SMALL GROUP INSTRUCTION AND MATHEMATICS

ACHIEVEMENT IN AN ONLINE SCHOOL ENVIRONMENT

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CERTIFICATION OF APPROVAL

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ABSTRACT

Growth in mathematics achievement for students enrolled in online schools has been slow and not at the level of proficiency on standardized tests. Studies have shown a consensus for more research in best practices of effective teaching strategies for online educators. Additionally, research shows students enrolled in online schools who have consistent interaction with their teachers and peers throughout a mathematics course are more positive in their self-reflections and have higher end of course and standardized test scores. Building on the existing knowledge regarding mathematics achievement in online education, the question investigated was: What are the effects of synchronous group instruction on the mathematics achievement of fifth grade students who receive their instruction online? In this context, synchronous group instruction is defined as instruction happening between the teacher and students at the same time, but at different locations. The control group, during the 2017/2018 academic year, did not receive the small group instruction. The treatment group, during the 2018/2019 academic year, received small group instruction in 30 minute sessions, held once every other week throughout the school year. Analysis of the results showed fifth grade students who received synchronous group instruction online outperformed the fifth grade students who did not receive synchronous group instruction online. The results suggest that the online synchronous group instruction has a positive effect on fifth grade achievement in mathematics.
CHAPTER I
INTRODUCTION

Background of the Study

Technology controls physical environments, connects humanity through handheld devices, and even keeps hearts beating, but a format for a school? According to Van’T Hooft (2008), learning has become increasingly mobile over the last decade and “focuses not on learners and technologies, but on the interactions between them” (p. 13). Online schooling, has become a reality for many California families, including those with elementary school children. Online or virtual schooling offers families an alternative to traditional public schooling for their children’s education. Without the constraints of the four walls of the traditional school building, families are finding they have more choices. For example, they are no longer tied to the preset schedule of the school day. Additionally families choosing online education for their children may find more educational value for their students’ personal interests such as sports, artistic opportunities and travel (Gulosino & Miron, 2017).

The speed and popularity of emerging online schools has created the need to study best instructional practices that are happening within some of the largest schools. The school selected for the current study is a K-12 online public charter school. The school began serving students in 2004 and is operated by an independent Board of Directors made up of educators, parents, and community representatives. The school is accredited by the Schools Commission of the Western Association of
Schools and Colleges. The goal of the school is to provide opportunities for students to become interactive and involved while preparing them to be members of society as adults while building on their unique strengths in a setting that is both safe and connected to a larger community. Students attend school primarily from home. Their daily work is supervised by a parent or other family member who is the learning coach for the student. They follow a Personalized Learning Plan developed by the teacher and learning coach that integrates technology with a standards aligned curriculum under the supervision of professional, certificated teachers. Teachers provide synchronous online lessons for students in either one to one, small group, or whole class formats. All academic materials are provided to the students at no cost to the family. To combat the social isolation associated with online learning, field trips and other in-person learning and social activities are offered on a regular basis. The 2018 Parent Satisfaction Survey results showed that 93% of parents agreed that technology tools improve their child’s learning experience and 95% of the parents agree that the curriculum is high quality and their children are satisfied with the program.

The online composition of this school results in students spread over eight counties in the central region of California. While the students’ scores are at or above the state average in English language arts, analysis of the state’s new accountability metrics showed the mathematics scores were in the ‘orange’ or second lowest performance level for the 2017-2018 school year. The orange performance indicator
directed the school to implement improvements to mathematics instruction during the 2018-2019 school year.

**Statement of the Problem**

The school that was selected for this study decided to focus on improving mathematics achievement across all grade bands; this was particularly important in the primary grades as the motto is “Elementary Leads the Way” and the fifth-grade scores were a substantial part of the problem. According to the Smarter Balanced Assessment Consortium (2018), students must demonstrate level 3 performance and achievement to show grade level mastery of the standards in preparation for college and career readiness. The school’s scaled scores for the 2017/18 school year for fifth grade students was 2463 which places them in the low end of the fifth grade level 2 achievement range 2455-2527. Their goal is to move students to the level 3 range of 2528-2578.

