of student achievement has lagged (Arnesen et al., 2019; Hart et al., 2019; Iswan & Sari, 2022; Molnar et al., 2021; Taylor & McNair, 2018). For elementary students, full-time virtual learning opportunities are being realized (Digital Learning Collaborative, 2019; Foundation for Blended and Online Learning, 2018; Iswan & Sari, 2022). The problem is that the differences in achievement between full-time Missouri elementary seated students and Missouri elementary full-time online students are currently unknown. For example, suppose full-time virtual students' achievement differs significantly from full-time seated students. In that case, an argument could be made that full-time virtual

learning is inappropriate for elementary students. However, suppose the achievement of full-time virtual students is not significantly different from full-time seated students. In that case, an argument could be made that either mode of instruction is appropriate for elementary students. This study will help fill the gap in determining performance differences between full-time online and full-time seated elementary students in Missouri.

Missouri Learning Standards are provided for teachers and students in core and elective subjects. Standards for core subjects (ELA, Math, Science, and Social Studies) are further divided by grade-level groupings. K-5 and 6-12 standards are provided. Fifth grade was selected for research because standards change after fifth grade, and students are assessed in ELA, Math, and Science during their fifth-grade year. Each year students in fifth grade are assessed using MAP sponsored by the Department of Elementary and Secondary Education (MODESE, n.d.). For the 2019 testing cycle, 40.3% of fifth graders tested in the proficient/advanced category for math, 47.1% of fifth graders tested in the proficient/advanced category for ELA, and 42.5% of fifth graders tested in the proficient/advanced category for science. While online and seated students are exposed to the same learning standards by a Missouri-certified teacher, differences in academic outcomes have yet to be determined. This study was needed to determine if a performance difference exists between full-time online elementary students and full-time seated elementary students.

**Purpose of the Study**

The purpose of this causal-comparative study was to test Simonson's (1995) equivalency theory by comparing fifth grade full-time online elementary students and

fifth grade full-time seated elementary students in terms of achievement as measured by MAP scores in the state of Missouri. In this study, the researcher compared the achievement outcomes of full-time online fifth-grade students to the achievement outcomes of full-time seated fifth-grade students. Determining differences in achievement outcomes of full-time online and full-time seated fifth-grade students would help determine students' equivalent learning experiences, which applies directly to equivalency theory (Simonson, 1995).

The dependent variable used in this study was student achievement/outcomes as measured by fifth-grade MAP assessment scores. Student achievement categories for MAP assessments are below basic, basic, proficient, and advanced. This study used the percentage of students who scored proficient and advanced on fifth-grade ELA, Math, and Science MAP assessments. Student achievement data were requested at the district level. The independent variable used in this study was whether fifth graders were online students or seated students; online students are generally defined as students enrolled in an approved MOCAP provider course.

**Research Questions**

The purpose of this study was to determine the difference in proficient and advanced achievement levels for online fifth-grade students as measured by MAP scores versus achievement levels of proficient and advanced for seated fifth-grade students as measured by MAP scores. The following research questions guided the study:

RQ1: What is the difference in fifth-grade proficient and advanced English Language Arts MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year?

RQ2: What is the difference in fifth-grade proficient and advanced Math MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year?

RQ3: What is the difference in fifth-grade proficient and advanced Science MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year?

**Null Hypotheses**

($H_0$1): There will be no statistically significant difference between proficient and advanced fifth-grade English Language Arts MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year.

($H_0$2): There will be no statistically significant difference between proficient and advanced fifth-grade Math MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year.

($H_0$3): There will be no statistically significant difference between proficient and advanced fifth-grade Science MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year.

**Significance of the Study**

Missouri Statue 161.670. grants all full-time Missouri students access to online educational opportunities through the MOCAP platform (Revisor of Missouri, 2018). However, research has not been able to keep up with enrollment gains in online learning (Hart et al., 2019). There is a gap in the literature focusing on virtual elementary students' performance compared to seated elementary students' performance; therefore, this study is significant. Available research has been limited and mainly confined to secondary and postsecondary students (Hart et al., 2018, 2019; C.-H., Lin et al., 2019; Xu & Jaggers,

2013). Studies completed at the secondary level have focused on the differences between course environments, course enrollment numbers, and course demographics (Cavalluzzo et al., 2012; Heppen et al., 2017; C.-H., Lin et al., 2019). This study will contribute to the already established online student achievement literature base (Cavalluzzo et al., 2012; Hart et al., 2018, 2019; Heppen et al., 2017; Ch.-H., Lin et al., 2019; Molnar et al., 2021; Xu & Jaggers, 2013). This study will expand the literature base to include elementary students, an age group currently missing from online student achievement literature.

At the time of this research, Missouri was one of three states to offer elementary online course offerings through a state-run virtual school. Missouri's state-run virtual school is overseen by MODESE. All online course vendors and individual courses must be vetted to meet specific criteria before being offered to Missouri students. Additionally, all online courses offered in Missouri are taught by a Missouri-certified teacher (MODESE n.d.).

Within Missouri, knowing the difference in academic performance of full-time online and full-time seated elementary students is essential. State policymakers, in addition to local boards of education, district and building-level administrators, and parents could use the findings from this study when determining the best educational interest placement for elementary students. Beyond Missouri, this study could help other states effectively determine the appropriate oversight needed to implement online course offerings at the elementary level.

**Definition of Key Terms**

Key terms relevant to this study have been defined. Key terms include the key term and the definition of the key term.

**Full-Time Online Student.** Students who take all their courses through an online organization (Barbour, 2009).

**Online/Virtual School.** Schools where all or most of teaching and learning happens online (Watson et al., 2011).

**Synchronous Learning.** Online learning where students interact with teachers and peers during live class sessions (Keaton & Gilbert, 2020).

## Limitations

Limitations were as follows:

- Accuracy of provided MAP data
- Reliability of MAP scores based on Data Recognition Corporation (DRC) protocols
- DESE data protocols and internal controls
- Lack of MAP data for spring 2020 caused by COVID-19
- The number of fifth-grade elementary students enrolled in MOCAP courses
- Student efforts on MAP assessments throughout Missouri
- Student testing environments throughout Missouri
- MOCAP provider students used for online instruction
- Prior experience in online course format

## Delimitations

Delimitations were as follows:

- Fifth-grade students enrolled at public school districts in Missouri
- Fifth-grade ELA, Math, and Science MAP scores for 2019, 2021, & 2022

- Every fifth-grade student eligible to take MAP assessments
- English Language Arts, Math, and Science scores
- District average composite scores
- Fifth graders enrolled in virtual education for the entire year. Fifth graders enrolled in virtual education for part of the year were considered seated students.
- Theoretical Framework

**Assumptions**

Assumptions were as follows:

- DESE databases were up-to-date and accurate.
- All students were taught the same Missouri Learning Standards.
- All students gave their best effort on MAP assessments.

**Design Controls**

This qualitative, causal-comparative study looked at the differences between achievement scores of full-time online elementary students and full-time seated elementary students. The study was based on Simonson's equivalency theory (1995) that seated and online students should have equivalent learning experiences that lead to equivalent learning outcomes. A sample *t* test was used to compare student achievement scores of full-time online elementary students and full-time seated students. Provided MAP data were assumed to be accurate and reliable. Grade-level assessment technical reports are provided for each testing year to ensure grade-level tests are accurate and reliable. Internal controls from DESE require data with a value less than 5 to be suppressed. Districts with less than five online fifth graders would have their online and

seated MAP data suppressed by DESE. MAP data from 2019-2020 were not included as MAP was not taken in the spring of 2020 due to school shutdowns caused by COVID-19. Online students in Missouri can choose their online experience from an approved vendor through MOCAP. Missouri districts utilize established DESE testing protocols when giving MAP assessments. Student effort, prior experience in online courses, and student testing environments were limitations for this study.

Data were examined for achievement differences during the 2020-2021 and 2021-2022 school years. Compared data were collected from Missouri, public school fifth-grade students who took ELA, Math, and Science MAP assessments. Percentages of students scoring proficient and advanced were used. Data were requested at the district level. Collected data were provided by DESE after a data request form was completed and free from researcher influence. The independent variable for this study was the course delivery method; some students enrolled in fifth grade through an online provider while others enrolled in fifth grade in a seated format. Students enrolled through an approved online provider were assigned a specific program code provided by DESE.

While Missouri Learning Standards are specific to Missouri students, generalizations can be made for other states about equivalent learning experiences. Exposure to Missouri Learning Standards is a requirement of all MOCAP-approved courses. MAP data were accurate and valid based on established controls set up by DESE. To avoid bias, MAP data that had already been collected by DESE were used (MODESE, n.d.). MAP data were collected every spring; once MAP assessments are completed, data are sent directly to DESE without interference from local school districts. Since the data were collected and housed in the DESE database, the data were free from

researcher influence. DESE designated students that took online courses with a program code of 50 or 52. Students that transitioned back to a seated environment during the school year were considered seated students; only students that stayed in an approved MOCAP provider the entire year were considered online students. Data request forms were sent to DESE to access scores and placement during the studied year. DESE provided the requested data to complete the research project when received and processed. As MAP assessments are state assessments and given regularly, students were assumed to have given their best effort.

**Summary**

"The Internet is unquestionably one of the most important driving forces of change in the contemporary world" (Warf, *Journal of Geography* 2019, pg. 77). Missouri Virtual Instructional Program was established in 2007 as Missouri's designed online school. Renamed Missouri Course Access and Virtual School Program (MOCAP), it provides every student in the state the opportunity to take courses taught by Missouri-certified teachers from an internet-connected device 24 hours a day, 7 days a week. Simonson's equivalency theory is built around the idea that while there should be different learning experiences for online and seated students, those learning experiences should be equivalent (Simonson et al., 1999). Critical factors of equivalency theory are the concept of equivalency, learning experiences, appropriate application, students, and outcomes. The purpose of this causal-comparative study was to test Simonson's (1995) equivalency theory by comparing fifth-grade full-time online elementary students and fifth-grade full-time seated elementary students in terms of achievement as measured by MAP scores in the state of Missouri. Differences in academic achievement for fifth

graders as measured by math, ELA, and science scores were used for this study. This study will fill the gap in literature where a comparison of student achievement between seated and virtual elementary students is needed. With the increase in full-time online student enrollment at the elementary level, this study was needed to guide leaders and policymakers in future decision-making processes (Miron et al., 2018).

Chapter Two of this study contains a review of literature organized by theme. The literature review includes the history of online education, rural student challenges, and online learning effectiveness. Chapter Three outlines the methodology used for this study. The methodology contains methods, design, and data analysis. Chapter Four presents the findings of this study. Analysis of results, researcher's interpretations, and recommendations for further studies are presented in Chapter Five.

# CHAPTER TWO

## REVIEW OF RELATED LITERATURE

The leading source of 24-hour access to vital information is the internet. The availability has impacted every aspect of human life to information provided through reliable internet access (Abubakar & Salmanu, 2018; Ilgaz & Gülbahar, 2020). With decreasing internet access costs, more people can access information. Educational companies, leaders, teachers, and students have taken full advantage of reliable internet access; students now have access to new communication, research, and educational opportunities (Aslan & Karakus Yilmaz, 2021; Ilgaz & Gülbahar, 2020). Online education is an educational opportunity that has grown in popularity. Missouri statue 161.670 grants all full-time Missouri students access to online educational opportunities through the MOCAP platform (Missouri Revisor of Statutes, 2018). While the popularity of online/virtual education has increased, research focusing on the effectiveness of online/virtual education has been limited. Studies examining the performance of elementary online/virtual students have been nearly nonexistent (Arnesen et al., 2019; Hart et al., 2018, 2019; C.-H. Lin et al., 2019; Xu & Jaggers, 2013). Michael Simonson (1995) argued that online/virtual learners' outcomes should be equivalent to seated learners' outcomes.

The first section of this literature review will outline the theoretical framework used for this study. Simonson's (1995) equivalency theory provided the theoretical framework for this study. The history of online/virtual education and the global response to COVID-19 are included. After the history of online/virtual education, students' demographic trends in online courses are provided. Next is an explanation of overall

student learning experiences in online learning formats; this section describes course design. Next, federal and state accountability measures are discussed. After accountability, student achievement on international, national, and state assessments is provided. Student achievement in virtual schools follows. Chapter Two finishes with a summary and describes what will come in Chapter Three, Chapter Four, and Chapter Five.

**Equivalency Theory**

Distance education has existed in different forms since the 1840s, but the theoretical base for distance education was left unfilled through the 1970s (Simonson, 2019). Holmberg (1985) stated that a theoretical framework was needed for distance education to make confident decisions. Keegan (1986) and Moore (1994) expressed concern that distance education would weaken and make slow progress without describing and defining distance education. Keegan (1996) published *The Foundations of Distance Learning,* which classified three types of distance learning theory: theories of independence and autonomy, theories of industrialization of teaching, and theories of interaction and communication. Wedemeyer's (1981) theory of independent study outlined 10 characteristics of technology adoption and learner independence, six characteristics of independent study systems, and four elements present in every episode of teaching and learning. Formulated first in the 1970s and later built upon, Moore's (1989) theory of independent study and theory of transactional distance center on the ideas of the distance between teacher and learner and the amount of autonomy for the learner. Peters' (1988) theory of industrialization of teaching looked at distance learning through the lens of industrial and economic theory. By comparing distance learning to the

production of goods, new terminology was developed, but Peters argued that pre-industrial distance learning could not have existed. Holmberg's (1985) theory of interaction and communication emphasized the relationship between students' feelings of cooperation, belonging, questioning, and teacher effectiveness; Holmberg presented seven assumptions related to his theory. In 1995 Holmberg revised his idea with the addition of eight new components. Keegan (1996) hypothesized that linking teachers and students from various locations creates a virtual classroom. Building upon previous theories and Keegan's hypothesis, Simonson's equivalency theory was born.

Equivalency theory is rooted in the American core values of education: use of classroom teachers as the facilitators of learning, small class sizes, local control, teacher and student rapport, and personalized learning (Simonson et al., 1999). Simonson's (1995) equivalency theory comprises several key components: equivalency, learning experience, appropriate application, students, and outcomes (Simonson et al., 1999). Central to equivalency theory is the belief that distance and local students should have equivalent learning experiences, and students with equivalent learning experiences should have equivalent learning outcomes. Simonson et al. (1999) argued that equivalent learning experiences are not identical learning experiences, and those who provide identical learning experiences are making mistakes. Simonson et al. (2011) added that when a regular course is converted to a distance-delivered system, the effectiveness of the distance-delivered course decreases. Distance and local learners should not have identical learning experiences because they are not in the same environment (Simonson et al., 1999). Since distance learners are experiencing a different environment than local learners, they should have different learning experiences. Designers of distance learning

experiences should consider the unique needs of their students. As a result of these considerations, distance learners might access other learning activities, resources, and strategies than their local counterparts to provide an overall learning experience equivalent to the distance and local learners (Simonson et al., 2011). Distance and local learners should experience learning activities appropriate for their setting, needs, instructional materials, and timing (Simonson et al., 1999). Outcomes, which are the measurable changes in the cognitive ability of each learner after taking a course or unit, are measured in two ways.

Instructor-determined outcomes come from student performance against specific course goals and/or objectives. Instructor-determined outcomes are demonstrated after the completion of a course or unit. Student-determined outcomes are specific to the learner and based on what the learner hopes to accomplish as a result of taking the course or unit; many times, student-determined outcomes show up in follow-up courses or specific job environments (Simonson et al., 1999). Distance learning experiences should not be identical but equivalent to local students regarding student outcomes (Simonson & Seepersaud, 2019). Acceptance and implementation of equivalency theory are critical to the approval of distance education. Until the public views distance and traditional learning as equivalent, distance learning will continue to be viewed as peripheral in education circles (Simonson et al., 1999).

