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The Impact of Student Learning Pathway Choices During the COVID-19 Pandemic on Academic Achievement

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THE IMPACT OF STUDENT LEARNING PATHWAY CHOICES DURING THE COVID-19 PANDEMIC ON ACADEMIC ACHIEVEMENT

By
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Approval Page

This dissertation was submitted by Lauren Canfield under the direction of the persons listed below. It was submitted to the Gardner-Webb University College of Education and approved in partial fulfillment of the requirements for the degree of Doctor of Education at Gardner-Webb University.

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Abstract

THE IMPACT OF STUDENT LEARNING PATHWAY CHOICES DURING THE COVID-19 PANDEMIC ON ACADEMIC ACHIEVEMENT. Canfield, Lauren, 2023: Dissertation, Gardner-Webb University.

In the fall of 2020, students chose the learning pathway that best suited their situation due to the COVID-19 pandemic. Learning pathways were face-to-face, virtual synchronous, and virtual asynchronous. Because of this, in the fall of 2021, all students demonstrated learning loss. The learning loss, however, was not congruent among students. This quantitative study sought to determine if a student's learning pathway choice during the COVID-19 pandemic impacted their academic achievement as measured by grade point average, end-of-course exam scores for Algebra I, and qualification for Tier 2 academic interventions in a multi-tiered system of support. This study was conducted in a large school district in South Carolina. The population used was the students in one of the district's high schools who entered their first year of high school during the 2021-2022 school year. Independent *t* tests and chi-square tests of independence were used to determine if a student's measure of academic achievement was independent of their learning pathway choice during the 2020-2021 school year. This study found that overall, students learning in the face-to-face pathway had higher academic achievement than their peers on the virtual synchronous pathway. This study did not have enough data to make any conclusions regarding students on the virtual asynchronous pathway. The findings of this study could lead to better training and preparation for teachers and students moving toward virtual learning options in the future.

Keywords: COVID-19, virtual learning, academic achievement, quantitative

Table of Contents

Tables

Figures

Chapter 1: Introduction

In 2020, the world experienced the onset of the COVID-19 pandemic. Everything came to a stop: businesses, social events, and education. In March 2020, students in a suburban school district in South Carolina, where this study was conducted, were sent home to finish the school year virtually. Teachers, students, and administrators were forced into a new form of teaching and learning. Online learning "was rolled out quickly, inequitably, and in many cases without academic rigor" (Klein, 2022, para. 5). This changed the structure, stability, and routine of education for students, teachers, and parents (Goldberg et al., 2021).

In the fall of 2020, there were mixed reactions to reopening schools as COVID-19 was still a great concern to many. In the United States, each region, state, and individual school district made different decisions regarding how best to proceed (Asare et al., 2021). Students in the school district where this study was conducted were given the option of three different learning pathways: face-to-face, asynchronous virtual learning, and synchronous virtual learning. Face-to-face refers to in-person learning, asynchronous virtual learning refers to learning that takes place completely online and at the learner's pace, and synchronous virtual learning is learning that takes place online but in which the class meets virtually at a regularly scheduled time. In the fall of 2021, all students were required to return to in-person learning.

Schools adopted virtual learning strategies out of necessity without results or research to justify their instructional choices. Existing literature contained few studies on the effectiveness of virtual or hybrid models of teaching in secondary education prior to the COVID-19 pandemic (Dorn et al., 2020). Students around the world have

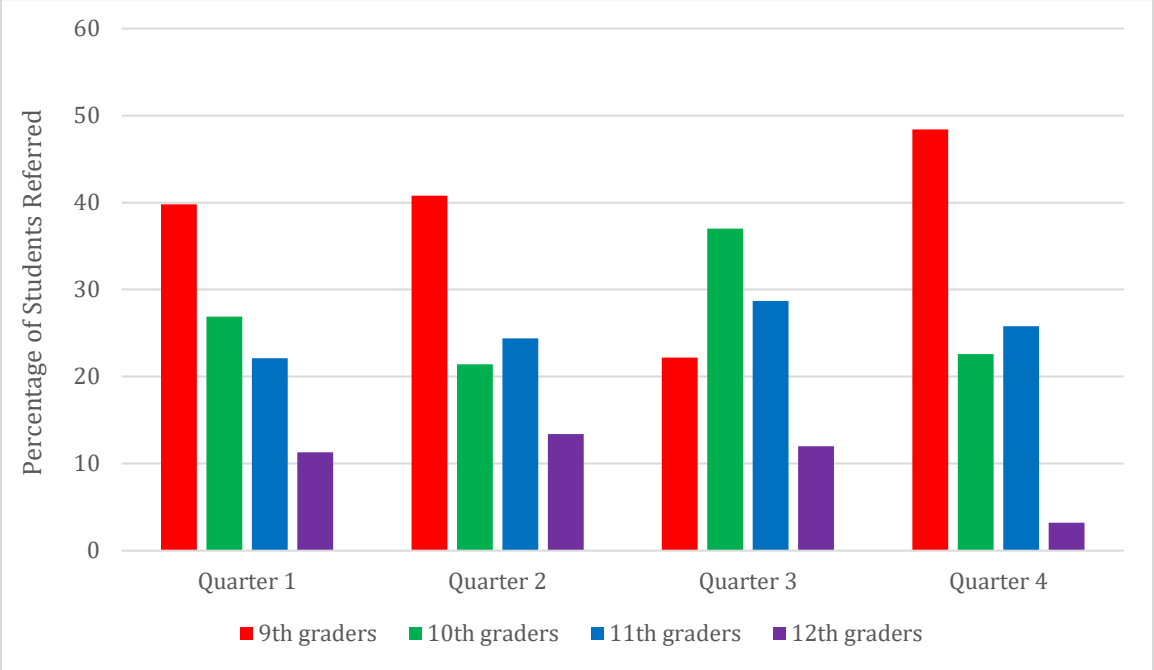
demonstrated learning loss over the course of the COVID-19 pandemic (Aboagye et al., 2020; Auxier & Anderson, 2020; Chisadza et al., 2121; Dorn et al., 2020; Hammerstein et al., 2121; Kamenetz, 2022). This study examined the extent to which students' learning pathways in the fall of 2021 impacted their academic achievement as measured by the change in end-of-year grade point averages (GPAs), Algebra I end-of-course (EOC) exam scores, and qualification for Tier 2 academic interventions through a multi-tiered system of support (MTSS).

Statement of the Problem

Research showed that students in all grade levels had experienced a learning loss over the course of the COVID-19 pandemic (Auxier & Anderson, 2020). At this suburban high school in South Carolina, the students who entered their first year of high school in the fall of 2021 showed the greatest loss in learning as measured by the frequency of referral to Tier 2 academic interventions through MTSS compared to other grade levels. Figure 1 shows the breakdown of referrals for students at this high school for Tier 2 MTSS interventions.

Figure 1

2021--2022 Tier 2 Academic Support Referrals



In three of the four quarters of the 2021-2022 school year, ninth-grade students were the largest population of students referred for Tier 2 MTSS interventions at this school. The only quarter when they were not the highest population referred was the third quarter. This could be attributed to the school's master schedule. The school was on a block schedule, and most beginner-level courses, of which ninth-grade students make up the largest population, switch at the beginning of the third quarter. Teachers might have been reviewing past knowledge during this quarter in order to assess the present achievement levels of their students and deliver the new content of the course best. Most upper-level courses, of which 10th, 11th-, and 12th-grade students make up the highest population, are continued into the third quarter, and content continues to be new to those students. Figure 1 does not differentiate between students according to their learning pathways in the previous school year.

Because each student could choose their learning pathway during the 2020-2021 school year, the learning loss was not congruent among the ninth-grade cohort. Goldberg et al. (2021) wrote that students may have struggled with virtual learning due to many factors, including a lack of motivation, conditions of the physical learning environment, or an inability to work independently. Learning environments, for example, varied between students who chose the face-to-face learning pathway and those who chose asynchronous or synchronous virtual pathways, as the former were in a school building and the latter were not. Further, the learning environments varied between each student who chose asynchronous or synchronous virtual pathways depending upon their home situation. The same is true of motivation and the ability to work independently as they varied between individual students, and the support for students in these areas varies with the type of instruction they received.

Purpose of the Study

At the onset of the COVID-19 pandemic, schools switched quickly to various methods of virtual instruction (Asare et al., 2021). Since that shift in the method of delivering educational content to students, learning loss has been seen across grade levels and demographics (Dorn et al., 2020; United Nations Sustainable Development Group, 2020). In this suburban high school in the fall of 2020, students had to select a learning pathway to suit their needs and situation best as the COVID-19 pandemic continued. They could select from a face-to-face model, an asynchronous virtual model, or a synchronous virtual model. This study sought to identify to what extent academic achievement was impacted by the pathway students selected during the 2020-2021 school year. Academic achievement was measured by the change in end-of-year GPAs, Algebra

I EOC exam scores, and qualification for Tier 2 academic support through MTSS.

Research Questions

This study explored the effects of learning pathways on student academic achievement. It used quantitative methods to collect and analyze historical data. It answered the following research questions:

1. To what extent did the students' learning pathways impact the next year's academic achievement as measured by the change in end-of-year GPAs?
2. To what extent did the students' learning pathways impact academic achievement as measured by the Algebra 1 EOC exam scores?
3. To what extent did the students' learning pathways impact the likelihood of student qualification for Tier 2 academic interventions in an MTSS in their first year of high school?

Significance of the Study

A study done by the Consortium of Chicago School Research in 2005 reported that failing one semester class in a student's freshman year of high school decreased the likelihood of graduating on time from 80% to 63% (Callender, 2014). Since the height of the COVID-19 pandemic, digital learning platforms have become more and more a part of the secondary education model, but there was limited research on the effectiveness of digital learning in the secondary educational setting (Dorn et al., 2020). During the first year of the COVID-19 pandemic, students in this suburban school district received instruction in one of three ways: face-to-face, asynchronous virtual, or synchronous virtual. The results of this study could help educational leaders, teachers, parents, and students better understand the impact of virtual learning versus learning in a more

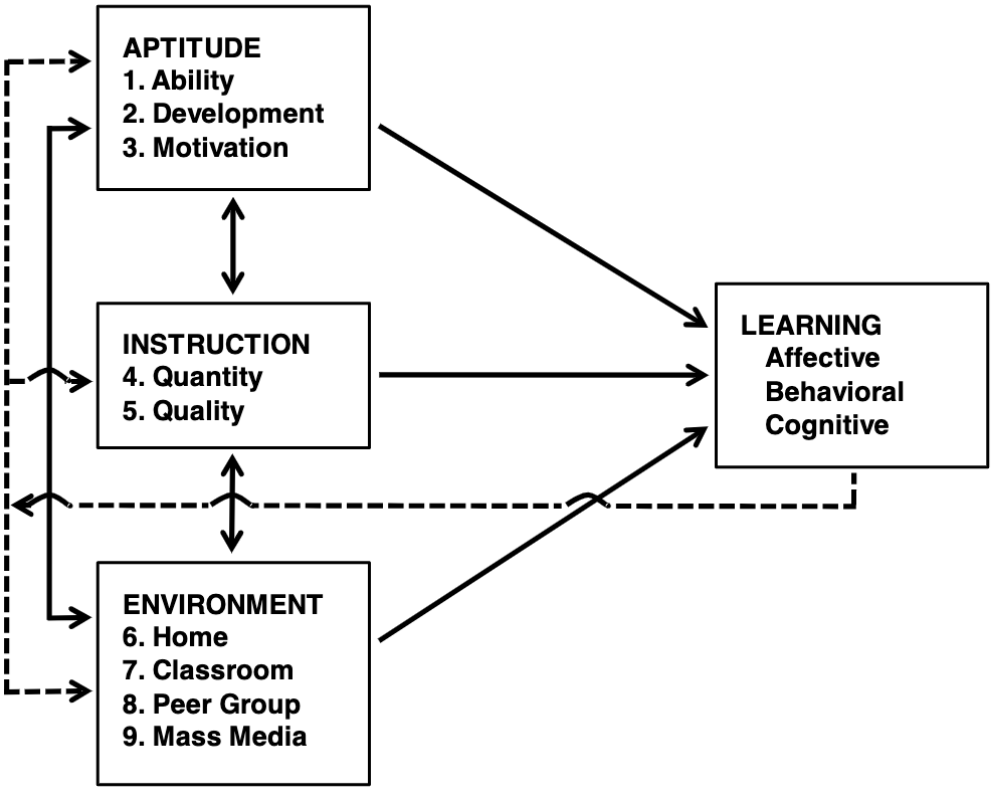
traditional, face-to-face format on academic achievement in secondary education. Educational leaders could use the results of this study to inform their decisions regarding a shift to virtual learning in an emergency, as well as inform decisions about professional learning opportunities for teachers in their district. Teachers could grow from the results of this study by realizing best practices for individual student needs and different pathways of teaching. Finally, students and parents could use the findings of this study to inform their educational pathway decisions better and gain insight into individual learning styles and pathways best suited for each individual child.

Theoretical Framework

Herbert J. Walberg wrote his Model of Educational Productivity in 1981. It evolved from John Carroll's model of school learning developed in 1963 (Neumann et al., 2012). He wrote that nine factors, divided into three categories, contributed to student academic achievement. Walberg's theory is summarized in Figure 2.

Figure 2

Walberg's (1981) Model of Educational Productivity



(Fraser et al., 1987, p. 158)

The three categories that influence academic achievement, according to Walberg (1981), are aptitude, instruction, and environment. Aptitude is broken down into ability, which is measured by one's performance on tests; development, that is, one's age and maturity level; and motivation, as measured originally by personality tests but is more modernly known as grit. The instructional category consists of quantity or time spent learning and quality or effectiveness of instruction. Walberg confirmed that each of the first five factors must be present in some capacity for learning to take place (Kirschenbaum, 1993). The final category, environment, is made up of home, classroom, peer group, and mass media. This was the major difference between Walberg's theory

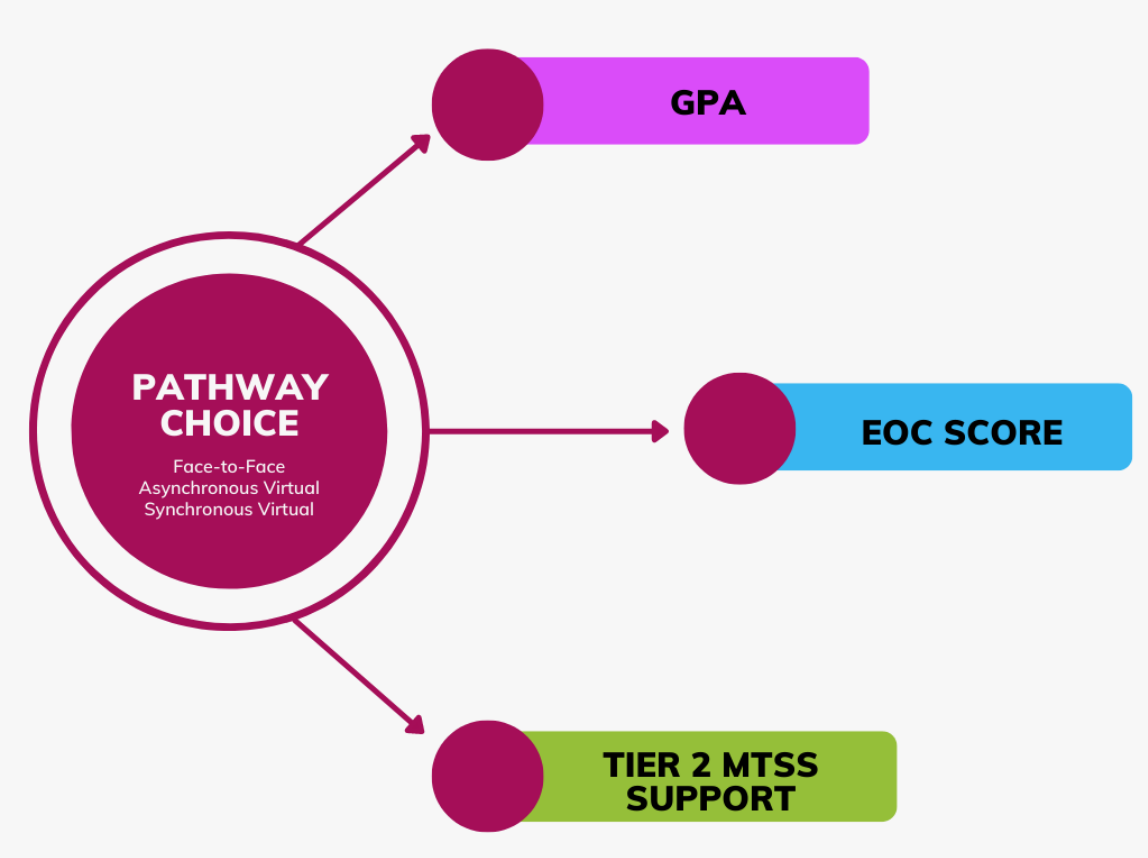
and previous theories (Neumann et al., 2012). Home refers to such things as parental involvement, having basic needs met, and what is deemed important by one's parents. Classroom refers to the class morale and climate. Peer group relates to the peer group one has outside of school and the values of that group. Mass media refers to the amount of leisure time one experiences in a day (Kirschenbaum, 1993). In an interview with Kirschenbaum (1993), Walberg stated that high ability is not enough for academic success. One's persistence in attaining a goal is more important for academic success. In essence, hard work is more important than IQ (Kirschenbaum, 1993). This idea is relatable to the more modern theory of grit and academic success (Rogers, 2017).

Conceptual Framework

To guide this study, I developed the framework in Figure 3. It provides a map of the influence a student's learning pathway may have had on their academic achievement as measured by Algebra I EOC exam scores, GPA, and frequency of referral to Tier 2 MTSS academic interventions.

Figure 3

Conceptual Framework



In Walberg's (1981) theory of educational productivity, he stated that aptitude, instruction, and environment impact student achievement. There is significant research on academic achievement, but the unique situation created by the COVID-19 pandemic provided an opportunity to look specifically at the different methods of teaching and learning that were available and their impact on student achievement. This quantitative study similarly examined the potential impact learning pathways had on academic achievement.

Definition of Terms

The following terms were used in this study.

Asynchronous Virtual Learning

Instruction in which content, lessons, activities, and resources are provided exclusively online. The learning is self-directed, with no virtual meetings of the class as a whole (Khalil et al., 2020; Yang et al., 2021). It is flexible, communication takes place largely by email or discussion boards, and learning and teaching can take place anywhere and anytime within a prescribed timeframe (Garris & Fleck, 2022). Knowledge is largely theoretical, questioning is objective, and there are no hands-on opportunities for students (Maatuk et al., 2021). The use of computer technology and the Internet are the main components (Aboagye et al., 2020).

Synchronous Virtual Learning

Instruction in which content, lessons, activities, and resources are provided online with the students participating in regularly scheduled virtual class meetings (Asare et al., 2021; Garner-McCaskill, 2022). This can take place simultaneously with students who are participating face-to-face. All learning experiences that are available to face-to-face students are also available in a digital format that is equally as effective (Goralski & Falk, 2017). This allows all students easy access to the teacher and the teaching materials during class meeting times and after (Maatuk et al., 2021). Virtual synchronous learning has a live teacher, real-time learning, teacher/student interactions, and collaboration opportunities. It provides more opportunities for effective teaching and learning through social interaction (Asare et al., 2021).

Face-to-Face Learning

Largely accepted traditional classroom learning. There is one teacher who meets in person with a set group of students at a regularly set time and provides instruction. Communication happens verbally, with real-time feedback from the teacher and peers alike. It takes place in a physical classroom, and information is mostly delivered by the instructor. There are hands-on opportunities, and technology is used as a tool instead of a necessity in delivering content (Chisadza et al., 2021).

