Tutoring Interventions in Mathematics: The Use of Tutoring to Close the Achievement Gap Among Second-Grade Students

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Abstract

The purpose of the current study was to determine the effect of after school tutoring interventions on students' academic performance in the area of mathematics. The study involved 26 second-grade students over a period of 8 weeks. While both groups received general classroom instruction, one group received additional biweekly after-school math tutoring. Student achievement was measured using a pre and posttest benchmark assessment. The results indicated higher achievement data for students who received the after school tutoring. Student attitudes toward mathematics were measured using a survey. The survey results showed no significant difference between student attitudes in the two groups. Additionally, student engagement was measured with a checklist. The checklist results also showed no significant difference between student engagement in either group. Based on these results, it can be concluded the after-school tutoring improves second grade students' academic achievement in math, but does not affect attitudes toward mathematics or classroom participation.

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Achievement gaps exist between many different subgroups for a myriad of reasons. The most widely studied achievement gaps are those between minority students and their majority peers, as well as those between percentile groups within a school's population (Porter, 2005). These achievement gaps exist due to socioeconomic factors such as family income and regional demographics as well as factors such as parent involvement and cognitive ability. Furthermore, these achievement gaps exist in all subject areas, but schools are most often evaluated based on the significance of these gaps in students' reading and math performance. Books such as *Closing the Attitude Gap* by Principal Kafele (2013) argued that students' attitudes contribute to the widening of these gaps; however, others such as Geist (2015) and Ramirez, Gunderson, Levine, and Beilock (2013) suggested that these gaps exist due to a lack of foundational skills coupled with anxiety. As a result, researchers have developed different intervention methods aimed at closing these achievement gaps.

Area of Focus

The importance of mathematical understanding. In their 2014 Annual Report, the private organization Achieve stated that college and career readiness programs in the United States demand that students develop strong problem solving and quantitative reasoning skills (Achieve, 2014). These skills are often developed through mathematics instruction, and this level of instruction begins in early elementary classrooms. Students in grades kindergarten through second grade begin to develop these skills through cognitively guided instruction, which is promoted through the use of the new Common Core mathematics standards. These instructional standards focus on the development of base ten and place value understanding in kindergarten through second grade; each year the instruction goes deeper and expands upon students' prior knowledge. Developing a strong sense of base ten understanding is essential for further success in more advanced mathematics classes that begin in upper elementary school (Lent, 2012).

National mathematical achievement gaps. Despite these newly adapted Common Core standards, an achievement gap between struggling students and the rest of their grade level peers still exists across the country, specifically in the area of mathematics (Porter, 2005). The state of Georgia specifically recognizes and categorizes schools based on achievement gaps; however, these achievement gaps are not limited to the Southeast (Achieve, 2014). Porter (2005) argued that achievement gaps of substantial measure are present throughout the United States. These achievement gaps are present between racial groups, ability groups, and across subject areas (Porter, 2005). Unfortunately, despite significant research and interventions, these achievement gaps continue to appear, and result in lower designations and reviews for schools (Geist, 2015).

School level achievement gap. Achievement gaps exist between various groups within schools; however, the achievement gap between the lower 25% and the rest of the school can often be significant. The achievement of the lower 25% is used by the state school superintendent to determine a school's designation under the Flexible Waver renewal program. This program allows schools to be designated as Reward, Priority, Focus, and Alert schools based on student performance, particularly how the lower 25% perform when compared with the state average. The achievement gap can be measured across individual subject areas or in terms of test score data (Porter, 2005). A school with a significant achievement gap that does not improve over the course of 3 years was identified as a Focus school. This particular designation occurred within a rural school in northeast Georgia. This particular school had not shown significant improvement in the lower 25% achievement gap over the past 3 years, and began the 2015-2016 school year with the Focus school designation. The data collected for this classification came from the school's CRCT scores for students in third through fifth grade.

In the state of Georgia, achievement gaps exist in all core content area based on standardized test scores. On standardized math assessments, economically disadvantaged students had a pass rate that is six percentage points lower than the state pass rate of 84.2% (Barge, 2013). There was also an eight percentage point achievement gap between this subgroup and the White pass rate of 94% (Barge, 2013). The Black and White achievement gap in math was significantly larger. The Black subgroup pass rate of 75.8% was almost eight percentage points below the state pass average, but it was a full 15 percentage points below the White pass rate (Barge, 2013).

School level initiative to make mathematics interventions a priority. Prior to designation as a Focus School, a school wide goal of increasing mastery of the mathematics standards was added to the 2014 county wide strategic plan. Due to the fact that this school was identified as a Focus School, a school wide Flexible Learning Program (FLP) was put into place as part of the 2015 School Improvement Plan. This program was originally developed as part of the 2015 School Improvement Plan, and then became part of the Focus School Intervention Plan. As part of this FLP, all students had access to a computer based learning platform that provided targeted intensive practice in both reading and mathematics for at least 30 minutes a week during their computer lab specials rotation. Students completed pre-assessments as well as biweekly formative assessments that assessed their progress and planned their lessons.

Need for after-hours tutoring. Due to the recent Focus School classification, students identified as the lower 25% must be provided with additional flexible learning time for 50 minutes every 6 days as part of the school specials schedule. While these students received targeted practice in both reading and mathematics, there was no one-on-one student teacher interaction. The entire program was computer based and did not allow for immediate feedback or remediation during a lesson. Additionally, these students needed additional support if they were going to make the progress necessary to close the achievement gap. If certified teachers provided multiple research based intervention strategies such as *cover copy compare* and *see the story* during biweekly tutoring sessions that took place before or after regular school hours, students would have the opportunity to further develop the fundamental skills necessary for success in advanced areas of mathematics (Rothman & Henderson, 2011).

Review of the Literature

Students across the nation perform at different levels within mathematics classrooms on a daily basis. However, when this performance, particularly on standardized tests, shows significant statistical variances between subgroups within a larger demographic, an achievement gap exists. These achievement gaps occur because of social, economic, and academic factors (Giest, 2015; Howley, 2013). Additionally, these gaps directly relate to the practices used by teachers within classrooms (Mecee & Wingate, 2010). Achievement gaps are measured based on statistical analyses of standardized tests, and are discussed in terms of comparative subgroup performance (Clotfelter, Ladd, & Vigdor, 2009; Nielsen, 2015). Research suggests that tutoring is an effective method for closing the math achievement gap

(Fuchs et al., 2013a; Fuchs et al., 2013b; Jitendra et al., 2013; Rothman & Henderson, 2011). This research however has significant limitations such as small sample size or inconclusive evidence due to lack of a control group (McCallum & Schmitt, 2010).

Understanding the math achievement gap: Students. The achievement gap is not a new concept in the area of mathematics. Research suggests the achievement gap in mathematics is a national trend that has become more prevalent in recent years (Achieve, 2014; Giest, 2015; Howley, 2013; Robinson & Theule-Lubienski, 2011). Howley (2013) suggested that rural students have significantly wider achievement gaps in mathematics. This difference can be a direct result of their parents' own educational experiences as well as the caliber of educators drawn to rural areas (Howley, 2013). However, Howley's (2013) data also provided evidence of strong mathematical talent in rural areas, which allowed Howley to suggest that high mathematical achievement is possible for students in rural schools. The constantly changing mathematics standards played a part in creating the national achievement gap, and in order to close this gap students, teachers, and parents must have a working understanding of math standards and expectations across grade levels (Achieve, 2014).