**History of Online/Virtual Education**

Distance learning, now commonly known as online/virtual learning, dates to the 1800s (Caruth & Caruth, 2013; Palvia et al., 2018; Simonson et al., 2011; Vincenzes et al., 2019). Studying by correspondence was the first form of distance learning, started in

1873 by Anna Eliot Ticknor. The Society to Encourage Studies at Home allowed women to correspond with teachers via mail while completing their studies (Caruth & Caruth 2013; Hansen, 2017; Simonson & Seepersaud, 2019; Vincenzes et al., 2019). By the 1890s, colleges such as The University of Chicago and The University of Wisconsin started offering courses via correspondence. Student and faculty participation waned at the University of Chicago, and the program was closed by the 1900s (Simonson & Seepersaud, 2019; Vincenzes et al., 2019).

The 1920s marked two significant milestones in the history of distance learning. First, distance learning was introduced at the secondary level via The University of Nebraska. Second, there was a shift in delivery methods from the postal service to electronic communications (Palvia et al., 2018; Park & Shea, 2020; Simonson et al., 2011; Vincenzes et al., 2019). The popularity of radio significantly impacted education; in 1925, The University of Iowa offered the first credit-bearing radio course in the United States. Simonson and Seepersaud (2019) highlighted the popularity of radio station construction on college campuses; at the highest point, 176 radio stations were being used by colleges and universities for educational purposes.

A new decade brought advancements in technology. Continuing to be a pioneer in distance learning, The University of Iowa offered the first course via television in 1934. The popularity of television-based courses grew steadily during the 1950s and 1960s. Station access grew from 20 fixed-range channels to national access with the start of Columbia Broadcasting System (CBS) and National Broadcasting Company (NBC) (Palvia et al., 2018; Park & Shea, 2020; Simonson & Seepersaud, 2019; Vincenzes et al., 2019). Public Broadcasting System (PBS) was created in 1969 as the nation's first

national public television system. As a result, Coastline Community College opened its doors in 1970 as its first nonphysical televised campus (Vincenzes et al., 2019). Satellite communication made its debut in the 1960s and 1970s. This technology did not become cost-effective until the 1980s; once cost-effective, colleges and universities quickly utilized these technologies to offer courses in real-time. Satellite televised courses peaked by the end of the 1980s, with over 1,000 colleges and universities embracing this new technology.

In 1989 The University of Phoenix began using online technology through CompuServe (Palvia et al., 2018; Vincenzes et al., 2019). The internet development in the early 1990s created yet another shift in distance education. Vincenzes et al. (2019) pointed out that colleges and universities continued using the newest technology. Two years after the internet development, the first completely online university, Jones International University, offered five undergraduate programs and 24 graduate degrees. As the popularity of online courses continued to grow, course offerings failed to meet student expectations (Palvia et al., 2018). Online course providers introduced "blended" or "hybrid" courses, taking advantage of online and face-to-face formats. Currently, virtual providers utilize both synchronous and asynchronous course formats to meet the diverse needs of online students (Palvia et al., 2018; Park & Shea, 2020; Vincenzes et al., 2019). Synchronous instruction allows all students to access the curriculum simultaneously; platforms that make this possible include Google Hangouts, ZOOM, Skype, and Blackboard Collaborate.

Hansen (2017) and Palvia et al. (2018) described the newest wrinkle to online education, massive open online courses (MOOC) that have become popular in the last 10

years. Both private and public organizations are developing MOOCs to provide information in an organized manner for little or no tuition (Hansen, 2019). Virtual reality, augmented reality, competency-based curriculum, and centralized development models are hypothesized areas of future exploration for online students (Hansen, 2019).

Virtual learning was thrust into the spotlight during the spring of 2020. In response to the global pandemic caused by the spread of COVID-19, educational systems around the world quickly shifted instructional delivery methods as school facilities were forced to close (E. Anderson & Hira, 2020; Bhaumik & Priyadarshini, 2020; Hira & Anderson, 2021; Mann et al., 2021; Molnar et al., 2021; Moore-Beyioku, 2021; Spitzer & Musslick, 2021). COVID-19 spotlighted equitable internet access and quality online teaching (Husser et al., 2020; Irwin et al., 2021; Williams et al., 2021). Hira and Anderson (2021) pointed out that COVID-19 forced schools to shift education rather than temporality pause education, as is the case during natural disasters. With school closures impacting roughly 94% of the world's student population in over 190 countries, educational systems used various methods to meet student needs (Bhaumik & Priyadarshini, 2020; Cheng et al., 2020; Moore-Beyioku, 2021). Paper packets, video conferencing, and synchronous and asynchronous online learning were methods schools used to meet student needs (E. Anderson & Hira, 2020; Bhaumik & Priyadarshini, 2020; Moore-Beyioku, 2021; Williams et al., 2021). Teachers around the world were suddenly utilizing new teaching approaches; these new approaches forced educators to rely on each other to meet the needs of students (Kaiser & McKenna, 2021). The development of practical online courses is a lengthy process, and teachers were not afforded this timeframe in response to educational shifts caused by COVID-19. As a result of the quick

implementation of online learning in response to COVID-19, online learning has been described using different terms (Hodges et al., 2020). Emergency remote teaching, emergency remote learning, and social distance teaching are terms used to describe teaching during COVID-19 (E. Anderson & Hira, 2020; Bhaumik & Priyadarshini, 2020; Bozkurt & Sharma, 2020; Castro & George, 2021; Larson & Farnsworth, 2020; Withers et al., 2021). As the pandemic continued through the start of the 2020-2021 school year, 2 out of every 3 students in the United States started the year in a distance learning format (Irwin et al., 2021). Distance learning requires a device and reliable internet access. While access to devices and reliable internet has increased, students of color and low socioeconomic status continue to lack access to needed resources (Chennamsetti, 2020; Hussar et al., 2020; McGuinness, 2020). Schools and districts provided the necessary technology for needy students (T.C. Anderson, 2020; Irwin et al., 2021). Hussar et al. (2020) added that half of students without internet access did not see the need or importance of internet access. Bishop (2021) pointed out that regular student participation in online learning activities decreased during COVID-19. Students of color and low socioeconomic status regularly participated at the lowest rates. Further, while students prefer to take seated classes, online synchronous, online asynchronous, and hybrid formats have grown in popularity since the pandemic (Castro & George, 2021).

**Student Demographics of Online Students**

Technology has been described as the great equalizer in education (Guofang et al., 2018). Online courses are developed and implemented using new technologies. With the increase in online course availability, students have greater access to online learning opportunities. Greater access should help more diverse students in online learning

(Freidhoff, 2018; Jackson et al., 2021; Kennedy & Ferdig, 2018; Schilmoeller et al., 2018). Leichty (2021) added that basic equitable infrastructures must be in place before diverse populations of students take online courses. Students in rural areas are less likely to access broadband internet and internet-accessible devices (Guofang et al., 2018; Leichty, 2021). To help expand broadband opportunities in rural areas, the federal government implemented a support program known as E-Rate. This program helps rural school districts provide broadband internet access for students while at school. With the sudden closure of schools caused by COVID-19, rural students were sent home and left without broadband internet access. Through local funds and CARES Act money, districts provided rural students with mobile hotspots and internet-ready devices to continue learning at home. Even with these supports, some students in rural areas struggled with accessibility during COVD-19 (T.C. Anderson, 2020; Irwin et al., 2021; Leichty, 2021). Jackson et al. (2021) pointed out that teachers who recognize the demographic makeup of their class and have the proper training are better able to adapt learning experiences to meet the diverse needs of their students. Adjusting learning experiences to meet the different needs of students is a component of Simonson's (1995) equivalency theory.

Demographic trends for virtual school students have started gaining state and national attention (Gulosino & Miron, 2017; Jackson et al., 2021; Mann, 2019). While the percentage of minority students enrolled in online courses had improved since the 2014-2015 school year, minority students continued to be underrepresented in virtual schools. For the 2013-2014, 2014-2015, and 2016-2017 school years, the percentage of Black, Hispanic, Asian, Pacific Islander, and Native American students enrolled in full-time virtual schools remained steady and below national averages for respected demographic

groupings. White students' enrollment in full-time virtual schools decreased during the same period (Gulosino & Miron, 2017; Molnar et al., 2017, 2019). Minority students enrolled in blended schools held steady percentagewise for the 2013-2014, 2014-2015, and 2016-2017 school years, while the number of White students enrolled in blended schools decreased during the same time.

Mann (2019) argued that diversity patterns in online schools must be looked at from a state and national perspective. While most students enrolled in online schools are White, differences among states exist. Mann pointed out that Pennsylvania, Maine, and Ohio have the same percentage of White students enrolled in traditional and online schools, while Kansas, California, and Minnesota have a higher percentage of White students enrolled in virtual schools than conventional schools. Colorado is one state that has experienced a higher rate of White students in traditional schools when compared to virtual schools.

Gulosino and Miron (2017) showed that during the 2013-2014 school year, 33.1% of students enrolled in full-time virtual schools qualified for free and reduced lunch. Molnar et al. (2017) added that during the 2014-2015 school year, 32.4% of students enrolled in full-time virtual schools qualified for free and reduced lunch. Molnar et al. (2019) added that during the 2016-2017 school year, 31.5% of students enrolled in full-time virtual schools qualified for free and reduced lunch. Both full-time virtual enrollment averages are well below the national average of 51.3% for the same period. While the overall full-time enrollment for students who qualified for free and reduced lunch went down from 2013-2014 to 2016-2017, there were variances within the online sector. Free and reduced online enrollment increased in the for-profit, nonprofit, and

charter sectors, with the most significant increase in nonprofit enrollment, a 25.3% increase. Independent virtual and district schools had smaller enrollment during the 2016-2017 school year than in 2014-2015. Blended school enrollment grew by 5.9% from 2014-2015 to 2016-2017, with 50.6% of enrolled students qualifying for free and reduced lunch; blended schools during the 2016-2017 school year were the closest to reflecting the national average (Molnar et al., 2019).

Students receiving special education services accounted for 12.9% of the student population in virtual schools and 12.5% in blended schools during the 2014-2015 school year; both percentages were below the national average of 13.1% (Molnar et al., 2017). During the 2016-2017 school year, students receiving special education services accounted for 15.5% of virtual school enrollment and 12.1% of the student population in blended schools; virtual school enrollment was higher than 13.1%. English Language Learner (ELL) students enrolled in virtual and blended schools at much lower percentages during the 2016-2017 school year than in the 2014-2015 school year (Molnar et al., 2017, 2019). During the 2016-2017 school year, virtual and blended ELL enrollment was below the national average (Molnar et al., 2019). Students in historically underserved/disadvantaged populations enroll in online courses at lower rates. Underserved/disadvantaged populations enroll at lower rates because they do not have the same access to reliable internet or lack internet-ready devices away from school (Chennamsetti, 2020; Hussar et al., 2020; McGuinness, 2020).

While the population of males and females enrolled in public schools is nearly evenly split, males to females enrolled in virtual and blended schools are not (Gulosino & Miron, 2017; Molnar et al., 2017, 2019). Females enrolled in virtual and blended schools

at higher rates than their male counterparts. Molnar et al. (2017, 2019) agreed that in the middle grades, male and female enrollment is nearly split 50/50; in the secondary grades, females enroll at higher percentages than males. Finally, during the 2013-2014, 2014-2015, and 2016-2017 school years, students' virtual and blended school enrollment was highest in Grades 9-12. Students at the 12th-grade level had the highest enrollment percentage in blended and virtual schools during the 2016-2017 school year. Molnar et al. (2019) argued that the high enrollment numbers of 12th graders are because students are attending credit recovery or an alternative graduation program.

**Online Learning Experience**

Access to reliable internet service is only part of meeting the needs of online students. In addition to reliable internet access and internet-ready devices, the student must have quality learning experiences (Almekhlafi et al., 2020; Bolt-Lee, 2021; Hussar et al., 2020; McGuinness, 2020). Serdyukov (2015) defined pedagogy as a science that makes educators aware of different teaching and learning standards and strategies that guide what, to whom, how, and when to teach. Steele et al. (2019) further described pedagogy as including all strategies that enhance a student's learning experience. Apostolou et al. (2020) and Luscinski (2018) described research-based best practices as more effective methods than other alternatives due to the positive outcome. Research-based best practices are techniques or methodologies that have been shown by experience and data to lead to desired results. Pedagogy and best practices have been described in multiple ways throughout educational literature. Additionally, pedagogy and best practices are used concurrently and interchangeably in the literature (Cantamessa, 2018; Pardino et al., 2018; Roddy et al., 2017; Steele et al., 2019). Effective research-based

instructional strategies are essential for successful teaching and quality learning experiences. Quality learning experiences increase the speed and depth of student learning (Almekhlafi et al., 2020; Apostolou et al., 2020; Bolt-Lee, 2021; Bransford et al., 2001; Ford, 2018; PološkI Vokic & Aleksic, 2020). Bolt-Lee (2021) added that using research-based instructional strategies saves teachers time by eliminating trial and error for unknown and ineffective instructional practices. An effective research-based instructional strategies framework sets the stage for increased teacher effectiveness and positive student outcomes in both seated and virtual class formats (Almekhlafi et al., 2020; Bolt-Lee, 2021; Bransford et al., 2001; Shah, 2019; Pološki Vokic & Aleksic, 2020). Online pedagogical studies and research have been mostly isolated to the graduate and undergraduate levels (Cantamessa, 2018; Pardino et al., 2018; Roddy et al., 2017; Steele et al., 2019). Utilizing effective research-based instructional strategies in online and seated class formats promotes equivalent learning experiences and outcomes for students (Simonson, 1995).

Almekhlafi et al. (2020) and Bolt-Lee (2021) argued that Robert Marzano's instructional framework helps teachers make quality instructional decisions that lead to quality student learning experiences. Marzano's instructional framework consists of nine strategies organized into three broad groups. Setting objectives, reinforcing effort and providing recognition, and cooperative learning are arranged to create the learning environment. Cues, questions, advance organizers, nonlinguistic representations, summarizing and note-taking, assigning homework, and providing practice are organized to help students develop the understanding category. Identifying similarities and differences and generating and testing hypotheses are arranged in the helping students

extend and apply knowledge category. Almekhlafi et al. (2020) and Bolt-Lee (2021) agreed that educators' knowledge base around research-based instructional strategies is firm; however, the implementation of research-based instructional strategies needs to increase for students to be successful.

When implementing researched-based instructional strategies, educators need to be aware of the changing preferences of students (Položski & Aleksic, 2020). Simonson (1995) pointed out that student learning preferences have shifted to a student-centered learning environment instead of the more traditional teacher-centered learning environment. Teachers can create a student-centered learning environment, replacing the more traditional teacher-centered learning environment. The transition from teacher-centered learning environments to student-centered learning environments is part of constructivism, a branch of cognitive theory (Bransford et al., 2001; Položski & Aleksic, 2020; Qiu, 2019; Shah, 2019). Qiu (2019) and Shah (2019) added that the teacher still plays a critical role in student learning in a student-centered learning environment. Teachers in student-centered environments come alongside their students and assist in developing their meaning of learning and methods for learning. Getting to know individual students, building a positive and supportive culture, personalized and authentic learning experiences, collaboration, and self-regulation are critical components of the student-centered learning environment (An & Mindrila, 2020; Bransford et al., 2001; Položski & Aleksic, 2020; Qiu, 2019; Shah, 2019). Like research-based practices, teacher knowledge and acceptance of student-centered learning environments are positive even while implementing student-centered learning environments remains low (An & Mindrila, 2020).

Best practices in online educational systems need to go beyond online students' simple application and use of technology (Pardino et al., 2018). In addition, significant time should be spent developing skills, methods, and sound educational practices that allow students to succeed in an online environment (Pardino et al., 2018; Roddy et al., 2017; Wilson, 2018). Current research proposes multiple systems to help students be successful while taking online classes. Online course design should not replace or duplicate in-person learning experiences; instead, online course design should add to the pedagogical body of teaching (Kaden, 2020; Williams et al., 2021). Roddy et al. (2017) suggest that teachers should use The Technological Pedagogical Content Knowledge (TPACK), the community of inquiry model, as well as the "four pillars" of support for student success. Wilson (2018) argued for a model consisting of a more businesslike approach utilizing the four management functions of planning, organizing, leading, and controlling.