COVID-19 Pandemic

The time between March 2020-March 2021 when schools were forced to rapidly switch to various forms of virtual instruction for a time to prevent the spread of the COVID-19 disease. COVID-19 was a respiratory disease that originated in China in 2019 and was capable of producing serve symptoms and, in some cases, death, especially in older humans or those with underlying health conditions. It was labeled a pandemic in March 2020 (World Health Organization, 2023).

Grit

"In terms of education, 'grit' is a combination of your passion for learning, perseverance at task, and purposeful activities. Volition and conation are synonyms for grit" (Rogers, 2017, para. 1).

GPA

The average of all a student's grades in 1 school year (The Glossary of Education Reform, 2013). For this study, averages will be based on a 4.0 scale.

EOC Exam

"The End-of-Course Examination Program is a statewide assessment program of

end-of-course tests for gateway courses awarded units of credit in English/language arts, mathematics, science, and social studies" (South Carolina Department of Education, 2022b, Overview of the EOCEP section). EOC exam scores were used as a measure of student achievement in this study.

MTSS

Part of South Carolina Act 213, signed in 2018. It required the implementation of MTSS for all schools during the 2019-2020 school year. The MTSS was a framework that addressed the needs of the whole child. It is a 3-tiered support system that supports students academically, behaviorally, and socially/emotionally (South Carolina Department of Education, 2018, 2019a).

Organization of the Study

Chapter 1 provided an introduction to the problem, the purpose of this quantitative study, research questions related to this study, and the significance of the problem. It then outlined both the theoretical and conceptual frameworks that organize and frame the work of this study. Finally, important definitions were given to the readers to prepare them for their continued reading of this study.

Chapter 2 of this study provides a review of the existing literature on pandemics, including a history of pandemics and education; learning loss and emergency virtual learning; the pathway choices students had, including face-to-face, asynchronous virtual, and synchronous virtual; and various measures of academic achievement. In addition, the theoretical framework is discussed. It also justifies the need for further research on the topic of this study.

Chapter 3 addresses the methodology for the study and discusses the participants

and data that were used in this research. The data collection process and the tools for interpreting the data are also discussed.

Chapter 4 focuses on the presentation and organization of the data collected, and Chapter 5 is a summary of the data followed by a discussion of the findings as they relate to the theoretical framework. Lastly, in Chapter 5, the limitations of the study and implications for future research are discussed.

Chapter 2: Literature Review

The purpose of this study was to determine what effect, if any, a student's learning pathway during the COVID-19 pandemic had on their academic achievement. Achievement can be measured in several ways, but for this study, it was measured by Algebra I EOC exam scores, GPAs, and referrals to Tier 2 MTSS academic interventions.

A review of the existing literature is presented in Chapter 2. It provides context and background to support the work in this study. First, literature related to the history of education during pandemic situations is presented, followed by a review of the literature related to the three learning pathways: face-to-face, synchronous virtual, and asynchronous virtual. Finally, literature on multiple measures of student achievement is discussed.

Pandemics

According to the Centers for Disease Control and Prevention (2022), a pandemic occurs when there are more cases of a disease than expected in several countries, affecting large numbers of people. The COVID-19 pandemic was not the first pandemic to affect access to public education. In this section, the existing literature on the history of education during pandemics is presented as well as what happened in education specifically during the COVID-19 pandemic and literature on learning loss when education is impacted by outside forces.

History of Education During Pandemics

Educational institutions have been battling quarantine orders for centuries (Atterberry, 2020). The idea of quarantine dates back to the 14th century and the Black Death. Educational institutions were regularly moved far into the countryside to continue

their studies with a lower risk of spreading disease as many plagues, including the Black Death, affected Europe during that time. The next large-scale pandemic took place in 1918. It was named the Spanish Flu, and it is estimated to have killed between 20 and 40 million people worldwide (Atterberry, 2020). It lasted from September 1, 1918, to March 31, 1919. Schools' responses to the Spanish Flu were not consistent across the United States. While some schools closed for as long as 15 weeks, using a correspondence course model in which mail-in homework was used to continue some form of instruction, New York City and Chicago kept their schools open, even though they saw absenteeism rise to as much as 50% (Atterberry, 2020). In a study conducted by Stern et al. (2009) that examined infection rates during the Spanish Flu pandemic, it was deduced that closing schools may have contributed to as much as a 15% reduction in cases and up to a 40% reduction in peak attack rates. The original purpose of the study was to use the data to rationalize closing schools if future pandemics ensued. Those data were used in 2009 when a new strain of the flu burdened the United States. In May of that year, 726 schools were closed in order to slow the spread of that strain (Stern et al., 2009). Although that was not considered a pandemic, the response to the event in the closing of schools temporarily contributes to the history of educational impacts due to disease.

The COVID-19 pandemic became the largest disruption of education in United States history. On March 15, 2020, students across the nation were sent home from school (South Carolina Education Oversight Committee, 2021). Instruction moved to virtual methods, and exams were postponed or canceled (United Nations Sustainable Development Group, 2020). On April 22, 2020, South Carolina's governor announced that schools in the state would stay closed for the rest of the 2019-2020 school year

(South Carolina Education Oversight Committee, 2021). According to an analysis done by the Center for Reinventing Public Education in the fall of 2020, as cited by the South Carolina Education Oversight Committee (2021), less than half of school districts in the United States were operating fully in person. Instead, they were starting the school year with some sort of hybrid virtual learning (Olneck-Brown, 2021; South Carolina Education Oversight Committee, 2021).

COVID-19 Response

The response to the COVID-19 pandemic in the United States was to abruptly close schools. There was no option or choice but to transition to remote learning (Digital Learning Collaborative, 2022). A plan for transitioning to virtual learning was not laid out, and the burden of figuring out this new way of teaching and learning was put on districts, administrators, teachers, parents, and students. One teacher who was interviewed stated that they handed out packets of materials and wished the students luck (Kamenetz, 2022). Some districts were fortunate enough to have the resources to go fully virtual instead of using packets. The method of teaching and learning that took place at the onset of the pandemic, according to Hodges et al. (2020), was emergency remote teaching and learning. Hodges et al. defined emergency remote teaching as a "temporary shift of instructional delivery to an alternate delivery mode due to crisis circumstances" (Emergency remote teaching section). In other words, classes that would have been taught face-to-face otherwise were shifted to fully virtual. Figure 4 shows a comparison between emergency remote learning and typical virtual learning from the Digital Learning Collaborative (2022).

Figure 4

Contrasting Emergency Remote Learning and Online Learning

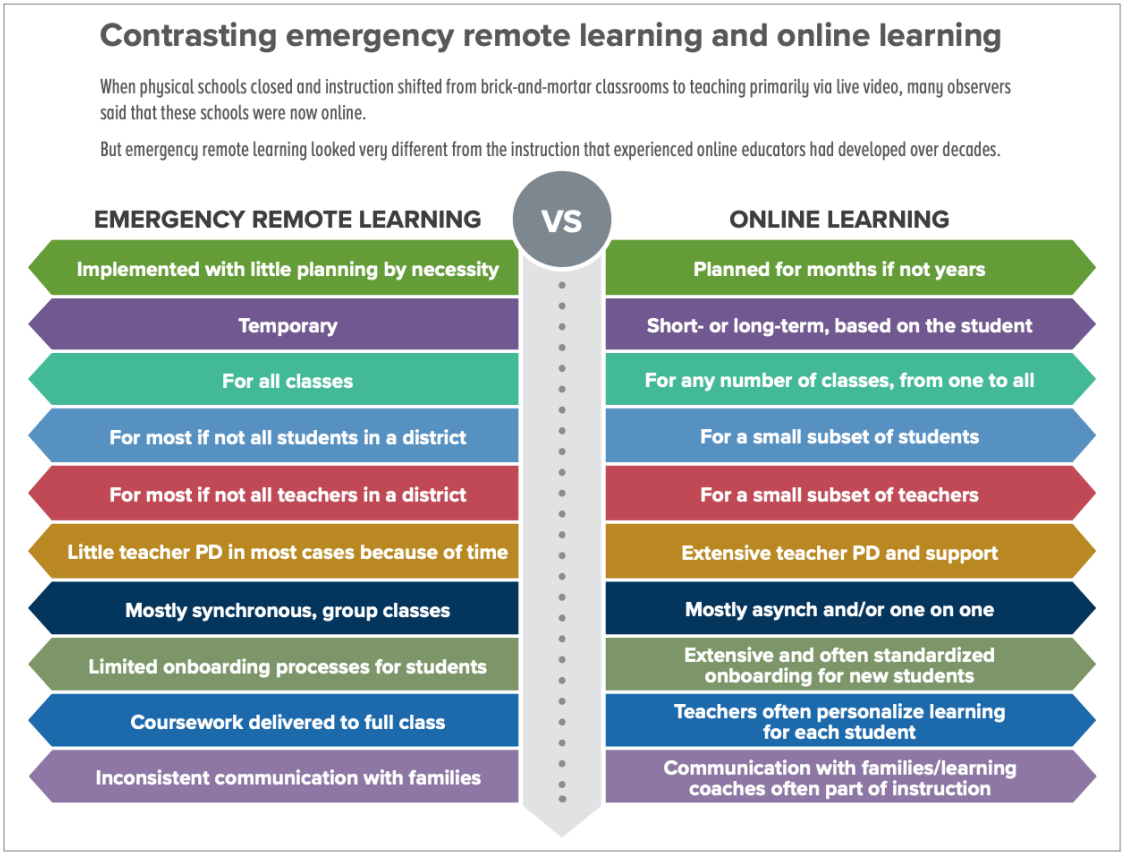


Figure 4 points out many differences between emergency remote learning and online learning. For this study, it is important to highlight that emergency remote learning is implemented with little planning, while online learning is planned for months, if not years. In addition, there is little professional development for teachers in emergency remote learning and extensive professional development in online learning. In emergency remote learning, coursework is delivered to the whole class, and the work is mostly synchronous. In online learning, the coursework is often personalized and mostly asynchronous.

The change to virtual instruction in the spring of 2020 was abrupt, causing the

implementation of online instructional practices to be less than ideal (Digital Learning Collaborative, 2022; Garris & Fleck, 2022). Schools lacked a good plan to transition to virtual learning. Teachers were guiding students in a multitude of learning models simultaneously. Asynchronous virtual learning students were learning away from the school building at their own pace with limited student-teacher interaction as well as student-student interaction. At the same time, synchronous virtual learning students were off school campuses but met virtually at a set time, received real-time feedback, and had teacher-student and student-student interaction via virtual meeting platforms such as Google Meet and Zoom (Goralski & Falk, 2017; Hodges et al., 2020).

While this crisis created innovation and adaptation in education, students were missing the classroom environment, social opportunities, hands-on learning approaches, and the nutrition that is commonplace in face-to-face educational settings (United Nations Sustainable Development Group, 2020). Despite the evolution and increased presence of virtual learning in the K-12 setting prior to the COVID-19 pandemic, most K-12 students and teachers were not ready to learn online (Aboagye et al., 2020). Most had little experience with online learning, and students may not have been prepared for the challenges that came with virtual learning (Kuhfeld et al., 2020). There was an increased focus on family needs and health in place of academics, and as Steinmayr and Spinath (2009, as cited in Aboagye et al., 2020) found, student lack of preparation often led to a lack of motivation. A study found student participation in online math decreased by 11% in the fall of 2020, compared to participation rates prior to schools being shut down due to the pandemic (Dorn et al., 2020). Most teachers were not prepared to apply virtual learning tools and strategies. This led to the ineffective use of virtual learning

tools and strategies, which raised questions about how effective instruction could have been (Skar et al., 2021). South Carolina's Education Oversight Committee (2021) identified an obstacle to emergency remote teaching to be a lack of clearly defined instructional practices for teachers to use while teaching virtually. A survey of teachers congruently found that they felt extrinsic barriers, such as lack of resources, were a larger obstacle than intrinsic barriers, such as motivation and skill (Khan, 2021).

There were also several challenges linked with virtual learning that have nothing to do with teaching and learning. According to data collected via Twitter, "learning support" was one of the most discussed themes by Twitter users during virtual learning due to COVID-19 (Asare et al., 2021). K-12 learners need to be guided through their learning by teachers, mentors, peers, etc., and that became difficult during virtual learning (Ahn & McEachin, 2017). Parents became teachers in a way they had never been expected to be before, which affected students from less affluent homes greater than their peers because their parents were less likely to be educated, and access to the Internet and other online resources was often limited (Auxier & Anderson, 2020; Kuhfeld et al., 2020). Black and Hispanic students also experienced inequity in virtual learning due to parental demands and access issues. These students were more likely to be impacted by the disease due to a lack of access to health care and insurance on top of their accessibility issues with online technology (Dorn et al., 2020).

There are several hypothesized effects of this shift from face-to-face educational settings to virtual educational settings (Skar et al., 2021). Klein (2022) surveyed teachers, principals, and district leaders for EdWeek in early February 2022. They were asked about their perceptions of the effectiveness of virtual learning compared to the traditional

face-to-face model of learning. Seventy percent of respondents reported that they felt virtual learning was “much less effective” than face-to-face learning. Three percent reported that virtual learning had “about the same level of effectiveness,” while only 1% each said they felt virtual learning was either “somewhat more effective” or “much more effective” than face-to-face learning and teaching (Klein, 2022). This could be due to the fact that teachers only had access to low-quality materials and often had unclear learning expectations and a lack of training (Aboagye et al., 2020).

While academic impacts are often considered the most important focus of the effects of the pandemic and the shift to remote education, there is also the issue of social interactions. When learning switched to remote, most students lost teacher-to-student interactions as well as student-to-student interactions (Maatuk et al., 2021; Skar et al., 2021). Learners lacked variety in their learning environment and were often isolated from their peers (Aboagye et al., 2020; Goldberg et al., 2021). The shift in the social dynamics of remote classes was felt by students in multiple ways. In a study of college students regarding classes that moved from face-to-face instruction to virtual instruction in the spring of 2020, students reported that classes were less enjoyable, less motivating, and less engaging (Garris & Fleck, 2022).

The shift to synchronous and asynchronous virtual learning shed light on several positive aspects of learning through a virtual pathway. One opportunity that was discovered during the shift was that virtual learning decreased the teacher workload and put more on the students (Maatuk et al., 2021). It was also discovered that teachers could not just take what they did in face-to-face learning and put it online—learning research in best practices for virtual course design and virtual teaching needed to be further defined

and put into use (Means et al., 2014).

Learning Loss

There was a lack of research on how the COVID-19 pandemic had affected students due to the uniqueness of the situation. It was the first instance of a large-scale school closure in which virtual learning was available to most students. The closest comparisons that could be made were situations where schools were closed for weather events, chronic absenteeism data, or studies on learning loss during summer vacation. All of this close research pointed to some amount of learning loss when students were not in school (Kuhfeld et al., 2020).

In September 2020, the World Health Organization made it clear they understood school closures had negative impacts on the education and development of children. By one estimate, more than three million students around the country were not meaningfully engaged in their education from March 2020 to September 2020. Summer learning loss was greatly represented in the existing research. During the COVID-19 pandemic, on average, schools in the United States were closed for 58 weeks, the longest among wealthy countries. In comparison, Finland's schools were closed for 33 weeks, the United Kingdom and China for 27 weeks, Japan for 11 weeks, and New Zealand for only 9 weeks (Kamenetz, 2022). The average summer break for United States schools was 12 weeks. Trends for learning loss during summer vacation showed that academic achievement usually slowed down, that the loss was greater in math than it was in reading, and that loss was greater in the upper grades than it was in the lower grades. It was also worth noting that summer learning loss was not significant or disparaging between racial or socioeconomic differences in students (Kuhfeld et al., 2020).

Hammerstein et al. (2021) reported that learning loss during emergency remote learning was similar to the learning loss during summer vacation.

Natural disasters have also caused schools to close and students to fall behind in their learning. The most notable and relatively recent was the closure of schools in New Orleans after Hurricane Katrina. The impact of a natural disaster on student development was found to be long-lasting and was often connected to psychological distress, which leads to trouble concentrating (Kuhfeld et al., 2020). Students were out of school only a few weeks after Hurricane Katrina, and it took students, on average, 2 years to catch up to where they had been academically (Kamenetz, 2022; Kuhfeld et al., 2020). Researchers have found that the academic effects of the COVID-19 pandemic have been worse and will be longer-lasting than those of Hurricane Katrina, implying many years to recover to pre-pandemic levels of achievement. Students were starting to progress in their reading and math achievement at rates close to that pre-pandemic, but they were so far behind that it was estimated that it would take at least 3 years for the average elementary student to recover. It was even longer for middle and high school students. This presented a problem as middle and high school students had a limited number of years before they were to graduate and move on from the K-12 educational setting (Kamenetz, 2022; Sparks, 2022). However, the South Carolina Education Oversight Committee (2021), in a sampling of 14 school districts, found that there was no statistical difference in the amount of learning loss when each of the learning pathways was compared.

Learning Pathways

The way instruction was delivered in each educational pathway impacted the way students learn. Two types of pathways are discussed in the following sections: face-to-

face instructional pathways and virtual instruction pathways. Virtual instruction is then broken down into asynchronous virtual instruction and synchronous virtual instruction. Finally, student achievement data associated with the different pathways are discussed.

Face-to-Face Pathway

Face-to-face instruction had traditionally been the standard for K-12 education. Face-to-face instruction allowed for hands-on experiences, student-teacher communication, student-student interaction, immediate feedback for students, and the opportunity for clarifying questions. It had been found to be more beneficial for learners who were not self-sufficient or lacked discipline (Chisadza et al., 2021). It had also been found that when morale was high in a traditional classroom, more students were successful. Things like being treated fairly, liking the class, being goal-directed, and feeling like they were accomplishing something also contributed to student success in face-to-face learning environments (Kirschenbaum, 1993). Prior to the COVID-19 pandemic, face-to-face learning had evolved to include virtual learning components as a complement to traditional instructional methods. Both methods of instruction were used depending on what was most convenient and/or most conducive to the content of the lesson (Garner-McCaskill, 2022; Goralski & Falk et al., 2017). This method of teaching had come to be known as blended instruction in some circles but for this study will be synonymous with face-to-face learning. Technology had been more integrated steadily into K-12 education as an aid to enhance more traditional methods of teaching and learning (Garner-McCaskill, 2022). The integration of virtual learning in face-to-face learning pathways had increased access to education, allowed for small-group and one-on-one teaching to take place more efficiently, addressed the diverse needs of students,

increased variety in instruction, and provided additional support for students in need of intervention or enrichment (Heuston, 1989; Means et al., 2014).

Virtual Learning Pathway

COVID-19 caused nearly every K-12 student in the United States to have their face-to-face educational instruction interrupted (Kuhfeld et al., 2020). Virtual learning originally started as the educational system's way to meet the demands of future employers as the skill sets necessary to work became more technologically focused, according to Hiltz and Turoff (2005, as cited by Goralski & Falk, 2017) . In virtual instruction settings, teachers became more of a facilitator of learning, and students were more in control of their learning (Heuston, 1989; Maatuk et al., 2021). Online learning was effective when instruction was carefully designed and planned out with the use of best practices. The average timeline for the development of a fully online university-level course was 6 to 9 months (Hodges et al., 2020). In 1981, a nonprofit called the Waterford Institute funded a prototype for public schools and technology integration called the Waterford School. Four hundred K-12 students were carefully chosen in order to mimic the demographics of a public school. They started by running the school for several months without any technology. Then, they introduced the first computer workstations. The staff decided they would be most useful in a lab setting with a paraprofessional assigned to support and implement the curriculum. Teachers quickly realized that they became more of a monitor and a coach than an instructor. The Waterford School found that they were able to provide more individualized instruction with the technology. Six years after the implementation of technology, the elementary level students grew by 61% in math, 33% in language arts, and 25% in reading. These instructional materials were

carefully sequenced to assure mastery of the content, and multiple modes of curriculum were delivered in the online setting (Heuston, 1989). Online learning has not always been considered best for student learning. As new systems of completely online learning developed, a stigma also developed that made online learning seem less valuable than traditional education from both university faculty and future employers (Garner-McCaskill, 2022; Goralski & Falk et al., 2017). The current literature also suggested that there were certain characteristics of students who were more successful in virtual classes. Students who had a quiet place to work, access to sufficient internet and technology, and a support system, such as an adult to help, were all privileges that contribute to students being more successful in a virtual learning environment (Kamenetz, 2022). Factors such as having parents who graduated from college and having higher socioeconomic status had also been found to contribute to student success in virtual classes (Auxier & Anderson, 2020). Considerations need to be made for the quality of the learning environment, ease of use of the digital platform, instructional support, peer interaction, participation, and types of assessments (Chisadza et al., 2021). The virtual settings had also been found to lend themselves to higher failure rates and higher dropout rates in high schools (Kamenetz, 2022).