One possible cause of the low scores is the amount of teacher contact with students in the elementary grade levels. Teachers have “classes” of forty to fifty students. The online structure of the class is different than the traditional brick and mortar school as the teacher does not actually see and work with each student daily. The teachers have a scheduled call every other week with each individual student. During the call, the teacher will do two tasks. First, they check in with the learning coach who works with the student daily (typically the parent) to answer questions or address concerns and provide updates on any upcoming events or school year cycle tasks that may need to be completed. Then, the teacher works with the student for
fifteen to twenty minutes and assesses student understanding of the lessons. Because it is a short call, there is minimal time for instruction. Teachers also hold two, one hour lessons per week for the whole class in an online format where the students log in simultaneously and see their teacher teaching in real time and have the opportunity to interact with one another. The minimal instructional time may lead to a lack of growth mindset and grit when it comes to a subject like mathematics which may cause students to struggle without teacher guidance.

Research Question and Hypothesis

**Question.** What are the effects of synchronous group instruction on the mathematics achievement of fifth grade students who receive their instruction online?

**Hypothesis.** There is no significant difference in mathematics achievement between fifth grade students who receive synchronous group instruction online and fifth grade students who did not receive synchronous group instruction online.

Significance of the Study

This researcher proposes a quantitative study to investigate the effects of group instruction on the standardized mathematics test scores of fifth grade students. This study may produce important information about the effects of group instruction on students who receive online instruction in mathematics. As the virtual school concept continues to grow, the results of this study may be useful to teachers and administrators when determining best instructional formats for online learning.
Limitations

This study will be limited to 50 fifth grade students who were receiving small group synchronous online instruction during the 2018-2019 academic school year and 50 fifth grade students who did not receive the small group instruction during the 2017-2018 academic school year.

Delimitations

For the purpose of this study, socioeconomic status, race, and gender of the students will not be taken into consideration.

Definitions of Core Concepts

The following is a list of definitions of terms used throughout this study:

**Brick and mortar school.** A physical site where students receive instruction in person in a traditional classroom setting.

**California Assessment of Student Performance and Progress (CAASPP).** A reporting system established on January 1, 2014 that replaced the Standardized Testing and Reporting (STAR) Program. The CAASPP system includes computer-based assessments including the Smarter Balanced English language arts/literacy and mathematics, the California Alternate Assessments, the California Science Tests, and the California Spanish Assessment.

**Group Instruction.** An online instructional format held with a teacher and 5 or less students using the school’s Livelesson platform which allows use of interactive tools such as video, microphone, chat pod, whiteboard, note pods,
and poll pods. The teacher conducts an hour lesson with students twice weekly, replacing the phone call instruction.

**Whole Class Instruction.** Online instruction held with a teacher and the entire class to review overall assignment activities and build community. Whole class instruction can also involve enrichment opportunities such as book clubs.

**Phone Call Instruction.** An original online format in which teachers call the learning coach and student twice monthly to answer questions and address concerns with the learning coach and then conduct a curriculum based assessment with the student to assess academic progress.

**Smarter Balanced Assessment Consortium (SBAC).** A computer adaptive assessment that measures student achievement and growth in English language arts and mathematics in grades 3-8 and high school.

**Synchronous Online Instruction.** Instructional activities that happen in real time between the instructor and students who are in different physical locations but connected and interacting through an online medium.

**Summary**

Chapter 1 described the background of this study and presented the statement of the problem, research question, and hypothesis. The significance of the study was identified, along with limitations, delimitations and definitions. Chapter 2 will present a literature review. Discussion will include information on strategies for
mathematics achievement, research about online instruction, and where the two merge.
CHAPTER II
REVIEW OF THE LITERATURE

Introduction

The purpose of this study was to determine the effects of small group synchronous online instruction on fifth grade mathematics achievement. Chapter II will first provide a discussion of online education to include the varied options now available. Next, previous studies on online instruction in K-12 school systems will be presented.

Discussion

The introduction of the internet in the 1980s opened a new frontier in education as online courses became available for students (Weems & Jones, 2019). Online education began at the college level with The University of Phoenix in 1989. The value of online education soon became apparent and classes began appearing for students that needed advanced or credit recovery courses in areas where access was limited such as in small town schools with low enrollment (Horn, 2010).

According to Horn (2010), online learning began as a transformative innovation. The transformation from brick-and-mortar to online learning helped address course scheduling conflicts, understaffing issues, and excessive costs.

Lips (2010) noted multiple reasons for the growth in online education. Online education offered scheduling flexibility in both time and place that the brick-and-mortar schools did not. Online learning also gave access to qualified teachers. In
some locations where qualified and specialized educators proved difficult to attract, online education offered an otherwise unattainable opportunity for students. Another benefit was the ability to personalize online learning to fit the needs of the individual student. Students were given the opportunity to work at their own pace towards completion of coursework. Students and educators found advanced and remedial online courses to be effective. Consequently, general education online courses became available for all grades from Kindergarten through twelfth grade.