Research also suggested that anxiety contributes to the achievement gap in math (Giest, 2015; Ramirez, Gunderson, Levine, & Beilock, 2013). The data in Giest's (2015) empirical study indicated that this anxiety is present in students in second grade, and already has a detrimental influence on math performance. However, if math anxiety is identified and remedied early in schooling, students have a greater chance of high mathematical achievement in the future (Giest, 2015). Ramirez et al. (2013) also assessed math anxiety in young elementary students. This research indicated that math anxiety negatively relates to math achievement; when students develop untreated math anxiety in early elementary school, their performance in middle and high school math courses is much lower than students without math anxiety (Ramirez et al., 2013).

Understanding the math achievement gap: Teachers. The achievement gap not only exemplifies student achievement or the lack thereof, but it is also directly related to educator practices (Giest, 2015; Mecee & Wingate, 2010; Ramierez et al., 2013). When teachers are confident in their own ability to teach math, students' confidence increases as well (Giest, 2015). In order to reduce the achievement gap among students with math anxiety, teachers need to introduce alternative problem solving strategies as well as incorporate confidence building exercises into math instruction (Ramirez et al., 2013). Research also suggested that teachers' understanding of diversity is essential to closing the achievement gap (Mecee & Wingate, 2010; Robinson & Theule-Lubienski, 2011). The achievement gap is present across genders, races, and ethnicities. However, diversity plays a part in identifying students who are at risk for lower math achievement. Mecee and Wingate (2010) discussed the importance of multicultural education as a means of closing the achievement gap. Teachers must have an understanding of the cultural and economic situations of their students in order to best teach them (Mecee & Wingate, 2010). Additionally, Mecee and Wingate (2010) found that students, regardless of race or economic status, performed better in classrooms where teachers held high expectations and used academic language on a regular basis. Robinson and Theule-Lubienski (2011) collected data in their empirical study that identified an achievement gap between males and females in mathematics. These data showed a large gap between female performances when compared to that of their male peers (Robinson & Theule-Lubienski, 2011). While the data provided evidence of strong female performance in math, it also indicated that females were more likely to fall into the math achievement gap (Robinson & Theule-Lubienski, 2011).

Understanding the math achievement gap. Because the achievement gap exists across a wide range of subject areas and age groups, there are also multiple means of assessing and measuring this gap (Clotfelter et al., 2009; Nielsen, 2015). The most common way to determine an achievement gap is by comparing test scores; these scores are deemed comparable due to the normative results (Nielsen, 2015). Nielsen (2015) argued that these gaps are innately bias as small score increases can inaccurately represent very large academic gains on a personal level for students. The achievement gap is also measured in terms of mean test scores and standard deviations; the more standard deviations that separate the two subgroups, the greater the achievement gap (Clotfelter et al., 2009).

In the state of Georgia, schools were designated as a focus school when this achievement gap, measured by the difference between mean subgroup scores, does not close significantly over the course of 3 years. In this system, the difference between means is compared with the state average difference. If the individual school shows a larger gap than the average state gap for three consecutive years, then the school will be classified as a focus school. This system of achievement gap classification does not measure gaps in terms of actual student performance, but rather by comparing this performance to the average performance across the state.

Research based strategies to close the math achievement gap. Due to the fact that the math achievement gap is widening, many interventions have been employed in order to increase student performance. Research has identified the positive effect of tutoring as a means of closing this gap (Fuchs et al., 2013a; Fuchs et al., 2013b; Jitendra et al., 2013; Rothman & Henderson, 2011). Fuchs et al. (2013a) worked with first grade students in an after-school tutoring program in order to improve their understanding of number sense. The data in this empirical study showed that students who received tutoring sessions closed the achievement gap more than students who did not receive the tutoring intervention; in many cases at risk students who did not receive tutoring actually widened the achievement gap based on their performance on the post assessment (Fuchs et al., 2013a). However, the data also showed that not all tutoring methods were successful. Students who received tutoring in the speed intervention group made higher gains than those in the non-speed group; however, both groups made higher gains than the control group which received no tutoring interventions (Fuchs et al., 2013a). Rothman and Henderson’s (2011) research addressed the effectiveness of school based tutoring programs and how they improved student achievement on standardized tests. The participants all came from the same ethnically diverse middle school in New Jersey, and they received a total of 48 hours of tutoring in their area of weakness. The results of this study indicated that the students who received after school tutoring performed better on standardized tests than their peers who did not receive the additional tutoring (Rothman & Henderson, 2011). This study also identified the importance of using district tutors who are familiar with the curriculum, as previous studies without district tutors did not have positive results (Rothman & Henderson, 2011). Additionally, Rothman and Henderson (2011) suggested that the tutoring was successful because of the duration, 48 hours, and the use of incentives throughout the program.

Jitendra et al. (2013) also concluded that students who received tutoring closed the achievement gap based on performance on post assessments. The data collected during the empirical study indicated that students who received tutoring that focused on problem solving skills performed better on post assessments than their peers who did not receive the tutoring interventions (Jitendra et al., 2013). Just as the 2013a study by Fuchs et al., Jitendra et al. (2013) found that only specific tutoring strategies were highly effective in closing the achievement gap.

The most effective strategy focused on schema-based instruction (SBI) where students focused on identifying the schema of each problem; by identifying basic problem types and developing a deeper understating of each schema, students were able to create a problem repertoire which made solving word problems easier (Jitendra et al., 2013). This study also determined that *think alouds* were effective tools for developing problem solving understanding, which directly affects the math achievement gap (Jitendra et al., 2013). Fuchs et al.'s 2013b empirical study also studied the effectiveness of tutoring as an intervention for at risk elementary students. The data presented in this study showed that student understanding improved more in the tutoring group than that of students in the control group who received no tutoring interventions (Fuchs et al., 2013b). As a result of this intervention, the achievement gap between at risk students and their peers narrowed significantly, and in some cases was eliminated entirely (Fuchs et al., 2013b).

Fuchs et al. (2013b) focused on background knowledge as part of their intervention. As a result, the experimental group improved more than the control group. Lent (2012) argued that building background knowledge is essential to improving student understanding. In order for students to develop stronger academic skills, they must first develop a strong understanding of the background knowledge and basic skills necessary for understanding the higher order thinking required for success in math courses (Lent, 2012). Research has suggested that tutoring is one way to provide additional instruction required for building background knowledge (Jitendra et al., 2013; McCallum & Schmitt, 2010; Rothman & Henderson, 2011). McCallum and Schmitt's (2010) empirical study compared the effectiveness of two commonly used interventions, Cover Copy Compare (CCC) and Facts that Last (FTL), with a class of 19 second-grade students from a school in the midwest. The data indicated that behaviorist based interventions were more effective than constructivist based interventions (McCallum &Schmitt, 2010). The behaviorist intervention of CCC improved student background knowledge, as it helped students improve fluency, which is a key background step in increasing math achievement.

Limitations of achievement gap research. Unfortunately, the research related to achievement gaps has significant limitations. McCallum and Schmitt's (2010) study does suggest that the CCC method is an effective intervention to help students increase fact fluency. However, all students received both methods throughout the study, which resulted in a lack of a control group. Thus, the data may be invalid because there was not a clearly defined experimental and control group. While students did show greater fact fluency when working with CCC, there is no way to determine if their fact fluency was increased solely by the CCC intervention, or if it was increased by the FTL intervention, or a combination of both interventions. Additionally, the quality of the interventions must be taken in to consideration. If a study does not evaluate the quality of the instruction during the tutoring time or lacks a strict curriculum for the tutoring sessions, the student achievement cannot be directly linked to the tutoring (Rothman & Henderson, 2011).

Current data also tends to focus on students in higher grades, particularly students in middle and high school. Clotfelder et al. (2015) worked with students in third through eighth grades. By focusing on older students, researchers have missed out on important information relating to the development of fundamental skills necessary for closing and hopefully preventing achievement gaps (Geist, 2015). Achievement gaps can begin as early as kindergarten, yet there is limited research involving this younger population (Porter, 2005).