There were several different models of virtual instruction. Most commonly, virtual classes were offered either synchronously or asynchronously. In the next sections, research that was specifically identified as synchronous and asynchronous virtual learning is discussed.

Asynchronous Learning Pathway

Most approaches to virtual learning prior to COVID-19 were asynchronous.

Asynchronous learning was learning that took place completely online and was largely self-paced. The role of the instructor was to provide feedback, coaching, and support instead of delivering content through direct instruction, like in face-to-face or synchronous learning (Heuston, 1989; South Carolina Education Oversight Committee, 2021).

One of the first K-12 asynchronous learning models in the United States was developed in Florida. It was established in 1997 and now offers over 190 courses to K-12 students. Students could choose a flex format, which allowed them to take virtual courses to supplement the courses they are taking face-to-face, or the full-time format, in which they took all their courses online. Florida Virtual issued student diplomas and state tests (Florida Department of Education, 2019).

In South Carolina, where this study took place, the virtual public school was started in 2007. In 2014, it was branded as VirtualSC, the name it still has today, and was run by the South Carolina Department of Education (VirtualSC, 2023). VirtualSC classes were taught by South Carolina Department of Education teachers and could be taken by students in addition to face-to-face classes or full time. VirtualSC also started a franchise program in 2014 that allowed school districts in South Carolina to use the content from VirtualSC courses but hire their own teachers to lead the virtual classes.

Nationally, and prior to the COVID-19 pandemic, virtual school enrollment grew about 6% each year. Elective course enrollments made up approximately 51% of courses taken, while core classes made up the other 49%. Students in Grades 9-12 made up the majority of the students participating in asynchronous virtual learning at 80%. During the 2020-2021 school year, there were 16,950 enrollments in virtual courses (Digital

Learning Collaborative, 2022).

Synchronous Virtual Learning Pathway

Synchronous virtual learning takes place outside of the physical brick-and-mortar classroom. All activities are completed online, but there are regularly scheduled class times in which all students in the class and the instructor meet for real-time instruction, interaction, and feedback between student and instructor and between the student and their peers. Research on specifically synchronous virtual learning is limited. One systematic review of the literature found that there were no published articles on the subject prior to 2000. They also noted that most of the research had been conducted in higher educational settings as opposed to secondary educational settings (Martin et al., 2017). One study found that student performance is better with synchronous virtual instruction than with asynchronous virtual instruction (Kamenetz, 2022). Synchronous students reported feeling more connected despite the fact that they were learning virtually (Goralski & Falk, 2017). Several studies support that a "blended approach," to which synchronous virtual and face-to-face learning were most similar, must be available for the highest student achievement (Aboagye et al., 2020).

Pathways and Student Achievement

Existing research on student achievement in different educational pathways is very inconsistent in its findings (Garner-McCaskill, 2022; Nguyen, 2015). Most of the research on virtual learning prior to the COVID-19 pandemic was related to higher education instead of secondary education. Seminal work by Means et al. (2014) suggested that students learning virtually generally outperform students learning face-to-face. Seminal work from Russell, as cited in Nguyen (2015), however, found that there is

no significant difference in student achievement between students learning virtually and those learning face-to-face. One study largely found that student achievement was lower for students who took virtual classes (Hart et al., 2019). Another study looked at the academic achievement of students attending the University of Pretoria pre-COVID-19 pandemic and post (Chisadza et al., 2021). It found that students who were largely face-to-face prior to the COVID-19 pandemic showed decreased performance when they had to go virtual (Chisadza et al., 2021).

A study of North Carolina students taking Algebra 1 in eighth grade found that virtual students did not perform as well as their face-to-face counterparts (Heissel, 2016). Table 1 shows Algebra 1 EOC exam passage rates for virtual students in Florida and South Carolina compared to state passage rates.

Table 1

EOC Student Passage Rates 2018-2021

	2018-2019 Passage rates	2020-2021 Passage rates
Florida virtual students	52%	46%
Florida state	39%	31%
South Carolina virtual students	58.8%	61.7%
South Carolina state	68.6%	61.5%

Note. 2019-2020 EOC testing was waived due to the COVID-19 Pandemic.

The information in Table 1 comes from reports completed by the Florida Department of Education (2019) and the South Carolina Department of Education (2022a), respectively. Prior to the COVID-19 pandemic, the data show that virtual students in Florida were performing at a much higher rate than the state as a whole, while in South Carolina, virtual students were performing at a lower rate than the state as a whole. In the year after schools were shut down for the COVID-19 pandemic, Florida

virtual students continue to perform better than the state, but South Carolina virtual students have almost the exact same passage rate as the rest of the state. This is more evidence that research regarding the impact of learning pathways on academic achievement is inconsistent. In Ahn and McEachin's (2017) study, completely asynchronous students underperformed face-to-face students as measured by their end-of-grade (EOG) test scores. It was suggested that this may have been due to a need for increased self-regulating learning and metacognitive skills to be successful in an asynchronous virtual learning setting (Ahn & McEachin, 2017). One student who was interviewed about his virtual instruction during the COVID-19 pandemic cited boredom and isolation as the hardest part. Teachers also found that with virtual learning, there was no way to make the students get online to learn (Kamenetz, 2022). In another meta-analysis of student achievement data, it was found that purely virtual instruction had similar results to purely face-to-face instruction with no technology integration, but that face-to-face, when technology was used as a tool, led to higher student achievement than a face-to-face pathway without technology.

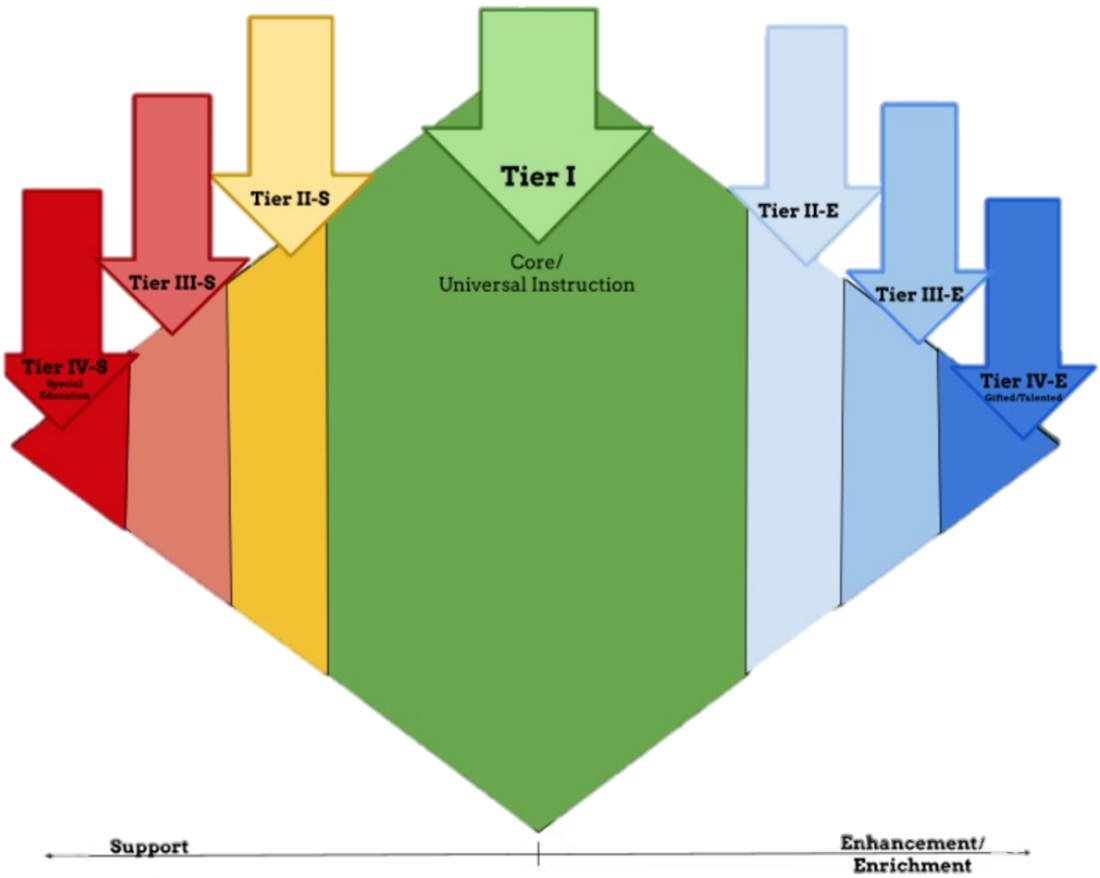
MTSS

In the 2017-2018 school year, the South Carolina state summative assessment, SC Ready, reading test data showed that only 41.2% of students in Grades 3-8 were achieving scores of "met" or above (South Carolina Department of Education, 2019a). To address this low achievement, SC Act 213 was written. It required the South Carolina Department of Education to create a framework for schools to use when implementing interventions for students (South Carolina Department of Education, 2018). An MTSS was the South Carolina Department of Education's framework for addressing the

academic needs of students. Figure 5, from the school district where this study was conducted, shows this framework visually.

Figure 5

MTSS Framework



It is through this framework that student achievement is tracked at the site of this study. The site began its first year of MTSS implementation in the fall of 2021. The site had been focused on academic achievement above the other facets of the framework. Measures of academic achievement for the MTSS program at the site where this study was conducted consisted of student scores in math and English on a universal screener and their grades/passage rates in the classes in which they were currently enrolled (South

Carolina Department of Education, 2019a).

MTSS was not an entirely new idea created by the South Carolina Department of Education. It was developed from the Response to Intervention (RTI) and Positive Behavioral Instructional Support (PBIS; Johnson, 2018). RTI emerged in 2002 after the No Child Left Behind legislation was signed. It used student data to identify at-risk students and a framework of interventions for those students (Johnson, 2018). In 2004, the Individuals with Disabilities Education Act allowed schools to use RTI data further when determining a student's eligibility for special education services (Johnson, 2018).

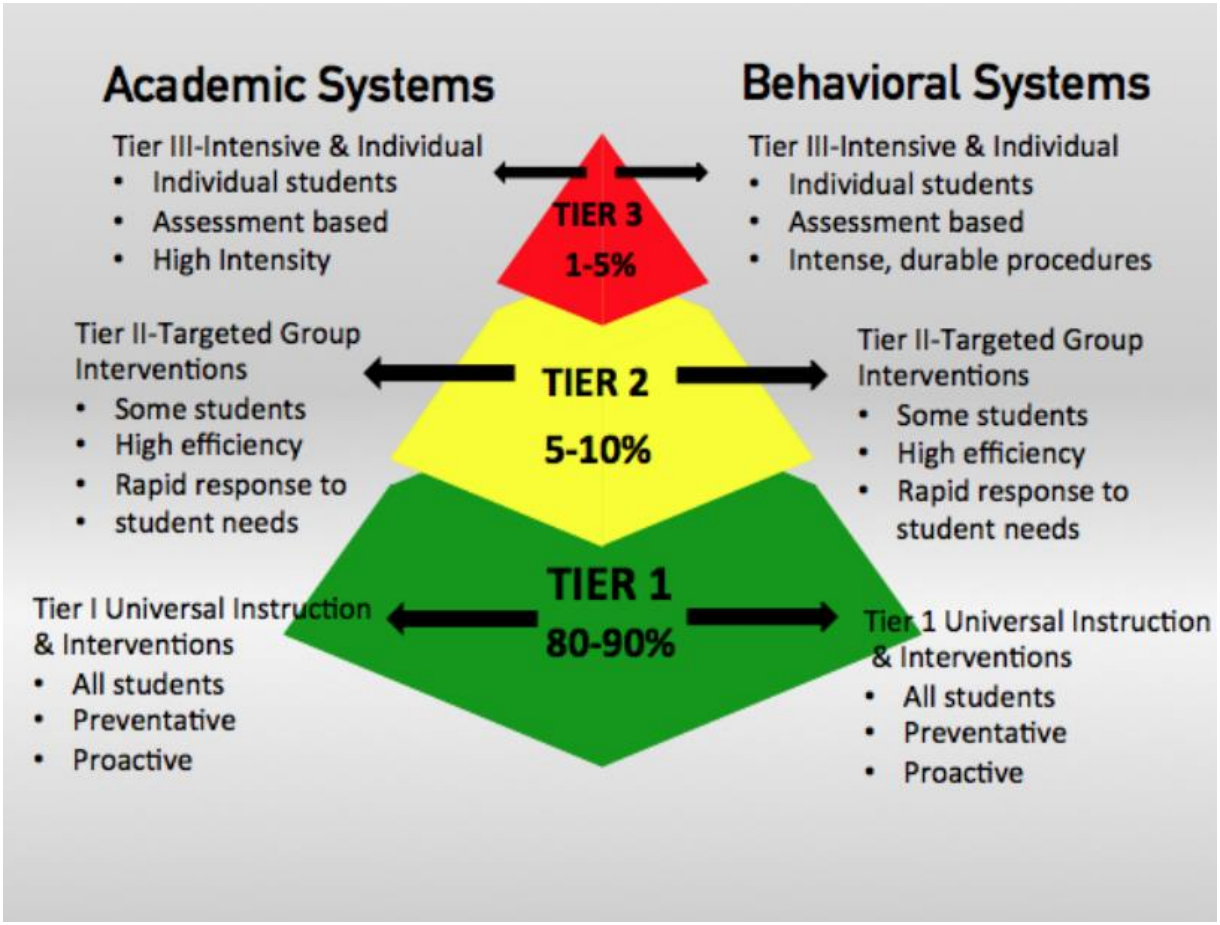
RTI is essentially a support system for students and teachers. It utilizes two approaches to interventions: a tiered system of support and a problem-solving approach. Successful implementation of the framework suggests a mix of both approaches (Callender, 2014). At-risk students should be identified using classroom student achievement data and a quick screener of skills. When an at-risk student is identified, a team discusses their concerns and brainstorms possible interventions. Those interventions and the severity of the underachievement of the student determine what tier of support the student will receive (Callender, 2014).

In 2014, the South Carolina Department of Education signed Act 284. It was named Read to Succeed. It sought to put interventions in place to address low student achievement, particularly in reading. It also set the benchmark that if a third-grade student could not demonstrate reading proficiency as measured by the SC Ready reading test, they must be retained (South Carolina Department of Education, 2022b). MTSS, written by the South Carolina Department of Education, built upon the ideas of RTI and began implementation to address the requirements of Read to Succeed in 2018.

MTSS is also a 3-tiered system of intervention support for students performing below academic expectations, but it addresses the whole child. It is a "holistic and personalized system of learning that incorporates academics and social-emotional behaviors into one framework" (South Carolina Department of Education, 2019a, p. 2). Its primary data source comes from an approved universal screener taken several times a year by all students. Once a student is identified, the appropriate tier of support must be determined. The tiers are shown in Figure 6.

Figure 6

South Carolina MTSS and PBIS Model



Source: South Carolina Department of Education, Office of Special Education Services. Created in 2018. Adapted from: OSEP Technical Assistance Center (2018). Multi-Tiered

System of Support (MTSS) & PBIS Model.

Tier 1

Tier 1 instruction takes place in all classrooms and with all students. Ideally, 80% or more of the student population is served through Tier 1 interventions. Tier 1 is focused on delivering core content that is based on state standards to all students. It is differentiated to meet the needs of students in a particular classroom. This could include differentiated instruction, student choice, ability grouping, or other types of core content instruction. It comes down to differentiating that universal instruction in a way that most students are as successful as possible. The effectiveness of Tier 1 instruction is determined by the results of a universal screener in the content area. This is an assessment that measures student achievement in a given content area. Students who are not meeting proficiency expectations based on student achievement data are moved to Tier 2 interventions to close the gap (Gibbons et al., 2019).

Tier 2

Tier 2 interventions should serve approximately 5% to 10% of the student population and targets specific skills that students are having trouble with. These students show that they are performing 1 to 2 years below grade level and are at risk of failing (Callender, 2014). Methods could include, in addition to core instruction, small group instruction, tutoring, or other targeted interventions that take place during the school day. These may take place within the core class time or be an additional period of supplemental instruction. Progress monitoring is a key component of Tier 2 to ensure that the interventions that are being used are effective. If they are found not to be, interventions should be adjusted (American Institutes for Research, n.d.).

Tier 3

Tier 3 intervention is intended for 1% to 5% of the student population. Students who require this type of support are normally more than two grade levels behind. These types of interventions are individual and intensive. They are also comprehensive in nature, covering multiple skill deficits, and should replace core instruction until the student shows improvement. Methods in Tier 3 instruction could include co-teaching, a collaboration between teachers, or a published digital intervention program. These interventions should be data-based and tailored to the individual student (American Institutes for Research, n.d.; Callender, 2014; South Carolina Department of Education, 2018).

In Figure 6, you also see a behavioral intervention system. MTSS is designed to address the whole child, including their behavioral and social/emotional development. Tiers of support are similar to those of academic interventions. This is a delimitation of the study and is discussed more in Chapter 3.

MTSS and Student Achievement

Studies related to MTSS and student achievement have been done mostly at the elementary and middle school levels. Research is split when correlating MTSS and student achievement. Hickson (2021) completed a study of seventh- and eighth-grade math and reading achievement, which found no statistical difference before and after the implementation of MTSS. In that study, however, it must be taken into consideration the sample group was only in their first year of implementation with the MTSS framework (Hickson, 2021). Other research suggests a positive effect when MTSS is implemented with fidelity. One study of 62 elementary schools over the course of 6 years found that

the implementation of MTSS had a positive effect on the reading growth of students overall (Haynes, 2012). Haas and Brown (2019) also found positive growth in student achievement when the MTSS framework was applied. Studies related to this must be carefully assessed as many take place after a very short time of MTSS implementation, and very little has been done at the high school level.

Theoretical Framework

Student achievement has been theorized through many different lenses over the years. Walberg's (1981) theory developed from Carroll's (1963) model of school learning (Neumann et al., 2012). Prior to Walberg's work, it had been theorized that behavior was a function of personality and environment. Education took that idea a step further and deduced that learning, therefore, was a function of aptitude and instructional treatment (Walberg, 1981). Walberg's major contribution to prior learning theories was that the learning environment had an influence on student achievement (Fraser et al., 1987). Walberg identified nine factors that contribute to educational productivity. He based his theory on economist ideas and found that increased test scores alone were not a good predictor of future success or productivity (Walberg, 1981). Walberg viewed educational productivity as a function of the nine factors experienced by students. Walberg divided his nine factors of educational productivity into three categories: student aptitude, instruction, and psychological environment. He found that high ability was not enough to maximize student achievement. Persistence in attaining the goal was more important (Reynolds & Walberg, 1992).