By the turn of the century, different types of online schooling, including hybrid versions began to emerge. Comprehensive online schools began as statewide virtual schools and as independent charter schools (Lips, 2010). Hybrid schools brought more flexibility. Students, for example, may attend a traditional brick-and-mortar school for half of a day and then finish online at home or another location later in the day. Other variations allowed a student to spend one or two days per week learning from teachers at a traditional brick-and-mortar location and work online the remainder of the week. Still other variations offer students the opportunity to work primarily online assisted by teachers every day throughout the week at a traditional brick and mortar school (Horn, 2010).

According to Gemin, Pape, and the Evergreen Education Group (2017), state virtual schools can offer a great deal of variety. In some states, districts are given more control over the administration of virtual schools. In other states, other entities may administer the school. For example, in Montana, the state funded online schools are administered by the state university system.
Virtual schools funded by the state have experienced the greatest growth. The high school core subjects of English language arts, mathematics, social studies, and science have the highest participation rates in state virtual schools with rising demands for both world languages and health and fitness courses. State virtual schools primarily consist of high school students but the middle and elementary school students have also begun to emerge as participants in online education. As with everything else regarding the state virtual schools, course grading also varies. Some states such as Florida, base completion on a passing grade while others base it on a percentage of course completion, regardless of the grade (Gemin et al., 2017).

Another type of online education is offered through virtual charter schools in which students “attend” full-time. These schools are public or private but are governed by the chartering authorities (Lips, 2010). Often, these schools belong to a consortia in order to receive reduced rates and access to online courses and materials. Schools can become full members of these groups with access to all courses or pay a slightly higher fee and just access certain courses as needed. The companies that provide the courses are considered vendors and many are crossovers from the traditional textbook publishers. In some instances, the education publisher, Pearson as an example, may own the school (Gemin et al., 2017).

One unique component of the fully online charter schools is the learning coaches, parents who monitor the coursework and progress of their student. The amount of engagement varies based on the age and grade level of the student. For elementary students and students with disabilities, the expectation of involvement can
be quite high. As the students move through the grades towards high school, parental involvement declines and the students spend the majority of their time working either independently or with the teacher either through online or phone sessions (Gemin et al., 2017). Although exact numbers are not known, many homeschool families are starting to transition to the online forum due to the ease of accessing curriculum and parental involvement (Horn, 2010).

The most varied type of online education is the hybrid school. These schools provide a mix of both in-person and online educational interactions for students (Lips, 2010). According to Horn (2010), the rise and variation of hybrid online schools are due to the nature of the families being served. There is a balance between the need for social interaction for the student, flexibility for the course, and the desire of the parent to keep the student engaged. Many school districts are finding that online learning provides an accessible avenue for students that are typically hard to reach such as those needing credit recovery. Mackey (2010) explained that some schools have set up locations in places such as shopping malls to reach dropouts.

The overall consensus is that as online schooling continues to grow, there is a need for further research and reform. Horn (2010) suggested that research should focus on newly emerging types of hybrid schools and identification of those most appropriate for students. Rice, Deschaine, and Mellard (2018) cautioned that further research on the impact of virtual learning on different groups of students is needed to determine why some do not benefit from an online experience. In the area of reform, groups that may benefit are families employed by the United States government.
Allowing online options for military and state department families could minimize the disruptive educational effects of their transitional lifestyle. Research and reform efforts may add to the base of knowledge about online education but more importantly “it will also push education toward a student-centered future” (Horn, 2010).

Research Studies

In 2004, St. Cyr conducted a case study utilizing an online mathematics program to provide an accelerated learning curriculum for an identified gifted mathematics student in an elementary setting. The program was the student’s only source of an accelerated mathematics curriculum. The study was conducted in an elementary school made up of approximately 400 socio-economically disadvantaged students located in a suburban setting.

The participant in the study was an advanced fourth grade student functioning at a sixth grade mathematics level. Prior to starting the case study, the researcher met with the student, parents, and administration to make sure all were in agreement regarding the best course of action for the student to be challenged with mathematics. The author struggled with the online portion at the beginning of the program. The author found that she did not have the correct computer system to run the program properly. It took quite a bit of time to order the correct parts and equipment before the program could begin, causing the student’s program to be modified in an effort to keep him challenged. Once the student was able to access the program, the researcher kept observations regarding the student’s engagement with
the program as well as his progress on the individual lessons and assessments (St. Cyr, 2004).