Purpose of math achievement gap study. This study aimed to determine the effectiveness of tutoring interventions for closing the math achievement gap among second-grade students. The state of Georgia has a significant achievement gap in mathematics between both Black and White students, as well as between economically disadvantages students and the overall state average (Barge, 2013). These tutoring sessions included research-based intervention methods that specifically targeted areas of weakness identified through pre-assessment benchmarks and county wide data. Additionally, this study incorporated interventions geared to lessen math anxiety discussed in detail by Geist (2015). Standardized test scores were compared in order to measure achievement gaps. This study provided insight into the effectiveness of tutoring in lower elementary grades. This data could benefit elementary classroom teachers by providing information on best tutoring practices, but it could also help all faculty and staff within focus schools. Because focus schools are required to offer flexible learning opportunities for all students, tutoring practices are paramount for creating these environments and additional learning opportunities for students. This study not only helped the faculty and staff at these focus school select appropriate math tutoring practices, but it also provided insight into tutoring's effect on student performance.

Research Questions

Research question 1. Will test scores on the math 3rd nine weeks post-assessment show a greater increase for students in the lower 25% who received small group tutoring as compared to students who did not receive small group tutoring?

Research question 2. Will small group tutoring improve attitudes toward mathematics for students in the lower 25% as compared to students who did not receive small group tutoring?

Research question 3. Will students in the lower 25% receiving small group tutoring have increased classroom engagement in general math classes as compared to other students in the lower 25 % who did not receive tutoring?

Definition of Variables

Small group tutoring. Small group tutoring is specific, intentional mathematics instruction that students receive in a group of 15 or fewer students (Jitendra et al., 2013). Tutoring occurred outside of regularly scheduled mathematics instruction. Tutoring instruction addressed grade level standards.

General classroom instruction. The instruction provided in a general education second-grade math class was aligned with state standards and curriculum. This instruction included Cognitively Guided Instruction (CGI) style word problem instruction, hands on manipulative use, small group centers, and whole group instruction.

SLO Assessment. Second-grade students are expected to master a specific set of grade level standards as determined in the state GSE standards list (Woods, 2015). This assessment is a countywide math assessment administered at the beginning and end of each school year. The pre assessment was administered in August, and the post assessment was administered in May. The assessment included a total of 25 questions that addressed second-grade mathematics standards, and scores of an 80 or higher demonstrated mastery of the second-grade nine week mathematics content.

Third Quarter Benchmark. Second grade students are also expected to master a specific set of grade level standards as determined in the state CCGPS standards list each nine weeks (Woods, 2015). This assessment was a countywide math assessment administered at the beginning and end of each nine week grading period. The assessment included a total of 19 questions that address second-grade mathematics standards, and scores of an 80 or higher demonstrate mastery of the second-grade nine week mathematics content.

Attitude toward mathematics. Students begin to develop attitudes toward mathematics at an early age (Geist, 2015). This attitude, good or bad, can directly affect a student's performance in a math classroom. Student attitude toward mathematics was measured using a ten-question survey. Students were asked about their overall feeling toward different concepts of mathematics as well as their confidence within a math classroom.

Participation. Classroom participation is necessary in mathematics classrooms as it provides opportunities for students to practice the skills. Participation was defined as students actively working problems and sharing solutions with the class. Participation was measured by recording the number of times a student completed an in class activity without redirection from a teacher, as well as the number of times a students raised their hand to share an answer, or had an on task conversation with their partner.

Lower 25%. Students in the lower 25% were the students who score the lowest on the beginning of the year SLO assessment. This demographic was determined by taking all SLO Assessment scores and putting them in increasing order. The scores were then divided into quartiles based on the total number of students who completed the assessment, and the students whose scores fell into the lowest quartile were then identified as the lower 25%.

Methods

Setting and Participants

The 2015-2016 student population in a rural north Georgia system where the research took place was 13,412. The Georgia Department of Education (2016) reported that 63% of the student population was White, 15% was Hispanic, 13% was Black, 5% was Asian, and the other 5% was Multiracial. This system was identified as a Title I system, due to the fact that 57% of the district's population was classified economically disadvantaged, and over 60% of the students received free or reduced-priced lunch (Georgia Department of Education, 2016).

The system also had 13% of its student population served in special education students, and 7% of the population received ELL services.

The research site was at an elementary school within the county that had a 2015-2016 population of 815 students in grades K-5. Of these 815 students, 55% were White, 18% Hispanic, 17% Black, 2% Asian, and 7% Multiracial (Georgia Department of Education, 2016). Seventeen percent of the student body received special education services, and 10% of students received ELL services. All 815 students received free breakfast and 68% of the school population received free or reduced lunch. The school was classified as a Focus School for the 2015-2016 school year because the achievement gap between the lowest 25% of students and the state average did not decrease significantly over the past 3 years. As a focus school, the research site school was required to meet specific state requirements, specifically those designed to provide additional learning opportunities for students.

The participants in this study were 26 second-grade students who were identified as falling in the bottom 25% based on their scores on the SLO pre-assessment taken in August. These students all demonstrated a significant deficit in mathematics, and showed an achievement gap based on the average 2015-2016 pre-assessment score. These 26 students came from all six second-grade homerooms within the research site school. The students were assigned to either the general classroom instruction group or tutoring intervention group based on several factors such as academic ability, race, and gender in order to create equitable groups.

The 13 students in the general classroom instruction group received no additional after school tutoring. Within this group there were five Black students, four White students, and four students who identified with a different ethnic group. There were seven males and six females within the general classroom instruction group. The general classroom instruction group's academic designations included four regular education students, three special education students, and six students who received EIP math services.

The tutoring intervention group received biweekly after-school tutoring twice a week for 45 minutes. This group was intentionally similar in demographics to the control group. There were 13 students who received the tutoring intervention. Four of these students were Black, five students were White, and four identified with a different ethnic group. This group was comprised of six males and seven females. Similarly to the general classroom instruction group, the tutoring intervention group has four general education students, two special education students, and seven students who received EIP math support.

Because there was no previous standardized achievement data on these students to indicate second-grade math achievement, students were given the county wide SLO Assessment as a pre-assessment at the beginning of the year, and they also completed the Third Quarter Benchmark pre-assessment prior to beginning the intervention.

Table 1
Demographic and Achievement Data for Participants

	Ethnic Group			Gender		Designation		
Group	Black 9	White 9	Other 8	Male 13	Female 13	RegEd 8	SpEd 5	EIP 13
General classroom instruction	5	4	4	7	6	4	3	6
Tutoring Intervention	4	5	4	6	7	4	2	7

A total of nine teachers participated in the study. The teachers involved in the study included all six second-grade homeroom teachers. These teachers provided the general classroom instruction to all 26 students throughout the study. Additionally, the two special education support teachers worked with the special education students in an inclusion setting throughout the study for 45 minutes a day for their general math instruction. The EIP math teacher also worked with the EIP math students to provide an additional 45 minutes of pull out intensive EIP math instruction on a daily basis. The tutoring was provided by the teacher-researcher.

Intervention

All 26 students in the study received classroom instruction in mathematics based on the same grade level lesson plans. Students received 90 minutes of math instruction daily. Students received 60 minutes of whole group teacher-guided instruction, and 30 minutes of small group instruction or math center rotations. Despite the fact that students came from different homerooms, the students all received the similar instruction due to the fact that the second grade teachers all planned together and taught similar units. Second-grade math instruction was guided by the state GSE math standards and followed the county scope and sequence chart for pacing. All six homeroom teachers taught the same standards during the same weeks. During the course of the study, students focused on second-grade geometry standards, second-grade word problem standards, and second-grade numbers and operations standards that addressed addition and subtraction with and without composing and decomposing numbers. Students completed the same assessments, and worked through the same classwork and centers. During the course of the study, all students completed the county wide Third Quarter Benchmark pre and post assessments. All students were taught using Cognitively Guided Instruction (CGI) problem solving models where students solve word problems and then discuss multiple strategies through the use of a discourse chart. Students were encouraged to use manipulatives throughout instructional time.