Aptitude

Aptitude is the first pillar of Walberg's (1981) theory. Today, two common

measures of aptitude are GPA and standardized tests like the EOC exams and EOG tests. Tests like EOC exams measure different aspects of student achievement other than GPA. GPA measures a wide range of skills, while standardized tests measure a narrower range of skills (Allensworth & Clark, 2020). GPA is a good measure of student achievement because it is an average that accounts for the variability that exists in grading such as a variety of different teachers, courses, and expectations (Alexander, 2022; Allensworth & Clark, 2020). GPA has been found to be the strongest predictor of academic success in colleges and universities (Alexander, 2022; Allensworth & Clark, 2020; Brookhart et al., 2016; Kurlaender & Cohen, 2019). In addition, GPA shows more than academic achievement. It also provides insight into academic enablers like effort, ability, study habits, grit, organization, and motivation (Alexander, 2022; Brookhart et al., 2016).

When the South Carolina Department of Education (2020) announced grace over grades during the COVID-19 pandemic, student engagement dropped drastically. Grading became arbitrary in an effort not to punish students for circumstances outside of their control. This hurt students who were motivated by receiving high marks on assessments. When there was nothing to work for, there was no point in working (Kamenetz, 2022; South Carolina Education Oversight Committee, 2021). Data show that on average, students were starting the 2020-2021 school year 1.5 months behind in reading and 3 months behind in math (Kamenetz, 2022). This falls in line with a study conducted by Kuhfeld et al. (2020) that projected by the fall of 2020, students would only make 63% to 68% of gains in reading and only 37% to 50% gains in math.

EOC exam scores have long been a standard measurement of student achievement and aptitude. A student's successful completion of Algebra I in eighth grade and a

passing score on the EOC are strong predictors of success in higher-level math courses when they are in high school (Means et al., 2014). Math and reading achievement were both affected by the learning loss due to the COVID-19 pandemic, although math seems to be affected more. After analyzing data from the fall of 2020, it was projected that seven of 10 seventh and eighth graders in South Carolina would be proficient in reading. In math, only one of every four was predicted to be proficient (South Carolina Education Oversight Committee, 2021). This was echoed by another study that projected a 70% gain in reading between the spring of 2020 to the fall but 50% or less in math (Kuhfeld & Tarasawa, 2020).

Motivation

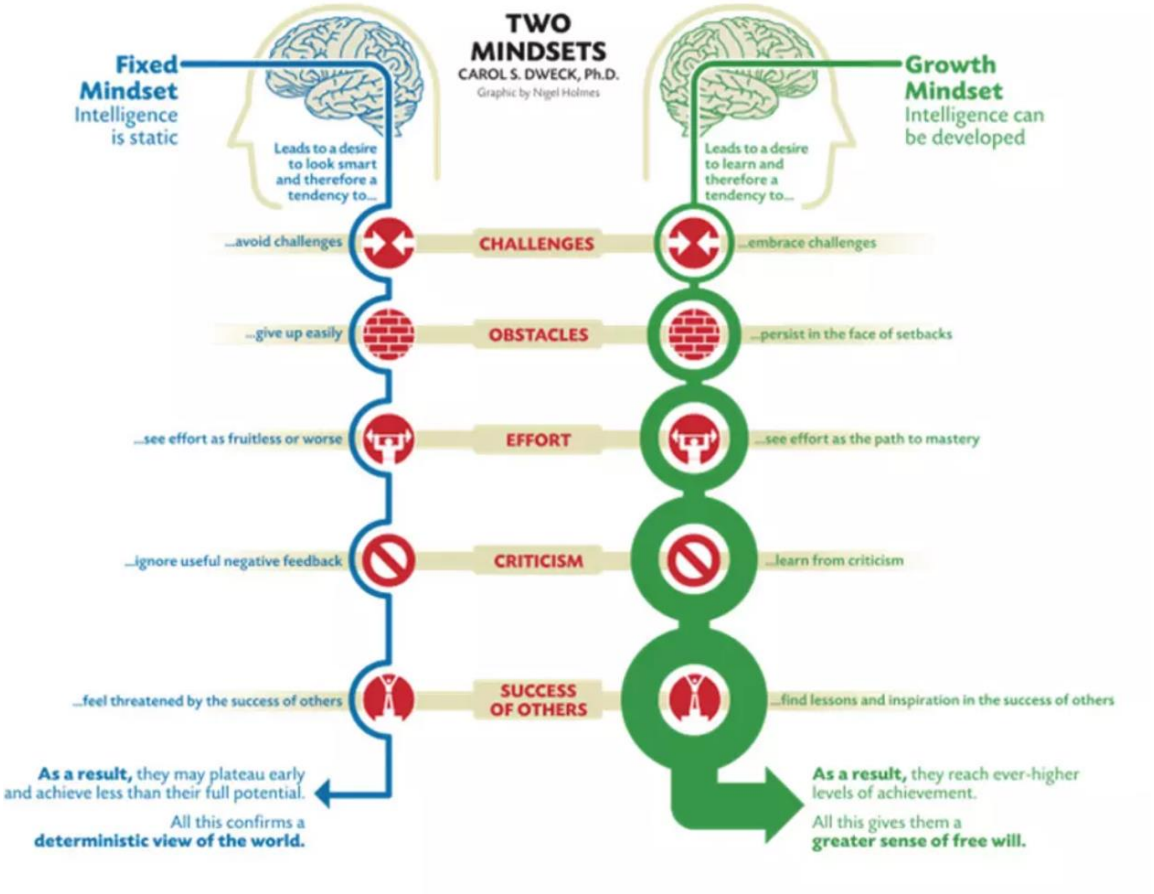
Motivation is also a component of Walberg's (1981) aptitude pilar. One study found that extroverted students had an increased interest in learning when they returned to the classroom in the fall of 2020. Goralski and Falk (2017) went so far as to say that the students who do well in asynchronous virtual classes must be self-motivated and not mind the isolation. This is largely thought to be related to the quality and frequency of their social interactions (Smith et al., 2021; Zuo et al., 2022). The student's perceived chance for success in learning and the value of that learning also affect motivation and student achievement. In other words, if a student is confident in the content of a lesson, the student will be more motivated. The value of a lesson is determined by the student's interest in the content and how useful they feel the skills they are learning will be to them in the future. The more valuable the student's perception of the content is, the higher their motivation and, in turn, their achievement (Smith et al., 2021).

Another mainstream theory in motivation is Dweck's (2016) growth mindset.

Growth mindset is associated with the belief that one's intellectual abilities can be developed. In contrast, a fixed mindset believes that one's intellectual abilities are set and cannot be developed any further (Dweck, 2016; Yeager & Dweck, 2020; Zhao et al., 2021). Figure 7 shows the characteristics of both a growth and a fixed mindset.

Figure 7

Growth Mindset Versus Fixed Mindset



Individuals with a growth mindset are characterized by having higher achievement, putting more energy into learning, feeling more empowered, and being more committed to projects (Dweck, 2016; Lavendaire, 2021). Individuals with a fixed mindset tend to avoid challenges, see effort as unimportant, and give up easily

(Lavendaire, 2021). Growth mindset is a paradigm that can be taught to students. Several courses of study or intervention systems have been created to help students shift their mindset to one of growth (Lemus, 2021). Research on growth mindset as it applies to student achievement is heterogeneous, but when studies with larger sample sizes and more diverse populations are pulled together, there is a clear positive correlation between growth mindset and higher academic achievement (Yeager & Dweck, 2020). Specifically, during COVID-19, one study of college students found a significant positive relationship between a growth mindset and learning engagement. Students in that study who had a growth mindset were more engaged in learning than their peers. They also had a different perception of the strength of the pandemic and their stress during the pandemic. This may be due to the fact that individuals with a growth mindset have different perceptions of challenges and setbacks. Determination and persistence in individuals with a growth mindset also may be a factor in higher engagement during COVID-19 learning (Zhao et al., 2021).

Growth mindset is often associated with grit when it comes to motivation and student achievement. Grit refers to a noncognitive skill related to an individual's passion and perseverance. Individuals with high levels of grit are determined and have high self-control and high self-regulation (Lam & Zhou, 2019; Mosanya, 2020). In a study of undergraduate students, it was found that grit, in combination with growth mindset, was a protective factor against academic stress during the COVID-19 pandemic (Mosanya, 2020).

In an interview conducted by Education Week, Angela Duckworth, who is a champion of grit, said that grit is only one part of being successful (Rich, 2017).

Perception, motivation, mindset, and grit could work together to create the overall motivation students have that influence their achievement. Duckworth also acknowledged that grit is hard to measure and assess. It should also be noted that her research and that of others support that grit may become stronger over time. This is supported by the maturity hypothesis that good qualities get stronger over time (Rich, 2017). This could be an important factor when looking at students of different maturity levels with regard to motivation.

Instruction

Student achievement, when looked at through the specific lens of the COVID-19 pandemic, is supported by Walberg's (1981) theory; however, due to summative test waivers and inconsistent grading practices, the research is missing valuable data points related to student achievement during the 2020-2021 school year (Kamenetz, 2022; South Carolina Education Oversight Committee, 2021). Walberg theorized that the amount of time students were engaged with learning had to be maximized to gain the most benefit. Quality and quantity of instruction need to be balanced for the highest student achievement (Kirschenbaum, 1993). The quantity of instruction is related to the time assigned for a given instructional task by a teacher (Walberg, 1981). During the pandemic, lessons were hastily put together online, and there were often directives that suggested that online assignments not be as long as those that might have been scheduled on the same topic if they had been in a face-to-face environment. In South Carolina, high school instructional day requirements were clearly communicated. During the pandemic, requirements were that each class should be no more than 20 to 45 minutes long with the total minutes per day totaling 120 to 270. Prior to the pandemic, face-to-face high school

classes, on a block schedule, lasted 90 minutes and students spent a total of 360 minutes per day engaged in learning (South Carolina Education Oversight Committee, 2021).

The MTSS framework adjusts the quantity of instruction for identified students as they move through the tiers of support. In Tier 2, students should receive additional instructional time in the content area in which they are struggling. This often comes in the form of small group instruction in addition to the classroom instruction the student would receive as part of Tier 1. In Tier 3 interventions, the quantity of instruction is increased even further through individual instruction that could come in the form of pulling a student out of the normal classroom instruction of another content to work specifically on the content with which they are struggling. This could also be private tutoring sessions or in a special education setting (Callender, 2014).

Quality of instruction or the use of best instructional practices also became variable during the pandemic. In a survey of K-12 teachers with years of experience ranging from 0 to 20 years, one study found that 95% of the respondents received little to no technology training in their preservice programs (Rosendahl, 2022). In the United States, teacher training programs rarely have an online teaching training component (Archambault et al., 2016), and it has long been reported that it is needed. Preservice teachers need to be taught how to integrate technology into instruction, but this is difficult because technology is constantly changing (Bakir, 2016; Brenner & Brill, 2016; Srisawasdi et al., 2018). The rapid switch to virtual learning and the lack of training teachers had on using technology for effective instruction led to a lower quality of instruction during the COVID-19 pandemic.

Environment

Walberg also found that grades were higher when parents or another close adult helped guide students in their learning (Kirschenbaum, 1993). This is related to the psychological environment. During the COVID-19 pandemic, students' homes, if they chose one of the two virtual pathways, became their learning environment. Even when schools reopened, many parents elected to keep their students at home, especially those in the Asian American, Black, and Latinx communities (Kamenetz, 2022). Data on the number of schools that opened in the fall of 2020 are incomplete because the United States Department of Education did not specifically collect it. However, as cited by Kamenetz (2022), a small data company, Burbio, collected data by analyzing data on school districts' websites throughout the fall of 2020. They found that by mid-October 2020, 42% of school districts were offering virtual learning only. Thirty-four percent of school districts were offering face-to-face learning 5 days a week but almost always offered a virtual option at the same time. The rest were offering face-to-face learning on a part-time basis, limiting the groups of students in the school building at any given time (Kamenetz, 2022). In February of 2021, the Biden administration released that 68% of Asian American, 58% of Black, and 56% of Hispanic fourth graders were still learning virtually, while almost 50% of White fourth graders were learning face-to-face. After almost a full year of the COVID-19 pandemic, four of every 10 students were still not learning face-to-face settings, and the majority of those were members of Black, Indigenous, and people of color communities. This implies that the impact of closing schools was not equal. Certain privileges like having a quiet place to work, having access to technology and the Internet, and having an adult who was literate and had the time to

help made virtual learning easier. Teenagers were also more affected by not being in school as they run out of time academically to catch up due to graduating and were more likely to be pulled from school to work or take care of their families (Kamenetz, 2022). Student perceptions of their own achievement during the COVID-19 pandemic and virtual learning tell a similar story to the data. Garner-McCaskill (2022) found that students reported that they experienced more burnout, decreased engagement, and decreased retention of content. Communication was frequently mentioned as a major factor affecting student achievement, with 60% of students stating that communication was difficult and it impacted their motivation and engagement. Largely, students in this study perceived virtual learning as less effective due to communication challenges, motivation to learn, quality of feedback, and the instructional strategies used (Garner-McCaskill, 2022).

Summary

The purpose of this study was to determine how a student's choice of learning pathway during the COVID-19 pandemic might have affected their academic achievement during the COVID-19 pandemic. Chapter 2 presented existing research related to the topics of education during pandemics, education during the COVID-19 pandemic, learning loss, learning pathways, student achievement, and MTSS. Existing research on aptitude, motivation, quality and quantity of instruction, and environment were also discussed. Chapter 3 presents the methodology of this study. It details the setting, participants, variables, instruments, data collection, data analysis, limitations, delimitations, and ethical considerations.

Chapter 3: Methodology

In the spring of 2020, students around the world were sent home from brick-and-mortar schools to avoid the spread of the COVID-19 virus. Students and teachers had no choice but to move to virtual learning. In the fall of 2020, students were able to select the best pathway for them to learn. They could return to face-to-face instruction, study virtually through an asynchronous model, or study virtually through a synchronous model. The purpose of this study was to determine what impact, if any, a student's choice of pathway had on their academic achievement by using quantitative historical data. Chapter 1 presented an overview of this study and reported the problem and need for research. Chapter 2 presented the existing literature related to the research questions and topics that were examined in this study. This chapter, Chapter 3, explores the methodology that was used to answer the research questions posed in Chapter 1. First, the setting and the participants in the study are discussed, followed by the independent variables and the instruments that were used in testing those variables. Data collection and analysis procedures are discussed next, followed by the limitations and delimitations of the study. Finally, ethical considerations for the study are reviewed.

Research Questions

This study sought to answer the following research questions:

1. To what extent did the students' learning pathways impact the next year's academic achievement as measured by the change in end-of-year GPAs?
2. To what extent did the students' learning pathways impact academic achievement as measured by the Algebra 1 EOC exam scores?
3. To what extent did the students' learning pathway impact the likelihood of

student qualification for Tier 2 academic interventions in an MTSS in their first year of high school?

Setting

The setting where this research study took place was a large, suburban high school in South Carolina. Enrollment the year this study was conducted at the high school was approximately 1,920 students in grades 9-12. Enrollment for ninth-grade students was approximately 535, 10th-grade had approximately 532 students, 11th-grade had approximately 460 students, and 12th-grade enrollment was approximately 390 students. Table 2 shows the demographic breakdown for the student population the year this study was conducted.

Table 2

Student Demographics 2022-2023

Demographic identifier	Demographic category	Percentage of total population
Gender	Male	50
	Female	50
Race	Black/African American	42
	White	37
	Two or More Races	5
	Asian or Pacific Islander	3
	Other	3
Gifted and talented		25
Multi-lingual learner		30
Served in special education		2
Students in Poverty		33

The gender and race information in Table 2 was all self-reported by families on their enrollment paperwork. According to student information in the school's PowerSchool program, students at the high school where this study was conducted were

split in half regarding gender. Forty-two percent of the population was identified as Black/African American, 37% as White, 5% as Two or more races, and 3% as Asian or Pacific Islander. Three percent were not identified. The gifted information, multi-lingual information, and special education information were collected from PowerSchool using academic records. Students gifted in academics or the fine arts made up 25% of the population, multi-lingual learners made up 39% of the population, and 2% of the population was served by special education programs. The poverty information was based on those families that applied for free and reduced lunch in the school year the data were collected. Thirty-three percent of the students enrolled at the high school where this study took place were considered students in poverty.

Participants

The participants used in the study were from a large, suburban high school in South Carolina. Students included in this study entered their first year of high school during the 2021-2022 school year. These students were at the end of their seventh-grade year when the COVID-19 pandemic caused them to transition rapidly to virtual learning. During their eighth-grade year, they were given the choice between three pathways of instruction. They could choose between face-to-face instruction, synchronous virtual instruction, or asynchronous virtual instruction. This specific group of students was chosen because they were the class with the largest number of students to qualify for Tier 2 MTSS academic interventions at the site of this research during the 2021-2022 school year.

According to the 2020-2021 South Carolina State Report Card, the high school had a graduation rate of 78.8% and a dropout rate of 5.1%. There were 119 teachers that

school year, 61.2% of students in poverty, and 25% of students served by a gifted and talented program.

Independent Variable

The students' learning pathways acted as the independent variable. There were three categories for the student pathway. They were face-to-face, virtual asynchronous, and virtual synchronous.

Instruments

This study measured the possible impact a student's choice of learning pathway during the 2020-2021 school year and the COVID-19 pandemic had on student achievement. The instruments that were used for this measure are end-of-year GPAs, Algebra 1 EOC exam scores, and referral to Tier 2 MTSS academic interventions.

GPA

In the state of South Carolina, where this study took place, a uniform grading policy was mandated to be adopted no later than the 2000-2001 school year for all students entering ninth grade for the first time. In accordance with that mandate, the South Carolina Department of Education adopted a policy in December 1999 and revised it in 2007, 2016, and 2017. The uniform grading policy was built on a 10-point scale. The full scale can be found in the appendix (South Carolina Department of Education, 2019b). According to the uniform grading policy, honors level courses were granted an additional 0.5 points; Advanced Placement, International Baccalaureate, and dual credit courses were granted an additional full point. The formula to calculate a GPA is the sum of all quality points multiplied by the units the course is worth divided by the sum of units attempted (South Carolina Department of Education, 2019b). An example of a

student's GPA calculation from the South Carolina Uniform Grading Policy can be found in Figure 8.

Figure 8

Student GPA Calculation Example

STUDENT EXAMPLE

Course Taken	Numerical Average	Quality Points	Unit
English 1	91	4.100	1
Algebra 1	87	3.700	1
Physical Science	94	4.400	1
World Geography, Honors	83	3.800	1
Physical Education	92	4.200	1
French 1	84	3.400	1

COMPUTATION

Quality Points		Units		
4.100	×	1.0	=	4.100
3.700	×	1.0	=	3.700
4.400	×	1.0	=	4.400
3.800	×	1.0	=	3.800
4.200	×	1.0	=	4.200
3.400	×	1.0	=	3.400

sum of units attempted **6.0** **23.600** sum of quality points × units

sum of (quality points × units sum of units attempted, rounded to 3 decimal places

23.600 ÷ 6.0 rounded **3.9333333 to 3.933**

Each course taken by the student in this example is listed along with the numerical average the student earned in the course, the quality point equivalency to that numerical average, and the number of units each course is worth. The quality points are multiplied by the units first. Then, the total units are calculated just as the sum of quality points multiplied by the unit. Those two sums are then divided and rounded to three decimal places to determine the example student's GPA (South Carolina Department of

Education, 2019b). There are several benefits to the unified grading policy. It aligns K-12 achievement measures with colleges and universities, and since several neighboring states were already using the 10-point scale, it provided a more equitable opportunity to students who may transfer schools at some point (Spearman, 2016). For this study, GPAs were evaluated for change. The eighth-grade GPA and the ninth-grade GPA were calculated using the 4.0 scale and with the unweighted method. The change was recorded as "positive" or "negative," depending on the change between the 2 years.