The purpose of this study was to determine if online learning could meet the needs of gifted elementary students in mathematics. The researcher analyzed observations and test scores of the participant. The ability of the student to work independently on many of the lessons allowed for the possibility of further acceleration. The researcher concluded that the results of the study suggest that the use of online learning for gifted elementary mathematics not only meets the needs of students but provides an opportunity not available in the traditional classroom (St. Cyr, 2004).

Carr (2012) conducted a study on the effectiveness of iPad use on mathematics achievement. The purpose of this study was to determine the effects of iPads as a 1-to-1 computing device for 5th grade students. This study was conducted in two rural Virginia elementary schools and included 104 students.

The students in this study were divided into two groups. The treatment group had access to iPads in mathematics during a nine-week period while the control group did not have the iPads during mathematics. Prior to the start of the study, all students took a district benchmark test to provide baseline data for the study. During the nine weeks of the study, the same mathematics standards were taught to both groups. The teachers of the two groups were then asked to complete a rubric regarding their daily lesson plans to measure alignment within the two groups. At the end of the nine week period, another benchmark test was used as the posttest (Carr, 2012).
An ANOVA was used to analyze the test data. The control group realized a positive overall gain of 6.67% while the treatment group saw a positive overall gain of 6.74%. The difference between the two groups was not statistically significant enough to conclude that the iPad usage was effective in increasing mathematics achievement (Carr, 2012).

Although the data showed iPad usage did not improve mathematics achievement over traditional learning, the researcher pointed out that more research should be conducted. The use of the iPads was limited to time in class and classroom time was missed due to snow, field trips, and state testing. The researcher proposed that different results might occur if students were issued their own device to take home and use at any time (Carr, 2012).

Harris-Packer & Ségo (2015) conducted a study on the effects of online instruction on academic achievement. The researchers’ purpose for this study was to determine the difference between the traditional classroom based and virtual delivery modes of instruction on academic achievement in K-12 public schools across the United States. They selected schools in ten different states that had at least four online schools operating within them. They also chose states that represented different geographical regions.

The researchers collected data from the 2012-2013 state test scores in both reading and mathematics from each state department of education in Florida, Michigan, Minnesota, Nevada, Ohio, Pennsylvania, South Carolina, Utah, Washington, and Wisconsin. Once the researchers collected the data, they averaged
the grade level proficiency scores to develop z scores for the schools’ performance. They compared the data of all traditional schools in the state to the data of the online schools. Schools were grouped into six different levels of proficiency based on the percentage of students scoring proficient in reading and mathematics. The six categories were 91% and above, 81% - 90%, 71% - 80%, 61% - 70%, 51% - 60%, and 50% and less (Harris-Packer & Ségol, 2015).

The researchers of this study presented three main conclusions. First, the overall results showed that online schools are not performing as well as traditional brick-and-mortar schools. Second, established online schools appeared to be more effective than newly opened online schools. The two schools that had been in existence for the longest period experienced higher proficiency rates and matched the state proficiency rates of traditional brick-and-mortar schools. Third, not all online schools performed the same (Harris-Packer & Ségol, 2015).

Waddell (2017) ran a study to distinguish the relationship between the size of online schools and student achievement in Texas. The participants of this study were students enrolled in grades 5 and 8 for mathematics and reading and grades 9 to 12 for English I, II, and Algebra I. The data were gathered from the Texas Academic Performance Reports for the 2013-2016 school years.

Data for this study were analyzed by averaging achievement percentages and student sample sizes. After the achievement percentages were averaged, then z tests were utilized to compare the smaller schools to the larger schools within the subgroups. There was a statistically significant relationship ($p < .001$) found between
the size of online schools and student achievement that showed smaller schools had higher student achievement. The only benefit found for larger online schools was in cost-effectiveness by educating a larger number of students at a lower cost (Waddell, 2017).

Czerkawski (2014) designed a review of deeper learning research in order to present guidelines for use in virtual educational settings. The review was completed at the University of Arizona where Czerkawski compiled the existing research available on deeper learning and online education. He examined classroom practices, synchronous experiences, learner engagement, online learning environments, and curricular restructuring. The researcher included studies that addressed both fully online and blended schools.

The studies were compared using tables to illustrate deeper learning strategies versus surface learning and deeper learning strategies found within the online learning environments. Czerkawski concluded that the course design for virtual schools can play a large part in supporting deeper learning if effective instructional practices are utilized. Additionally, because the background experiences of a student affect deeper learning, understanding the types of students enrolling in the online environment plays a factor and should be taken into consideration. Finally, more professional development is needed across the country on effective online instructional strategies to increase deeper learning experiences (Czerkawski, 2014).