Teachers of online courses should take full advantage of cognitivism beyond technology implementation. Serdyukov (2015) argued that online education needs its unique pedagogy grounded in a new theoretical framework. The proposed e-pedagogy would provide a conceptual base for all online courses. Steele et al. (2019) argued that it is nearly impossible to identify and describe universal best practices for all online classes. Instead, Bloom's Taxonomy should be utilized; by utilizing Bloom's Taxonomy framework, teachers should build their online courses based on when a student takes a class. Undergraduate courses should focus on remembering and understanding and advance to analyzing and evaluating at the doctoral level. Dwyer and Walsh (2020) added that development of higher order thinking skills is hindered in online courses. However,

Nussbaum et al. (2021) argued that online courses help students develop creativity and critical thinking skills regardless of age when developed and implemented correctly. The content area taught and experience with online courses should be considered when designing best practices for online courses. Despite the various theories around practical online systems and pedagogical philosophies, best practices have emerged (Cantamessa, 2018; Coker, 2018; Pardino, 2018; Roddy et al., 2017; Serdyukov, 2015; Steele et al., 2019; Wilson, 2018).

Like brick-and-mortar classrooms, the teacher's role is vitally important to the success of an online course (Ilgaz & Gülbahar, 2020; Roddy et al., 2017). As the level of teacher-to-student interaction increases, student engagement increases (Castro & George, 2021). Student engagement has been linked to better GPAs, personal development, school experience, and motivation (Castro & George, 2021; Martin & Bolliger, 2018; Zhoc et al., 2020). The teacher's ability and willingness to shift from a leadership teacher-centered model to a more learner-centered facilitator model helps students throughout their online course work (Serdyukov 2015). Creating and maintaining a solid teacher presence and social presence are key to the success of an online course. Timely feedback and communication from teacher to student are essential in creating and maintaining a solid teacher presence and social presence during an online period (Pardino et al., 2018; Roddy et al., 2017; Steele et al., 2019; Wilson, 2018). Students who experience a high social presence with teachers in online courses have higher course satisfaction. As the level of course satisfaction increases, so does the achievement and motivation of students (Alsadoon, 2018; Conklin & Dikkers, 2021). Providing timely feedback on assignments makes students feel less isolated, more comfortable, more

supported, and have a greater sense of belonging (Pardino et al., 2018; Roddy et al., 2017; Steele et al., 2019). Further, quality feedback was the most significant predictor of student satisfaction when taking an online course (Ilgaz & Gülbahar, 2020). As course satisfaction increases, so do students' achievements and motivation (Alsadoon, 2018; Conklin & Dikkers, 2021; Ilgaz & Gülbahar, 2020). Sound pedagogy and knowledge of best practices are critical to students' success regardless of class format; research focusing on pedagogy and learning best practices has not kept up with the increase in online course availability. Continued research is needed to move the knowledge of online best practices and pedagogy forward (Cantamessa, 2018; Pardino et al., 2018; Roddy et al., 2017; Serdyukov, 2015; Steele et al., 2019; Wilson, 2018). Implementing research-based instructional strategies in student-centered learning environments has had positive impacts on student achievement and classroom experiences (Christensen et al., 2019; D'Aquila et al., 2019; Dong et al., 2019; Jares et al., 2019: Opdecam & Everaert, 2019; Silva et al., 2019; Stephenson, 2019).

### *Course Design*

Developing and implementing quality courses is a challenge for teachers of both seated and online courses. Teachers developing established practices have the advantage of relying on experiences from earlier in their careers; many online teachers do not have these experiences and must utilize prescribed course design methods (Alizadeh et al., 2019; Brown et al., 2018; Conklin et al., 2020; Grant, 2021; Tannehill et al., 2018). As the popularity of online course offerings has increased in recent years, the demand for quality online learning experiences has also increased (Alqurashi, 2019; Baldwin & Ching, 2019; Lynch & Gaston, 2020; Sadaf et al., 2019). Online courses are

predominantly delivered through learning management systems such as Angel, Blackboard, Canvas, Moodle, and other learning management systems. In addition to delivery through learning management systems, online course development is guided by various evaluation instruments. Course developers use course evaluation instruments to develop, implement, monitor, evaluate, and adjust online courses (Alizadeh et al., 2019; Alqurashi, 2019; Baldwin & Ching; 2019; Brown et al., 2018; Conklin et al., 2020; Grant, 2021; Lynch & Gaston, 2020; Sadaf et al., 2019). Popular course evaluation instruments include International Association for K-12 Online Learning's (2011) *National Standards for Quality Online Courses*, Blackboard Exemplary Course Program Rubric (Blackboard 2017), CVC-OEI Course Design Rubric (California Virtual Campus-Online Education Initiative, 2018), Open SUNY Course Quality Review Rubric (OSCQR, 2018), Quality Learning and Teaching (California State University, 2019), Quality Matters Higher Education rubric (Quality Matters, 2018), Quality Online Course Initiative (Illinois Online Network, 2018), and Canvas Course Evaluation Checklist (Baldwin & Ching, 2019). Using learning management systems and course evaluation instruments has led some institutions to implement "course shells" where instructors are provided a template to build their courses (Grant, 2021; Tannehill et al., 2018). Tannehill et al. (2018) found that consistency in course design positively impacted the student experience in online classes and student performance.

While there are slight component variances amongst course evaluation instruments, the components of quality online courses are similar (Baldwin & Trespalacious, 2017; Bigatel & Edel-Malizia, 2018; Brown & Toussaint, 2017; Jeffery & Ahmad, 2018). Similar to seated learning environments, student success in online courses

is directly related to student satisfaction in the online environment (Alqurashi, 2019; Lynch & Gaston, 2020; Sadaf et al., 2019; Wolverton et al., 2020). Student satisfaction in online courses can be determined and improved using student feedback responses, and student responses are used for subsequent course review and revision (Alizadeh et al., 2019; Conklin et al., 2020; Grant, 2021; Lynch & Gaston, 2020; McGahan, 2018; Sadaf et al., 2019).

Online course designers should consider students' cognitive, socio-emotional, and behavioral engagement (Bigatel & Edel-Malizia 2018). Online course designers and facilitators should make a conscious effort to meet students' socio-emotional needs. Online course environments are not as conducive to meeting students' socio-emotional needs as face-to-face delivery methods (Bigatel & Edel-Malizia, 2018; Jeffery & Ahmad 2018). When online students' cognitive, socio-emotional, and behavioral needs are met, online students experience a greater feeling of community and membership during the online course (Bigatel & Edel-Malizia, 2018; X. Lin & Gao, 2020). Alqurashi (2019) and X. Lin and Gao (2020) pointed out that the most accurate predictor of student success in an online course is how students' socio-emotional needs are met, which leads to students feeling a part of the class community. Alqurashi (2019) added that students' sense of community can be built differently. Jeffery and Ahmad (2018) argued that the frequency and quality of student-to-instructor interaction significantly impact learning outcomes. However, Alqurashi (2019) and Wolverton et al. (2020) found that learner-content interaction, online learning self-efficacy, learner-learner interaction, and learner-instructor interaction positively impacted student outcomes. Learner-content interactions and online learning self-efficacy were the most significant predictors of student

satisfaction and learning. Ralston-Berg (2014) said that a critical factor for student success in an online course is not a student's sense of community but the organization, ease of navigation, and user-friendliness.

Like seated classes, online courses are not static and regularly require review and revisions (McGahan, 2018). Quality course review and modifications are made based on instructor and student feedback. Analysis of course evaluation instruments found that nearly one third of online frameworks lacked an adequate feedback instrument. Feedback instruments were used to determine the level and quality of interaction between students and instructors during and after the online course (Alizadeh et al., 2019; Baldwin & Trespalacios, 2017; Baldwin & Ching, 2019; Conklin et al., 2020; Lynch & Gaston, 2020; McGahan, 2018; Sadaf et al., 2019). When using student feedback with Quality Matters standards, courses were revised to meet the standards better. Course designers attended professional development focused on better aligning courses to Quality Matters standards. Students taking redesigned courses more closely aligned to Quality Matters standards had higher satisfaction rates as well as higher student outcomes when compared to students taking the same online class before redesign (Alizadeh et al., 2019; Conklin et al., 2020; Lynch & Gaston, 2020; Sadaf et al., 2019). Designing, implementing, monitoring, and revising quality online courses continues to be a priority within the online learning community (Adelstein & Barbour, 2017; Baldwin & Trespalacios, 2017; Bigatel & Edel-Malizia, 2018; Brown & Toussaint, 2018; Jeffery & Ahmad, 2018; Simonson, 1995). Local school districts are given the autonomy to develop and implement learning goals based on state standards. Regardless of how learning is developed or implemented, local school districts are responsible for meeting state

accountability requirements. In addition, states must meet federal accountability requirements (Hackmann et al., 2019; O'Keefe et al., 2021).

**Federal School Accountability Requirements Accountability**

Federal and state accountability systems have been implemented to meet the needs of a changing global market. For example, the Elementary and Secondary Education Act of 1965 (ESEA) was established to ensure equitable educational access for all students regardless of income, race, or disability. Changes are made to ESEA each time the Act is reauthorized. Responsibility to ensure equitable education access for all students regardless of income, race, or disability shifts between the federal and state governments with each reauthorization of ESEA. A consistent component in each reauthorization is policy to help close the achievement gaps amongst K-12 students (Acosta et al., 2020; Bjorklund-Young & Plasman, 2020; Green et al., 2021; V.M. Young, 2018).

State and national policymakers have focused on closing the achievement gap of K-12 students for over 30 years (Acosta et al., 2020; Bjorklund-Young & Plasman, 2020; Green et al., 2021; Tindal & Anderson, 2019). In 1983, policymakers began closing the achievement gap through state and national policies; closing the achievement gap started with developing and implementing standards to guide instructional practice. Students would then take state assessments based on these standards, and schools would be held accountable for student results. By implementing quality standards, policymakers believed that student performance would increase on state, national, and international assessments; as these assessments improved, American students would be better prepared to compete for jobs internationally and domestically (Acosta et al., 2020; Deas, 2018; H.

Li & Xiong, 2018; Ruff, 2019). Through the 1980s and 1990s, states continued to have autonomy in developing and implementing standards (Acosta et al., 2020; Ruff, 2019). With the passage of No Child Left Behind in 2001, the federal government took steps to help close the achievement gap. Students in third through eighth grade would take Math and ELA assessments. Schools would be responsible for meeting annual yearly progress targets set by the federal government for specific subgroups of students. By meeting yearly progress targets for particular subgroups, every student would be proficient in math and ELA by the end of the 2013-2014 school year. Schools that were not making adequate yearly progress would see reductions in federal funding (Acosta et al., 2020; Bjorkland & Plasman, 2020; Buzick & Weeks, 2018; Evans, 2019; Green et al., 2021; H. Li & Xiong, 2018; Ruff, 2019; Tindal & Anderson, 2019). In response to Russ and Berland (2019) and Bjorklund-Young and Plasman (2020), add that in 2010 standards reform took another turn with the implementation of Common Core State Standards. Policymakers and governors argued that uniform standards across the country would help American students become college and career ready, a higher level of readiness than the achievement of basic skills, which had previously been the standard. American students better prepared for college and careers would be more competitive in the global marketplace (Deas, 2018). Polikoff (2020) argued that achievement scores for students exposed to Common Core State Standards show conflicting results. In addition, staying within the Common Core framework, student achievement on NAEP assessments should rise by 2021 or 2023. With the passage of the Every Student Succeeded Act in 2015, the federal government was prohibited from developing and implementing nationwide standards. States were still responsible for closing the achievement gap of students;

however, this new legislation gave states greater autonomy in the development of standards and policies to help close achievement gaps (Close et al., 2018; Evans, 2019; Green et al., 2021; H. Li & Xiong, 2019; Tindal & Anderson, 2019). Students take formal summative assessments to determine the effectiveness of closing the achievement gaps. Students in the United States participate in international, national, and state assessment programs. The Trends in International Mathematics and Science Study (TIMSS) is used internationally. The National Assessment of Educational Progress (NAEP) is used nationally. The (MAP) is used at the state level for students in Missouri. International, national, and state assessments are used for different grades and subjects to determine student achievement. Assessment results are evaluated based on current policy. Adjustments to future policy are made based on student assessment performance (Close et al., 2018; Evans, 2019; Green et al., 2021; H. Li & Xiong, 2018; Tindal & Anderson, 2019). Hamlin and Peterson (2018) argued that while states have raised individual state standards, student performance against these standards has yet to rise.

### *International, National, and State Student Achievement Assessments*

Assessment of student learning is an essential part of the instructional process. Future learning can be enhanced by reflecting on previous assessment results. For example, to better prepare students for subsequent learning experiences, data from previous learning experiences are needed. Assessment data in the United States is collected at the international, national, and state levels. Different accountability systems, standards, and instructional methods worldwide need assessment data at different levels (Deas, 2018; Opateye & Ejike Ewin, 2022). National assessment achievement for students in the United States is measured using the (NAEP). International assessment

achievement for students in the United States is measured using The Program for International Student Assessment (PISA) and TIMSS (de Brey et al., 2021; Provasnik et al., TIMSS, 2019, 2021).

Equitable educational opportunities continue to be a challenge for students in the United States (Geesa et al., 2019, 2020; Lim & Sireci, 2017; Liou & Lin, 2021). White and Asian fourth-grade students outperformed all other race/ethnic groups in mathematics and science at the national level. Finally, fourth-grade students who attended schools with the lowest free and reduced percentage scored the best on TIMSS, while those with the highest free and reduced rate had the lowest scores on TIMSS (NCES., 2020). NCES (2020) pointed out the differences in achievement for fourth graders on the 2019 TIMSS. Differences between the highest and lowest students in the United States were more significant than in 14 other countries in mathematics. The difference between the highest and lowest students in the United States was more significant in science than in fifteen countries. Fourth-grade male students outperformed female students in mathematics and science, with a smaller achievement gap in Science (NCES, 2021). Liou and Lin (2021) and Geesa (2019, 2020) explained the differences in science achievement. Liou and Lin (2021) and Liou et al. (2020) argued that gender and grade-level motivation related to science are reasons for differences in achievement. Using three motivation factors--self-concept, intrinsic, and utility value--fourth-grade males in the United States had the highest motivation level in science (Liou & Lin, 2021). However, Geesa et al. (2020) and O'Dea et al. (2018) argued that while gender can predict TIMSS science outcomes in other countries, gender-based predictive science measures do not work for students in the United States. O'Dea et al. (2018) argued that while males perform better on assessments,

females have better grades. Further, Geesa et al. (2020) agreed with Liou and Lin (2021) that a positive attitude toward science and high-quality resources in the home positively impact science achievement. The number of books in the house was the most significant contributor to student achievement in science.

TIMSS is an international assessment given to fourth- and eighth-grade students every 4 years (Lim & Sireci, 2017; NCES, 2020). Results from TIMSS have been used to evaluate student groups and educational systems at the international level (Geesa et al., 2019, 2020; Güven & Akçay, 2019; Lim & Sireci, 2017; Liou & Lin, 2021; NCES, 2020; Saal et al., 2021). Student achievement was reported using low international, intermediate international, high international, and advanced international benchmark descriptors. According to NCES (2020), in 2019, 64 educational systems participated in TIMSS. Fourth graders from the United States had the 15$^{th}$ highest composite score in mathematics and the eighth highest composite score in science. Additionally, fourth-grade students exceeded international averages in every benchmark descriptor in mathematics and science.