Standardized Tests

Standardized tests are a measure of student achievement because they are reliable, objective, and fair (Alexander, 2022). For this study, EOC exam scores for the Algebra 1 course were used as one measure of academic achievement.

EOC Exams. EOC exams are state-wide standardized assessments that are given toward the end of instruction in a course. The goal of EOC exams is to measure student college and career readiness, but they also lend themselves to several accountability measures. They measure student achievement of content and are required to meet the criteria to graduate and the college and career ready criteria. EOC exams also provide a measure of educator effectiveness by improving the connection between state standards and instruction and compliance for federal funding (Council of Chief State School Officials, 2011; South Carolina Department of Education, 2022a). In South Carolina, students are required to take EOC exams in the gateway courses that serve as prerequisites to higher-level courses later in their high school careers. Courses that require an EOC exam are English II, Algebra I, Biology I, and United States History. The EOC exam counts as 20% of a student's final grade in the corresponding course, but

passing the exam is not required to pass the course or to graduate (South Carolina Department of Education, 2022a). For this study, EOC exam scores are divided into two groups: passing and failing. The criteria for passing and failing are based on the universal grading system. Passing is a score of 60 and above, and failing is a score of 59 and below. Only EOC exam scores from the Algebra 1 test are used for this study.

Validity and Reliability of EOC Exams. Validity refers to the process of evaluating how relevant the intended interpretation of a test score is to its proposed use (American Educational Research Association et al., 2014). There are several measures of validity that can be used when evaluating a test. The South Carolina Department of Education puts out an operational test technical report each year. The validity information is contained in that report for the past year's tests. In the 2020-2021 EOC Examination Program Operational Test Technical Report, the intended purpose of the EOC test is to identify areas of strength and areas for improvement in student performance, inform stakeholders of progress toward meeting state academic performance standards, and show evidence for the state's accountability program (South Carolina Department of Education 2021). The state used a company called Data Recognition Corporation to develop the test forms.

The report stated that an item review and test form development process supported the test's validity based on content. Performance level setting that was performed in a collaborative and participatory way and the standard manner that the test was administered further contributed to the validity of the test. The construct-related validity of the test was supported by test reliability studies, evaluations of the internal test structure, and an evaluation of the relationship between test scores and external variables.

The reliability results were supported by the finding that test scores remained relatively stable when the test was repeated under similar conditions. It is worth noting that due to a federal assessment waiver that was granted to cancel testing in the spring of 2020, these results come from a smaller testing population than in years prior.

MTSS

The last instrument was the qualification for Tier 2 MTSS academic interventions. To meet the criteria for MTSS at the high school where this study was conducted, a student must be failing 50% or more of their course load with a course grade of 50% or lower. This was assessed quarterly by teachers, and a referral was put into the system recommending the student for Tier 2 MTSS academic interventions. The categories for this measure in this study were yes and no. “Yes” indicated that the student qualified for Tier 2 academic interventions because they failed at least 50% of their classes. “No” indicated that the student did not qualify for Tier 2 academic interventions because they did not fail at least 50% of their classes as assessed quarterly.

Data Collection

Data for this study were ex post facto and collected from the school site’s PowerSchool data clerk. All student identification information was redacted, and the following data points with the students’ randomly assigned identifying numbers only were reported: end-of-year GPAs for school years 2020-2021 and 2021-2022, pathway choice for school year 2020-2021, end-of-year grades for all courses in school years 2020-2021 and 2021-2022, and EOC exam grades for Algebra 1. The clerk also reported demographic information, by identifying numbers only, including special education enrollment, race, participation in multilingual learner supports, and gender.

Data Analysis

A chi-square test of independence was used to determine if a student's pathway choice was independent of their student achievement. A chi-square test was run for each of the instruments used in this study: Algebra 1 EOC exam scores, GPAs, and qualification for Tier 2 MTSS academic interventions in the ninth-grade year. The chi-square test of independence is a nonparametric test. This means there are no assumptions about the data, such as the assumption of a normal distribution of the data. The chi-square test also does not require equal variance across the data. This means it is not necessary for the data to be equally distributed from the mean or average of the data. Chi-square tests are best for samples that are not of equal size and have categories that are mutually exclusive, and where expected values are greater than 5. This test provides not only information on statistical significance but also more detailed information on how groups performed in the study (McHugh, 2013). This nonparametric test was appropriate for these data because the variables in this study are nominally scaled or categorical variables (Urdan, 2017). The sample sizes in this study were not equal, as the number of students in each pathway was not controlled or manipulated in any way. Members of each sample group were only counted in one of the pathway categories, making them mutually exclusive. The expected values in this data set should have been more than 5. If they were less than 5, the data point was thrown out. This met the requirements for the chi-square test and made it appropriate for this study.

An independent *t* test was also used to analyze the average academic achievement during the school years. In contrast to the chi-square test, the independent *t* test is a parametric test that assumes a normal distribution of the data in a sample. It also requires

equal variance and independence of sample groups (Kim, 2015). The independent *t* test is appropriate for these data as the means of GPA and Algebra I EOC exam scores in each pathway were compared. The independent *t* test compares one sample to itself pre and posttreatment, or it can be an intergroup comparison where one group is compared to another posttreatment. Both comparisons were used in this study. The pre/post format was used in comparing GPAs of students before and after the pandemic. This is appropriate because the students were only compared to themselves before and after the treatment. The intergroup comparison was made in comparing each pathway to the others after the learning pathway was implemented.

Table 3 shows how data for each research question were analyzed. Each student was compared only to themselves each year with each instrument. Academic achievement was tracked by the average exam scores, changes in GPA, and the number of courses passed each year.

Table 3

Data Analysis

Research question	Instrument	Data collected	Method of analysis
To what extent did the learning pathway impact the next year's academic achievement as measured by the change in end-of-year GPAs?	Cumulative GPA	Quantitative values	Chi-square *t* test
To what extent did the learning pathway impact student achievement as measured by the Algebra 1 EOC exam?	EOC exam scores	Quantitative values	Chi-square *t* test
To what extent did the learning pathway influence the likelihood of student qualification for Tier 2 MTSS support in their first year of high school?	Qualification to Tier 2 MTSS academic supports	Quantitative values	Chi-square

A chi-square test of independence was used to analyze end-of-year GPAs and pathway choices. A student's pathway was the independent variable, and the change in the end-of-year GPA was the dependent variable. The change in GPA was calculated by taking the student's GPA during their eighth-grade year and subtracting the student's GPA at the end of their ninth-grade year. A chi-square test was chosen because it tells whether two variables are likely to be related or not.

An independent *t* test was also used to analyze the average GPA of students in each pathway group during the 2019-2020 school year and the 2020-2021 school year. The independent *t* test showed whether there was a statistically significant difference between the two averages.

A chi-square test of independence was also used to analyze Algebra 1 EOC scores and pathway choices. A student's pathway choice was the independent variable, and the test scores were the dependent variable. Passing test scores were those that were 60% or above, according to the school district's grading scale. Failing test scores were those that were 59% and below. The chi-square showed whether the test scores are dependent on the learning pathway or not.

An independent *t* test was also used to analyze the average Algebra 1 EOC exam scores for each pathway. The average scores for each student were compared between the two pathways. The independent *t* test showed whether there is a statistically significant difference between the two scores.

Finally, a chi-square test of independence was used to show if qualifying for Tier 2 MTSS academic interventions was independent of a student's pathway choice. Again, the student's pathway choice was the independent variable, and the student's qualifying or not qualifying for Tier 2 MTSS academic intervention each year was the dependent variable. Students were counted as qualifies if they met the requirements according to the school's MTSS plan as assessed quarterly. If they did not meet the requirements, they were counted as does not qualify. The chi-square test showed whether pathway choice affected the likelihood of a student qualifying for MTSS or not.

Limitations

A limitation of this study was not knowing the social/emotional impact of the COVID-19 pandemic on students and teachers. It was estimated by one source that nearly 200,000 children in the United States were bereaved and/or orphaned during the COVID-19 pandemic (Kamenetz, 2022). Research shows that contributing factors to poor

outcomes in online learning include competing priorities, attrition, lack of technological skills, and underdeveloped skills for independent learning (Means et al., 2014). Another limitation of this study was a lack of data on what the instructional conditions were like for students who chose the virtual synchronous or virtual asynchronous pathways. In April 2020, it was estimated that two of every three childcare centers were closed and that one of every three remained closed until April 2021 (Kamenetz, 2022). This could imply that the burden of childcare in households with younger children and parents who could not work from home fell on the late middle school-age to high school-aged children, impacting their instructional conditions when learning virtually. Teacher preparedness and course design were other limitations of the study. Data were not collected on teacher training and aptitude at teaching in a virtual synchronous pathway, nor were training and aptitude data for moving a course to a virtual asynchronous format collected.

Delimitations

Several choices were made to narrow the focus and scope of this study. One of these choices was to limit the independent variable to pathway choice only. No other demographic information was used when determining what, if any, impact student pathway choice had on academic achievement. There was also the choice to use students who entered their first year of high school during the 2021-2022 school year. These students made up the highest percentage of students who were referred to Tier 2 MTSS supports in its first year of implementation at the site that was used in this study. They also had the unique experience of moving from a middle school environment to a high school environment without having the transitional learning experience. This group of

students finished their seventh-grade year online when schools were shut in the spring of 2020 due to the COVID-19 pandemic. Their eighth-grade year, which is generally a time of transition from the middle school framework and preparation for the high school experience, was delivered in the pathway format that they chose in the 2020-2021 school year. These students' ninth-grade year, and first year of high school, was also the first time in a year and a half that all students were required to return to face-to-face learning and that testing and grading requirements were back to what they had been previous to the pandemic. This made their experience with learning during the COVID-19 pandemic unique and interesting in the context of this study. Lastly, the choice to use only one high school's class was made to limit the number of other variables that might have impacted student learning as much as possible. If other high schools were to be included in this study, there may have been discrepancies due to the teachers a student had or the overall expectations of online learning at different schools.

Ethical Considerations

The data for this study were collected directly from the school district of which the site is a part. Because the data are historical, individual students did not have knowledge of the information being used in this study. In order to remain ethically sound, the principal of the site and the district were informed of the explicit details of the study and the data being requested. As they maintained those historical, educational records, they were the party granting consent for the use of their data instead of the individual students. The Family Educational Rights and Privacy Act (FERPA) is a federal law in place to protect student privacy in educational records. It states that generally, a school must have written permission to release information from an educational record. It also

states, however, that the school can disclose educational records to school officials with a legitimate educational interest (United States Department of Education, 2022). I handled all of the data and was a school official with a legitimate educational interest; therefore, FERPA guidelines were followed. In addition, the identity of individual students remained confidential. When the data were received by the study, student identifying information had been redacted, and an identification number was given in its place. This ensured that the privacy of the individual students was maintained throughout the study.

Summary

The first two chapters of this study have taken you through the proposed problem and background of the problem, a statement of research questions, and a summary of existing research related to the problem and the research questions. Chapter 3 described the methodology, instruments, and data collection that were used in this study of the possible impacts of a student's choice of learning pathway during the COVID-19 pandemic on their academic achievement. In addition, the limitations and delimitations of the study were presented. In the remaining chapters, the data are presented in addition to a thorough analysis of those data findings and implications for the impact pathway choices may have had on student academic achievement. Recommendations for practice and suggestions for future research are also discussed.

Chapter 4: Results

Introduction

The purpose of this quantitative research study was to identify to what extent student achievement was impacted by the pathway students selected during the 2020-2021 school year due to the COVID-19 pandemic. The pathways students could choose from were face-to-face learning, virtual synchronous learning, and virtual asynchronous learning. Student achievement was measured in several different ways: EOC Algebra I exam grades, GPAs, and qualification for Tier 2 academic interventions in an MTSS. The study sought to identify any differences in those measures of academic achievement between the students in each pathway.

Chapter 4 presents the results of the study and the statistical tests that were used to achieve those results. The research questions are revisited, followed by a summary of the descriptive statistics for the sample population. Finally, the results are shared along with an interpretation.

Research Questions

This study aimed to answer the following research questions:

1. To what extent did the students' learning pathways impact the next year's academic achievement as measured by the change in end-of-year GPAs?
2. To what extent did the students' learning pathways impact academic achievement as measured by the Algebra 1 EOC exam scores?
3. To what extent did the students' learning pathways impact the likelihood of student qualification for Tier 2 academic interventions in an MTSS in their first year of high school?

Summary Descriptives

The data used in this study were historical scores stored by the high school in which the study took place. In total, data were collected on 386 students. Not all students had a record of all of the data points used in this study, so the sample size for each data point is given before the results. Of the 386 students, 200 were on the face-to-face learning pathway, 185 were on the synchronous virtual learning pathway, and one was on the asynchronous virtual pathway. All of the students entered their first year of high school during the 2021-2022 school year and were enrolled at the site. Their learning pathway choice took place during their eighth-grade year. Table 4 highlights the demographic information of the study participants.

Table 4

Student Demographic Information

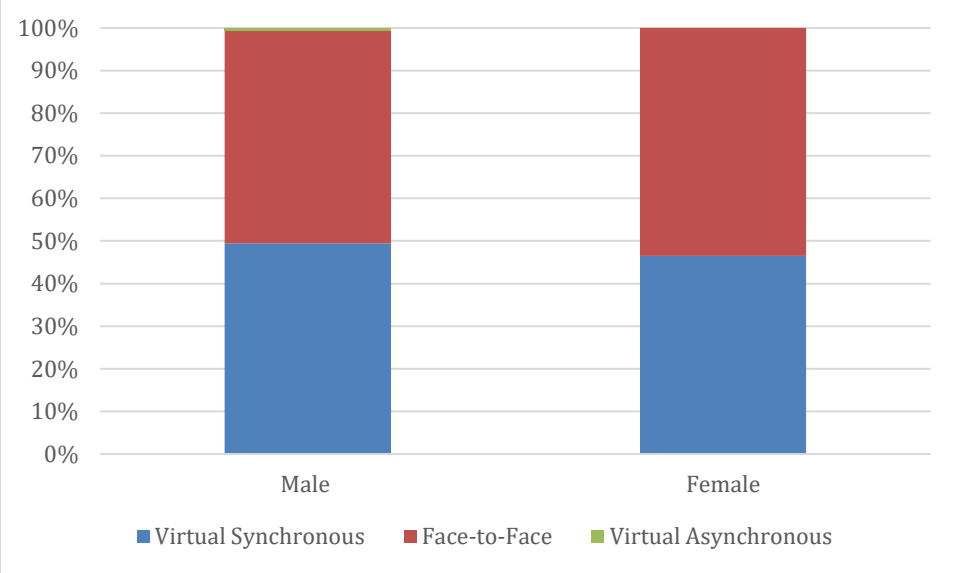
Indicator		Total number of students	Percentage in face-to-face pathway	Percentage in virtual synchronous pathway	Percentage in virtual asynchronous pathway
Gender	Male	188	50%	49.46%	.53%
	Female	198	53.53%	46.46%	0%
Race	Asian	9	22.22%	77.77%	0%
	Black/African American	126	39.68%	60.31%	0%
	Hispanic	77	42.25%	58.14%	0%
	Mixed	34	52.94%	44.11%	2.94%
	White	139	69.78%	30.21%	0%
	Hawaiian/Pacific Islander	1	100%	0%	0%
Multi-Lingual learner		67	58.20%	40.29%	1.49%
504		19	47.36%	52.63%	0%
Individual education plan		34	26.47%	44.11%	0%

The information in Table 4 was collected from the site's PowerSchool program,

which keeps track of grades, attendance, and demographic information of the students as entered by parents or guardians at the time of registration. The first demographic category that was collected was gender. The breakdown of student gender by pathway can be seen in Figure 9.

Figure 9

Gender Breakdown by Learning Pathway

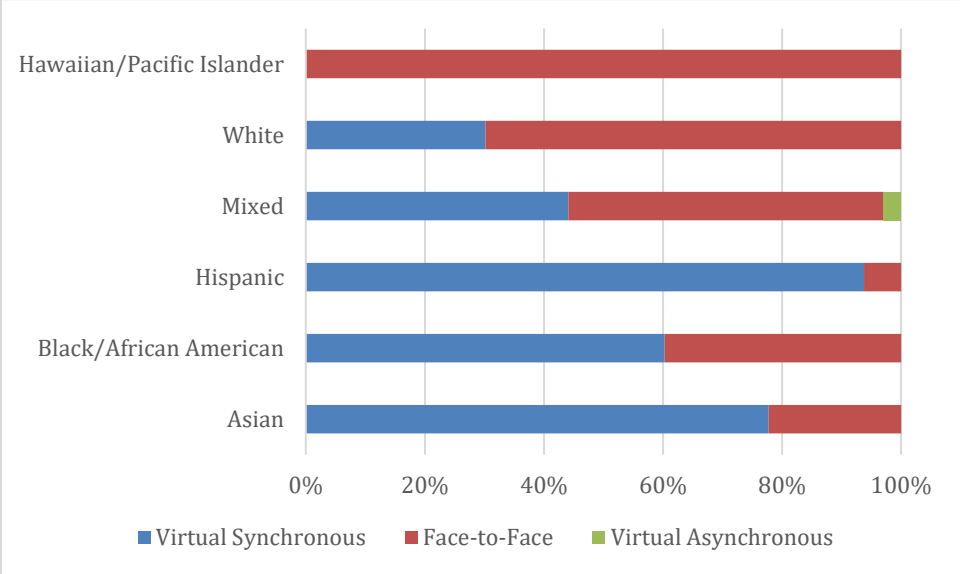


Of the 386 students who were considered for this study, 188 were male and 198 were female. Of those populations, 50% of males chose the face-to-face learning pathway, 49% chose the virtual synchronous pathway, and 1% chose the virtual asynchronous pathway. Of the female students, 53% chose the face-to-face pathway, 46% chose the synchronous virtual pathway, and none chose the asynchronous virtual pathway.

The next demographic category was race. The breakdown of student race can be found in Figure 10.

Figure 10

Racial Breakdown by Learning Pathway

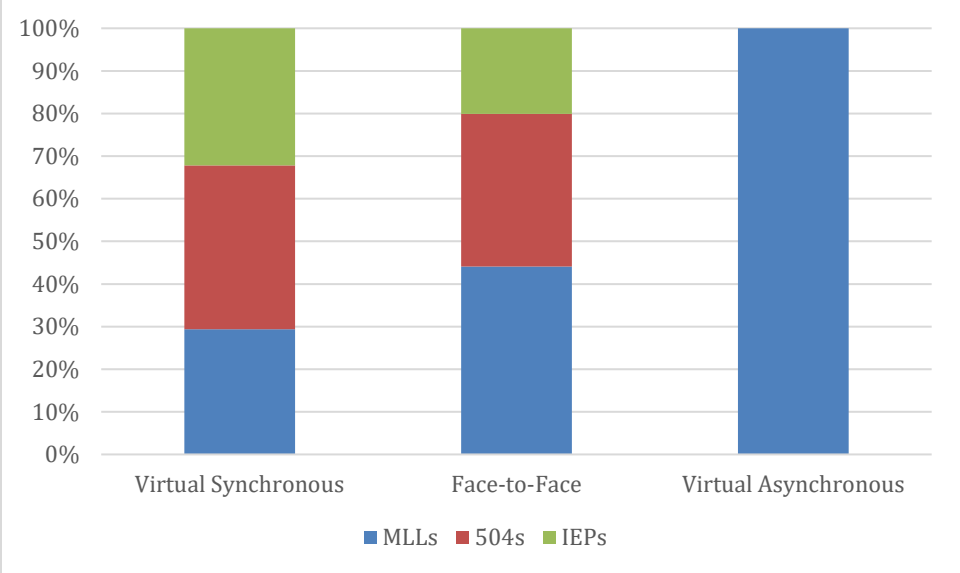


In the population, there were nine students identified as Asian, 126 as Black/African American, 77 as Hispanic, 34 as Mixed Race, 139 as White, and one as Hawaiian/Pacific Islander. Of the students who identified as Asian, 22% chose the face-to-face learning pathway, 78% chose the virtual synchronous pathway, and none chose the virtual asynchronous pathway. Of the majority of students who identified as Black/African American, 60% chose the virtual synchronous pathway, while only 40% chose the face-to-face pathway. Fifty-eight percent of students who identified as Hispanic chose the virtual synchronous pathway, and 42% chose the face-to-face pathway. Of the students who identified as Mixed, 53% chose the face-to-face learning pathway, 44% chose the virtual synchronous pathway, and 3% chose the virtual asynchronous pathway. For students who identified as White, the face-to-face pathway represented 70% of the student choice, and 30% chose virtual synchronous. One student, who chose the face-to-face pathway, identified as Hawaiian/Pacific Islander.