Students within subgroups also received equitable instruction. All of the special education students received inclusion instruction within the same classroom with the same two support teachers. The EIP students also received the same instruction because they all worked with the same EIP teacher to complete math interventions on a daily basis for 45 minutes during the whole group math instruction in the general education classes. Consistency of instruction was regulated through the use of similar lesson plans and pacing guides across the grade level.

The general classroom instruction group received no additional support aside from any required special education or EIP instruction. These 13 students only received the instruction provided within their classroom. Students in the general classroom instruction group completed an hour and a half of math instruction each day. This block of time was divided into an hour of teacher-guided whole group or partner practice and a half hour of small group math centers. Students also completed daily CGI problems that went along with the unit of study. Any additional services provided through EIP or special education were done according to individual students' designations; these services were provided on a daily basis.

The tutoring intervention group received the same general classroom instruction as the classroom instruction group. However, these students received additional after school tutoring. The tutoring took place twice a week for 45 minutes after school on Tuesday and Thursday afternoons. Tutoring was conducted by the teacher researcher. The tutoring consisted of several research-based interventions such as Cover Copy Compare, and See the Story activities where students would model teacher examples and create concrete illustrations to help them solve word problems. The students worked on basic number sense and place value skills in order to increase their base ten knowledge during the first 4 weeks of tutoring. Students also worked through CGI word problems during the final 4 weeks of the tutoring intervention in order to utilize see the story strategies. During each tutoring session, students focused on one skill that aligned with a specific second-grade math standard. The skill was introduced in a short 3-5 minute teacher guided mini-lesson. After the mini-lesson, students completed a very structured guided practice period where they utilized the intervention such as Cover Copy Compare or See the Story. After the students completed the guided practice, they participated in a dialogue where students were able to explain their thinking. Finally, students completed an independent practice activity where they continued to practice the session's skill.

All 26 research participants completed the same performance assessments. Prior to beginning the interventions, all second-grade students completed the county wide Third Quarter Benchmark pre-assessment as well as the SLO Assessment at the beginning of the year. The SLO Assessment consisted of 25 multiple choice and short response questions that address the most significant second-grade mathematics standards. Students complete this assessment during the first 2 weeks of school, and it served as a baseline for all subsequent assessments. Throughout the school year, students also completed quarterly benchmark assessments that assessed the most significant GSE skills during each quarter. During the course of the study, the 26 participants completed the Third Quarter Benchmark pre and post-assessment. This assessment served as the pre and post assessment for the study. At the conclusion of the tutoring intervention, students completed the county wide Third Quarter Benchmark post-assessment. This post-assessment included the same 19 multiple choice and short response questions from the pre-assessment. All second-grade students completed the same assessment in order to show individual growth throughout the school year. This Third Quarter Benchmark post-assessment also served as the post-assessment for the 26 research participants. The pre-assessment and post-assessment scores were compared to determine growth for each research participant. These growth scores were then compared to determine the effectiveness of the tutoring intervention.

Data Collection

The data in this study were collected with a series of three separate assessment tools. Students completed a pre and post achievement assessment in the form of the county wide formative assessment (CFA) known as the Third Quarter Benchmark assessment. Students' attitudes toward math were also assessed using a 10-question survey. Classroom engagement was also assessed using a five-point checklist. Data from these individual assessments were analyzed and compared in order to compare the effectiveness of the tutoring intervention group against the classroom instruction control group. In addition to these three formal assessment tools, fieldnotes were completed throughout the entirety of the research intervention implementation. These fieldnotes included intervention dates, student activity, instructional techniques, and any other pertinent data from the individual intervention sessions.

Math Third Quarter Benchmark assessment. The countywide math Third Quarter Benchmark assessment served as the achievement assessment. The Benchmark was developed by the county as a common assessment across all schools in the county. This assessment was developed for grades K-3 as the student achievement measure part of the TKES teacher evaluation because these grades did not have Georgia Milestones data to determine student growth. As a result, the assessment was classified as a high stakes assessment, and educators could only access the assessment during the testing window. Thus, the actual assessment was not included as an appendix.

The math Third Quarter Benchmark assessment was comprised of 19 questions that address the second-grade math standards MGSE2NBT1, MGSE2NBT2, MGSE2NBT5 MGSE2NBT7, MGSE2AO1, MGSE2AO2, MGSE2G1, MGSE2G3, MGSE2MD1, MGSE2MD7, MGSE2MD8, and MGSE2MN10. Students completed 10 multiple choice questions, and 9 short answer questions that required them to solve CGI-style word problems and write a short one-sentence narrative explaining the strategy they used to solve the problem. Each question was then scored against a rubric provided by the county. The assessment was graded out of a 100-point scale. Partial credit was not available. Students then received a percentage grade out of a possible 100%.

All 113 second-grade students at the research school completed the Third Quarter Benchmark assessment twice during the year. The pre-assessment was administered during January 2016, and the post-assessment was administered during the final week of March 2016. The test was given on a predetermined day during the county's two-week testing window. All teachers in the same grade had to administer the assessment at the same time on the same day during the testing window. Any make-up tests were administered by the grade level EIP teacher on the final day of testing. The assessment was administered according to county wide regulations. During the administration of the assessment, all questions and answer choices were read aloud to students. Questions could be repeated if necessary, but not paraphrased. Any additional explanation of the questions was prohibited, as teachers followed a written prompt during testing. Teachers paced the test based on student completion. Teachers waited until all students answered a question before proceeding to the next question. In order to grade the assessments, teachers were required to check out the tests as a grade level and score them in the presence of the school testing coordinator.

Pre and post-assessment scores were evaluated with descriptive analysis (*M*, *SD*). Despite the fact that the Third Quarter Benchmark assessment had been evaluated for validity and reliability through peer review throughout the county prior to implementation. The scores provide meaningful information on students' math achievement, which provides construct validity as well. Results were compared using descriptive analysis (*M*, *SD*) for both the tutoring intervention group and the classroom instruction control group in order to assess the effectiveness of the intervention. An unpaired t-test was also performed to compare the data.

Student attitude survey. The Attitude Toward Math survey (Appendix A) was developed by the teacher-researcher in order to determine the participants' feelings and attitudes toward mathematics prior to and after the completion of the tutoring intervention. The Attitude Toward Math survey was a ten-question Likert-scale survey. Due to the age of the student participants, each question had only three answer choices: *no*, which was also represented with a frowning face; *don't know*, which was represented with a straight line face; and *yes*, which was represented with a smiling face. The teacher-researcher made a point to explain what each face meant prior to students beginning the survey, and repeated the explanation after each question when students selected their answer. The teacher-researcher assigned a numerical value to each answer ranging from one (*no*) to three (*yes*). The teacher-researcher administered the Attitude Toward Math survey in a one-on-one setting with each student participant. Students were informed that their participation was optional and voluntary prior to completing the survey. Each question was read aloud, and the answer choices were repeated after each question. The teacher researcher waited until the student participant had answered the question before reading the next question.

The survey's reliability and validity was determined through peer review by the other second-grade teachers as well as the school's academic coach. The data were compared using descriptive analysis (*M, SD*) and compared with an unpaired *t*-test in order to determine the effectiveness of the tutoring intervention at improving students' attitude toward mathematics.