The NAEP program consists of long-term trend NAEP and state and national NAEP assessments. Assessments measure students' achievement in fourth, eighth, and 12th grades in reading, mathematics, and science. Like state assessments, students earn a raw score between 0 to 500 for English and math and 0 to 300 for science. Raw scores place students on NAEP below basic, NAEP basic, NAEP proficient, and NAEP advanced categories. A national governing board ensures the quality and assessed curriculum of the NAEP program (de Brey et al., 2021; Hussar et al., 2020; Lim & Sireci, 2017). During the 2019 NAEP assessments, fourth-grade students had average raw scores

of 220 on the English assessment (de Brey et al., 2021; Husser et al., 2020). English assessment scores for fourth graders have been between 217 and 220 from 1992 through 2019 (Husser et al., 2020). Proficiency level breakdowns show that during 2019, 34% of students were below basic, 31% were basic, 26% were proficient, and 9% were advanced. Proficiency percentages have remained relatively consistent with no significant changes in raw scores. In 2019, 35% of fourth-grade students were advanced or proficient compared to 28% of fourth graders in 1992. de Brey et al. (2021) added that during the NAEP assessment program, White students have continually scored better than Blacks, Hispanics, and Asian/Pacific Islanders. While White students have continually scored the highest, the achievement gap between White and Black students has decreased since 1992. Simultaneously, the achievement gap between White and Hispanic students has stayed relatively the same. However, during the 2019 assessments, Asian/Pacific Islander and Asian ethnicity groups outperformed White students. Black and American Indian/Alaska Native had the lowest performance. In addition, the poverty level of students and achievement levels were inversely proportional (Husser et al., 2020). During the 2019 NAEP assessments, fourth-grade students had average raw scores of 241 on the Math assessment (de Brey et al., 2021; Husser et al., 2020). Math assessment scores for fourth graders have been between 213 and 241 from 1990 through 2019 (Husser et al., 2020). Proficiency level breakdowns show that during 2019, 19% of students were below basic, 40% were basic, 32% were proficient, and 9% were advanced. Significant changes in student raw scores reflect proficiency level changes. In 1990, 13% of fourth graders were proficient or advanced in math compared to 41% of fourth graders in 2019. de Brey et al. (2021) and J. L. Young et al. (2017) added that during the NAEP assessment

program, white students have continually scored better than Blacks, Hispanics, and Asian/Pacific Islanders. J. L. Young et al. (2017) argued that the academic performance of black students could be attributed to a lack of engagement with the content and a lower degree of positive learner identity. While white students have continually scored the highest, the achievement gap between white and black students and white and Hispanic students decreases. However, during the 2019 assessments, Asian/Pacific Islander and Asian ethnicity groups outperformed white students. Black and Pacific Islander ethnic groups had the lowest performance. In addition, following a similar trend to ELA achievement, the poverty level of students and achievement levels were inversely proportional (Husser et al., 2020).

All 50 states participate in NAEP assessments as well as individual state assessments. NAEP assessments are based on NAEP standards, while state assessments are based on state standards. With only a small percentage of students taking state NAEP exams compared to state exams, comparisons of state assessments and NAEP assessment scores are needed. Since standards differ from state to state, using state assessment data and NAEP data, mapping state standards into NAEP standards can be achieved (Bandeira et al., 2019; Hamlin & Peterson, 2018; Kaplan & Huang, 2021; Lee & Wu, 2017; Troia et al., 2018). Using quantitative measures, between 2007 and 2017, states meeting NAEP basic proficiency levels or higher for ELA increased in number while states meeting only below basic NAEP ELA proficiency levels decreased. Between 2007 and 2017, one state had NAEP ELA standards in the proficient achievement level. Differences between equivalent scores of state standards decreased (Bandeira et al., 2019). Between 2007 and 2017, states meeting NAEP basic proficiency levels or higher for Math increased in

number and states meeting only below basic NAEP Math proficiency levels decreased. Between 2007 and 2017, 11 states had NAEP Math standards in the Proficient achievement level. Differences between equivalent scores of state standards decreased (Bandeira et al., 2019). Bandeira et al. (2019) agreed with Hamlin and Peterson (2018) that the strength of state standards has risen in recent years. Using a traditional A-F scale, fourth- and eighth-grade reading and math standards were measured against NAEP standards. States more closely aligned with NAEP standards received A grades than states less aligned with NAEP standards. With the introduction of Common Core in 2009, no state had standards earning an "A" rating; as of 2017, 16 states had standards earning an "A" rating, with other 27 states having standards earning a "B" rating. Bandeira et al. (2019) and Hamlin and Peterson (2018) used two methods to align state and national standards better to demonstrate the states' work. Using NAEP results, students were not any more college and career ready based on career-ready standards; however, focusing on just Common Core State Standards, students showed positive achievement results. Lee and Wu (2017) and Petrilli (2020) added that to see the long-term achievement gains of students, states need to stay the course of offering high-quality curricular materials aligned with high-quality standards. In addition, staying within the Common Core framework, student achievement on NAEP assessments should rise by 2023.

Missouri has taken steps to raise state standards; Missouri SB 1080 set the expectation that Missouri performance standards would be met but would not exceed NAEP performance standards. To meet this expectation, specific percentages of students would need to score proficient on state assessments (Ferrara et al., 2021). Missouri performance standards were above NAEP basic thresholds for fourth-grade math and

reading and eighth-grade reading (Bandeira et al., 2019). While standards met the basic threshold, Missouri standards were given a "C" rating (Hamlin & Peterson, 2018). Missouri student performance on NAEP has remained consistent and mirrored the national averages during the last two testing cycles. Compared to NAEP results from 2000, Missouri students performed significantly better in the previous two testing cycles (Kaplan & Huang, 2021). Hamlin and Peterson (2018) contended that there is no relationship between rising standards and test-score growth. Ferrara et al. (2021) pointed out that the NAEP performance for Missouri students has increased since implementing legislation that more closely aligns with state and NAEP standards.

Missouri Students in Grades 3-8 participate in MAP. Students are assessed in Math, ELA, and Science. State assessments are used to determine the achievement levels of students based on Missouri Learning Standards. Students' achievement is categorized by percentages of advanced, proficient, basic, and below basic students on corresponding MAP assessments (Sieminski, 2021). However, student achievement in Missouri has matched students' achievement in other states. For example, in response to COVID-19, the state of Missouri canceled all state assessments during the spring of 2020. Students' assessment scores in the spring of 2021 were below students' previous scores in similar grades. This trend was matched in Missouri and across the country (Ferrara et al., 2021; Middleton, 2020; Olson, 2020).

Students in the United States participate in state, national, and international assessments. Performance on these assessments continues to stagnate at the state, national, and international levels. While standards have been adjusted and improved, performance continues to stall. Innovative educational approaches must be implemented to move student

achievement forward. Innovative educational practices should be closely monitored and evaluated to determine the impact on student achievement. In recent years online/virtual environments have grown in popularity. Monitoring and evaluation of this innovative approach are outlined in the next section.

**Student Achievement Trends in Online/Virtual Environments**

Virtual or online K-12 enrollment has grown in popularity nationwide in the past decade (Fuller, 2017; Hart et al., 2019; Lin et al., 2019; Miron et al., 2018; Molnar et al., 2019, 2021). While growth in K-12 online education has grown in recent years, credible research on the impacts of online education and student achievement is still lacking (Hart et al., 2019; Molnar et al., 2021). While credible research might be limited, the available research helps determine the appropriate place and function of online learning in the K-12 classroom. Hart et al. (2019), C.-H. Lin et al. (2019), and Rahimi and Yadollahi (2017) agreed that students taking an online course can experience higher levels of achievement when compared to students that are taking the same class in a seated format. However, Gulosino and Miron (2017), Molnar et al. (2019, 2021), Miron et al. (2018), Miron and Urschell (2012), and Zimmer et al. (2003) argued that virtual student performance falls short when compared to seated student performance.

Between the 2016-2017 and 2019-2020 school years, full-time virtual schools grew from 429 to 477. Enrollment in full-time virtual schools also increased from 295,518 students to 332,379 students (Miron et al., 2018; Molnar et al., 2021). Most full-time virtual schools in the United States are classified as education management organizations or EMO which are large for-profit organizations that can maximize profits based on current school funding formulas due to their high student-teacher ratio and low

operating costs. While individual school districts are opening more virtual schools, EMOs dominate the virtual school sector (Molnar et al., 2021). Miron et al. (2018), Molnar et al. (2019, 2021), and Gulosino and Miron (2017) examined the performance of virtual and blended schools in the United States using state data obtained from school performance report cards. School performance report cards provided academic achievement, demographic, and accountability information. Like traditional brick and mortar schools, virtual and blended schools' performance was based on Math, ELA and Science achievement scores. Attendance, college and career readiness, ACT/SAT scores, dual credit courses, performance growth, and student and parent satisfaction are additional indicators used to determine virtual and blended school performance. Differences in the accountability measures by the state and some states' frozen accountability systems do not allow a comprehensive picture of virtual and blended school performance (Gulosino & Miron 2017; Miron et al., 2018; Molnar et al., 2019, 2021). More data detailing the performance of virtual and blended schools have become available in recent years (Molnar et al., 2021).

As states continue to have frozen accountability systems, consistent virtual school data have been challenging (Gulosino & Miron, 2017; Miron et al., 2018; Molnar et al., 2019, 2021). Between the 2014-2015 and 2019-2020 school years, the number of states offering full-time virtual schools has grown from 35 to 40; during the same period, the number of states providing performance reports for virtual schools has been between 19 and 28 (Gulosino & Miron 2017; Molnar et al., 2021). Virtual schools are divided into for-profit EMO, nonprofit EMO, charter, independent, and district. For-profit EMO virtual schools have consistently enrolled more students than any other category of virtual

schools (Gulosino & Miron, 2017; Miron et al., 2018; Molnar et al., 2019, 2021). While for-profit EMOs enroll the most students, their overall performance has consistently been near the bottom. During 2014-2015, 8 out of 34 for-profit virtual schools were rated as "acceptable" for the 2019-2020 school year, and 35 out of 94 for-profit virtual schools were rated as acceptable. The 37.2% of for-profit virtual schools rated acceptable during the 2019-2020 school year was the highest percentage of acceptable for-profit virtual schools between 2014-2015 and 2019-2020 (Gulosino & Miron, 2017; Molnar et al., 2021). Charter virtual schools that also enroll many students do not perform well. Virtual charter schools had the highest acceptable rated percentage during the 2019-2020 and 2017-2018 school years; using state performance criteria, 35.2% of virtual charter schools were rated acceptable (Molnar et al., 2019, 2021). Virtual charter schools had the lowest percentage of acceptable rated schools during the 2014-2015 school year, when 20% were rated acceptable (Gulosino & Miron, 2017). District virtual schools, which have grown in popularity in the last few years, continually have the lowest enrollment but have the highest percentage of schools rated "acceptable" using state performance criteria (Gulosino & Miron, 2017; Miron et al., 2018; Molnar et al., 2019, 2021). District-operated virtual schools had the lowest "acceptable" percentage during the 2014-2015 school year, when 37.84% of district-operated virtual schools were rated "acceptable" (Gulosino & Miron 2017). Over 50% of district-operated schools have been rated "acceptable" since the 2016-2017 school year (Miron et al., 2018; Molnar et al., 2019, 2021). Gulosino and Miron (2017) pointed out that during the 2014-2015 school year, 22 out of 121 virtual schools outperformed state averages for student proficiency benchmarks. Nonprofit and district-operated virtual schools had the highest percentage

exceeding state averages. Smaller district-operated virtual schools outperformed large for-profit virtual schools (Gulosino & Miron, 2017; Miron et al., 2018; Molnar et al., 2019, 2021). Students who attend Broward Virtual School, a small district-run virtual school in Florida, have performed better on district and state assessments than students not enrolled at Broward Virtual School (Fuller, 2017).

Miron et al. (2018) argued for two key factors that predict the success of virtual schools. First, virtual school size and student-teacher ratio play an essential role in individual student achievement and the success of the virtual school as a whole. Miron et al. (2018) and Waddell (2017) found that virtual schools that enroll less than 500 students and have fewer than 60 students per teacher were rated "acceptable" more often than virtual schools with greater than 60 students per teacher and more than 500 students. Students enrolled at virtual schools with fewer than 1,000 enrollments performed better than those enrolled at larger virtual schools. When a student takes an online course and how many students are in the online course have shown to be positive factors for student achievement (Hart et al., 2019; Hornbeck et al., 2019; C.-H. Lin et al., 2019). C.-H. Lin et al. (2019) suggested that as core area class sizes increase for an online course, student achievement for the respective course will rise. C.-H. Lin et al. (2019) also discovered differences in virtual student achievement based on class size. Increasing the number of students enrolled in high school online classes positively impacted student achievement for math, science, and social sciences until the enrollment reached 45; when virtual class enrollment was higher than 45, student achievement decreased. Increases in class size did not positively or negatively impact student achievement in English and foreign language courses. Students outside of core area courses have shown success with online courses.

English as First Language (EFL) students had high levels of student achievement on the Key English Test (Rahimi & Yadollahi, 2017).

Students who fail to graduate high school cost themselves an estimated $133,700 in future lifetime earnings and cost the nation billions of dollars in public assistance, crime and justice, and public health (Rickels et al., 2018). The on-time 4-year graduation rate in The United States has increased from 81% in 2013-2014 to 85% in 2019-2020. Virtual schools have experienced an increase in on-time 4-year graduation rates during the same period. In 2013-2014, 40.6% of virtual students graduated on time; this increased to 54.6% of students in 2019-2020. While virtual schools have experienced growth in on-time 4-year graduation rates, virtual school graduation rates continue to be well under the national averages for the same period (Gulosino & Miron, 2017; Molnar et al., 2021). Graduation rates of students attending virtual district schools continue to outpace independent, nonprofit, for-profit, and charter virtual schools (Gulosino & Miron, 2017; Miron et al., 2018; Molnar et al., 2019, 2021). In addition to lower graduation rates, virtual school students do not perform as well as seated students on state assessments. However, in Ohio, high-achieving virtual students passed the state graduation exam at the same rate as their seated peers (Ahn & McEachin, 2017). Overall performance of virtual students is less than seated students; similar performance gaps exist between high-achieving and low-achieving students in both seated and virtual environments. Success in virtual schools or classes did not translate to increased success at the postsecondary level. High-achieving virtual secondary students did not graduate from college quicker than students who did not take a virtual class in high school (Ahn & McEachin, 2017; Callahan & King, 2018). In addition to initial credit, many schools turn

to virtual courses for credit recovery (Hart et al., 2019; Heppen et al., 2017; Rickels et al., 2018). Algebra I virtual credit recovery students reported the virtual environment being more complicated than the seated environment. While the setting was reported as more complex, there was no difference in long-term outcomes for students who took Algebra I credit recovery in a virtual environment compared to students who took Algebra I credit recovery in a seated environment (Heppen et al., 2017). In addition, students who take virtual credit recovery classes are more likely to pass follow-up courses and continue toward graduation; first-time virtual course takers are less likely to take and pass future virtual courses and continue toward graduation (Hart et al., 2019; Rahimi & Yadollahi, 2017). Hart et al. (2019), C.-H. Lin et al. (2019), and Rahimi and Yadollahi (2017) all agreed that online learning better prepares students to meet the needs of a 21st-century workforce, and further research is needed to determine the level of technological awareness, maturity, motivation, and self-directedness of K-12 online students. Gulosino and Miron (2017), Miron et al. (2018), and Molnar et al. (2019, 2021) argued that pockets of virtual schools have shown success, but as a whole, virtual schools come up short in overall performance when compared to brick-and-mortar schools. Studies examining the effectiveness of online learning for elementary students have been limited. Available research for online elementary students has come from individual schools in response to COVID-19 (Darmiany & Maulyda, 2022; Iswan & Sari, 2022). Darmiany and Maulyda (2022) found that student creativity dropped when elementary students were learning at home because of COVID-19. The increase in lecture class format caused the drop in creativity. In addition, plagiarism increased, and student performance decreased. Iswan and Sari (2022) added that the effectiveness of an online learning environment

significantly impacts the learning outcomes for more advanced students at the elementary level.