Special populations included students who were identified as multi-lingual learners (MLLs), students with Individual Education Plans (IEPs), and students with 504 plans. The breakdown of students in these special populations can be found in Figure 11.

Figure 11

Special Populations Breakdown by Learning Pathway



The 19 students with a 504 plan were split, with 47% choosing the face-to-face learning pathway and 53% choosing the synchronous virtual pathway. The majority of the 34 students with IEPs chose the synchronous virtual learning pathway (44%), while the rest chose the face-to-face pathway (27%). In the MLL population of 67 students, 58% chose the face-to-face learning pathway, 40% chose the virtual synchronous pathway, and 2% chose the virtual asynchronous pathway.

The large takeaway from the demographic information is that the majority of the minority populations at the site where this study took place chose the virtual synchronous pathway, while the majority of White students chose the face-to-face pathway. It is also worth noting that the majority of students with IEPs also chose the virtual synchronous

pathway. This is important because the two population groups, face-to-face and virtual synchronous, are not equal; therefore, the statistics used in this study must be appropriate for heterogeneous groups.

Presentation of Findings

This section presents the findings of the research study. It is organized by the research questions that were asked at the beginning of this study. Each section includes the collected data represented in table and narrative form and an interpretation of that data.

Research Question 1

The first research question in this study was to what extent the students' learning pathway impacted the next year's academic achievement as measured by the change in the end-of-year GPA. First, a chi-square test for independence was conducted to determine if the student learning pathway was independent of the change in a student's GPA between the end of their eighth-grade year and the end of their ninth-grade year. The 10-point universal grading scale, which can be found in the appendix, was used to calculate the unweighted GPA of each student. Then, those data were used to determine if the student's GPA increased or decreased between the eighth-grade year and the ninth-grade year. The chi-square test results are shown in Table 5.

Table 5

Change in GPA Chi-Square Results

	Value	df	Asymptotic significance (2-sided)	Exact sig. (2-sided)	Exact sig. (1-sided)
Pearson chi-square	9.411	1	.002		
Continuity correction	8.759	1	.003		
Likelihood ratio	9.454	1	.002		
Fisher's exact test				.002	.002
Linear-by-linear association	9.384	1	.002		
N of valid cases	343				

Note. sig=significance

There were a total of 343 students in this data set: 169 of the students were in the virtual synchronous learning pathway, and 174 were in the face-to-face learning pathway. No students in this data set learned in the virtual asynchronous pathway. In the virtual synchronous group, 94 of the students' GPAs increased between their eighth- and ninth-grade years, and 75 decreased. Comparatively, in the face-to-face group, 68 of the students' GPAs increased between their eighth- and ninth-grade years, and 106 decreased. The model showed statistical significance, X^2 (1) = 9.41, p = .002; therefore, there is an association between a student's learning pathway choice and the change in their GPA between their eighth- and ninth-grade years. Therefore, it can be concluded that the pathway choice and the change in GPA are dependent on each other. In the virtual synchronous pathway, 26 more students saw an increase in their GPA than those in the face-to-face pathway between their eighth- and ninth-grade years. Thirty-one students in the face-to-face pathway had a decrease in their GPAs between their eighth- and ninth-grade years.

An independent *t* test was also run for student GPAs at the end of their eighth-

grade year and for the end of their ninth-grade year to determine if there was a relationship between learning pathway choice and average GPA. Figure 12 and Table 6 show the results of the independent *t* test for eighth-grade GPAs.

Figure 12

Eighth-Grade GPA Outliers Box Plot

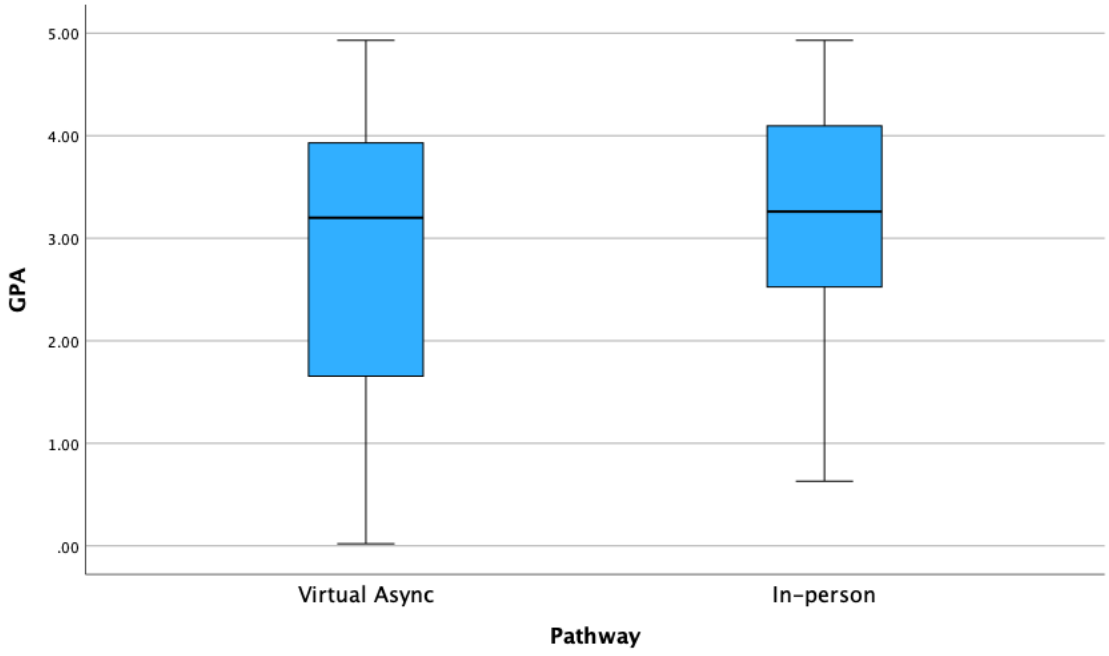


Figure 12 shows that there were no outliers in this data set, so equal variances were assumed. In this data set, 176 students were in the virtual synchronous group, and 195 were in the face-to-face group. No students were in the virtual asynchronous group. The average GPA for virtual synchronous students was 2.87, and the average GPA for face-to-face students was 3.25 at the end of their eighth-grade year.

Table 6

Eighth-Grade GPA Independent t Test Results

		Levene's test for equality of variances		*t* test for equality of means					
						Significance			
		F	Sig.	t	df	One-sided p	Two-sided p	Mean difference	Std. error difference
GPA	Equal variances assumed	19.775	<.001	-3.275	369	<.001	.001	-.37983	.11597
	Equal variances not assumed			-3.234	329.027	<.001	.001	-.37983	.11746

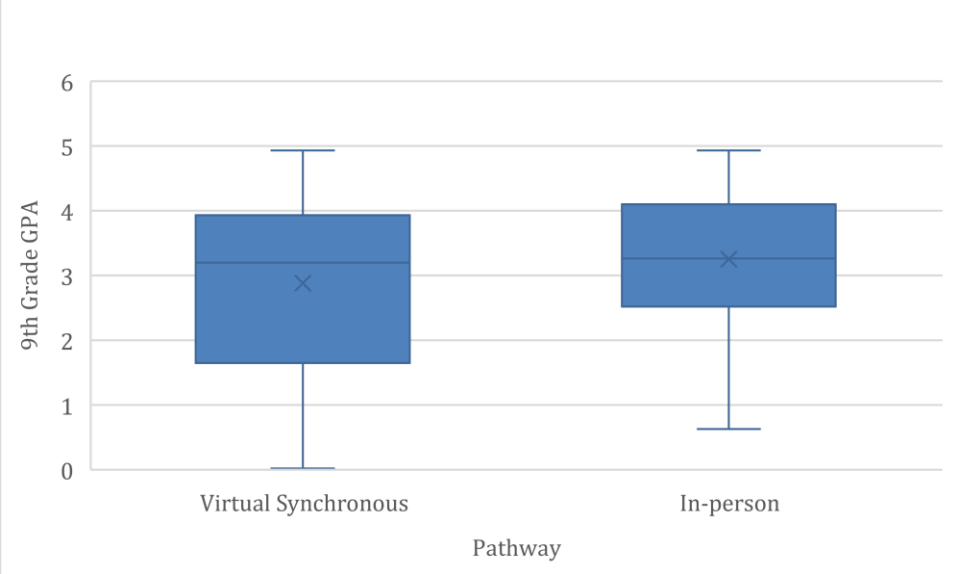
Note. sig=significance

The results showed statistical significance, t(369) = -3.275, p = .001; therefore, there was statistical significance between learning pathway choice and the average GPA of students at the end of their eighth-grade year. On average, face-to-face students' GPAs were .3799 points higher than their virtual synchronous peers at the end of their eighth-grade year.

An independent *t* test was also run for the students' ninth-grade GPAs. Figure 10 shows the box plot to indicate outliers in the data set.

Figure 13

Ninth-Grade GPA Outliers Box Plot



As Figure 13 shows, there were no outliers in the ninth-grade GPA data set. In this data set, 175 students were on the virtual synchronous pathway, and 195 were on the face-to-face pathway. No students were on the virtual asynchronous pathway. The average GPA for students in the virtual synchronous pathway was 2.8797 and 3.2548 for students in the face-to-face pathway at the end of their ninth-grade year. Table 7 shows the results of the independent *t* test.

Table 7

Ninth-Grade GPA Independent t Test Results

		Levene's test for equality of variances		*t* test for equality of means					
						Significance			
		F	Sig.	t	df	One-sided p	Two-sided p	Mean difference	Std. error difference
GPA	Equal variances assumed	19.737	<.001	-3.227	368	<.001	.001	-.37505	.11621
	Equal variances not assumed			-3.184	326.707	<.001	.002	-.37505	.11780

Note. sig=significance

The results showed statistical significance, t(368) = -3.227, p < .001; therefore, there was statistical significance between learning pathway choice and average GPA at the end of the students' ninth-grade year. On average, students in the face-to-face learning pathway had a GPA that was .37 points higher than those on the virtual synchronous learning pathway; therefore, there was a statistically significant positive relationship between learning pathway choice and ninth-grade GPA.

Research Question 2

The second research question in this study asked to what extent the students' learning pathway impacted academic achievement as measured by the Algebra 1 EOC exam. Table 8 shows the results of a chi-square test of independence.

Table 8

EOC Chi-Square Results

	Value	df	Asymptotic significance (2-sided)	Exact sig. (2-sided)	Exact sig. (1-sided)
Pearson chi-square	4.358	1	.037		
Continuity correction	3.924	1	.048		
Likelihood ratio	4.364	1	.037		
Fisher's exact test				.043	.024
Linear-by-linear association	4.346	1	.037		
N of valid cases	355				

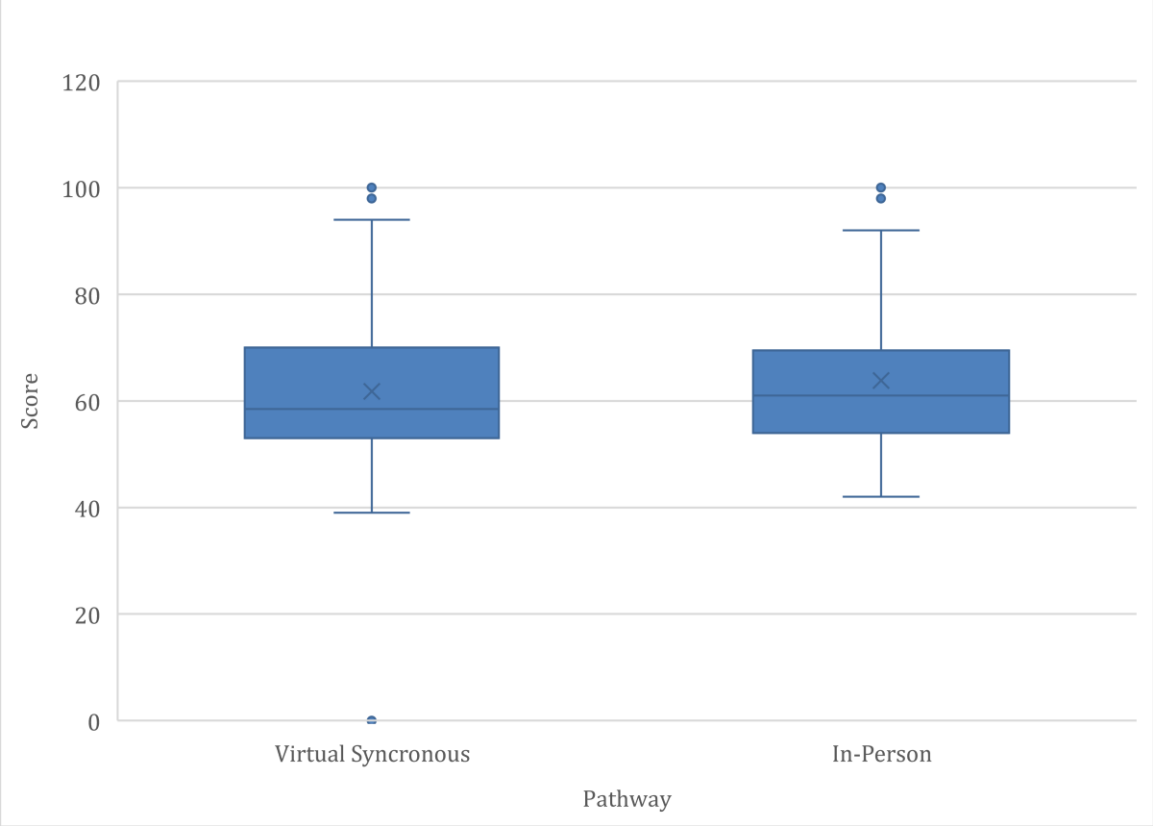
Note. sig=significance

In this data set, there were a total of 192 students. Of the total set, 166 were a part of the virtual synchronous group, and 189 were part of the face-to-face group. No students in this data set were a part of the virtual asynchronous group. In the virtual synchronous group, 80 students passed the Algebra 1 EOC exam with a 60% or higher. Eighty-six students in this group failed the EOC exam. In the face-to-face group, 112 students passed the exam, and 77 students failed. The results showed significance, X^2 (1) = 4.58, p = .037; therefore, it can be determined that there was a statistically significant positive relationship between learning pathway choice and passing the Algebra 1 EOC exam. Thirty-two more students passed the EOC exam in the face-to-face learning pathway than in the virtual synchronous pathway.

An independent *t* test was also run to determine if the score on the Algebra 1 EOC exam was independent of the learning pathway choice. First, a box plot was created to determine if there were any outliers in the data set. The box plot can be found in Figure 14.

Figure 14

EOC Outliers Box Plot



From this box plot, it was determined that both groups, virtual synchronous learners and face-to-face learners, had some outliers. The results of the *t* test can be found in Table 9.

Table 9

EOC t Test Results

		Levene's test for equality of variances		*t* test for equality of means					
						Significance			
		F	Sig.	t	df	One-sided p	Two-sided p	Mean difference	Std. error difference
GPA	Equal variances assumed	.096	.757	-1.455	353	.073	.147	-2.05065	1.40949
	Equal variances not assumed			-1.447	338.049	.074	.149	-2.05065	1.41690

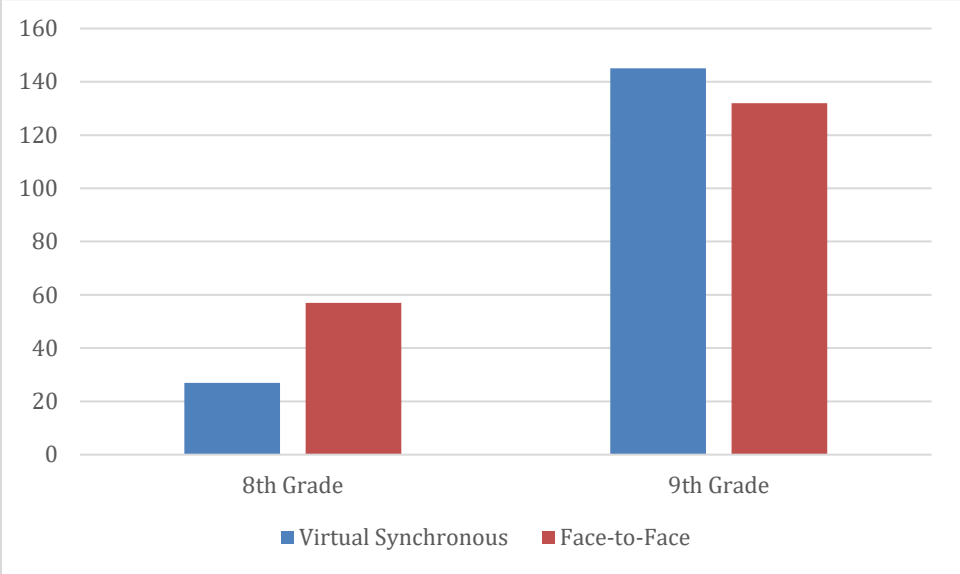
Note. sig=significance

There were a total of 355 students in this data set. In the virtual synchronous group, there were 166 students; in the face-to-face group, there were 189 students. There were no students in the virtual asynchronous group. The average EOC exam score for students in the virtual synchronous group was 61.80. The average EOC exam score for students in the face-to-face group was 63.85. The results showed statistical significance, $t(353) = -41.455$, $p = .074$; therefore, it can be concluded that despite face-to-face students scoring 2 points higher on average than virtual synchronous students, there is no statistical significance between learning pathway choice and Algebra 1 EOC exam score.

One more analysis of those data included comparing students who took the Algebra I EOC exam in eighth grade and those who took it in ninth grade. Figure 15 shows the breakdown of students in each pathway and the year they took Algebra I.

Figure 15

Number of Students Taking Algebra I



There were 385 students in the sample. Eighty-four of those students took Algebra I during their eighth-grade year. Twenty-seven of the students who took Algebra I in eighth grade were on the virtual synchronous pathway, and 57 were on the face-to-face pathway. Of the 27 students who were on the virtual synchronous pathway, only 14 students took the Algebra I EOC exam. In the face-to-face pathway, 53 of 57 students took the Algebra I EOC exam. There were 10 students in the sample who did not take Algebra I until their 10th-grade year. There were also nine students in the sample who had not taken Algebra I at the time the data were collected, and there were four students who took Algebra I in both eighth grade and ninth grade. Students in these three groups were not included in the comparison. Table 10 shows the independent *t* test comparing pathways and Algebra I EOC exam scores of the students who took the test in eighth grade.