Classroom engagement checklist. The classroom engagement checklist (Appendix B) was adapted from a larger checklist created by the International Center for Leadership in Education. The teacher-researcher selected five classroom engagement checklist questions that were scored using a five-point Likert-scale with corresponding numerical values ranging from *very high* (5) to *very low* (1). This classroom engagement checklist was completed by the teacher-researcher for each student participant prior to and after the completion of the interventions. Each student was observed for the entirety of their 90 minute math instruction. The observation was broken down into 3 sections: CGI instruction, whole group instruction, and small group instruction/center work. Each section had a separate checklist. After the completion of the observations, scores were calculated for each student using the numerical values assigned to the Likert-scale responses. The results for the tutoring intervention group and classroom instruction control group were compared using descriptive analysis (*M, SD*). The validity of this student engagement assessment was determined through peer review by the other five second-grade teachers as well as the school's academic coach.

Fieldnotes. The fieldnotes form (Appendix D) was developed by the teacher-researcher to record observations from the intervention sessions. The fieldnotes form was used during each tutoring session. The teacher-researcher recorded the date as well as the specific tutoring intervention that was used and how this intervention was implemented during the tutoring session. The teacher-researcher also recorded student response to the intervention. The fieldnotes form was also used to record insight and thoughts from the teacher-researcher following each tutoring session. The fieldnotes form was completed by the teacher-researcher after each tutoring session, and the information was used to aid in the intervention methods and results narratives for this research.

Results

The purpose of this study was to examine the effect of tutoring interventions on second-grade math achievement. Throughout the course of the study, the teacher-researcher collected data using four different research tools. Achievement data were collected with a pre-assessment and post-assessment using the countywide Third Quarter Benchmark. Additionally, participants in the study completed attitude surveys about mathematics before and after the 8-week intervention period. The teacher-researcher and other second-grade teachers also collected participation data with a classroom participation checklist, and the teacher researcher utilized fieldnotes to record observations throughout the tutoring sessions.

The teacher-researcher collected achievement data with the use of a pre-assessment and post-assessment. The pre-assessment was administered to both the general classroom instruction group and the tutoring intervention group prior to the first tutoring session. The pre-assessment used was the county third quarter benchmark assessment, which addressed core second-grade standards including solving word problems involving regrouping, adding multiple addends, and subtracting with regrouping. The post-assessment was administered after an 8-week period when the final tutoring intervention was completed. Table 1 compares and pre-assessment and post-assessment achievement scores for both students in the general classroom instruction group and the tutoring-intervention group. The achievement scores were analyzed using descriptive statistics (*M*, *SD*) and a one-tailed *t*-test. Both groups showed a significant gain from the pre-assessment to the post-assessment. The general classroom instruction group (n = 13) scored 22 points higher on the pre-assessment (M = 52.00) than the tutoring intervention group (n = 13) scored on the pre-assessment (M = 29.15). The general classroom instruction group (M = 72.00) also scored 9.31 points higher than the tutoring-intervention group (M = 62.69) on the post-assessment.

The mean increase in achievement was also compared in Table 1. Both groups had a mean increase in scores from the pre-assessment to the post-assessment. However, the tutoring-intervention group (M = 33.54) had a higher mean increase than the general classroom instruction group (M = 20.00). The mean increase reached statistical significance (t (26) = 1.63, p = 0.05). There was a 13 point difference in mean score increase between the tutoring intervention group, and the general classroom instruction group. Cohen's *d* revealed that the tutoring intervention had a medium effect size (d = 0.67). Students receiving a tutoring intervention were expected to increase their scores 16.25% more than students not receiving the intervention.

Table 1

Comparison of Pretest and Posttest Performance for All Students

	Pretest		Posttest		*t*-value	*p*	Mean Increase	*SD*	*t*-value	*p*
	M	*SD*	*M*	*SD*						
General classroom instruction (n = 13)	52.00	24.99	72.00	14.11	-2.27	< .05*	20.00	24.26	1.63	0.05
Tutoring Intervention (n = 13)	29.15	22.27	62.69	22.33	-1.45	0.08	33.54	17.07		

*p < .05; **p < .01; ***p < .001

Information about students' attitude toward mathematics was collected through the use of attitude surveys. Students in both the general classroom instruction group and the tutoring intervention group completed a 10-question pre-assessment attitude survey prior to the start of tutoring. All students (n = 26) also completed the same 10-question attitude survey as a post-assessment after the completion of the 8-week tutoring intervention. The pre-assessment and post-assessment survey results for the tutoring intervention group are compared in Table 2. Only question 1 (p = 0.04) and question 10 (p = 0.04) showed statistically significant differences. Question 2 through question 9 did not have a p-value of less than 0.05, which showed no statistically significant differences. Question 1 (M = -0.38), question 5 (M = -0.08), and question 6 (M = -0.08) all showed a mean loss from the pre-assessment to the post-assessment.

Table 2

Comparison of Pre/Post Student Attitude Survey for Tutoring Intervention Group

	Pre-Intervention Survey		Post-Intervention Survey			
Survey item	*M*	*SD*	*M*	*SD*	*P*	Mean Gain/Loss
1. I like math.	2.84	0.37	2.15	0.80	0.04	-0.38
2. Math is my favorite subject.	2.15	0.80	2.46	0.88	0.15	0.31
3. I enjoy solving word problems in math.	2.23	0.72	2.53	0.78	0.33	0.31
4. I make good grades in math.	2.07	0.86	2.23	0.93	0.47	0.15
5. Math is easy for me.	2.25	0.69	2.23	0.83	0.39	-0.08
6. I am as good as, or better at math than most students in my class.	1.61	0.65	1.53	0.66	0.38	-0.08
7. I enjoy learning new concepts in math.	2.54	0.66	2.76	0.60	0.18	0.23

8. I am comfortable explaining my answers to the class during math class.	2.00	0.71	2.15	0.89	0.31	0.15
9. I feel comfortable asking questions in math class if I do not understand.	2.23	0.72	2.46	0.77	0.34	0.23
10. When I work on math I feel calm and confident.	2.31	0.63	2.69	0.48	0.04	0.38

Table 3 compares the pre and post-assessment survey results for the general-classroom instruction group. Only question 2 ($p = 0.02$) and question 9 ($p = 0.03$) reached statistical significance. The other 8 questions did not have a *p*-value of less than 0.05, which showed no statistical significance. Question 1 ($M = -0.15$) and question 6 ($M = -0.15$) both showed a mean loss from the pre-assessment to the post-assessment, while all other questions showed a mean gain.