**Summary**

Online/virtual schools and courses continue to grow in popularity due to the ease of access. Online/Virtual courses are neither time nor location dependent (Kwon et al., 2019; Miron et al., 2018; Molnar et al., 2021). Colleges and universities were the first to take advantage of online/virtual learning formats (Palvia et al., 2018; Park & Shea, 2020; Simonson & Seepersaud, 2019; Vincenzes et al., 2019). Missouri statue 161.670. grants all full-time Missouri students access to online educational opportunities through the MOCAP platform (Missouri Revisor of Statutes, 2018). While several forms of online/virtual schools are in operation across the country, Missouri is one of the 21 states with a state-run virtual/online school. Of the 21 virtual state schools, Missouri is one of three virtual state schools to offer courses K-12 (Digital Learning Collaborative, 2019; The Foundation for Blended and Online Learning, 2018). For online/virtual schools to continue to grow, students should be exposed to equivalent learning experiences compared to seated students. When online students' equivalent learning experiences are realized, online and seated students should have equivalent learning outcomes (Simonson et al., 2011, 2015). While the popularity of online/virtual education has expanded to include K-12 education, most research has been focused on postsecondary students. Limited online/virtual research has been conducted at the K-12 level; within the K-12 sector, research is further limited at the elementary level (Hart et al., 2018, 2019; C.-H. Lin et al., 2019; Xu & Jaggers, 2013). Student experience and achievement data are conflicting at both the postsecondary and secondary levels, while student experience and

achievement data are limited at the elementary level (Gulosino & Miron, 2017; Hart et al., 2019; C.-H. Lin et al., 2019; Miron & Urschell, 2012; Molnar et al., 2021).

The researcher tested Michael Simonson's (1995) equivalency theory in this study. Equivalency theory states that online/virtual students should have equivalent learning experiences to seated students; equivalent learning experiences will produce equivalent learning outcomes. The researcher tested the hypothesis that no statistically significant difference exists between online and seated fifth-grade students, measured by MAP ELA, Math, and Science achievement scores.

Chapter Three outlines the methodology used for this study. The methodology includes methods, design, and data analysis. Chapter Four presents the findings of this study. Analysis of results, researcher's interpretations, and recommendations for further studies are presented in Chapter Five.

# CHAPTER THREE

# RESEARCH DESIGN AND METHODOLOGY

Online class enrollment has grown recently (Hart et al., 2019). As a result, Missouri students have access to singular or multiple class enrollment options through the MOCAP program. This study aimed to see the difference in the academic achievement of rural full-time online students and rural non-full-time online students as measured by MAP scores. In addition, a quantitative causal-comparative method was selected, and a *t* test was used to see what differences existed in achievement. This quantitative causal-comparative study looked specifically at MAP achievement scores of online fifth graders and MAP achievement scores of seated fifth graders. In addition, math, science, and ELA MAP scores were used for this study.

Chapter Three describes the quantitative causal-comparative approach used for this study. The first section outlines the study's purpose, the research questions that guided the study, and the null hypothesis for each research question: participants selection and sampling, research setting, research design, and instrumentation. Third, procedures and data analysis are outlined. Lastly, a summary of Chapter Three and a preview of Chapters Four and Five are provided.

## Purpose of the Study

The purpose of this causal-comparative study was to test Simonson's (1995) equivalency theory. In this study, the researcher compared the achievement outcomes of full-time online fifth-grade students to the achievement outcomes of full-time seated fifth-grade students. Determining differences in achievement outcomes of full-time

online and full-time seated fifth-grade students would help determine students' equivalent learning experiences, which applies directly to equivalency theory (Simonson, 1995).

The dependent variable used in this study was student achievement/outcomes. Student achievement categories for MAP assessments are below basic, basic, proficient, and advanced. For this study, student achievement/outcomes were determined to be the percentage of students scoring in the proficient and advanced categories on fifth-grade ELA, Math, and Science MAP assessments. The independent variable used in this study was whether fifth graders were online students or seated students; online students are generally defined as students enrolled in an approved MOCAP provider course.

**Research Questions**

The purpose of this study was to determine the difference in proficient and advanced achievement levels for online fifth-grade students as measured by MAP scores versus achievement levels of proficient and advanced for seated fifth-grade students as measured by MAP scores. The following research questions guided the study:

RQ1: What is the difference in fifth-grade proficient and advanced English Language Arts MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year?

RQ2: What is the difference in fifth-grade proficient and advanced Math MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year?

RQ3: What is the difference in fifth-grade proficient and advanced Science MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year?

**Null Hypotheses**

($H_0$1): There will be no statistically significant difference between proficient and advanced fifth-grade English Language Arts MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year.

($H_0$2): There will be no statistically significant difference between proficient and advanced fifth-grade Math MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year.

($H_0$3): There will be no statistically significant difference between proficient and advanced fifth-grade Science MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year.

**Participants**

Participants in this study were Missouri fifth grade public school students who enrolled in virtual courses full-time during the 2020-2021 school year and Missouri 5th grade public school students enrolled in seated courses full-time during the 2020-2021 school year. While individual students were the participants in this study, data were requested and collected at the district level. Students that transitioned between online and seated settings were considered seated for this study. Students who moved within and out of state were included in this study.

**Selection/Sampling**

For this study, student assessment scores of proficient and advanced as measured by fifth grade MAP scores in Math, Science, and ELA for the 2020-2021 school year were used. Students in the fifth grade who took the MAP test were used for this study during the corresponding years. Students with a DESE program code of 50 or 52 were

identified as virtual students. Collected data from MODESE were used for this study. While MAP data were available through the open-access database, a data request was made to MODESE (MODESE, n.d.) for the specific data used in this study. Since data from MODESE had already been collected and sorted, this study qualified as a causal-comparative ex post facto study. To generalize between variables, a total population sampling format would be used (Creswell & Creswell, 2018). For this study, the total population sampling was limited to full-time and seated Missouri public school fifth graders that took a MAP test in Math, Science, or ELA during the 2020-2021 school year. Requested data from MODESE for the specific grade, content areas, and school years made the total population sampling possible. Requested student achievement data on the MAP achievement scores of Math, Science, and ELA of fifth-grade students were examined to see if differences between full-time and seated students existed. Finally, to compare full-time virtual and seated student achievement, an independent sample *t* test was used.

**Research Setting**

This causal-comparative ex post facto study was located in Missouri and used performance data for fifth-grade MAP assessments. With just over six million people, Missouri is the 18$^{th}$ most populous state and has a composite cost of living index of 89.1, the fifth best in the United States (Missouri Economic Research and Information Center, 2020; United State Census Bureau, 2020). At the time of the study, Missouri consisted of 518 public school districts, 568 high schools, 49 junior highs, 295 middle schools, and 1,221 elementary schools; 86,670 teachers and administrators were currently employed in Missouri public schools. The school-aged demographic is represented in Table 1:

**Table 1**

*State-Aged Demographics and Missouri Demographics*

| Missouri Demographics | School-Aged Demographics |
|---|---|
| American Indian/Alaska Native | .4% |
| Asian | 2.1% |
| Black | 15.4% |
| Hawaiian/Pacific Islander | .4% |
| Hispanic | 7.2% |
| Multi-Race | 4.9% |
| White | 69.6% |

MODESE houses an open-access database; however, requested data were not available in the open-access database. Since the requested data were provided from the MODESE database, the research setting included this open-access database. MAP satisfied the requirements to create an assessment system that measured academic standards for Missouri students. MAP assessments are based on predetermined learning standards; student proficiency levels are based on assessment performance against these predetermined learning standards. Missouri Learning Standards are divided into two broad categories, K-5 and 6-12. Because fifth-grade is the highest-grade level for elementary standards, fifth-grade MAP scores were chosen by the researcher. All fifth-grade MAP data were included; no data distinctions were made for various socioeconomic or SPED classifications. MAP assessment data were collected yearly. District assessment coordinators are responsible for implementing testing protocols and quality assurance measures developed by MODESE (MODESE, n.d.) to ensure testing fidelity throughout the state.

Proctors of MAP assessments are provided testing protocols and quality assurance training before testing; documentation is provided to MODESE once training has been

completed. During the testing window established by MODESE, building-level testing coordinators organized all MAP materials, developed testing schedules, and ensured all grade-level and content assessments were submitted. In addition, students accessed MAP assessments by logging into INSIGHT, a secure testing platform. Completed MAP assessments were housed by INSIGHT before being sent to MODESE. Districts and MODESE did not have access to assessment results until assessment results were shared by INSIGHT. In addition, testing protocols and quality assurance measures were implemented to ensure testing reliability and validity (MODESE, n.d.). In addition, each year, Data Recognition Corporation provides the state of Missouri with a grade-level technical report; grade-level assessment reliability and validity are included in the grade-level technical report.

**Research Design**

Creswell (1994) described quantitative research as collecting and analyzing data using mathematical methods to explain a phenomenon. Simon and Goes (2013) described ex post facto research as using already collected data that has not yet been used for research purposes. This quantitative, causal-comparative ex post facto study was used to compare the achievement of fifth-grade full-time online students against that of fifth-grade full-time seated students. A causal-comparative design was chosen because a comparison was made between two groups based on an event that had already occurred (Creswell & Creswell, 2018). For this study, full-time online or full-time seated placement when taking MAP assessments and MAP assessment data had already been collected. A qualitative research method was utilized since comparing two groups was made based on proficient and advanced achievement scores.

The independent variable for this study was student placement for instruction before taking fifth-grade MAP assessments. A full-time online student received all their instruction through an approved virtual provider. Full-time online students are assigned a MODESE program code of 50 or 52. Students not assigned a MODESE code of 50 or 52 were classified as full-time seated students. The dependent variable for this study was student achievement measured by fifth-grade MAP assessments. The researcher aimed to establish whether a significant difference existed between student placement for instruction (independent variable) and student achievement measured by fifth-grade MAP assessments (dependent variable). Requested data were provided ex post facto. An independent samples *t* test statistical method was utilized to determine if a significant difference existed between student placement for instruction and student achievement measured by fifth-grade MAP assessments (Cresswell & Cresswell, 2018).

**Procedures**

To protect human participants during the research process, dissertation guidelines of Southwest Baptist University require prior approval from the Research Review Board (RRB) before the beginning of any research project. In addition, the researcher requested RRB approval to collect district-level MAP achievement data and student placement data for the 2020-2021 and 2021-2022 school years. RRB approval was given to collect and analyze the requested data. RRB approval form can be found in Appendix A. Data used were district percentages of students who scored proficient and advanced on fifth-grade MAP assessments and placement during instruction; data were requested at the district level. An Excel spreadsheet was utilized to share information with the committee chair

and researcher. District, teacher, and individual student identities were protected during the research.

Requested data from MODESE was provided through a data request form. The data request form can be found in Appendix B. The requested data were delivered in an Excel spreadsheet. Data were organized by school year, district, percentage of students scoring advanced and proficient, and placement during instruction. Total population sampling was used in this study; the total population is used to sample an entire population. Total population sampling was selected because the sample size and the number of students taking fifth grade in an online format were relatively small. All MODESE data from districts with five or fewer full-time online students was suppressed to protect student identity. These districts were not included in the total population sampling. Student achievement data were organized based on the independent variable. Students with a program code of 50 or 52 were given a 1, and students without a program code of 50 or 52 were given a 0.

**Instrumentation**

Data used to answer the research questions in this study were obtained from the MODESE. Since the data were not included in the open-access portion of the MODESE website, a data request form was completed. Permission to complete a data request form for the requested data was provided through Southwest Baptist University's (SBU) RRB process. Missouri state assessments are written to assess students' knowledge and understanding of Missouri Learning Standards. In addition, Missouri Learning Standards are agreed upon as grade-level and content-specific learning priorities. Finally, the Data Recognition Corporation (DRC) works with MODESE to ensure test reliability and

validity. Through this partnership, MAP assessment cut scores have been changed to maintain MAP assessments' reliability and validity. For example, fifth-grade students in Missouri take MAP assessments in ELA, Math, and Science. According to the MAP grade-level assessment technical report from 2019, the Cronbach's Alpha for fifth-grade ELA was .91, .93 for Math, and .90 for Science. A Cronbach's alpha between 0 and 1 is reliable (Data Recognition Group, 2019).

Missouri state assessments are built around multiple reporting categories, domains, and clusters. In addition, students will see various question formats and performance events. For example, "Grade level assessments may contain selected-response (SR) items, evidence-based selected response (EBSR), constructed response (CR) items, writing tasks (WT), performance events (PE), and/or technology-enhanced (TE) items" (MODESE, 2020, para.3). For example, the fifth-grade Math MAP assessment consists of questions related to number sense and operations in base 10 number sense and operations in fractions, relationships and algebraic thinking, geometry and measurement, and a performance event. Fifth-grade ELA MAP assessment consists of questions related to reading literacy/reading informational, research writing, writing/language, and speaking and listening. Fifth-grade Science MAP assessment consists of questions related to physical science, life science, and earth and space sciences. While the data provided by MODESE could not be verified, MODESE reported directly to the state legislature; therefore, MODESE-provided data were assumed to be accurate. DRC's (2020) annual MAP grade-level technical manual provides proof of MAP assessment validity. For the 2020-2021 testing cycle, fifth-grade ELA Cronbach's

Alpha was .91, Mathematics was .91, and Science was .91. A Cronbach's alpha higher than .8 is considered good (DRC, 2020).

**Data Analysis**

Statistical analysis was used to analyze the data to answer the stated research questions and subquestions. The requested data were provided via an Excel spreadsheet. Once requested data were received, the organization of the data took place. The organization consisted of creating multiple Excel spreadsheets that could be imported into Statistical Package for Social Sciences (SPSS). Spreadsheets were labeled by subject (ELA, Math, and Science) and year (2020-2021 and 2021-2022) for identification purposes. The organization identified two columns, the independent and dependent variables. The percentage of students scoring proficient and advanced on designated MAP assessments was moved to the dependent variable column. Student placement for instruction was moved to the independent variable column. Students who received instruction in a full-time online environment were identified with a 1, and students who received instruction in a full-time seated environment were identified with a 0. Care was taken to identify missing or inaccurate data through the data organization process. Missing and inaccurate data were corrected before importing them into SPSS. Once data were imported into SPSS, independent *t* tests were run for each null hypothesis, and *p*-values, mean, and standard deviation were reported for each null hypothesis. Demographic information was not included in this study.

Laerd Statistics (2022) pointed out that before running independent sample *t* tests, six assumptions need to be addressed to determine if independent *t* tests were appropriate. Assumption 1, using a continuous scale to measure the dependent variable, was addressed

using MAP test performance for each subject and year examined. Assumption 2, an independent variable consisting of two separate groups, was addressed using full-time online and full-time seated fifth-grade students. Assumption 3, independence of observations, was addressed using Program Codes 50 and 52 for full-time online students; these codes prevented students from being reported in full-time online and full-time seated groups. Assumptions 4, 5, and 6 were addressed using SPSS software. Assumption 4, no significant outliers that could negatively influence results, was addressed through the use of SPSS software. Outliers can negatively impact independent *t* tests; using SPSS software, outliers were easily identified, and outliers were examined for why they might exist and their statistical impact based on the goals of this study. Assumption 5, the assumption of normal distribution of the dependent variable for each independent variable, was addressed using the Shapiro-Wilk test of normality. Normal data distribution was represented by *p*-values greater than 0.5; data with values less than 0.5 were considered a nonnormal distribution. Finally, nonnormal distributed data violates the assumption of normality. Assumption 6, homogeneity of variances, was tested using Levene's test for homogeneity of variances, *p*-values greater than .05 represent an equal variance between variables, and the *t* test could be interpreted with equal variance assumed. A similar or significant difference between variables represents *p*-values less than .05, and *t* test are interpreted with equal variance not assumed.