Ahn and Thomas B. Fordham Institute (2016) conducted a study on the achievement of online schools in Ohio. The purpose of the study was to answer
questions about what kind of students are enrolling in virtual schools and how they perform compared to their peers in the traditional brick-and-mortar district schools. Data were gathered from the Ohio Department of Education for school years 2009-2013.

The data used were from two different assessments, the Ohio Achievement Assessment for students in grades 4-8 covering mathematics and reading and the Ohio Graduation Tests for students in grade 10 covering mathematics, reading, writing, social studies, and science. Test data were converted to z scores for analysis. The results of this study showed that the students enrolling in online schools are often unique in the way they learn. Many have struggled in the traditional brick-and-mortar setting for one reason or another. Online schools may need to target the students that are a better fit for the online learning environment rather than attempting to enroll everyone who wants to try online education. The results of the study also showed that students in grades 4-8 in the online schools had lower achievement on state assessments than students in the traditional brick-and-mortar schools. Finally, the researcher concluded that online education should be further studied to identify instructional practices that are most effective in the online environment (Ahn & Thomas B Fordham Institute, 2016).

Lueken, Ritter, and Beck (2015) completed a study to determine the impact of online learning on student achievement based on time enrolled in an online program. Participants in the study came from one virtual school which is described as a K-8 fully online school, limited by the state to 500 students. Enrollment maxes
out every year so the school must employ a lottery system to fill any slots that are available from year to year. Students were grouped by one, two, and three consecutive years of online enrollment and subgrouped by ethnicity, special needs, and academic performance. The comparison groups consisted of public school students in traditional brick and mortar schools.

The data were collected from two statewide exams administered to students in grades 3 through 8. These are identified in the study as the criterion-referenced test (CRT) and norm-referenced test (NRT). Data were collected over a five year period, 2006-2007 through the 2011-2012 school year. The CRT is achievement based and aligned with the NCLB requirements while the NRT focuses on general skills and knowledge (Lueken et al., 2015).

Test scores were compared with consecutive enrollment in the online school to determine if students recovered from an initial decline in their first year scores. The researchers used academic growth models to compare student achievement between the students attending online schools and brick-and-mortar schools. In the second part of their study where they matched online students with similar students from the traditional brick-and-mortar schools, they used a propensity matching technique (Lueken et al., 2015).

The results of this study showed that students experience a drop in their score the first year of enrollment. However, by year two, they start to recover from that drop and then by years three through five, not only are they fully recovered, but often are outperforming their matched peers in the traditional brick-and-mortar
classroom. The author concluded that the students enrolling in online schools need to be a good match for this type of school in order to stay enrolled long enough to obtain the benefits seen by the third year of enrollment (Lueken et al., 2015).

Kim, Park, and Cozart (2014) conducted a study on student motivation in online mathematics courses. The purpose of the study was to understand why some students succeed and what might help those who do not. The participants were secondary students in the southwestern United States enrolled in a fully online high school. The average age of the students was 16 years and 61% of the students were female. There were 72 participants in the study.

Data were collected using the Motivated Strategies for Learning Questionnaire which contained 22 questions. The questions involved the three categories of self-efficacy, intrinsic value, and test anxiety. Students responded to each question using a Likert scale. The data were analyzed using a three-step hierarchical multivariate regression model (Kim et al., 2014).

The results showed that the strategy most helpful to struggling students was constructive interaction between the student and instructor. Another strategy was group discourse in the mathematics course. The researcher concluded that the students who are most likely to succeed are those who are more independent and self-regulate as results showed they have higher achievement in online courses (Kim et al., 2014).

Choi, Waters, and Hoge (2017) facilitated a study on self-reflection and mathematics performance. The purpose of the study was three fold. First, they
wanted to determine the connection between self-reflection and mathematics performance. Second, they wanted to see what patterns emerged between elementary, middle, and high school students in regards to self-reflection. Lastly, they wanted to find out if providing opportunities for self-reflection in an online environment improved mathematics performance.

In order to answer the three questions of this study, the researchers conducted three studies retrospectively. The first one was conducted in a Midwestern state 2014-2015 and included 355 online secondary students taking an algebra I course. The second study included eight different online schools across the United States and included 461 students in grade 5, 653 students in grade 7, and 1,137 students in grade nine in their first semester of their respective mathematics courses. The third study included the students from the first two studies as well as the matched students from the previous year who did not receive the self-reflection (Choi et al., 2017).

Data were collected from students in the studies using reflection assessments. Performance data consisted of unit tests and final course scores. The data were analyzed using measurement models for the reflection assessments. Multiple regression models were used to find the connection between course performance and self-reflection. Propensity score matching was used to compare the control and treatment groups (Choi et al., 2017).