Table 3

Comparison of Pre/Post Student Attitude Survey for General-Classroom Instruction Group

	Pre-Intervention Survey		Post-Intervention Survey			
Survey item	*M*	*SD*	*M*	*SD*	*p*	Mean Gain/Loss
1. I like math.	2.25	0.80	2.23	0.72	0.39	-0.15
2. Math is my favorite subject.	2.00	0.82	2.00	0.91	0.50	0.00
3. I enjoy solving word problems in math.	2.00	0.81	2.61	0.65	0.02	0.61
4. I make good grades in math.	1.84	0.68	2.07	0.75	0.21	0.07
5. Math is easy for me.	2.46	0.66	2.69	0.48	0.16	0.15
6. I am as good as, or better at math than most students in my class.	1.92	0.65	1.77	0.59	0.26	-0.15
7. I enjoy learning new concepts in math.	2.15	0.89	2.46	0.77	0.18	0.15

8. I am comfortable explaining my answers to the class during math class.	1.84	0.68	2.15	.89	0.16	0.23
9. I feel comfortable asking questions in math class if I do not understand.	2.00	0.57	2.46	0.66	0.03	0.31
10. When I work on math I feel calm and confident.	2.46	0.66	2.61	0.50	0.25	0.15

The attitude data for all students (*n* = 23) is compared in Table 4. The mean increase for question 6 (*p* = 0.04) showed statistical significance. Question 6 also showed statistically significant differences with both the classroom instruction group and the tutoring intervention group in the pre and post-assessment analysis in Tables 2 and 3 as well. However, all other questions did not reach statistical significance. Both the tutoring-intervention and the general classroom instruction group showed an increase in "liking math," and the tutoring-intervention group showed a larger mean increase (*M* =0.31) when asked if they liked math. Additionally, the tutoring-intervention group showed a higher mean increase (*M*= 0.62) than the general classroom instruction group (*M*= 0.00) when asked if math was their favorite subject. The tutoring-intervention group also has a higher mean increase (*M*= 0.38) than the general classroom instruction group (*M*= 0.15) when asked if they feel calm and confident when answering math problems. However, the general classroom instruction group showed a higher mean increase (*M*= 0.38) when asked if they feel comfortable explaining answers to the class. Both groups showed the same mean increase (*M*= 0.31) when asked if they enjoy learning new math concepts. Additionally, both groups showed a negative trend when asked if they are as good, or better at math than other students in their class. However, the tutoring-intervention group showed a lower mean decrease (*M*= -0.08) than the general classroom instruction group (*M*= -0.31)

Table 4

Comparison of Pre/Post Student Attitude Survey Mean Increase for All Students

	General Classroom Instruction		Tutoring Intervention Group			
Survey item	*Mean increase*	*SD*	*Mean increase*	*SD*	*t*-value	*p*
1. I like math.	0.07	0.75	0.31	0.63	1.07	.15
2. Math is my favorite subject.	0.00	.41	0.62	0.75	-.029	0.38
3. I enjoy solving word problems in math.	0.62	0.65	0.31	0.75	0.32	0.37
4. I make good grades in math.	0.23	0.44	0.15	0.38	-1.59	0.07
5. Math is easy for me.	0.23	0.63	0.08	0.76	0.81	0.21
6. I am as good as, or better at math than most students in my class.	-0.31	0.63	-0.08	0.49	1.81	0.04
7. I enjoy learning new concepts in math.	0.31	0.63	0.31	0.48	0.00	0.50
8. I am comfortable explaining my answers to the class during math class.	0.31	0.48	0.15	0.85	-0.80	0.21
9. I feel comfortable asking questions in math class if I do not understand.	0.38	0.51	0.23	1.39	-1.00	0.33
10. When I work on math I feel calm and confident.	0.15	0.38	0.38	-1.39	1.38	0.19

Student participation data were collected using a participation checklist. The teacher-researcher and the other second-grade teachers used this checklist to monitor student participation during three separate math segments. The same five-section checklist was used to collect data with all student-participants (n = 23) prior to the first tutoring session and after the completion of the 8-week tutoring intervention period. Students could earn a total of 25 points, which would signify the highest level of classroom engagement. The pre-assessment and post-assessment student participation data during CGI instruction is compared in Table 5. The general classroom instruction group (*M* = 16.16) had higher pre-assessment student participation than the tutoring intervention group (*M* = 15.38). The general classroom instruction group (*M* = 20.00) also had higher post-assessment student participation during CGI instruction than the tutoring intervention group (*M* = 15.84). The *p*-values for both the general classroom instruction group ($p = 0.32$) and the tutoring-intervention group ($p = 0.40$) were not less than 0.05, which showed no statistical significance. The tutoring intervention group had a higher mean increase (*M* = 0.46) than the general classroom instruction group (*M* = 0.23); however, the *p*-value ($p = 0.27$) did not reach 0.05 which showed no statistical significance. Cohen's *d* calculation ($d = 0.20$) showed a small effect size. Students receiving the tutoring intervention would participate 0.27% more than students not receiving the intervention.

Table 5

Comparison of CGI Participation for All Students

	Pretest		Posttest		*t*-value	*p*	Mean Increase	SD	*t*-value	*p*
	M	*SD*	*M*	*SD*						
General classroom instruction (*n* = 13)	16.61	2.14	20.00	2.64	-0.45	0.32	0.23	1.36	0.61	.27
Tutoring Intervention (*n* = 13)	15.38	2.40	15.84	2.76	-0.24	0.40	0.46	0.96		

$^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$

Student participation data were also collected during small-group instruction using the same five-section checklist with all student-participants (*n* = 23). Pre-assessment data collection began prior to the first tutoring session, and post-assessment data was collected after the completion of the 8-week tutoring intervention period. Students could earn a total of 25 points, which would signify the highest level of classroom engagement. The pre and post-assessment student participation data during small-group instruction is compared in Table 6. The general classroom instruction group (*M* = 17.23) had higher pre-assessment student participation than the tutoring intervention group (*M* = 16.07). The general classroom instruction group (*M* = 18.00) also had higher post-assessment student participation during CGI instruction than the tutoring intervention group (*M* = 16.69). The *p*-values for both the general classroom instruction group ($p = 0.25$) and the tutoring intervention group ($p = 0.19$) were not less than 0.05, which showed no statistical significance. The tutoring intervention group had a slightly higher mean increase (*M* = 0.67) than the general classroom instruction group (*M* = 0.61); however, the *p*-value ($p = 1$) showed no statistical significance. Cohen's *d* calculation ($d = 0.04$) showed a negligible effect size. Students receiving the tutoring intervention would participate 0.07% more than students not receiving the intervention.

Table 6

Comparison of Small Group Observation for All Students

	Pretest		Posttest		*t*-value	*p*	Mean Increase	*SD*	*t*-value	*p*
	M	*SD*	*M*	*SD*						
General classroom instruction ($n = 13$)	17.23	1.83	18	1.67	-0.67	0.25	0.61	1.76	0	1.00
Tutoring Intervention ($n = 13$)	16.07	2.43	16.69	2.21	-0.89	0.19	0.67	1.33		

$^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$

Finally, student participation data was collected during whole-group instruction using the same five-section checklist with all student-participants ($n = 23$). The pre-assessment data was collected prior to the first tutoring session. Post-assessment data was collected after the completion of the 8-week tutoring intervention period. Students could earn a total of 25 points, which would signify the highest level of classroom engagement. The pre-assessment and post-assessment student participation data during whole-group instruction is compared in Table 7. The general classroom instruction group (*M* = 14.69) had lower pre-assessment student participation than the tutoring-intervention group (*M* = 16.69). The general classroom instruction group (*M* = 15.46) also had lower post-assessment student participation during CGI instruction than the tutoring intervention group (*M* = 17.00). The *p*-values for both the general classroom instruction group (*p* = 0.24) and the tutoring-intervention group (*p* = 0.31) were not less than 0.05, which showed no statistically significant differences. The general classroom instruction group had a higher mean increase (*M* = 0.77) than the tutoring-intervention group (*M* = 0.38); however, the *p*-value (*p* = 0.26) showed no statistically significant differences. Cohen's *d* calculation (*d* = 0.25) showed a small effect size. Students receiving no tutoring intervention would participate 0.37% more than students receiving the tutoring intervention.

Table 7
Comparison of Whole Group Observation for All Students

	Pretest		Posttest		*t*-value	*p*	Mean Increase	*SD*	*t*-value	*p*
	M	*SD*	*M*	*SD*						
General classroom instruction (*n* = 13)	14.69	2.75	15.46	2.90	-0.69	0.24	0.77	1.64	0.65	0.26
Tutoring Intervention (*n* = 13)	16.69	1.65	17	2.25	-0.49	0.31	0.38	1.55		

**p* < .05; ***p* < .01; ****p* < .001

The tutoring-intervention group met with the teacher-researcher twice a week for 8 weeks. During each of the tutoring sessions fieldnotes were taken by the teacher-researcher. The after-school tutoring sessions took place on Tuesday and Thursday afternoons in the teacher-researcher's classroom. The students involved in the tutoring sessions, were the 13 students that comprised the tutoring-intervention group.