Independent sample *t* tests were appropriate as independent sample *t* tests compare the means for two groups. Since the independent variable was student placement for instruction before taking MAP assessments, independent sample *t* tests were appropriate for this study (Cresswell & Cresswell, 2018). Collected and organized data

were reviewed in SPSS, and independent variable means were compared based on 1 or 0 values. Students who received instruction in a full-time online environment were identified with a 1, and students who received instruction in a full-time seated environment were identified with a 0. Independent variable means were analyzed to determine whether a statistically significant difference existed. Statistically significant differences would be determined based on data analysis. For example, a value of $p > .05$ would not be a statistically significant difference because the researcher fails to reject the null hypothesis. A value of $p < .05$ would be a statistically significant difference because the null hypothesis would be rejected. Testing for significant differences shows results did not happen by chance.

Cohen's *d* was utilized to determine the effect size between the two groups. Cohen (1988) pointed out that .20, .50, and .80 are small, medium, and large effect sizes. A statistically significant difference was determined between the dependent variable of the percentage of students proficient and advanced and the independent variable of placement for instruction using independent samples *t* tests. Assumption and test results were reported (Cohen, 1988; Laerd Statistics, 2022).

**Summary**

Creswell (1994) described quantitative research as collecting and analyzing data using mathematical methods to explain a phenomenon. Simon and Goes (2013) described ex post facto research as using already collected data that have not yet been used for research purposes. This quantitative, causal-comparative ex post facto study aimed to see if a statistically significant difference existed in achievement levels for fifth-grade students who participated in the MAP as full-time online students versus students who

took fifth grade in a seated format during the 2020-2021 school year. Chapter Three described the methodology used for the study, including research questions, hypothesis, participants, research setting, research design, instrumentation, and data analysis. Chapter Four details an analysis of the data. The organization of results, findings, and limitations are detailed. Chapter Five provides conclusions and recommendations for further study.

# CHAPTER FOUR

## ANALYSIS OF THE DATA

The purpose of this causal-comparative study was to test Simonson's (1995) equivalency theory by comparing fifth-grade full-time online elementary students and fifth-grade full-time seated elementary students in terms of achievement as measured by MAP scores in the state of Missouri. Chapter Four briefly describes research methodology. Data analysis is presented in Chapter Four to answer each research and sub-research question. Answering each research and sub-research question determined whether the null hypotheses were rejected or failed to be rejected.

Online courses and cyber schools have quickly grown in popularity (Borup et al., 2019; Chapman, 2018; Hornbeck et al., 2019; Mann et al., 2021; Molnar et al., 2019). In Missouri, online courses are accessible to all Missouri students through the state's online school, Missouri Course Access and Virtual School Program (MOCAP). Missouri Virtual Instruction Program was established in 2007 as Missouri's designed online school. Renamed Missouri Course Access and Virtual School Program, it provides every student in the state the opportunity to take courses taught by Missouri-certified teachers from an internet-connected device 24 hours a day, 7 days a week. As the popularity and availability of online educational programs continue to increase, quality research is needed to determine the effectiveness of online education for elementary students (Arnesen et al., 2019; Darmiany & Maulyda, 2022; Iswan & Sari, 2022; Mann et al., 2021; Molnar et al., 2019; Shagiakhmetova et al., 2022). Michael Simonson's (1995) equivalency theory provided the support for this study. Simonson's equivalency theory is built around the idea that while there should be different learning experiences for online and seated students, those learning experiences should be equivalent (Simonson et al.,

1999). Chapter Four examines whether a statistically significant difference existed between full-time online fifth-grade students in Missouri public schools and full-time seated fifth-grade students in Missouri public schools during the 2018-2019, 2020-2021, and 2021-2022 school years as measured by MAP.

**Research Questions**

The purpose of this study was to determine the difference in proficient and advanced achievement levels for online fifth-grade students as measured by MAP scores versus achievement levels of proficient and advanced for seated fifth-grade students as measured by MAP scores. The following research questions guided the study:

RQ1: What is the difference in fifth-grade proficient and advanced English Language Arts MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year?

RQ2: What is the difference in fifth-grade proficient and advanced Math MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year?

RQ3: What is the difference in fifth-grade proficient and advanced Science MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year?

**Null Hypotheses**

($H_0 1$): There will be no statistically significant difference between proficient and advanced fifth-grade English Language Arts MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year.

($H_0$2): There will be no statistically significant difference between proficient and advanced fifth-grade Math MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year.

($H_0$3): There will be no statistically significant difference between proficient and advanced fifth-grade Science MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year.

**Data Analysis and Findings**

Research questions and null hypotheses were investigated by completing an analysis of the data using SPSS. To compare ELA, Math, and Science MAP performance between full-time online fifth-grade and full-time seated fifth-grade students, independent samples *t* tests were conducted for the year 2020-2021. Statistical outcomes from SPSS were used to reject or fail to reject each null hypothesis. The independent variable was student placement during instruction, while the dependent variable was the percentage of students scoring proficient and advanced on ELA, Math, and Science. In order to compare differences, MAP data were obtained for each year. Whether a statistically significant difference existed between the dependent variable (MAP proficiencies) and independent variable (placement for instruction) was the focus of this study. An independent samples *t* test was used in order to determine the statistical significance in student achievement between full-time online and full-time seated Missouri fifth graders (Creswell & Creswell, 2018).

**Selection/Sampling**

For this study, student assessment scores of proficient and advanced students as measured by fifth-grade MAP scores in Math, Science, and ELA for the 2020-2021

school year were used. Students in the fifth grade who took the MAP test were used for this study during the corresponding years. Students with a DESE program code of 50 or 52 were identified as virtual students. Collected data from MODESE were used for this study. While MAP data were available through the open-access database, a data request was made to MODESE (n.d.) for the specific data used in this study. Since data from MODESE had already been collected and sorted, this study qualified as a causal-comparative ex post facto study. To generalize between variables, a total population sampling format was used (Creswell & Creswell, 2018). For this study, the total population sampling was limited to full-time and seated Missouri public school fifth graders that took a MAP test in Math, Science, or ELA during the 2020-2021 school year. Requested data from MODESE for the specific grade, content areas, and school years made the total population sampling possible. Requested student achievement data on the MAP achievement scores of Math, Science, and ELA of fifth-grade students were examined to see if differences between full-time and seated students existed. Finally, to compare full-time virtual and seated student achievement, an independent sample *t* test was used.

**Research Setting**

This causal-comparative ex post facto study was located in Missouri and used performance data for fifth-grade MAP assessments. With just over 6,000,000 people, Missouri is the 18th most populous state and has a composite cost of living index of 89.1, the fifth best in the United States (Missouri Economic Research and Information Center, 2020; United State Census Bureau, 2020). At the time of the study, Missouri consisted of 518 public school districts, 568 high schools, 49 junior highs, 295 middle schools, and

1,221 elementary schools; 86,670 teachers and administrators were currently employed in Missouri public schools. The school-aged demographic is represented in Table 1.

**Table 1**

*State-Aged Demographics and Missouri Demographics*

| Missouri Demographics | School-Aged Demographics |
|---|---|
| American Indian/Alaska Native | .4% |
| Asian | 2.1% |
| Black | 15.4% |
| Hawaiian/Pacific Islander | .4% |
| Hispanic | 7.2% |
| Multi-Race | 4.9% |
| White | 69.6% |

**Data Analysis**

Statistical analysis was used to analyze the data to answer the stated research questions and sub-questions. The requested data were provided via an Excel spreadsheet. Once requested data were received, the organization of the data took place. The organization consisted of creating multiple Excel spreadsheets that could be imported into SPSS. Spreadsheets were labeled by subject (ELA, Math, and Science) and year (2020-2021) for identification purposes. The organization identified two columns, the independent and dependent variables. The percentage of students scoring proficient and advanced on designated MAP assessments was moved to the dependent variable column. Student placement for instruction was moved to the independent variable column. Students who received instruction in a full-time online environment were identified with a 1, and students who received instruction in a full-time seated environment were identified with a 0. Care was taken to identify missing or inaccurate data through the data

organization process. Missing and inaccurate data were corrected before importing them into SPSS. Once data were imported into SPSS, independent *t* tests were run for each null hypothesis, and *p*-values, mean, and standard deviation were reported for each null hypothesis. Demographic information was not included in this study.

Laerd Statistics (2022) pointed out that before running independent sample *t* tests, six assumptions need to be addressed to determine if independent *t* tests were appropriate. Assumption 1, using a continuous scale to measure the dependent variable, was addressed using MAP test performance for each subject and year examined. Assumption 2, an independent variable consisting of two separate groups, was addressed using full-time online and full-time seated fifth-grade students. Assumption 3, independence of observations, was addressed using Program Codes 50 and 52 for full-time online students; these codes prevented students from being reported in full-time online and full-time seated groups. Assumptions 4, 5, and 6 were addressed using SPSS software. Assumption 4, no significant outliers that could negatively influence results, was addressed through the use of SPSS software. Outliers can negatively impact independent *t* tests; using SPSS software, outliers were easily identified, and outliers were examined for why they might exist and their statistical impact based on the goals of this study. Assumption 5, the assumption of normal distribution of the dependent variable for each independent variable, was addressed using the Shapiro-Wilk test of normality. Normal data distribution was represented by *p*-values greater than 0.5; data with values less than 0.5 were considered a nonnormal distribution. Finally, nonnormal distributed data violates the assumption of normality. Assumption 6, homogeneity of variances, was tested using Levene's test for homogeneity of variances, *p*-values greater than .05

represent an equal variance between variables, and the *t* test could be interpreted with equal variance assumed. A similar or significant difference between variables represents *p*-values less than .05, and *t* tests are interpreted with equal variance not assumed.

Independent sample *t* tests were appropriate as independent sample *t* tests compare the means for two groups. Since the independent variable was student placement for instruction before taking MAP assessments, independent sample *t* tests were appropriate for this study (Creswell & Creswell, 2018). Collected and organized data were reviewed in SPSS, and independent variable means were compared based on 1 or 0 values. Students who received instruction in a full-time online environment were identified with a 1, and students who received instruction in a full-time seated environment were identified with a 0. Independent variable means were analyzed to determine whether a statistically significant difference existed. Statistically significant differences were determined based on data analysis. For example, a value of $p > .05$ would not be a statistically significant difference because the researcher fails to reject the null hypothesis. A value of $p < .05$ would be a statistically significant difference because the null hypothesis would be rejected. Testing for significant differences shows results did not happen by chance.

Cohen's *d* was utilized to determine the effect size between the two groups. Cohen (1988) pointed out that .20, .50, and .80 are small, medium, and large effect sizes. A statistically significant difference was determined between the dependent variable of the percentage of students proficient and advanced and the independent variable of placement for instruction using independent samples *t* tests. Assumption and test results were reported (Cohen, 1988; Laerd Statistics, 2022).

## Results

Examination of the research questions and their hypotheses yielded the following results.

Research Question 1:

RQ1: What is the difference in fifth-grade proficient and advanced English Language Arts MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year?

Null Hypothesis 1:

($H_0 1$): There will be no statistically significant difference between proficient and advanced fifth-grade English Language Arts MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year.

Table 2 shows ELA group statistics for this study. The number of participants, mean percentage of students scoring advanced and proficient, standard deviation, and standard error mean are presented.

**Table 2**

*ELA Group Statistics*

| Year | Full-Time Virtual | *N* | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| 2020-2021 | Yes | 60 | .395 | .129 | .017 |
| | No | 60 | .440 | .130 | .017 |

Table 3 shows the Shapiro-Wilk Test of Normality for ELA during the 2020-2021 school year. Statistic, degrees of freedom, significance of normality variance, and full-time seated or full-time virtual are displayed.

**Table 3**

*ELA Shapiro-Wilk Test of Normality*

| Year | Statistics | *df* | *Sig.* |
|---|---|---|---|
| 2020-2021 | .982 | 120 | .101 |

Table 4 shows Levene's Test for equality of variance for ELA during the 2020-2021 school year. Equal variance assumed, *F*, and significance of variance are displayed.

**Table 4**

*Levene's Test for Equality of Variance for ELA*

| Year | Equal Variance Assumed | *F* | *Sig.* |
|---|---|---|---|
| 2020-2021 | Yes | .001 | .980 |

Table 5 shows the significance of difference between ELA MAP scores of full-time seated and full-time online fifth-grade students during the 2020-2021 school year. Mean difference, significance, standard error difference, Cohen's *d,* upper and lower confidence levels, degrees of freedom, and *t* values are displayed.

**Table 5**

*ELA Independent Samples t Test*

| Year | *t* | *df* | Sig. (2 tailed) | Mean Difference | Std. Error Difference | 95%Cl | | Cohen's *d* |
|---|---|---|---|---|---|---|---|---|
| | | | | | | *LL* | *UL* | |
| 2020-2021 | 1.938 | 118 | .055 | .04572 | .02359 | -.0009 | .0924 | .129 |

*Note.* Cl = confidence interval; *LL* = lower limit; *UL* = upper limit.

For Research Question 1, 2020-2021 ELA consisted of 60 districts with reportable data. To determine if there was a statistically significant difference between full-time online fifth-grade students and full-time seated fifth-grade students an independent

sample *t* test was run. Outliers were observed in the data, as assessed by inspection of a boxplot but the sample was robust enough to continue. MAP performance was normally distributed, as assessed by Shapiro-Wilk's test of normality ($p > .05$), and there was homogeneity of variances, as assessed by Levene's test for equality of variances ($p = .980$). There was not a statically significant difference between full-time online fifth-grade students ($N = 60$, $M = .395$, $SD = .129$) and full-time seated fifth-grade students ($N = 60$, $M = .440$, $SD = .130$) by a difference of .04572 (95% Cl, -.009 to .0924), $t(118) = 1.938$, $p < .055$. The null hypothesis ($H_0$1a) failed to be rejected: since the *p* value was close to the .05 threshold this data set deserves more attention. Effect size was .129 using Cohen's *d*.

Research Question 2:

RQ2: What is the difference in fifth-grade proficient and advanced Math MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year?

Null Hypothesis 2:

($H_0$2): There will be no statistically significant difference between proficient and advanced fifth-grade Math MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year.

Table 6 shows Math group statistics for this study. The number of participants, mean percentage of students scoring advanced and proficient, standard deviation, and standard error mean are presented.

**Table 6**

*Math Group Statistics*

| Year | Full Time Virtual | *N* | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| 2020-2021 | Yes | 65 | .268 | .135 | .017 |
| | No | 65 | .370 | .150 | .019 |

Table 7 shows the Shapiro-Wilk test of normality for Math during the 2020-2021 school year. Statistic, degrees of freedom, significance of normality variance, and full-time seated or full-time virtual are displayed.

**Table 7**

*Math Shapiro-Wilk Test of Normality*

| Year | Statistics | *df* | *Sig.* |
|---|---|---|---|
| 2020-2021 | .974 | 130 | .015 |

Table 8 shows Levene's Test for equality of variance for Math during the 2020-2021 school year. Equal variance assumed, *F*, and significance of variance are displayed.

**Table 8**

*Levene's Test for Equality of Variance for Math*

| Year | Equal Variance Assumed | *F* | *Sig.* |
|---|---|---|---|
| 2020-2021 | Yes | .870 | .353 |

Table 9 shows the significance of difference between Math MAP scores of full-time seated and full-time online fifth-grade students during the 2020-2021 school year. Mean difference, significance, standard error difference, Cohen's *d,* upper and lower confidence levels, degrees of freedom, and *t* values are displayed.

**Table 9**

*Math Independent Samples t Test*

| Year | *t* | *df* | Sig. (2 tailed) | Mean Difference | Std. Error Difference | 95%Cl | | Cohen's *d* |
|---|---|---|---|---|---|---|---|---|
| | | | | | | *LL* | *UL* | |
| 2020-2021 | 4.079 | 128 | <.001 | .10184 | .24964 | .0524 | .1512 | .142 |

*Note.* Cl = confidence interval; *LL* = lower limit; *UL* = upper limit.