The results of this study showed that there is a positive connection between self-reflection and mathematics performance. The highest connection was seen at the
middle school level. The patterns found among the differing grade levels were that the younger students reflected more and were more consistent. High school students were less reflective which declined during more difficult units. The researchers determined that further study was needed to identify the best practices for generating self-reflective questions that would increase participation across all grade levels and promote higher achievement in mathematics in an online environment (Choi et al., 2017).

Choi and Waters (2018) conducted a study on small group discourse sessions in online mathematics courses. The purpose of this study was to determine if there is a connection between small group discourse and mathematical performance and confidence level. The researchers defined the discourse sessions as half hour meetings with no more than ten students per facilitator focused on problem solving and mathematical reasoning. The participants were students at two different online schools. One was a school in the Midwestern United States while the other was in the West. Both schools were similar in years of existence and performance levels. The study was conducted during the 2016-2017 academic year and consisted of 898 students in grades 3-5 from 10 different classrooms.

Data were collected from different sources in order to complete this study. Teachers utilized participation logs to record how many discourse sessions for which students participated. Students completed reflection assessments about the discourse sessions. Performance data were collected using end of course assessments
and state assessment results. The data were analyzed using a multiple regression model (Choi & Waters, 2018).

The results of this study showed that the discourse sessions are predictive of higher mathematics scores on both the end of course and state assessments (p-value = 0.005). Participation in the discourse sessions was not predictive of higher mathematics confidence levels (p-value = 0.564) (Choi & Waters, 2018).

Kim and Hodges (2012) designed a study on emotions and mathematics achievement in online courses. The purpose of this study was to determine the effects of emotion control treatment on students’ academic emotions, motivation towards mathematics courses, and mathematics achievement. Academic emotions are defined as emotions that are related to activities or outcomes directly related to educational achievement. Emotion control is defined as the ability to control the attention, appraisal, and regulation of emotion in a given situation. Researchers also wanted to know if the academic emotions were related to one another and to motivation. The study took place in the Southwestern United States at a public university. There were 95 participants enrolled in algebra and trigonometry courses. Students were primarily female and averaged 19 years of age. The participants were randomly assigned to either the treatment or control group. Participants in this study earned extra credit for their participation in the study.

The treatment for this study consisted of a Web-based video containing slideshows that the participants were required to watch without skipping any slides. The Achievement Emotion Questionnaire in Mathematics was used to
measure academic emotions while motivation was measured by a course interest survey. Mathematics performance was measured using the first exam of the semester. A one-factor MANOVA was used to assess the data on academic emotions while one-way ANOVAs were used for motivation and performance (Kim & Hodges, 2012).

Results showed statistically significant effects on positive emotions. The group that watched the treatment video had increased feelings of enjoyment (p-value = .045), motivation (p-value = .025), and pride (p-value = .042). However, the results did not translate over into a significant increase in achievement (p-value = .376). The results showed a significant difference in motivation between the group that watched the emotion treatment video (M = 3.21) and the group that did not (M = 2.90). With further study, emotional support could play a positive role in increasing mathematics motivation in an online environment (Kim & Hodges, 2012).

Synchronous instruction in online education is defined as instruction and learning happening at the same time but not at the same location. A teacher utilizing a webcam and students watching and interacting from their homes or offices would be an example of synchronous instruction. Asynchronous instruction is defined as instruction and learning happening both at a different time and location. Students watching and responding to a pre-recorded lesson would be an example of asynchronous instruction. Baker and Hjalmarson (2019) conducted a self-study to advance synchronous learning experiences. The purpose of this study was to determine how to support collaboration during synchronous online learning sessions.
The study was conducted at an urban university in the Atlantic area of the United States. The two participants of the study were both relatively new to online teaching. They each taught two sections of the mathematics coaching course. The data collected included weekly teacher reflections and student questionnaires (Baker & Hjalmarsen, 2019).

The data were analyzed for themes using open coding. Then a cross-case analysis was utilized to find any similarities and differences. Although the interactions between the students were uncomfortable for the students at first because of the unfamiliarity of the online environment, the results showed students found that they benefited from the interaction. Additionally, the use of technology offered multiple ways to interact and respond simultaneously so students could participate at their own speed. Finally, the researcher concluded that the role of the instructor was to facilitate the online learning environment in such a way as to optimize collaboration (Baker & Hjalmarsen, 2019).