Based on data collected in the fieldnotes one theme that emerges was that of student engagement. During the small group tutoring sessions, students were consistently engaged. The teacher-researcher did not have to redirect any students when they worked with unifix cubes to model addends to equal ten. All 13 students worked with their manipulatives correctly and created the correct models. Additionally, the students all recorded their work in their math notebooks during the activity. The theme of student engagement was also seen during the fact family lesson, when students had to model fact families using unifix cubes. Again, students completed the activity without redirection. They created the fact family model and recorded it in their math journal. During this lesson, students asked for their journals as soon as they began the tutoring session, and wanted to start recording in the journal before the end of the introduction. This same level of engagement was noted each time that unifix cubes and math journals were used as a part of the tutoring interventions.

Additionally, data collected from fieldnotes also supported the theme of confidence when discussing mathematical content. When students had to share examples of the fact families that they created using unifix cubes, all 13 students volunteered to share. Additionally, eight of the 13 students volunteered to share a second fact family model. Students also demonstrated confidence when discussing mathematical content during the word problem tutoring sessions. After students completed a word problem, they were given the opportunity to share their strategy with the group. Only three students were selected during each round of sharing but all students were encouraged to discuss similarities and differences between the three strategies as well as between the strategies presented and the student's own work. During the first discussion session, all 13 students shared a similarity or difference between the three strategies. Additionally 5 students volunteered to share a similarity between their own work and the example strategies.

During the final word problem tutoring session, all 13 students answered all four questions. Each student shared a similarity and a difference between the three example strategies, and each student shared a similarity and a difference between their own work and the example strategies.

Discussion

Conclusions

In order to determine if CGI-style tutoring interventions improved student achievement, attitude, and classroom participation, students completed a series of pre and post-assessments. Students in both the general classroom instruction group and the tutoring intervention group completed pre-assessments prior to the tutoring interventions, and they also completed post-assessments at the concussion of the 8-week tutoring interventions.

In order to determine the effect of CGI-style tutoring interventions on student achievement, students in both the tutoring intervention group and the general classroom instruction group (*n* = 26) completed a 19-question pre and post-assessment. When examining academic achievement both the group average and group mean increase from the pre-assessment were analyzed. The general classroom instruction group (*M* = 72.00) scored 9.31 points higher than the tutoring intervention group (M = 62.69) on the post-assessment. These data were inconsistent with the findings of Fuchs et al. (2013a) study which suggested that students who received tutoring interventions scored higher on assessments that students who did not receive tutoring interventions. However, when the mean increase from the pre-assessment was analyzed, the data showed that the tutoring intervention group (*M* = 33.54) had a higher mean increase than the general classroom instruction group (*M* = 20.00). Comparison of the groups' data showed that while the students in the tutoring intervention group did not outscore the general classroom instruction group in terms of test score, they did outperform in terms of academic progress. However, comparisons also showed that students receiving tutoring interventions will have a larger increase in their scores from the pre-assessment to the post-assessment. These findings support Fuchs et al. (2013a), who stated that tutoring interventions helped close the achievement gap. Jitendra et al. (2013) also found that tutoring interventions helped close the achievement gap based on an increase in student growth. However, Rothman and Henderson (2011) found that students who received tutoring interventions outperformed students not receiving tutoring in both growth and overall scores on standardized tests, which was not the outcome of the current study.

The effect of tutoring interventions on students' attitudes toward mathematics was measured using a pre and post-assessment attitude survey. The data was compared using both mean change and mean post-assessment score. Both comparisons found statistically insignificant changes. The lack of statistical significance when comparing the data showed that the tutoring intervention did not have an effect, either positive or negative, on students' attitudes toward mathematics. This finding is consistent with the findings in Mecee and Wingate's 2010 study, which determined that student attitude was not dependent on external factors or instruction strategies; instead, it was greatly influenced by teacher expectations. However, both Lent (2012) and Fusch et al. (2013b) suggested that tutoring is an effective way to build background knowledge, which can in turn improve students' attitude toward mathematics. While the increase in background knowledge was not measured as part of the current study, the data do not support the improved attitude toward mathematics reported in Fusch et al. (2013b) and Lent's (2012) studies.

Classroom observation checklists were used to measure the effect of the tutoring interventions on students' classroom participation. The checklists were administered by both the teacher-researcher and other second-grade homeroom teachers during the pre and post-assessment windows. The average classroom participation score and the average score increase of the general classroom instruction group and the tutoring intervention group were compared. When the data were compared, the results were not statistically significant. The general classroom instruction group had a higher average participation score for both CGI instruction ($M = 20$) and small group instruction ($M = 18$), while the tutoring intervention group had a higher average participation score ($M = 17$) during whole group instruction. When the mean increase of both groups was compared, the general classroom instruction group showed a higher mean increase in whole group instruction ($M = 0.77$), while the tutoring intervention group had a higher mean increase in both and small group instruction ($M = 0.67$) and CGI instruction ($M = 0.46$). However, as the data did not reach statistical significance for CGI instruction ($p = 0.27$), small group instruction ($p = 1$), or whole group instruction ($p = 0.26$), no relationship can be proven between tutoring interventions and classroom participation. These comparisons suggested that tutoring interventions do not have an effect, positive or negative, on classroom participation in math among second-grade students. This conclusion differs from the findings of Porter's 2005 study which suggested that closing the achievement gap can increase student confidence and participation.

Significance/Impact on Student Learning

The purpose of this study was to determine the effect of tutoring interventions on academic achievement in mathematics. This achievement directly related to the concept of the achievement gap, which is the academic difference between low performing students and the average academic performance of grade level peers (Porter, 2005). In order to close the achievement gap, students in the lowest performing subgroup must make continual gains in order to score closer to the mean score within their grade level (Mecee & Wingate, 2010). When academic achievement data on the post-assessment were compared for both the tutoring intervention group and the general classroom instruction group, the tutoring intervention group (M = 33.54) showed a statistically significant 13 point higher mean increase from the pre-assessment to the post-assessment. These data suggest that after-school CGI style tutoring interventions result in larger academic gains, which can in turn work to close the achievement gap.

When students completed CGI-style interventions, they solved one word problem and then participated in a teacher-lead discourse. Students shared how they solved the problem, compared strategies and discussed similarities and differences among the strategies used. The variety of strategies allowed students to build a deeper knowledge base of the fundamentals necessary to solve more complex word problems (Jitendra et al., 2013). This dialogue allowed students to view multiple problem solving strategies and discuss the process involved in each different strategy. The use of dialogue and student centered discussion is essential in understanding more complex mathematical concepts (Lent, 2012). The student attitude survey comparisons did not result in statistically significant data to support this impact. However, student achievement data supports the claim that students who received tutoring interventions mastered complex mathematical concepts, as there was a statistically significant increase from the pre-assessment and post-assessment within the group.

Additionally, Fusch et al. (2013a) suggested that tutoring is only effective if the tutoring intervention used effectively targets the needs of the students. The statistically significant mean increase among the CGI-style tutoring intervention group suggests that this specific style of tutoring is effective at closing the achievement gap. The diversity within the intervention group also suggests that CGI-style interventions effectively improve academic achievement across gender, racial, and special services subgroups.

