ABSTRACT

Elizabeth Pendleton Pierce, BUILDING CONFIDENCE AND COMPETENCE: EXPLORING THE IMPACT OF PEER TUTORING ON HIGH SCHOOL MATH PERFORMANCE AND SELF-EFFICACY (Under the direction of Dr. Travis Lewis). Department of Educational Leadership, May 2025.

Multiple factors contribute to schools nationwide having an increasing number of teacher vacancies upon the start of each school year. Pay dissatisfaction, high workload, increased expectations with paperwork, and concerns with educational policy are among the reasons that teachers indicate regarding why they leave the profession. With high levels of teacher departures and a diminished pipeline of incoming teachers to fill vacancies, school administrators must explore other strategies to maintain quality instruction. Peer tutoring is one such strategy and involves high-performing students assisting their peers to provide academic support. Often, there can be social-emotional benefits from peer tutoring as well.

At Traditional High School, following the COVID-19 pandemic, math scores were trailing behind the state average. A peer tutoring program was identified as a viable strategy to improve math scores, address the math achievement gap at the school, and place another person in the classroom to help remediate struggling students. This inquiry aimed to examine the effects of this peer tutoring program framework on student attitudes, math achievement, and self-confidence. Using a mixed-methods approach, data from state testing, student surveys, and teacher and peer tutor interviews were collected and analyzed to evaluate how peer tutoring impacted growth and academic success. Findings indicate that peer tutoring increases student attitudes toward math, student self-efficacy, and student achievement in mathematics. The framework implemented for peer tutoring may be replicable in other content areas and similar instructional setting. The findings also offer important insights for improving math performance outcomes and easing the strain caused by teacher shortages in similar schools.

BUILDING CONFIDENCE AND COMPETENCE: EXPLORING THE IMPACT OF PEER TUTORING ON HIGH SCHOOL MATH PERFORMANCE AND SELF-EFFICACY

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DEDICATION

To mama who taught me to be fiercely independent and confident in the ability to always take care of myself and work hard, I carry you always in my heart. You still give me the ambition to do challenging things. To my daddy who never excepts an excuse, always listens and makes me laugh, and believes in me completely, I am forever grateful to you and so thankful that you are my daddy. I love you and thank you for always being the best.

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To my children, Zachary, Candace, Jackson, and Garrett, you are all the reason I do all that I do. I hope that this is just one stop along my journey that shows you how capable you are of anything, no matter how difficult it may seem. You are each my heartbeat and make me so proud. No matter what I may achieve, you will certainly be my greatest accomplishment and greatest joy. I love you so very much.

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CHAPTER 1: INTRODUCTION

Teachers are perhaps the most vital component of a school for student learning and growth. While research shows there is no national teacher shortage, the data also shows 45% of public schools with at least one vacancy (Wong, 2022). Moreover, the number of vacancies in higher poverty areas and special education positions is alarmingly higher than in others. The places that need highly qualified, dedicated teachers do not have that access. While poor compensation is a factor in attracting teachers to these schools, it is not the biggest issue with the teacher shortage from state to state (Tye & O'Brien, 2002). Increases in accountability, paperwork, the competition created for public education, high stakes evaluations, politics, flawed policies, and constant changes in expectations from states and administration are what those leaving or never entering the profession indicate to be the leading causes contributing to the teacher shortage. There is a growing exodus of qualified teachers leaving the profession to pursue other employment, and recruitment efforts are not addressing the underlying causes of the weak teacher pipeline (Strauss, 2017).

Teacher shortages are not a new issue (Ingersoll, 2001). Only a few decades ago, North Carolina was innovative in teacher recruitment strategies with the development of the North Carolina Teaching Fellows scholarship program, a four-year award that requires recipients to teach in a North Carolina (NC) public school for at least four years to repay the award (Schlemmer, 2022); pay incentive for teachers who hold or obtain master's degrees; and pay incentive for teachers who hold National Board Certification. For young men and women entering the teaching profession, obtaining National Board Certification offered a 12% increase in pay, while a master's degree offered a 10% pay increase. Toward the end of the 1990s and early 2000s, these incentives and furthering a professional learning for educators was no longer

the primary focus for legislators (Berry & Shields, 2017). After the recession in 2009, programs like the NC Teaching Fellows were cut by the NC legislature, only to return in 2013 on a much smaller scale. Only select universities kept the program at all, and others only admitted a fraction of the students traditionally enrolled. Additionally, teachers no longer received incentives to further their education with a graduate degree. Health insurance was no longer free to educators, their retirement packages were not as lavish, and when new educators retire, they would not receive benefits at all. These factors contributed to the growing NC teaching shortage (Schlemmer, 2022). Furthermore, individuals who entered the profession could not have anticipated the emerging need for active shooter drills as a pressing reality, nor the exposure to students experiencing severe poverty, the financial losses incurred over time, the erosion of autonomy within their classrooms, the diminishing resources amid policies that may negatively impact students, and the growing competition for public education created by the North Carolina Department of Education (Strauss, 2017). Such challenges discourage teachers from remaining in the classroom.