Table 10

Eighth-Grade Algebra I EOC t Test

		Levene's test for equality of variances		*t* test for equality of means					
						Significance			
		F	Sig.	t	df	One-sided p	Two-sided p	Mean difference	Std. error difference
Alg. EOC score	Equal variances assumed	.001	.980	-1.153	65	.127	.253	-4.93935	1.40949
	Equal variances not assumed			-1.115	19.582	.139	.278	-4.93935	1.41690

Note. sig=significance

In this data set, there were 67 students with Algebra I EOC exam scores from their eighth-grade year. There were 14 students who took Algebra I in eighth grade on the virtual synchronous learning pathway and 53 students on the face-to-face learning pathway. The average EOC exam score for students taking Algebra I in eighth grade on the virtual synchronous pathway was 67.92. The average EOC exam score for students taking Algebra I in eighth grade on the face-to-face pathway was 72.86. The results showed $t(65) = -1.153$, $p = .253$; therefore, it can be concluded that despite face-to-face students scoring almost 5 points higher on average than virtual synchronous students, there is no statistical significance between learning pathway choice and Algebra 1 EOC exam score for students who took the test during their eighth-grade year.

Table 11 shows the independent *t* test comparing pathways and Algebra I EOC exam scores of the students who took the test in ninth grade.

Table 11

Ninth-Grade Algebra I EOC t Test

		Levene's test for equality of variances		*t* test for equality of means					
						Significance			
		F	Sig.	t	df	One-sided p	Two-sided p	Mean difference	Std. error difference
Alg. EOC score	Equal variances assumed	.1.938	.165	1.317	272	.094	.189	1.73002	1.31353
	Equal variances not assumed			1.323	271.948	.093	.187	1.73002	1.30758

Note. sig=significance

In this data set, there were 274 students with Algebra I EOC exam scores from their ninth-grade year. There were 144 students who took Algebra I in ninth grade on the virtual synchronous learning pathway and 130 students on the face-to-face learning pathway. The average EOC exam score for students taking Algebra I in ninth grade on the virtual synchronous pathway was 62.01. The average EOC exam score for students taking Algebra I in ninth grade on the face-to-face pathway was 60.27. The results showed $t(272) = 1.317$, $p = .094$; therefore, it can be concluded that despite virtual synchronous students scoring 2 points higher on the Algebra I EOC exam than face-to-face students, there is no statistical significance between pathway and Algebra 1 EOC score in ninth grade.

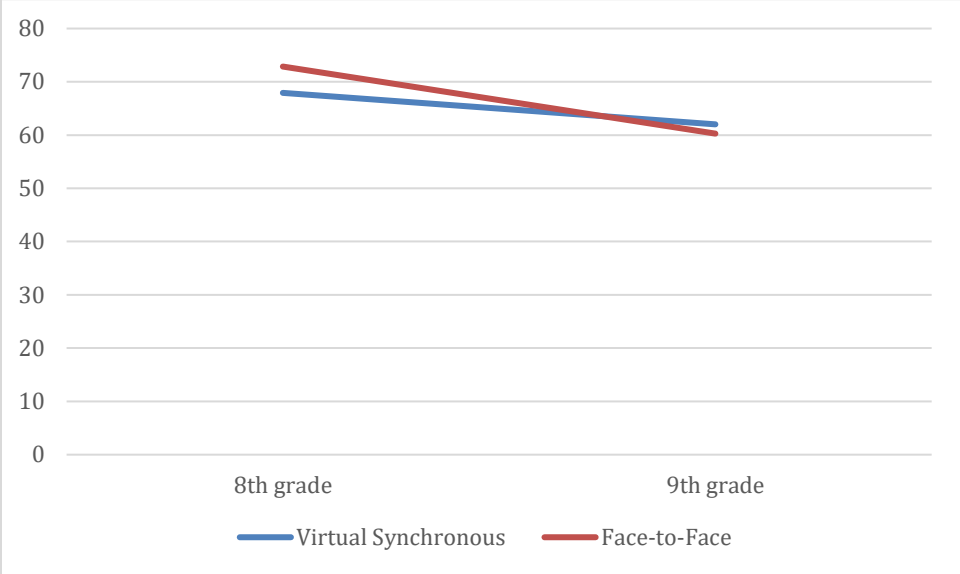
It is interesting to note that when students took the EOC in eighth grade, students were learning in their chosen pathways. Face-to-face students scored higher on average than students in the virtual synchronous pathway. This would support that students in the

face-to-face pathway had higher academic achievement than the virtual synchronous students; however, for students who took the Algebra I EOC exam in ninth grade when all students were back in the face-to-face pathway, those students who had learned in the virtual synchronous pathway scored higher, on average, than their face-to-face peers. This negates the previous statement about academic achievement. It might also have to do with the number of students who did not have an EOC exam score despite having taken the course. In the group of students who took Algebra I in eighth grade, 17 of the 84 students did not have a score reported for the EOC exam. This is likely due to the fact that schools were able to choose whether or not they would give and/or count EOC exam scores according to the South Carolina Department of Education guidelines. If those 17 students' scores could have been included in the data set, the results of the *t* test might have been different. In the groups of students who took Algebra I in ninth grade, only four of them did not have a score reported for the EOC exam. The student data from the ninth-grade set are more complete.

Figure 16 shows the average Algebra I EOC exam scores for each grade level and pathway.

Figure 16

Average Algebra I EOC Exam Scores



Overall, Algebra I EOC exam scores were higher for students in both pathways when the exam was taken during their eighth-grade year. This is contrary to what might have been predicted according to existing literature and the theoretical framework used in this study. Walberg's (1981) theory identified maturity as one of the contributing factors to a student's educational productivity. If these results were to follow his theory, students who took the Algebra I EOC exam during their ninth-grade year would have scored higher than the students who took the Algebra I EOC exam during their eighth-grade year because ninth graders are, presumably, a year older than eighth graders, have an additional year of experience in school, and are more mature. Instead, these results show that students who took the Algebra I EOC exam during their ninth-grade year scored lower than their eighth-grade peers, regardless of the learning pathway they had chosen. There could be several explanations for this. The first is that the standard math

curriculum for an eighth grader is “eighth-grade math,” not Algebra I. Algebra I is a ninth-grade course. It could be assumed that any student who took Algebra I during their eighth-grade year had been identified as a student who was gifted in math and could be successful in taking it a year early. If they are gifted in math, it would also be expected that they would score higher on the Algebra I EOC exam than those who were not gifted in math and therefore waited until their ninth-grade year to take the course.

Another explanation could be that after the 2020-2021 school year, when EOC exams were not counted against a student’s final grade per the South Carolina Educational Guidelines, students did not take the Algebra I EOC exam as seriously as they should have. Students may have been skeptical of whether the test would actually count and therefore may not have put forth their best effort.

Schools had the choice of whether or not to give EOC exams during the 2020-2021 school year; 17 of the 84 students, or 20%, who took the Algebra I course during their eighth-grade year did not have a score reported. During the 2021-2022 school year, only four of 278 of the students, or less than 2%, who took the Algebra I course did not have a score reported. The scores for ninth graders taking the EOC exam might be lower due to the fact that almost all of the scores were reported, whereas 20% of the scores are missing from the eighth-grade students.

Students who chose the virtual synchronous pathway have a more consistent average, regardless of the year they took the Algebra I EOC exam. This is interesting because students who chose the face-to-face learning pathway had higher scores, for the most part, than virtual synchronous students, according to the independent *t* test.

Research Question 3

Research Question 3 asked to what extent the learning pathway impacted the likelihood of students qualifying for Tier 2 academic interventions through MTSS during their first year of high school. A chi-square test of independence was run for this. The results can be found in Table 12.

Table 12

MTSS Qualification Chi-Square Results

	Value	df	Asymptotic significance (2-sided)	Exact sig. (2-sided)	Exact sig. (1-sided)
Pearson chi-square	1.115	1	.291		
Continuity correction	.805	1	.370		
Likelihood ratio	1.115	1	.291		
Fisher's exact test				.341	.185
Linear-by-linear association	1.112	1	.292		
N of valid cases	382				

Note. sig=significance

In this data set, there were 382 students in total: 184 in the virtual synchronous group and 198 in the face-to-face group. In the virtual synchronous group, 25 students met the qualifications for MTSS during their ninth-grade year, and 159 did not. In the face-to-face group, 20 met the qualifications for Tier 2 MTSS academic interventions during their ninth-grade year, and 178 did not. There was one student in the virtual asynchronous group who did not qualify for MTSS, but because that data set was so small and the expected values were less than 5, that data point was removed from the chi-square test. The results showed X^2 (1) = 1.115, p = .291; therefore, there was no significant association between learning pathway and qualification for Tier 2 academic interventions through MTSS.

Summary

From the statistical test results explained in this chapter, many things can be determined. First, it was found that there is a statistically significant positive relationship between the increase in a student's GPA between their eighth- and ninth-grade years and their learning pathway. More students in the virtual synchronous pathway had an increase in their GPAs than students in the face-to-face learning pathway. Next, the statistics show that there is a statistically significant positive relationship between eighth-grade and ninth-grade GPAs and learning pathways. In both populations, face-to-face students had higher GPAs than their virtual synchronous counterparts.

Tests run regarding EOC exam scores returned different results. The statistics showed that there is a statistically significant positive correlation between passing the Algebra 1 EOC exam and learning pathway choice. On average, students in the face-to-face pathway scored higher than those in the virtual synchronous pathway; however, statistics showed that there is no statistical significance between the average Algebra 1 EOC exam score and the learning pathway choice.

In the last research question, a student's likelihood to qualify for Tier 2 academic interventions in MTSS was investigated. Tests showed that student qualification for Tier 2 academic interventions was not related to their learning pathway. In the next chapter, these results are analyzed in a narative fashion. Conclusions and implications are discussed first followed by recommendations for practice and suggestions for future research. Finally, a conclusion to the study is presented.

Chapter 5: Discussion

This chapter draws conclusions from the findings presented in Chapter 4. It begins with the research questions, conclusions, and implications drawn from the findings in Chapter 4. Next, recommendations for practice are discussed, followed by suggestions for future research. Finally, a conclusion of the full study is presented.

Research Questions

The purpose of this study was to answer the three following research questions:

1. To what extent did the students' learning pathways impact the next year's academic achievement as measured by the change in end-of-year GPAs?
2. To what extent did the students' learning pathways impact academic achievement as measured by the Algebra 1 EOC exam?
3. To what extent did the students' learning pathways influence the likelihood of student qualification for Tier 2 academic interventions in an MTSS in their first year of high school?

The measures of academic achievement that were used in this study were GPAs, scores on Algebra 1 EOC exams, and qualification for Tier 2 academic interventions in an MTSS. Qualification for Tier 2 academic support was based on the parameters the school site created. Those qualifications were that students were failing 50% of their course load with a 50% or less. Grades were evaluated quarterly for this measure. Data used in this ex post facto study came from a specific population of students. These students were enrolled in XX High School and entered their first year of high school during the 2021-2022 school year. The high school was large and had a very diverse student population. Students included in this study were from multiple races,

socioeconomic backgrounds, different degrees of English proficiency and served in general education, gifted education, and special education. Beginning their first year of high school during the 2021-2022 school year meant that their learning pathway choices took place during the year they were enrolled in eighth grade. They were chosen as the test population because of the transitional nature of a student's eighth-grade year.

The statistics used in this study include the chi-square test for independence and the independent *t* test. These tests were chosen because they are appropriate for the comparison of two heterogeneous groups that are independent of one another. The groups in this study are heterogeneous due to the fact that their learning pathway choices were not made in order to ensure that the academic achievement of the groups was equal. Students chose their pathways regardless of whether they were gifted, were served by special education, or were multi-lingual students, etc. The groups are considered independent because students can only belong to one pathway group. The independent variable in all of the statistical tests was the learning pathway of the students: face-to-face, virtual synchronous, or virtual asynchronous. The dependent variables were the change (positive or negative) in ninth-grade GPA as compared to eighth-grade GPA, average eighth-grade GPA, average ninth-grade GPA, the average score on the Algebra 1 EOC exam, pass/fail rate on the Algebra 1 EOC exam, and the qualification for Tier 2 academic interventions in MTSS. All statistical calculations were made using SPSS software.

Conclusions and Implications

Research Question 1 looked at the dependent variables regarding GPA. It asked, "To what extent did the students' learning pathways impact the next year's academic

achievement as measured by the change in end-of-year GPAs?" Each student's GPA at the end of their eighth-grade year was compared to their GPA at the end of their ninth-grade year. GPAs were calculated using the 10-point grading scale, and unweighted GPAs were used. On the unweighted scale, no extra weight is given to grades that are earned in classes taken at the honors level or above. The unweighted GPA was used in order to eliminate the possibility of subjectivity in grades that had been given based on the difficulty of a class. The statistics showed that there were more students with a positive change between their eighth- and ninth-grade GPAs in the virtual synchronous learning pathway than in the face-to-face learning pathway. This could indicate that students in the virtual synchronous pathway had further to grow than their face-to-face counterparts between their eighth-grade and ninth-grade years. That is to say that at the end of their eighth-grade year, students on the virtual synchronous pathway had lower GPAs than students in the face-to-face pathway and, therefore, had a positive increase in their GPA by the end of their ninth-grade year. It also speaks to the fact that in their ninth-grade year, when all students were required to return to the face-to-face pathway, the students in the virtual synchronous pathway and the one student on the virtual asynchronous pathway were the only groups that experienced a true shift in the way educational material was being presented. The student on the virtual asynchronous pathway was not considered because the group was too small in number to analyze. Students who had been on the virtual synchronous pathway returned to an educational setting they had been familiar with prior to the pandemic where teachers provided direct instruction, as opposed to being merely a facilitator, and were physically in the room to motivate and guide students as they learned (Maatuk et al., 2021). The data also showed

that both eighth- and ninth-grade students in the face-to-face learning pathway had higher GPAs on average than students in the virtual synchronous pathway. This relationship was found statistically significant, potentially suggesting that academic achievement was higher for students in the face-to-face pathway as well as more consistent, as shown by the less frequently positive change in their GPAs between their eighth-grade and ninth-grade years. This might be due to a difference in the quality of instruction between pathways that could be linked to the amount of knowledge and support teachers had when developing the virtual synchronous classes in the emergency situation of the COVID-19 pandemic. Online instruction is only effective when it is carefully designed (Hodges et al., 2020). Because most schools did not have a good plan for the emergency transition to virtual learning caused by the COVID-19 pandemic, there was little time to plan and design the curriculum. Teachers had limited access to high-quality materials and often unclear expectations for virtual learning (Aboagye et al., 2020; Digital Learning Collaborative, 2022; Garris & Fleck, 2022). This all contributed to a lower quality of instruction in the virtual synchronous pathway.

This is related to Walberg's (1981) theoretical framework shared at the beginning of this study. Walberg's second area of educational productivity was instruction. He broke instruction down into two parts: quantity and quality (Fraser et al., 1987). From the guidance of the state and the school district where this study took place, we know that the recommendations for virtual instruction were shorter lessons and less work online than students had experienced in classrooms prior to the COVID-19 pandemic and less than those students were receiving in the face-to-face pathway (South Carolina Education Oversight Committee, 2021). The data support, therefore, that students on the face-to-

face learning pathway had a greater quantity of instruction than students in the virtual synchronous pathway, potentially contributing to their higher GPAs.

Quality of instruction was also incongruent between students in different pathways during the 2020-2021 school year. There were limited best practices known and used for virtual learning, and there was little time for teachers to fully develop a curriculum in order for virtual learning to have high quality (Digital Learning Collaborative, 2022). Face-to-face learning was essentially the same during the COVID-19 pandemic as it had been before, so established best practices could continue to be used. This resulted in a higher quality of instruction. Students in this pathway continued to learn through hands-on experiences, real-time student-teacher communication, and interactions with peers (Chisadza et al., 2021). The higher average GPAs in face-to-face students during both the eighth-grade and ninth-grade years support this.

Research Question 2 dealt with academic achievement as measured by Algebra 1 EOC exam scores. It asked, “To what extent did the students’ learning pathways impact academic achievement as measured by Algebra I EOC exam scores?” It was found that students on the face-to-face pathway were more likely to pass the Algebra I EOC exam with a grade of 60% or higher than those in the virtual synchronous pathway. This, again, suggests that academic achievement was higher for students in the face-to-face pathway as more students passed the exam. Average EOC exam sores between the two pathways, however, were found to be independent of the pathway choices. That means that regardless of the pathway a student was on, their average Algebra I EOC exam score was about the same. This might be attributed to the fact that the two groups of students, face-to-face and virtual synchronous, had EOC exam data sets with outliers in both the upper

and lower ranges. These data are unreliable due to the fact that *t* tests require normal distributions and variance of means. The outliers in each pathway's data skew the normal distribution and the variance of means.

The sample populations in this study were not equal, they were heterogeneous. There was no control over how many gifted students or multilingual learners, for example, were in each learning pathway's data set. This fact may explain the study's finding that average EOC scores were independent, or not statistically significant, of pathway choice. Walberg's (1981) first area of educational productivity was aptitude. Ability, development, and motivation were its components (Fraser et al., 1987). The learning pathway groups are heterogeneous. Students in each group had a variety of abilities and motivations before the pandemic that they carried into their learning pathway. This study did not group students by ability or motivation; however, development was considered in comparing eighth-grade data to ninth-grade data. In each pathway, there was a mix of students who took the Algebra 1 EOC during their eighth-grade year and students who took the Algebra 1 EOC during their ninth-grade year. It could be expected, according to Walberg's theory, that students in ninth grade are more developed, due to age and years in school, than students in eighth grade and would, therefore, score better if they took the Algebra I EOC exam in ninth grade. In both groups, there was no statistical significance between the learning pathway choice and average Algebra I EOC exam scores. Additionally, in both face-to-face and virtual synchronous learning pathways, students who took the Algebra I EOC exam in ninth grade had lower scores, on average, than their peers who took the EOC exam in eighth grade. This goes against Walberg's theory but might be explained because the groups are

not equal. More academically gifted students would have been enrolled in Algebra I courses during their eighth-grade year, which is a year earlier than prescribed by the South Carolina Department of Education.

This outcome that goes against Walberg's (1981) Model of Educational Productivity might also have to do with students missing key instruction on strategies for transitioning to high school from middle school. It was during their eighth-grade year that this population of students had to choose their learning pathway. In a study done by Hanover Research (2017), it was found that students face several academic and social challenges in their transition from middle to high school. In high school, class sizes are much larger, teachers are less nurturing, and courses are more rigorous. Students take on more responsibility for their learning, and environments are less personalized. High school courses also have higher stakes, as specific credits are required for graduation. During their eighth-grade year, students are often taught organizational strategies, social strategies, and instructional strategies to help with the challenges of the transition to high school (Hanover Research, 2017). Because students were in different learning pathways for their eighth-grade year, they could have missed some, if not all, of that instruction, leading to lower Algebra I EOC exam scores in ninth grade.

Research Question 3 defined student achievement by the qualification for Tier 2 MTSS academic interventions. It asked, "To what extent did the students' learning pathways impact the likelihood of student qualification for Tier 2 academic interventions in an MTSS in their first year of high school?" The qualification, as defined by XX High School, where this study was conducted, was that students were failing 50% of their classes with a 50% or less. There were five more students in the virtual synchronous

pathway who qualified for Tier 2 MTSS academic interventions than students in the face-to-face learning pathway; however, there was no statistical significance between a student's pathway choice and their qualification for interventions in their ninth-grade year. The larger implication is that while virtual synchronous instruction and face-to-face instruction resulted in students passing the majority of their courses, greater academic success was experienced by those in the face-to-face learning pathway due to fewer students qualifying for MTSS. This could be related to the difference in student motivation that was talked about in the literature review or Walberg's (1981) idea of quality versus quantity instruction that was muddied by virtual instruction requirements during COVID-19. Face-to-face learning pathways were found to be more beneficial for students who were not self-sufficient or lacked discipline (Chisadza et al., 2021); however, students, regardless of their level of self-sufficiency and discipline, were forced into the virtual synchronous pathway due to outside factors not studied in this research, which was not suited to their motivational style. Student motivation comes from various sources and was not a factor measured by this study.