For Research Question 2, 2020-2021 Math consisted of 65 districts with reportable data. To determine if there was a statistically significant difference between full-time online fifth-grade students and full-time seated fifth-grade students an independent sample *t* test was run. There were no outliers in the data, as assessed by inspection of a boxplot. Missouri Assessment Program (MAP) performance was not normally distributed, as assessed by Shapiro-Wilk test of normality ($p > .05$); the independent samples *t* test was robust to this violation so the *t* test could proceed, and there was homogeneity of variances, as assessed by Levene's test for equality of variances ($p = .353$). There was a statically significant difference between full-time online fifth-grade students ($N = 65$, $M = .268$, $SD = .135$) and full-time seated fifth-grade students ($N = 66$, $M = .370$, $SD = .150$) by a difference of .102 (95% Cl, -.0524 to .1512), $t(128) = 4.079$, $p < .001$. The null hypothesis ($H_0$2a) was rejected. Effect size was .142 using Cohen's *d*.

Research Question 3:

RQ3: What is the difference in fifth-grade proficient and advanced Science MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year?

Null Hypothesis 3:

($H_0$3): There will be no statistically significant difference between proficient and advanced fifth-grade Science MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year.

Table 10 shows Science group statistics for this study. The number of participants, mean percentage of students scoring advanced and proficient, standard deviation, and standard error mean are presented.

**Table 10**

*Science Group Statistics*

| Year | Full Time Virtual | *N* | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| 2020-2021 | Yes | 57 | .355 | .121 | .016 |
| | No | 57 | .427 | .129 | .017 |

Table 11 shows the Shapiro-Wilk test of normality for Science during the 2020-2021 school year. Statistic, degrees of freedom, significance of normality variance, and full-time seated or full-time virtual are displayed.

**Table 11**

*Science Shapiro-Wilk Test of Normality*

| Year | Statistics | *df* | *Sig.* |
|---|---|---|---|
| 2020-2021 | .977 | 114 | .044 |

Table 12 shows Levene's Test for equality of variance for Science during the 2020-2021 school year. Equal variance assumed, *F*, and significance of variance are displayed.

**Table 12**

*Levene's Test for Equality of Variance for Science*

| Year | Equal Variance Assumed | *F* | *Sig.* |
|---|---|---|---|
| 2020-2021 | Yes | .009 | .926 |

Table 13 shows the significance of difference between Science MAP scores of full-time seated and full-time online fifth-grade students during the 2020-2021 school year. Mean difference, significance, standard error difference, Cohen's *d,* upper and lower confidence levels, degrees of freedom, and *t* values are displayed.

**Table 13**

*Science Independent Samples t Test*

| Year | *t* | *df* | Sig. (2 tailed) | Mean Difference | Std. Error Difference | 95%Cl | | Cohen's *d* |
|---|---|---|---|---|---|---|---|---|
| | | | | | | *LL* | *UL* | |
| 2020-2021 | 3.088 | 112 | .003 | .0724 | .0235 | .0235 | .1190 | .125 |

*Note.* Cl = confidence interval; *LL* = lower limit; *UL* = upper limit.

For Research Question 3, 2020-2021 Science consisted of 57 districts with reportable data. To determine if there was a statistically significant difference between full-time online fifth-grade students and full-time seated fifth-grade students an independent sample *t* test was run. There were no outliers in the data, as assessed by inspection of a boxplot. Performance was not normally distributed, as assessed by Shapiro-Wilk test of normality ($p > .05$), and there was homogeneity of variances, as assessed by Levene's test for equality of variances ($p = .926$). There was a statically significant difference between full-time seated fifth-grade students ($N = 57$, $M = .427$, $SD = .129$) and full-time online fifth-grade students ($N = 57$, $M = .355$, $SD = .121$) by a

difference of .072 (95% Cl, .0235 to .1190), $t(112) = 3.088$, $p < .003$. The null hypothesis ($H_0$3a) was rejected. Effective size was .125 using Cohen's *d*.

**Summary**

Chapter Four presented data analysis and findings for this study. Research setting/sampling and demographic information was presented. Chapter Four included research questions and null hypotheses. For each research question and null hypothesis Levene's test for equality of variance, Shapiro-Wilk Test of Normality, and independent samples *t* tests were run. Each null hypothesis was rejected or failed to be rejected based on whether a statistically significant difference was identified. If the effect size was statistically significant the null hypothesis was rejected; if the effect size was not statistically significant the null hypothesis failed to be rejected. Chapter Five includes a summary of findings, professional implications, and recommendations for future research.

# CHAPTER FIVE

# CONCLUSIONS AND RECOMMENDATIONS

The leading source of 24-hour access to vital information is the internet. The availability has impacted every aspect of human life with information provided through reliable internet access (Ilgaz & Gülbahar, 2020; Abubakar & Salmanu, 2018). While the popularity of online/virtual education has increased, research focusing on the effectiveness of online/virtual education has been limited. Studies examining the performance of elementary online/virtual students have been nearly nonexistent (Arnesen et al., 2019; C.-H. Lin et al., 2019; Hart et al., 2018; Hart et al., 2019; Xu & Jaggers, 2013). Simonson (1995) argued that online/virtual learners' outcomes should be equivalent to seated learners' outcomes. Distance and local learners should not have identical learning experiences because they are not in the same environment (Simonson et al., 1999). Since distance learners are experiencing a different environment than local learners, they should have different learning experiences. The purpose of this causal-comparative study was to test Simonson's (1995) equivalency theory by comparing fifth-grade full-time online elementary students and fifth-grade full-time seated elementary students in terms of achievement as measured by MAP scores in the state of Missouri. This study examined Simonson's equivalency theory using a quantitative ex post facto casual-comparative study format to determine the performance of fifth-grade full-time online and fifth-grade full-time seated students on ELA, Math, and Science MAP assessments. Examining MAP performance from the 2021-2022 school year, the researchers determined if statistically significant differences existed between the full-time online and full-time seated fifth-grade students. Chapter Five summarizes the research

question findings, discussion, implications, and recommendations. A summary is provided at the end of Chapter Five.

**Research Questions**

RQ1: What is the difference in fifth-grade proficient and advanced English Language Arts MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year?

RQ2: What is the difference in fifth-grade proficient and advanced Math MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year?

RQ3: What is the difference in 5th Grade proficient and advanced Science MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year?

**Null Hypotheses**

($H_0$1): There will be no statistically significant difference between proficient and advanced fifth-grade English Language Arts MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year.

($H_0$2): There will be no statistically significant difference between proficient and advanced fifth-grade Math MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year.

($H_0$3): There will be no statistically significant difference between proficient and advanced fifth-grade Science MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year.

**Summary of Findings**

Quantitative statistical analysis was used to investigate each research question and null hypothesis. Independent samples *t* tests were run for each research question to

determine if a statistically significant difference existed. In order to measure the effect of the differences Cohen's *d* was utilized. Research questions aimed to determine if a statistically significant difference existed between full-time online and full-time seated fifth-grade students as measured by the percentage of students that scored proficient and advanced on ELA, Math, and Science MAP assessments. Each research question had a sub-question based on the assessment year. Findings were organized by content area and year.

In the area of ELA, for the 2020-2021 school year, 60 districts had reportable data. There was not a statically significant difference between full-time online fifth-grade students ($N = 60$, $M = .395$, $SD = .129$) and full-time seated fifth-grade students ($N = 60$, $M = .440$, $SD = .130$) by a difference of .04572 (95% Cl, -.009 to .0924), $t(118) = 1.938$, $p < .055$. The null hypothesis ($H_0 1$) failed to be rejected since the p-value was close to the .05 threshold; this data set deserves more attention. The effect size was .129 using Cohen's *d*. In summary, data analysis did not demonstrate a difference in student performance.

In the area of Math, for the 2020-2021 school year, 65 districts had reportable data. There was a statically significant difference between full-time online fifth-grade students ($N = 65$, $M = .268$, $SD = .135$) and full-time seated fifth-grade students ($N = 66$, $M = .370$, $SD = .150$) by a difference of .102 (95% Cl, -.0524 to .1512), $t(128) = 4.079$, $p < .001$. The null hypothesis ($H_0 2$) was rejected. The effect size was .142 using Cohen's *d*. In summary, data analysis demonstrated a statistically significant difference in student performance. However, the effect size measuring the difference between the two samples was measured at .142 using Cohen's *d.* An effect size of .142 represent a small effect size

between two samples. While independent samples t-test demonstrated a statistically significant difference in student performance the effect size between the two samples was small.

In the area of Science, for the 2020-2021 school year, 57 districts had reportable data. There was a statically significant difference between full-time seated fifth-grade students ($N = 57$, $M = .427$, $SD = .129$) and full-time online fifth-grade students ($N = 57$, $M = .355$, $SD = .121$) by a difference of .072 (95% Cl, .0235 to .1190), $t(112) = 3.088$, $p < .003$. The null hypothesis ($H_0 3$) was rejected. The effect size was .125 using Cohen's *d*. In summary, data analysis demonstrated a statistically significant difference in student performance. However, the effect size measuring the difference between the two samples was measured at .125 using Cohen's *d.* An effect size of .125 represent a small effect size between two samples. While independent samples t-test demonstrated a statistically significant difference in student performance the effect size between the two samples was small.

**Discussion**

The researcher sought to test Michael Simonson's (1995) equivalency theory for this study. Simonson's equivalency theory is built around the idea that while there should be different learning experiences for online and seated students, those learning experiences should be equivalent (Simonson et al., 1999). Equivalency theory includes equivalency, learning experiences, appropriate application, students, and student outcomes. Distance learning experiences should not be identical but equivalent to local students' outcomes. (Simonson et al., 2011, 2015). The results of this study add to the knowledge base examining the relationship between student placement and student

performance. In addition to adding to the knowledge base examining student placement and student performance this study specifically examined the impact of student placement and student performance at the elementary level.

As evidenced by the results of this study, while the effect size is small, there is a statistically significant difference between elementary full-time online and elementary full-time seated student performance on Math and Science MAP assessments. Full-time seated students performed better on the Math and Science MAP assessment than full-time online students. While full-time seated students performed better than full-time online students, the effect size was minimal for both Math and Science. In the area of ELA, full-time seated students did not perform better than full-time online students. The results were consistent with literature examining student placement and student performance where seated student performance was better than online student performance (Gulosino & Miron, 2017; Molnar et al., 2019, 2021; Miron et al., 2018; Miron & Urschell, 2012; Zimmer et al., 2003). However, ELA performance results were consistent with literature describing online student performance as being similar to or slightly better than seated student performance (Hart et al., 2019; C.-H. Lin et al., 2019; Rahimi & Yadollahi, 2017). The results of this study add a new layer to the student placement and performance literature. Unlike other studies examining differences between student placement and student achievement, a theoretical framework guided this study. In addition, this study focused on the elementary level and examined data from a state with a high level of control over virtual/online education. Equivalency theory includes equivalency, learning experiences, appropriate application, students, and student outcomes.

In Missouri, all online providers must be vetted by independent outside agencies. Vetted courses are checked for alignment of Missouri Learning Standards with corresponding grade levels and must be taught by a teacher certified in Missouri. Through this process, online students in Missouri receive equivalent learning experiences to seated students. Missouri's elementary online providers utilize a synchronous learning model; students log in each day and receive instruction in real time. This method satisfies the appropriate application component of equivalency theory. Through legislative processes, Missouri has ensured that all students have access to online education; online providers in Missouri are limited to tuition that equals the reimbursement for each student. This means online providers are essentially not for profit. All of these measures at the state level ensure that online and seated students have the most equivalent learning experience possible. This background led the researcher to hypothesize that ELA, Math, and Science learning outcomes would be equivalent. Test results showed that Math and Science did not identify equivalent learning outcomes. Simonson's (1995) equivalency theory for student outcomes was not true for Math and Science. While equivalency, learning experiences, appropriate application, and students were not thoroughly examined for this study, results did not support equivalent outcomes for elementary full-time online students in Math and Science when compared to elementary full-time seated students. However, ELA performance for elementary full-time students supported the theory that online students have equivalent learning outcomes when compared to elementary full-time seated students.

Studies examining online course development, pedagogy, and learner experience have increased as online course enrollment has become more popular. Whether seated or

online, students with quality learning experiences have higher levels of performance (Almekhlafi et al., 2020; Bolt-Lee, 2021; Hussar et al., 2020; McGuinness, 2020). Similarly, quality teachers are a critical component of student success; teachers who take the time to build positive relationships with students and implement students centered learning environments increase student performance (An & Mindrila, 2020; Bransford et al., 2001; Pološki & Aleksic, 2020; Qiu, 2019; Shah, 2019). In the same way development of quality online courses through the course evaluation instruments has been shown to increase the quality of courses and subsequent learner experience. Online course providers in Missouri are subject to strict quality control measures. Outside agencies have thoroughly examined every online course for alignment with Missouri Learning Standards; a Missouri-certified teacher teaches every online course. In addition, each course is evaluated based on web content accessibility guidelines. The results of this study confirm and contradict the established literature linking quality course development, learner experience, and learning outcomes (Almekhlafi et al., 2020; Bolt-Lee, 2021; Hussar et al., 2020; McGuinness, 2020; An & Mindrila, 2020; Bransford et al., 2001; Pološki & Aleksic, 2020; Qiu, 2019; Shah, 2019). All online courses are evaluated for quality development before being offered to Missouri students, and quality learner experience is provided by synchronous instruction from a Missouri-certified teacher. Online students in Missouri are taking quality online courses with the best learning experience possible. While Missouri has done an excellent job of providing the best online courses in the best online environments, Math and Science student outcomes were not equivalent to seated student outcomes. However, ELA student outcomes were equivalent when compared to seated student outcomes. When examining literature

centered around quality course development, learner experience, and learning outcomes, the Math and Science results contradict the established literature, while ELA results confirm the established literature.

This study was limited by multiple factors outside the researcher's control. First, the accuracy and reliability of MAP data were limited as the researcher had no control over the collected data. The number of students enrolled in online courses during the 2020-2021 school year was unknown and out of the researcher's control. Third, the study design was adjusted based on available information through the MODESE database. While elementary students in Missouri have been able to take online courses for multiple years, performance data was not collected before the 2020-2021 school year. As a result, the percentage of students scoring proficient and advanced were requested at the district level. Data availability was limited due to MODESE's internal controls, policies, and practices. As part of MODESE's internal controls, data sets with fewer than five participants were suppressed. As a result, districts with five or more full-time online students were not suppressed and included in this study; this reduced the number of districts with reportable data. For the 2020-2021 testing cycle 60 districts had reportable data for ELA, 65 districts had reportable data for Math, and 57 districts had reportable data for Science. The researcher had no control over testing environments throughout the state of Missouri. In addition, student effort on MAP tests was out of the researcher's control. Finally, throughout the study, the number of approved MOCAP providers continued to grow: 12 vendors had been approved at the beginning of the study. At the conclusion of this study, 18 vendors had gained approval to offer online classes in Missouri. The results of this study can be applied throughout Missouri and the online

learning community as a whole. As this was the first year of online student achievement data collection at the elementary level in Missouri, achievement data should be used cautiously for large-scale decision-making. At the same time, data were collected during the end of the COVID-19 global pandemic. Seated student performance during the 2020-2021 testing cycle was below pre-pandemic levels; this means that while full-time seated student performance was lower in 2020-2021 than in previous years, full-time seated students still performed better than full-time online students. The online learning community's application comes from processes and internal controls Missouri has put in place to ensure equivalent learning opportunities and experiences for all Missouri students.

**Professional Implications**

Full-time online students did not perform as well as full-time seated students in ELA and Science; full-time online students had similar performance to full-time seated students in Science. The test results give all stakeholders a glimpse of how full-time online elementary student achievement compares to full-time seated elementary student achievement. Before this study, differences in achievement between full-time online elementary and full-time seated elementary students in Missouri were unknown. As local, state, and national stakeholders are charged with closing student achievement gaps, having achievement data from different instructional settings helps leaders make decisions in the best interests of students.