K-12 students are emotionally, socially, and academically behind, and there are not enough people entering the field of education to meet the needs required of our schools (Capp et al., 2018). As enrollment in teacher preparation programs steadily decreases at an alarming 35% in only five short years, teachers are rapidly leaving the profession to seek out various options in employment, retire, or disregard the profession altogether (Berry & Shields, 2017). With climbing student enrollment in schools and declining highly qualified teachers available due to the stress and changes seen in the profession, achievement gaps are increasing in Math at the school level without the main source of low teacher numbers being addressed by recruitment efforts (Ingersoll, 2001). When combined with stagnant and decreasing academic performance,

many schools are mired in a devastated place of low achievement and ineffectiveness. Research shows that success in goal achievement is directly related to math achievement, yet only 12% of high school seniors are proficient when they graduate (Dobbins et al., 2014). Math and science achievement is a predictor of how students will do in next steps of their education, as those who perform well possess more organizational skills and a motivation to succeed.

Administrators are having to find creative solutions with staffing and scheduling, while still ensuring students receive the quality of instruction necessary to become positive, contributing members to our society and economy. One such solution is the implementation of a peer tutoring structure. Peer tutoring involves successful students providing academic support to one another and assisting teachers daily in their classrooms (Johnson, 2017). In this structure, both the peer tutor and tutee gain knowledge about the skill in practice, and deficits in learning can possibly be addressed at a more saturated rate than with a teacher alone. Utilization of peer tutoring could prove quite beneficial when there is a teacher shortage in a content area or a need for a substitute teacher. Most importantly, learning from peers in smaller settings can help close achievement gaps and mitigate learning loss at a more rapid rate (Tang et al., 2021).

Background of the Problem of Practice

The site of this inquiry, a high school in eastern North Carolina which we will call Traditional High School (THS), a pseudonym, is no exception to the challenges of teacher shortages and low student performance facing U.S. public schools. A decline in math test scores is telling of this breakdown for the students at THS. On North Carolina's End of Course (EOC) exams, THS students are underperforming in Math 1 and Math 3 when compared to their peers across the state. It is important for all stakeholders to grasp where the students are starting and each goal that they need to reach to show growth toward proficiency. When assessments are

administered, student Growth is measured through a statewide tool, Education Value-Added Assessment System (EVAAS). For THS, EOC assessments are given to students for select courses at the end of each semester. EVAAS offers a projection number for each student, which serves as a goal for students to meet. After the assessment, EVAAS collects the data of these assessments, and growth is determined based on the students meeting the projection point. Proficiency is determined based on the number of students meeting the score considered to be on grade level.

A typical high school student will take one math a year beginning with Math 1 and ending with Math 4. Every student is responsible for receiving four math credits before graduation. However, some students are eligible to take Math 1 in middle school, allowing them to begin with Math 2 in high school. If a student takes two courses in math per academic year, they can have their math credits completed by their sophomore year. Math 1 is a standard Algebra class and Math 2 focuses heavily on Geometry standards. Math 3 is a continuation of both Algebra and Geometry. Math 4 is a combination of Math 1-3 but with more of a focus on functions and statistics. A student on track to receive their high school diploma and associate degree will enroll in Precalculus instead of Math 4. Math 1 and Math 3 are both state-tested in high school, with only one being a student's marker score. Those who enter high school taking Math 1 will use that course as their marker, while those who enter taking Math 2 will use Math 3 as their marker score.

Although there have been higher points in the achievement data over the years, scores at THS have plummeted from 44.7% to 21.6% in Math 1 from 2013 to 2022. To receive a proficient score, a student must receive a scale score of 548, a 63rd percentile, and 43% correct.

Math 3 is a continuation of Algebra and Geometry standards. THS resides at 34.9 proficient in Math 3 with the state designating proficiency at a scale score of 550, or 57th percentile, and a 57% correct (North Carolina Department of Public Instruction [NCDPI], n.d.).

While efforts have been made to lessen class size, hire highly qualified and effective math teachers for the classrooms, and provide teachers with the resources needed for effective instruction, adequate growth and proficiency outcomes have not been realized. Between 2016 and 2022, the school district in which THS resides, which we will call Traditional School District, or TSD, also a pseudonym, did not have one full year of instruction due to unforeseen inclement weather disasters and the COVID-19 pandemic response. This only deepened the academic issues, such as alignment and student engagement, that already existed. In 2020 when the response to the COVID-19 pandemic led to school closures, any progress in student performance that had been achieved was severed, leading to a "survival mode" for instruction.