Only one student in the test population chose the virtual asynchronous pathway. This was not a large enough population to run any statistical analysis or comparisons to the other two learning pathways. This was likely an inaccurate measure of how many students actually chose the virtual asynchronous pathway during the 2020-2021 school year. This is because the ex post facto data could only be collected from students who were currently enrolled in XX district. It is likely that students who experienced success in the virtual asynchronous learning pathway never returned to their brick-and-mortar school and, instead, continue their secondary education in a virtual asynchronous format.

This would mean that they would have been withdrawn from XX High School in order to enroll in a virtual asynchronous learning model, and their historical data were not available for analysis in this study.

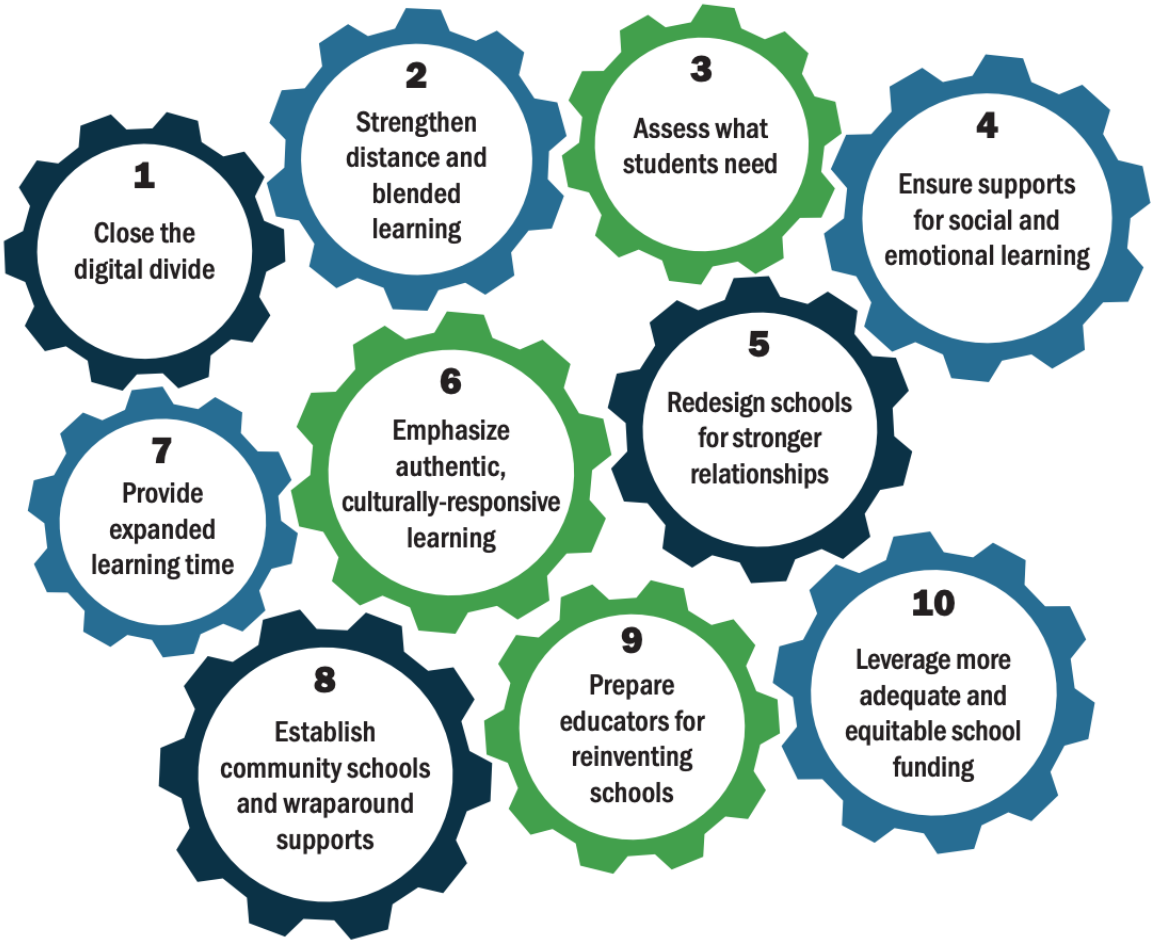
Recommendations for Practice

In 2020, the way the world knew education changed forever because of the COVID-19 pandemic. All students were forced to learn virtually at first and then were given a choice between three learning pathways: face-to-face, virtual synchronous, and virtual asynchronous. The method and procedure for preparing and delivering educational content were different in each pathway. Student achievement was affected greatly but not equally across the different pathways (Aboagye et al., 2020; Auxier & Anderson, 2020; Chisadza et al., 2121; Dorn et al., 2020; Hammerstein et al., 2021; Kamenetz, 2022). In order for students to be educationally productive, Walberg suggested that they must have, to some degree, appropriate aptitude and instruction (Fraser et al., 1987). There is evidence in this study that students in the face-to-face learning pathway had higher academic achievement than students in the virtual synchronous pathway. The test group was not large enough to make any determinations regarding students in the virtual asynchronous learning pathway.

In a report by Darling-Hammond et al. (2020), a framework for restarting schools after the COVID-19 pandemic was developed. This framework can be seen in Figure 17.

Figure 17

A Framework for Restarting and Reinventing Schools



The report used what was learned during the shutdown of schools during the COVID-19 pandemic to inform the framework. It was intended to create equitable and effective teaching and learning regardless of the medium in which the teaching and learning take place (Darling-Hammond et al., 2020). It was made up of 10 components related to vitrual education. It covered closing the digital divide, strengthening distance and blended learning, assessing what students need, ensuring supports for social and emotional learning, providing expanded learning time, emphasizing authentic culturally

responsive learning, redesigning schools for stronger relationships, establishing community schools and wraparound supports, preparing educators for reinventing schools, and leveraging more adequate and equitable school funding. As a result of this study, recommendations for school leaders speak to Components 2, 3, and 9: strengthening distance and blended learning, assessing what students need, and preparing educators for reinventing schools.

As a result of this study, three recommendations for school leaders have been established. The first is that teachers need additional training in developing virtual courses and effectively implementing virtual curricula in the classroom in an effort to strengthen distance and blended learning and prepare teachers for reinventing schools (Darling-Hammond et al., 2020). This is related to Components 3 and 9 from Darling-Hammond et al.'s (2020) model. From the results of this study, it can be concluded that students on the virtual synchronous pathway did not receive an equal education, in the general sense, to that of their face-to-face peers. This is supported by the data that showed face-to-face students had higher academic achievement than students on the virtual synchronous pathway; therefore, virtual (distance) learning needs to be strengthened. Educational leaders could use this information to better prepare teachers, students, and parents for virtual education possibilities in the future. There is a need for virtual synchronous instruction to match the instructional quality of face-to-face instruction. More training in the development of virtual classes, teaching strategies in virtual learning environments, and more time to develop and transition to a virtual learning pathway could improve the academic achievement of students in virtual pathways in the future (Bakir, 2016; Darling-Hammond et al., 2020; Digital Learning

Collaborative, 2022; Hodges et al., 2020; Srisawasdi et al., 2018). Best practices and training for creating and teaching virtual courses should be developed in the way face-to-face courses have been created and taught. Educational leaders could develop and provide training to teachers in order to help them develop more effective methods of teaching in the virtual setting. Best practices could be studied and identified for use in virtual instruction models. Planning a curriculum based on best practices for student achievement in a virtual setting could lead to more equal academic results among students in different learning settings (Digital Learning Collaborative, 2022). This information could also be used by colleges and univeristies with teacher preparation programs. Incorporating courses on digital teaching in curriculum building at this point in the future teacher's training could take some of the burden off school districts to provide this essential training.

The second recommendation based on the results of this study is that students need to be more prepared before taking virtual classes. This is part of Component 3 of Darling-Hammond et al.'s (2020) framework for assessing what students need. Strategies for success in a virtual learning environment need to be taught and practiced prior to taking virtual classes. This is due to the more independent nature of virtual classes as opposed to face-to-face classes. Students take on more of the responsibility for their learning and the organization of their time spent learning. Students could be better supported in a virtual learning setting by teaching them how to schedule and manage their time and learning and teaching organizational skills to aid in their achievement in an environment where a teacher is more of a facilitator and there is less direct instruction. Research has shown that most students in Grades K-12 need to be guided through their

learning (Ahn & McEachin, 2017). In the case of the emergency shift to virtual learning during the COVID-19 pandemic, there was no preparation for students to lose the guiding figure of their teacher if they chose the virtual synchronous pathway. If those things had been practiced before a student was put into a virtual learning environment, it would have likely yielded higher academic achievement. The findings of this study suggest preparing students better for virtual instruction. Schools that had done more work prior to the pandemic in terms of connectivity, expectations, engagement, and attendance were more prepared for students to learn virtually (Sparks, 2022). Future studies could then be done to see if students who received that training prior to engaging in a virtual learning setting had higher academic achievement than those that did not.

The last recommendation, also related to assessing what students need (Darling-Hammond et al., 2020), was that students who were in the virtual synchronous pathway during the COVID-19 pandemic likely need more interventions and support as they continue their secondary education in order to make up for the learning loss sustained during that time. The learning loss experienced during the COVID-19 pandemic had a magnitude unlike any other. Tom Kane, the faculty director at the Center for Education Policy Research, said that it was so large that it could not be countered with individual programs (Sparks, 2022). Instead, Kane suggested that improvement plans be developed with systematic interventions that consider the number of students who need them (Sparks, 2022). Educational leaders and teachers need to take this into consideration when making plans to help those students with their learning loss. Prior to the COVID-19 pandemic, it was common to develop individual plans for students who had fallen behind significantly from their peers. After the COVID-19 pandemic, there are too many

students needing intervention for teachers to create intervention plans for each student. Instead, more widely effective intervention programs need to be put into place and executed with fidelity to help students regain the ground they have lost (Sparks, 2022). It must also be considered that intervention programs that work at the elementary level are usually not suited for high school implementation. Research needs to be done to choose intervention plans that are effective at each level of education, elementary, middle, and high, as each level requires different methods.

Suggestions for Future Research

The results of this study provide several opportunities for future research. This section explores opportunities for future research in the relationship between environmental factors and student achievement and the relationship between learning pathways and student academic achievement in larger populations.

This study did not consider the environmental factors of students during their eighth-grade year. These could include things like whether or not the student was working or watching siblings if they were virtual, what their learning space was like, and if their parents had the education required to help their students in the event they needed it. These factors may have contributed to the academic achievement of students, especially in the virtual pathways but were not a factor considered in this study.

Walberg's model of educational productivity found three categories of influence that impacted academic achievement: aptitude, instruction, and environment (Fraser et al., 1987). To conduct a study that investigated student learning environments in each pathway would be to look into Walberg's third category of environment through a qualitative lens (Fraser et al., 1987). To ensure equal representation, students could be

selected based on their learning pathway choice. Then, all students could be given a survey about the conditions of their learning environment during that time. Factors such as if masks were worn by their teachers and peers, if they were socially distanced from their peers, and if they were able to work collaboratively would be pertinent to students in the face-to-face pathway. Having a designated, quiet space for learning; the number of siblings in the home; internet accessibility; and the educational level of parental figures might pertain to the two virtual pathways. All students could also be asked about the impact of COVID-19 on their families and friends. Students who experienced more death and sickness might show different degrees of academic achievement based on their social/emotional state during that time.

It might also be interesting to ask all students, regardless of the pathway, about their motivation, number of hours spent working, accessibility to the teacher for help, and their perceived difficulty of the work they were asked to do. The study would have to be, at least in part, qualitative, and the study would have to be expanded to include a significant number of students in the virtual asynchronous pathway. Students and parents could be asked about the reasons they chose the learning pathway they did. Cross-referencing the mindset of students, fixed mindset versus growth mindset, with their pathway choice and their academic achievement might also uncover links between the motivation of students as it relates to their success in a given pathway. Those results could then be used in future instances when a learning pathway could be chosen for individual students. A screener type of assessment could be developed to determine in which pathway students would be most likely to succeed.

Another limitation of this study was the size of the population that was included.

This study only looked at one grade level at one high school. With a larger test population, greater weight could be given to the findings relating learning pathways to the different measures of academic achievement. This study also only used three measures of student achievement. Using more measures of student achievement, like English II EOC exam scores or graduation rate, might reveal a more holistic understanding of the relationship between learning pathways and student academic achievement.

Also related to the small sample size, this study cannot make any conclusions about virtual asynchronous student achievement. This is attributed to the extremely small sample size of that group in the population that was considered for this study. If a larger test population was studied, it could produce enough data to make conclusions about academic achievement related to the virtual asynchronous learning pathway.

Further research could also be conducted by expanding the study to include other schools and/or grade levels. The population used in this study was chosen because the students experienced different pathways during the transition of their eighth-grade year. It would be interesting to see if the findings are consistent across students who experienced different pathways during years that were not as transitional. It could also be interesting to see if findings are consistent when you look at populations from other schools in the district, state, or even across the country. It might uncover that some states were more ready to transition to virtual learning at the onset of the COVID-19 pandemic than others.

A final recommendation is related to Walberg's (1981) idea of ability in his model of educational productivity. The groups in this study were heterogeneous. Ability levels were not a consideration when the students were grouped for this study. A study

could be conducted where this same population of students is grouped by pathway choice and then by ability levels. Identification as gifted and talented, special education, and multi-lingual learner could be used as categories for the groups. This organization of the data could reveal patterns in academic achievement for students with different ability levels in each pathway. Perhaps it would suggest that students with a certain ability level performed better in one learning pathway over another. These results could lead to even more informed decision-making when considering learning pathways for students in the future.

Conclusion

Walberg (1981) theorized that learning was a function of aptitude and instructional treatment. March of 2020 and the onset of the COVID-19 pandemic forced all schools into emergency virtual learning. Accommodations were made for standardized testing requirements and grading criteria (South Carolina Education Oversight Committee, 2021). In the fall of 2020, still faced with different levels of caution related to COVID-19, students each carried their existing aptitude into various instructional treatments or learning pathways. Students in XX High School chose between a face-to-face pathway, a virtual synchronous pathway, and a virtual asynchronous pathway. Students and teachers in each pathway had no special preparation for the pathway in which they would teach and learn. This study set out to determine to what extent, if any, academic achievement was impacted by a student's learning pathway. Academic achievement was measured by GPA, Algebra I EOC exam scores, and qualification for Tier 2 academic interventions through MTSS.

The findings of this quantitative study support that a student's GPA was affected

by their choice of learning pathway. Students in the face-to-face learning pathway had higher GPAs, on average, than their virtual synchronous peers. Those students in the virtual synchronous pathway also demonstrated more positive change in their GPAs when all students were required to return to face-to-face learning settings in the fall of 2021, while their face-to-face counterparts' GPAs remained more consistent, further supporting that virtual synchronous students had lower GPAs at the end of their eighth-grade year. This study's findings also support that a student's learning pathway impacted their performance on the Algebra I EOC exam. Students in the face-to-face learning pathway had a higher average score on the EOC exam than those in the virtual synchronous pathway. Students in the face-to-face learning pathway were also more likely to pass the Algebra I EOC exam with a 60% or higher than their peers in the virtual synchronous learning pathway. Finally, the findings of this study support that a student's learning pathway did not have an impact on a student's likelihood of qualifying for Tier 2 MTSS academic interventions. There was not a significant difference in the number of students who qualified for Tier 2 academic interventions in the face-to-face pathway and the virtual synchronous pathway.

While there are many things that contribute to a student's academic achievement, this study looked solely at the methods of instruction. Face-to-face students showed higher academic achievement within the constructs of this study than students on the virtual synchronous pathway. There was not a large enough sample population to make any determination related to students who chose the virtual asynchronous pathway. These findings are important to school leaders and teachers who are now teaching students from both pathways with incongruent learning loss from the pandemic. The findings in this

study could influence the way teachers are trained to teach virtual classes and the way that parents weigh the decision for their child to enroll in virtual classes in the future. They could also influence the intervention methods that are used to help these students get back to the academic achievement levels they experienced prior to the COVID-19 pandemic.

The existing research on relevant topics was presented in Chapter 2. Information on educational productivity, virtual learning, and learning loss was investigated. The existing research mirrors the findings of this study. When virtual instruction is provided without proper training for teachers or students, the quality of instruction suffers and therefore academic achievement suffers (Skar et al., 2021). While all students experienced a loss of learning during the COVID-19 pandemic, the learning loss was greater for those students who participated in virtual synchronous learning pathways, as is supported by the data in this study. More teacher and student training and support are necessary when virtual instruction is the method of learning as, prior to the pandemic, research showed that most teachers did not have knowledge of best practices in virtual course design and virtual teaching (Means et al., 2014).

The limitations of this research were shared, along with implications for future research. This study focused on the instructional method's impact on academic achievement. More research needs to be done to create a full picture of the different factors that impacted students and their academic achievement during the COVID-19 pandemic. Recommendations for educational leaders, teachers, parents, and students based on the findings of this study and a framework developed by Darling-Hammond et al. (2020) were also presented. Carefully planned research, training, and practice for

virtual learning are needed in order for students to be successful.

The COVID-19 pandemic presented challenges in education that the world had never experienced before. In its aftermath, students were left years behind in their education, especially in math. With more rigorous and specific training in virtual teaching and learning, this method of learning could have less of an impact on academic achievement.

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Appendix

South Carolina Uniform Grading Policy 10-Point Scale

10 Point Grading Scale

South Carolina Uniform Grading Scale Conversions				
Numerical Average	**Letter Grade**	**College Prep Weighting**	**Honors Weighting**	**AP/IB/Dual Credit Weighting**
100	A	5.000	5.500	6.000
99	A	4.900	5.400	5.900
98	A	4.800	5.300	5.800
97	A	4.700	5.200	5.700
96	A	4.600	5.100	5.600
95	A	4.500	5.000	5.500
94	A	4.400	4.900	5.400
93	A	4.300	4.800	5.300
92	A	4.200	4.700	5.200
91	A	4.100	4.600	5.100
90	A	4.000	4.500	5.000
89	B	3.900	4.400	4.900
88	B	3.800	4.300	4.800
87	B	3.700	4.200	4.700
86	B	3.600	4.100	4.600
85	B	3.500	4.000	4.500
84	B	3.400	3.900	4.400
83	B	3.300	3.800	4.300
82	B	3.200	3.700	4.200
81	B	3.100	3.600	4.100
80	B	3.000	3.500	4.000
79	C	2.900	3.400	3.900
78	C	2.800	3.300	3.800
77	C	2.700	3.200	3.700
76	C	2.600	3.100	3.600
75	C	2.500	3.000	3.500
74	C	2.400	2.900	3.400
73	C	2.300	2.800	3.300
72	C	2.200	2.700	3.200
71	C	2.100	2.600	3.100
70	C	2.000	2.500	3.000
69	D	1.900	2.400	2.900
68	D	1.800	2.300	2.800
67	D	1.700	2.200	2.700
66	D	1.600	2.100	2.600
65	D	1.500	2.000	2.500
64	D	1.400	1.900	2.400
63	D	1.300	1.800	2.300
62	D	1.200	1.700	2.200
61	D	1.100	1.600	2.100
60	D	1.000	1.500	2.000
59	F	0.900	1.400	1.900
58	F	0.800	1.300	1.800
57	F	0.700	1.200	1.700
56	F	0.600	1.100	1.600
55	F	0.500	1.000	1.500
54	F	0.400	0.900	1.400
53	F	0.300	0.800	1.300
52	F	0.200	0.700	1.200
51	F	0.100	0.600	1.100