Cavanaugh, Gillan, Kromrey, Hess, and Blomeyer (2004) conducted a meta-analysis on distance education and K-12 student outcomes. The purpose of the study was to find how online schools compared to traditional brick-and-mortar schools on measures of academic achievement.

Data were collected using searches of databases, journals, websites and bibliographic resources to find studies that matched the set criteria of the meta-analysis. After review, there were 80 studies that were evaluated but only 14 qualified to be included in the meta-analysis according to the criteria. Effect sizes
were calculated using Cohen’s $d$. The overall weighted mean effect size, -0.028, showed that overall students experienced similar achievement online as in the traditional classroom. The unweighted effect sizes ranged from -1.158 to 0.597. These results indicate some areas of online education are more effective than traditional brick-and-mortar schools while others are much worse. The researcher concluded that online education overall measures closely with traditional brick-and-mortar schools on measures of academic achievement (Cavanaugh et al., 2004).

Gulosino and Miron (2017) conducted a study on the growth and performance of online schools. The purpose of this study was to describe the growth of both fully online and hybrid schools, the types of students attending online schools, and academic achievement.

Data were collected from the National Center for Education Statistics as well as state education agencies and individual school websites. The schools included in the study were full time public elementary and secondary online or blended schools with a minimum of 25 enrolled students during the 2013-2014 year (Gulosino & Miron, 2017).

The results of the study that were reported descriptively showed a high percentage of white students (70%) attending online schools in comparison to other racial groups. Additionally, performance ratings indicated that students who were struggling in the traditional setting may continue to struggle in the online environment. The researchers found the largest growth in virtual schooling was in the elementary and middle school levels. Finally, the researchers concluded that families
need to be better informed prior to making a choice about online schooling so that they are aware of the expectations of the online environment (Gulosino & Miron, 2017).

Summary

This chapter provided a review of the literature on online education in K-12 school systems. Chapter 3 will present a methodology that includes the sample population, instrumentation, data collection, and analysis.
CHAPTER III

METHODS AND PROCEDURES

Introduction

The purpose of this study is to determine the effects of small group synchronous online instruction on fifth grade mathematics achievement. Chapter III will present the procedures and methods, addressing this study’s sample, data collection, instrumentation, and analysis. The school identified for participation in this study was chosen for convenience and access.

Treatment Group

The treatment group for this study consisted of 50 fifth grade students enrolled in an online school in California’s Central Valley during the 2018-2019 school year. This school serves students in the eight counties of Sacramento, Amador, Calaveras, San Joaquin, Stanislaus, Contra Costa, Alameda, and Santa Clara. Approximately 43% of the students are low socio-economic status. There are approximately 4% English Language Learners and 12% students with disabilities. The ethnicity make-up of the school is 40% white, 26% Hispanic, 22% two or more races, 5% African American, 4% Asian, and 2% Filipino. All students complete schoolwork at home with the daily guidance of their learning coach, typically a parent, in the physical setting. The treatment group received biweekly 1 hour sessions totaling 18 hours of small group mathematics instruction in the online setting with their homeroom teacher. The objectives of the small group instruction included multi-digit operations in base ten, applying and extending understanding of the operations of fractions,
algebraic expressions, and beginning equations. Instruction was provided in 30 minute sessions, held once every other week throughout the school year.

**Control Group**

The control group consisted of 50 fifth grade students who attended the same school from 2017-2018. The participants were selected due to convenience and similar demographics to the treatment group. Participants received no small group mathematics instruction in their fifth grade school year.

**Methods, Procedures, and Subjects**

The researcher used non-probability sampling to select students who were convenient at the online elementary school. Mathematics scores from fifty students in each of the treatment and control groups were purposefully selected for analysis. The selected school was convenient because the administration was willing to provide anonymized standardized test data for this study. The school and sample students are likely not representative of all fifth grade students. Therefore, results may not generalize beyond the students included in this study. Names of students and the school remained anonymous in order to ensure confidentiality.

**Instrumentation and Data Collection**

The archival Smarter Balanced assessment scores of fifth grade students in the 2017-2018 and 2018-2019 school years will be used to determine if differences in achievement exist. The study was implemented by pulling the data from the Test Operations Management System (TOMS) accessed through the California Assessment of Student Performance and Progress portal. Fifth grade scores in the
range of 2219-2454 have not met the standard, those in the 2455-2527 range are considered “standard nearly met” while scores in the 2528-2578 range are considered “Standard Met” (Smarter Balanced Assessment Consortium, 2018). The assessments were administered in the month of May 2018 and 2019. Fifth grade was chosen for this study because it is the highest elementary grade level for this school and has had the lowest mathematics scores of the tested elementary grade levels.