Factors Influencing Implementation

Throughout the course of the study several factors influenced the implementation of the intervention. Because the intervention occurred after school hours during dismissal, the intervention students were subject to interruptions from announcements for bus call. The dismissal process changed during the first week of the tutoring intervention due to technical issues, and rather than dismissing busses over closed circuit television, individual busses were called over the school-wide intercom. Each tutoring intervention session was interrupted a minimum of 7 times due to busses being called over the intercom system. Each time the intercom came on, students stopped working to listen to the announcement. This caused students to lose focus and interrupted the flow of the tutoring sessions. These announcements continued distraction also caused students with attention issues to become off task after each announcement. This change in dismissal only negatively affected the tutoring intervention, because there were no school wide announcement made during the general classroom instruction time.

Additionally, during the course of the study, there was a change in the district math pacing guide. This change affected students in both the tutoring intervention group and the general classroom instruction group, as it caused all second-grade teachers to change their lesson plans. However, because the second-grade teachers planned together and followed the same pacing guide, this change did not negatively affect any of the classroom instruction. The same standards were still taught to all students at the same time. However, this did cause the pacing of the interventions to be sped up in order to accommodate for the change in grade level curriculum pacing. As a result, one less week was spent working on base ten skills, and an additional week was spent working on CGI-style word problem interventions. This change in pace did however allow students to practice solving new word problem formats prior to seeing them on the benchmark.

The final factor that influenced implementation was student attendance. The students selected for participation in the study were students who currently struggled in math. However, many of those students also had attendance issues meaning that they had already missed 10 or more days of school during the 2015-2016 school year. Thus, 8 of the 13 students missed at least 1 day of after-school tutoring interventions. Of the 8 students who missed 1 day, four students missed 2 days, and one student missed 4 days of after-school tutoring. This habitual absence caused these students to miss out on fundamental skill practice. Unfortunately, student attendance is often an uncontrollable factor on the teacher's part. However, due to repeated absences, five students missed at least 2 days of tutoring interventions, which could have negatively affected the usefulness of the intervention for those students.

Implications and Limitations

The implications of this study affected both the teacher-researcher and the research school. As a lead teacher, the teacher-researcher was in charge of developing professional learning plans for the grade level. Because the results of the study suggest a significant increase in academic achievement and a medium effect size, the teacher-researcher developed a CGI-style tutoring protocol for the following school year. Additionally, because the research school was designated as a focus school, they had to focus on improving the performance of the bottom 25% and closing the achievement gap. The research analysis within this study provided statistically significant data to support the use of CGI-style tutoring interventions as a means of improving academic achievement and closing the achievement gap. While the study focused on second grade students, CGI-style interventions are not grade specific, and can be implemented with any age student.

The implications of this study affected other schools within the research county as well, because three other schools were designated as focus schools for the 2016-2017 school year, and they needed to identify effective interventions. Additionally, CGI-style interventions would be easily implemented as the focus school's county provided free CGI professional learning for all teachers within the county. By providing the necessary training for this intervention, the county prepared teachers to implement it within their classrooms. When a teacher is familiar with a concept, they are more confident, and can more effectively teacher their students (Giest, 2015).

In order to share the results of the study within the research-school and the county, the teacher-researcher developed a professional learning presentation. The academic achievement data was shared with other teachers since it was the only data to provide statistically significant results. Additionally, the teacher-researcher developed a CGI-style tutoring plan for each grade level for the upcoming school year. This plan focused on the intervention methods used within the study. The professional learning presentation was also presented in the county teaching and learning bulletin, and the teacher-researcher created general CGI-style intervention plans for use at other schools within the county.

Although the study produces statistically significant academic achievement results, there were also limitations. Due to testing time-lines the study took place over an 8-week period. The study could have produced more accurate results if the interventions lasted an entire semester or school year. The additional time could also have produced statistically significant classroom participation and student attitude results. Additionally due to participant limitations only 26 students participated in the study. A larger number of participants from a variety of elementary schools would have provided a more diverse participant group. A larger participant group could also provide more detailed results that could be analyzed and compared by subgroup.

While the results of this study suggest that CGI-style interventions improve academic achievement, they may not be effective in all school settings. The research school was located in a rural area of north Georgia, and no urban students participated in the research study. Additionally, the teacher-researcher and other teachers within the county received CGI professional learning prior to the use of CGI-style interventions. If teachers do not have the proper background knowledge of CGI the interventions may not be as successful.

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Appendix A

Attitude Toward Math Survey

Thank you for your participation in this voluntary survey. You may stop the survey at any time. Your responses will remain private. If you have any questions during the survey, ask your teacher. By completing the entire survey, you provide consent for participation.

Directions: Read each question aloud to your students and have them mark their answer.

	No	Don’t Know	Yes
I like math.			
Math is my favorite subject.			
I enjoy solving word problems in math.			
I make good grades in math.			
Math is easy for me.			
I am as good as or better at math than most students in my class.			
I enjoy learning new concepts in math.			
I am comfortable explaining my answers to the class during math class.			
I feel comfortable asking questions in math class if I do not understand.			
When I work on math I feel calm and confident.			

Appendix B

Classroom Engagement Checklist

Protocol: Observe each participant of the study during their math instruction. The observational period should last the entire length of the math lesson. The observation will be broken down into 3 sections: CGI instruction, whole group instruction, and small group/center rotations. At the completion of each instructional period, the student's engagement will be rated using the checklist below.

Name of Observer: ____

Student: ___________________________ **Classroom Teacher**: ____________________

Date of Observation: _______________ **Time of Observation**: ___________________

CGI Instruction

OBSERVATIONS

	Very High	High	Medium	Low	Very Low
Positive Body Language	❒	❒	❒	❒	❒
Students exhibit body postures that indicate they are paying attention to the teacher and/or other students.					
Consistent Focus	❒	❒	❒	❒	❒
All students are focused on the learning activity with minimum disruptions.					
Verbal Participation	❒	❒	❒	❒	❒
Students express thoughtful ideas, reflective answers, and questions relevant or appropriate to learning.					
Student Confidence	❒	❒	❒	❒	❒
Students exhibit confidence and can initiate and complete a task with limited coaching and can work in a group.					
Fun and Excitement	❒	❒	❒	❒	❒
Students exhibit interest and enthusiasm and use positive humor.					

Small Group Instruction/Center Rotations

OBSERVATIONS

	Very High	High	Medium	Low	Very Low
Positive Body Language	❒	❒	❒	❒	❒
Students exhibit body postures that indicate they are paying attention to the teacher and/or other students.					
Consistent Focus	❒	❒	❒	❒	❒
All students are focused on the learning activity with minimum disruptions.					
Verbal Participation	❒	❒	❒	❒	❒
Students express thoughtful ideas, reflective answers, and questions relevant or appropriate to learning.					
Student Confidence	❒	❒	❒	❒	❒
Students exhibit confidence and can initiate and complete a task with limited coaching and can work in a group.					
Fun and Excitement	❒	❒	❒	❒	❒
Students exhibit interest and enthusiasm and use positive humor.					

Whole Group Instruction

OBSERVATIONS

	Very High	High	Medium	Low	Very Low
Positive Body Language	❒	❒	❒	❒	❒

Students exhibit body postures that indicate they are paying attention to the teacher and/or other students.

Consistent Focus	❒	❒	❒	❒	❒

All students are focused on the learning activity with minimum disruptions.

Verbal Participation	❒	❒	❒	❒	❒

Students express thoughtful ideas, reflective answers, and questions relevant or appropriate to learning.

Student Confidence	❒	❒	❒	❒	❒

Students exhibit confidence and can initiate and complete a task with limited coaching and can work in a group.

Fun and Excitement	❒	❒	❒	❒	❒

Students exhibit interest and enthusiasm and use positive humor.

Appendix C

Field Notes

Date	Observations