This study has implications within the online learning segment at the national and state levels. State and national policymakers have focused on closing the achievement gap of K-12 students for over 30 years (Acosta et al., 2020; Bjorklund-Young &

Plasman, 2020; Green et al., 2021; Tindal & Anderson, 2019). Online learning has continued to increase in popularity; performance data suggest that as the control of online environments moves further away from local districts, student performance decreases (Fuller, 2017; Hart et al., 2019; C.-H. Lin et al., 2019; Miron et al., 2018; Molnar, 2019; Molnar et al., 2021). National policymakers should look for opportunities to return educational decision-making to states. Missouri achievement data can help determine the appropriate place for online education at the elementary level. During the time of research, legislators have been able to keep large for-profit virtual schools out of Missouri; large for-profit virtual schools enroll the highest number of students and have the worst performance records (Gulosino & Miron, 2017; Miron et al., 2018; Molnar, 2019; Molnar et al., 2021). District-operated virtual schools have grown in popularity and reported the best performance among virtual schools. When deciding which MOCAP-approved vendor is appropriate for students, local decision-makers could explore district-operated MOCAP vendors; Missouri currently has seven district-operated MOCAP-approved vendors. Local school leaders could use this information to select the best online vendor for student success.

This study has implications within specific content areas. For example, online student performance did not match or exceed seated student performance in Math or Science. However, online student performance did match seated student performance in ELA. ELA standards for Missouri are separated into two broad categories, K-5 and 6-12. Many of the standards are repetitive and add specific skills as the grade level increases. ELA standards consist of reading and writing; both reading and writing require specific and timely feedback from teacher to student, which can be challenging to provide in an

online environment. In addition, timely feedback and communication from teacher to student predict student success in virtual courses (Pardino et al., 2018; Roddy et al., 2017; Steele et al., 2019; Wilson, 2018). Science standards in Missouri are constructed to provide students with a firm scientific foundation. Every educational discipline has components that bring the specific discipline to life. In Science, labs, demonstrations, and hands-on activities are the most used components to extend and accelerate learning. This authentic learning experience is lost when taking Science in an online format. Each grade's Math standards in Missouri builds on concepts and skills learned in previous grades. Math concepts can be less abstract than ELA and Science concepts; this could make Math concepts easier to teach and learn in an online environment.

This study has implications for online course designers. For example, when online students' cognitive, socio-emotional, and behavioral needs are met, online students experience a greater feeling of community and membership during the online course (Bigatel & Edel-Malizia, 2018; X. Lin & Gao, 2020). These feelings of community and membership lead to higher levels of student achievement. Lower levels of student performance in ELA and Science could demonstrate that cognitive, socio-emotional, and behavioral needs were not met when compared to seated students. Similar performance levels could demonstrate that cognitive, socio-emotional, and behavioral needs were met in Math compared to seated counterparts. MOCAP course design, monitoring, and revising should be a priority to meet students' cognitive, socio-emotional, and behavioral needs across disciplines.

This study has implications for online teachers. This study adds to the knowledge base that the teacher's role is vitally important to the success of an online course (Ilgaz &

Gülbahar, 2020; Roddy et al., 2017). Equivalency theory includes equivalency, learning experiences, appropriate application, students, and student outcomes. Like seated student environments, best practices and sound pedagogy promote student achievement. Mixed results from this study validate the need for continued research to move online best practices and pedagogy forward (Cantamessa, 2018; Pardino et al., 2018; Roddy et al., 2017; Serdyukov, 2015; Steele et al., 2019; Wilson, 2018). Results indicate that Math and Science best practices and pedagogy need to be adjusted, while ELA best practices and pedagogy help students perform similarly to seated students. The results of this study are limited to elementary full-time online and full-time seated student achievement. In addition, the results of this study are limited to the ELA, Math, and Science content areas. The results of this study both validate and contradict equivalency theory; further investigation into student outcomes of elementary full-time online students is recommended.

**Recommendations for Future Research**

The purpose of this study was to test Simonson's equivalency theory by comparing fifth-grade full-time online elementary students and fifth-grade full-time seated elementary students in terms of achievement as measured by MAP scores in Missouri. This study determined if a statistically significant difference existed between the two groups. This study identified statistically significant differences for ELA and Science null hypotheses between full-time online and full-time seated students. In addition, results did not identify a statistically significant difference in Math between full-time online and full-time seated students. While the research questions were

answered, as with any study, answering the research questions led to more questions that this study could not answer.

It is recommended that this study be replicated. This study identified baseline performance data for elementary students in Missouri. Due to COVID-19, state assessments were not given in 2020; no student achievement data were collected. While seated, student achievement was below pre-pandemic levels for the 2020-2021 testing cycle; seated students had higher achievement than online students in Math and Science. Current data are the only available data released by MODESE; while the data are valuable, more data are required to accurately frame the quality of elementary online education in Missouri. Data collected for this study were requested at the district level. This request suppressed multiple data points; only districts with five or more full-time online students could be included. It is unknown how many full-time online students were not included in this study. Therefore, collecting, analyzing, and reporting future elementary online achievement data at the student level is recommended. Requesting data at the student level requires an additional clearance from MODESE and internal controls to keep individual student data secure.

It is recommended that additional grade level MAP assessment data be examined. Students in Missouri begin taking MAP assessments in the third grade. While initial data have only been collected at the fifth-grade level adding earlier grade level assessment data will help bring the overall view of elementary virtual education in Missouri into better focus. Additionally, a close examination of student learning experience before third grade should be examined. At the fifth-grade level the majority of students are reading to learn, at the earlier grades students are learning to read. Knowing how to best teach

emerging learners and specifically emerging readers in a virtual format will add valuable insight to early childhood education and virtual education.

It is recommended that all components of Simonson's equivalency theory be examined. This study was focused on student outcomes; other components of Simonson's equivalency theory include learning experience, appropriate application, and students. Each component has an extensive literature base that should be explored further. Initial test results demonstrate a gap between full-time online and full-time seated students; identifying the reason for differences in achievement outcomes is essential. Missouri's MOCAP program insures equitable access to online courses for every Missouri student. It is recommended that demographic trends be looked at in Missouri. Our state is made up of mostly rural school district with few suburban and urban centers. Online providers in Missouri need to know if the demographic make-up of online/virtual elementary students matches the demographic make-up of seated elementary students. Knowing demographic trends of online/virtual students helps close the access gap and allows decision makers to better examine student performance data.

Full-time online student achievement is recommended to be collected, analyzed, and reported based on the MOCAP provider. During this research project Missouri adjusted the MOCAP program. MOCAP providers that partner with a Missouri public school district, charter school, or university are now allowed to count the enrolled student as a student of their district. Students that enroll with MOCAP vendors that do not have a Missouri school district, charter, school, or university as a partner are still enrolled in their home district. This distinction between MOCAP providers sets the stage for district run online/virtual schools and non-district run online/virtual schools. Historically, smaller

district run virtual schools have had better student performance when compared to non-district run online/virtual schools. Missouri has implemented practices and processes to help level the playing field of MOCAP providers. All MOCAP providers must play by the same rules to provide online education in Missouri. While all providers met the exact requirements, there is no guarantee that all students are offered the same educational experience. MOCAP student achievement data lead to another recommendation. Literature highlighting the importance of quality course design, implementation, reflection, and adjustment is extensive. Using the achievement data from each MOCAP provider, a full audit of course design, implementation, reflection, and course adjustment can be completed to meet student needs better.

At the time of this research, Missouri was one of three states to make available elementary online course offerings through a state-run virtual school. It is recommended that the achievement of Missouri students be compared to that of students in the other two states. Comparing achievement outcomes and where other starts are in their implementation timeline gives guidance to Missouri leaders on appropriate next steps.

**Summary**

As the popularity of online educational opportunities has grown, research on the impact of student achievement has lagged (Arnesen et al., 2019; Hart et al., 2019; Iswan & Sari, 2022; Molnar et al., 2021; Taylor & McNair, 2018). For elementary students, full-time virtual learning opportunities are being realized (Digital Learning Collaborative, 2019; Foundation for Blended and Online Learning, 2018; Iswan & Sari, 2022). Missouri Statue 161.670. grants all full-time Missouri students access to online educational opportunities through the MOCAP platform (Revisor of Missouri, 2018). Within

Missouri, knowing the difference in academic performance of full-time online and full-time seated elementary students is essential. State policymakers, in addition to local boards of education, district and building-level administrators, and parents, should use the findings from this study when determining the best educational interest placement for elementary students. The problem was that the differences in achievement between full-time Missouri elementary seated students and Missouri elementary full-time online students were unknown. For example, suppose full-time virtual students' achievement differs significantly from full-time seated students. In that case, an argument could be made that full-time virtual learning is inappropriate for elementary students. However, suppose the achievement of full-time virtual students is not significantly different from full-time seated students. In that case, an argument could be made that either mode of instruction is appropriate for elementary students. This study helped fill the gap in determining performance differences between full-time online and full-time seated elementary students in Missouri.

The purpose of this causal-comparative study was to determine if a statistically significant difference existed between fifth-grade full-time online elementary students and fifth-grade full-time seated elementary students in terms of achievement as measured by MAP scores in the state of Missouri. In this study, the researcher compared the achievement outcomes of full-time online fifth-grade students to the achievement outcomes of full-time seated fifth-grade students. Michael Simonson's (1995) equivalency theory provided the support for this study. Simonson's equivalency theory is built around the idea that while there should be different learning experiences for online and seated students, those learning experiences should be equivalent (Simonson et al.,

1999). Equivalency theory includes equivalency, learning experiences, appropriate application, students, and student outcomes. Limitations for this study were the accuracy and reliability of MAP data, MODESE protocols and internal controls, student effort, student testing environment, and prior experience in online course formats.

Three research questions guided this study: What is the difference in fifth-grade proficient and advanced English Language Arts MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year? What is the difference in fifth-grade proficient and advanced Math MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year? What is the difference in fifth-grade proficient and advanced Science MAP scores of full-time virtual students and seated students in Missouri for the 2020-2021 school year? An ex post facto quantitative causal-comparative methodology was used to complete the study. The independent variable used in this study was whether fifth graders were online students or seated students; online students are generally defined as students enrolled in an approved MOCAP provider course. The dependent variable used in this study was student achievement/outcomes as measured by fifth-grade MAP assessment scores. This study used the percentage of students who scored proficient and advanced on fifth-grade ELA, Math, and Science MAP assessments. Fifth-grade MAP data were requested and collected for the 2020-2021 school year. Once MAP data were collected and organized independent samples *t* tests were run for each null hypothesis. Null hypotheses were either rejected or failed to be rejected.

Using statistical analysis each research question was answered. Answers to each research question fulfilled the purpose of the study. Fulfilling the purpose of the study

identified whether Simonson's equivalency theory of equivalent outcomes for online and seated student was verified or contradictory for Missouri elementary students. For the year 2020-2021 school year while the effect size was small elementary full-time online student performance was statistically significantly different than elementary full-time seated student performance in Math and Science. For the 2020-2021 school year MAP data for full-time Missouri elementary online and seated students in Math and Science contradicted Simonson's equivalency theory for equivalent outcomes. For the 2020-2021 school year elementary full-time online student performance was not statistically significantly different than elementary full-time seated student performance in ELA. For the 2020-2021 school year MAP data for full-time Missouri elementary online and seated students in ELA verified Simonson's equivalency theory for equivalent outcomes.

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# APPENDICIES

## APPENDIX A

Southwest Baptist UNIVERSITY

COLLEGE OF PROFESSIONAL PROGRAMS
1600 University Avenue
Bolivar, Missouri 65613
(417) 328-2099

July 29, 2022

Re: Differences in MAP Performance of Online and Seated Fifth-Grade Students in Missouri Elementary Schools

Dear Nathan Carter,

On July 29, 2022, a review of your application and supporting documents for the above named research proposal was completed. The Research Review Board (RRB) for Southwest Baptist University has determined that the proposed research project meets the criteria for Exempt status as per policy 1.15.3 (A.1) in the faculty guidelines. As per the above policy "If the project is certified exempt, the principle investigator need not resubmit the project for continuing RRB review as long as there are no modifications in the exempted procedures". The study has now been approved, therefore, work on the project may begin.
If any modifications to the exempted procedures are made, the RRB will need to complete a new review of the changes to determine if the project remains Exempt or if further review is necessary.

Congratulations on the approval of your project, we wish you well during its completion.

Sincerely,

Joseph Sartorius, Ph.D.
Chair, Research Review Board
Professor of Graduate Studies

# APPENDIX B


## Data Request Form

**DIRECTIONS**

This form is to be used when requesting special reports from the Department of Elementary and Secondary Education (DESE). A number of resources are available through the Missouri Comprehensive Data System (MCDS) portal at http://mcds.dese.mo.gov/Pages/default.aspx. Allow at least three business days for notification regarding the status of your request. * Indicates a required field.

If there are costs involved in the fulfillment of your request for data, DESE will provide you with a time/cost estimate prior to moving forward with the data request. Minimum N-Size = 5. All cells with 5 or fewer students will be suppressed to protect student privacy. Some data requests may require a Memorandum of Understanding to be established.

Due to staff shortages within our data team, DESE is currently experiencing a longer than normal wait time for data requests to be reviewed and processed. We apologize. If you have not received notification from our office within 4-6 weeks of your request, please send an email to dsm@dese.mo.gov.

If you have any questions, contact the Office of Data System Management at dsm@dese.mo.gov or 573-522-3207.

**CONTACT INFORMATION**

| FIRST NAME: * | LAST NAME: * | TITLE: |
|---|---|---|
| DAYTIME PHONE: * | EMAIL: * | ORGANIZATION/AFFILIATION: |
| REQUESTOR: * Select... | DATE REQUESTED: 08/01/2022 | DATE NEEDED: * / / |

**REQUEST INFORMATION**

DESCRIBE THE PURPOSE/REASON FOR THE DATA REQUEST AND WHAT THE DATA WILL BE USED FOR (BE SPECIFIC - NEEDED FOR FEDERAL/STATE REPORTING PURPOSES, LEGISLATIVE REQUEST, RESEARCH PURPOSES, SUNSHINE LAW REQUEST, ETC.) (Text over 250 characters will not be saved.)*

| FORMAT OF DATA TO BE PROVIDED * | LEVEL OF AGGREGATION* | SCHOOL YEAR(S) NEEDED* (example 2015 equals 2014-2015 school year) |
|---|---|---|
| Select... | ☐ State Level<br>☐ District/LEA (Local Education Agency) Level<br>☐ Building Level<br>☐ Other Level (please describe): | |

| GRADE LEVEL(S): | | DISTRICT/LEA TYPE: | BUILDING LEVEL: |
|---|---|---|---|
| ☐ PK | ☐ 6 | ☐ All Public LEAs | ☐ All |
| ☐ K | ☐ 7 | ☐ Charter LEAs | ☐ Elementary |
| ☐ 1 | ☐ 8 | ☐ State Operated Programs | ☐ Middle |
| ☐ 2 | ☐ 9 | ☐ Nonpublic Schools | ☐ High School |
| ☐ 3 | ☐ 10 | ☐ Specific District/LEA(s) (please select below): | ☐ Charter School |
| ☐ 4 | ☐ 11 | | ☐ Specific School(s) (please list below): |
| ☐ 5 | ☐ 12 | | |
| ☐ PK-12 | ☐ K-12 | | |
| ☐ K-8 | ☐ 9-12 | | |

DATA REQUEST TYPE (Please choose only one of the following):

☐ Dissertation/Research

**Accountability**

☐ MSIP Accountability Results ☐ Educator Preparation Accountability Results

**Information not related to Accountability**

| | | | |
|---|---|---|---|
| ☐ State Assessments Results | ☐ College Readiness Results (ACT, SAT, etc.) | ☐ Career Readiness Results (Perkins, Career Education, CTSO) | ☐ General State/District/School Statistics |
| ☐ School Administrator/Teacher Information | ☐ District/School Course Information | ☐ Special Education | ☐ Other |

PROVIDE SPECIFIC DETAILS ON THE DATA THAT IS BEING REQUESTED (TEXT OVER 600 CHARACTERS WILL NOT BE SAVED)*

If additional supporting information is needed to process this request, upload a document by clicking the Browse button and selecting the supporting document.

Upload file: Choose File No file chosen

Submit Start Over