**Statistical Analysis**

The researcher used a $t$-test for independent samples to determine if a significant difference in mathematics achievement exists between the two groups. The statistical difference was determined using an alpha value of .05 level. Because archival data were used and any personal identifying markers were removed from the data, there should be very low to no ethical considerations for this study. All data are kept in a password locked computer.

**Summary**

Chapter III presented the methodology that includes the procedures and methods, sample population, instrumentation, data collection, and analysis. The results and findings of this study will be discussed in Chapter IV.
CHAPTER IV
DATA COLLECTION AND RESULTS

Introduction

The purpose of this study was to determine the effects of small group synchronous online instruction on fifth grade mathematics achievement. Chapter IV will present the statistical analysis of the data in relation to the hypothesis tested.

Analysis

Data were collected on 50 fifth grade students. Mathematics scores on the Smarter Balanced Assessment Consortium (SBAC) were gathered through a Central Valley California online school district. An independent samples t-test was used to determine if there was a significant difference in mathematics mean scores between the treatment group that received small group synchronous online instruction during the 2018-2019 academic year and the control group that did not receive small group synchronous online instruction during the 2017-2018 academic year. The alpha level was set at p<.05.

Findings Related to Null Hypothesis

There was a significant difference in mathematics achievement between the fifth grade students that received small group synchronous online instruction in the 2018-2019 academic year and fifth grade students that did not receive the small group instruction in the 2017-2018 academic year. The results of the analysis showed that fifth grade students who receive synchronous group instruction online outperformed the fifth grade students who did not receive synchronous group instruction online (see
Table 1). Therefore, the results suggest that the synchronous group instruction has a positive effect on fifth grade achievement in mathematics.

Table 1

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Group Mathematics 2017-2018</td>
<td>50</td>
<td>2425.44</td>
<td>102.406</td>
<td>-3.369</td>
<td>.001*</td>
</tr>
<tr>
<td>Treatment Group Mathematics 2018-2019</td>
<td>50</td>
<td>2495.38</td>
<td>105.181</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* p <0.05 level.

**Summary**

Chapter 4 presented the results of the data analysis. Chapter 5 will present the conclusions, implications, and recommendations for further study.
CHAPTER V

CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Introduction

The purpose of this study was to determine the effects of small group synchronous online instruction on fifth grade mathematics achievement. Chapter V presents a summary of this study with conclusions, implications, and recommendations for further research.

Conclusions

Data for this study were collected from the fifth grade students enrolled in an online school in the Central Valley of California over two consecutive years. Mathematics scores were collected from 50 students enrolled in the 2017-2018 and 50 students enrolled in the 2018-2019 academic year. Students in the treatment group received biweekly one hour sessions totaling 18 hours of small group mathematics instruction in the online setting with their homeroom teacher. An independent t-test was conducted to determine if there was a difference in the mathematics mean scores between the group of fifth grade students that received small group instruction and the group of fifth grade students that did not. The alpha level was set at p<.05. The results of the analysis showed a significant difference in the mathematics scores in favor of the treatment group.

Implications

The results are consistent with a study conducted on student motivation in online mathematics courses by Kim, Park, and Cozart (2014). In that study, the two
The greatest motivators relating to achievement in online mathematics courses were constructive interaction between the student and instructor and small group discourse. Another study consistent with the current results was a study conducted by Choi and Waters (2018) on small group discourse sessions in online mathematics courses. In the study, the purpose was to determine if a relationship existed between participation in the small group sessions and mathematical performance and confidence levels. While their study did not show a significant relationship regarding confidence levels, there was a positive relationship between group participants and achievement ($p = 0.005$).

Prior to the results of this study, the decision was made by the school where the study was completed to not only continue small group instruction but to also increase the number of sessions by focusing on targeted groups of students needing mathematical assistance. Due to the short-term nature of this study, it is difficult to draw any definitive conclusions on the effects of small group synchronous online instruction but it does provide credibility to the continuation of the small groups for further study.

**Recommendations for Future Research**

Future research on the effects of small group synchronous online instruction on mathematics achievement may include the following:

1. Conduct a quantitative study to determine the effects of small group synchronous online instruction on fifth grade mathematics achievement across the other 5 matching online districts within California.
2. Conduct a quantitative study to determine the effects small group synchronous online instruction on fifth grade mathematics achievement across a three year period.

3. Conduct a qualitative study to determine the perceptions and opinions of students, teachers, and administrators regarding small group synchronous online instruction.
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