TSD leadership knew something had to be done. All district and school leaders began an urgent feat for higher academic attainment. Beginning the school year with firm, yet simple non-negotiables, the plan of action proved successful. This time of accomplishment would also mark the time of the yearly environmental challenges. Each year, our district was forced out of the building for days or weeks at a time due to flooding from severe storms, hurricanes, or other inclement weather. Research indicates students who miss 10% of a school year will show less academic gains than peers of the same ability (Pyne et al., 2021). With each weather-related crisis, school leaders and district leaders of TSD met regarding how to help our students catch up on their missed learning and instructional time. Our school system met each adversity ready to overcome. School accountability data was at an all-time high for both growth and proficiency. Our graduation rate was at a record high. Dropout rates were at a record low. Nearly every

school was out of low-performing status. Our district was asked to attend and speak at multiple conferences regarding our incredible journey of high achievement. The district seemed to be at the highest of achievement points and still climbing when March 2020 arrived. COVID-19 affected the world and took us out of our buildings. There were detrimental effects on students' learning, although more severe in the lower grades where students are learning math and reading at a faster rate (Wyse et al., 2020). Research suggests student absenteeism, even during inclement weather, is connected to students not completing high school in their cohort. Student absenteeism during the pandemic shows that the top affected curriculum showing learning deficits in all grade levels was math, followed closely by science (Bennett, 2022). Teachers worked hard to keep students engaged in learning online, however, chronic absenteeism was at an all-time high during the COVID-19 pandemic response and throughout the transition back to in-person instruction in schools.

TSD uses a Multi-Tiered System of Support (MTSS) to provide students with strategies to overcome achievement gaps and social-emotional needs. More specifically, MTSS is a three-tiered framework that assists educators in supporting students through core instruction, targeted intervention, and intensive intervention depending on the needs of each student (Wyse et al., 2020). Each tier provides students with appropriate intervention that is specific to their area of need. Interventions at the core level provide instruction that everyone gets, tier 2 focuses on a targeted group of students that is approximately 12% or less of the whole group, and finally, the intensive tier provides a small portion of students with intense support. MTSS supports can include, reteaching, pre-teaching, small group instruction, peer tutoring, etc. When considering peer tutoring as a means of intervention for this inquiry, it is considered as both tier 2 and 3 strategies. Peer tutoring is one intervention of MTSS that can assist students in learning. Students

often feel more comfortable and confident in their abilities, knowledge, and academic struggles with a peer versus an adult (Ketterlin-Geller et al., 2019).

Context of Inquiry

THS is in a rural town in eastern North Carolina. While lacking in diversity for much of the school's history, it has recently seen a shift in demographics and is much more racially diverse. During the 2022-2023 school year, enrollment statistics indicated that approximately 45% of the student body identified as White, 27% Black, 14% Hispanic, 11% two or more races, and 3% Native American (see Figure 1). The average daily membership (ADM) indicates the total number of students that are enrolled in a school during a specific amount of time as set by the state of North Carolina (NCDPI, n.d.). In 2023-2024, our ADM is 766, with enrollment increasing over the previous three years from approximately 688 and 761.

THS has been in existence for almost 100 years, having been built in 1926 and first opening as a 1-12 grade community school (Hill, 2010). The community consistently verbalizes pride in the school and most families have multiple generations of graduates. It is common to hear from a grandparent picking up a child that they graduated from the school themselves. Approximately 30 students from within the district, as well as surrounding areas, submit transfer requests yearly with the intention of attending the school, which has contributed to increases in enrollment in recent years.

The school, as with all schools in the district, is considered a Title 1 school. Title 1 designation indicates that due to a high rate of students being classified as economically disadvantaged at the school, additional federal funds are provided to help the school acquire similar supports and resources that are often available to more affluent schools and families (Pangle, 2022).

While lacking diversity for much of the school's history, THS has recently seen a shift in demographics, as the school is now more diverse, showing more equitable percentages for all subgroups.

Math proficiency has been an ongoing challenge for THS. From 2013-2022, math proficiency has been well within or below the state average. With each passing year, efforts were made to increase proficiency and increase growth toward proficiency. Some years proved better than others, however, lacked any consistency.

Focus of the Problem of Practice

The focus of this inquiry is on the utilization of peer tutoring as a strategy to increase the math performance of high school students. Deficits in math achievement persist as does the demand for highly qualified teachers in the classroom. Instructional supports need to be explored to provide students with successful strategies to improve outcomes in math achievement. Peer tutoring is one potential approach to help begin to balance this unequal and unstable issue educators face (Falchikov, 2001). Other factors such as school closures and online instruction as a response to the COVID-19 pandemic only heightened issues for educators. Gregg and Shin (2021) examined the performance of students receiving face-to-face tutoring pre-COVID-19 versus online tutoring during the pandemic response. Their findings indicated improved performance for both groups.

While tutoring overall has demonstrated positive outcomes, additional research shows that lower-achieving students in high-poverty areas have higher success rates in math when paired with tutors, regardless of the tutors' ability in mathematics (Karsenty, 2010). This is possibly due to the increase in the tutee's confidence and acclimation with school, which further supports the notion that placing peer tutors in the classrooms can be extremely effective.

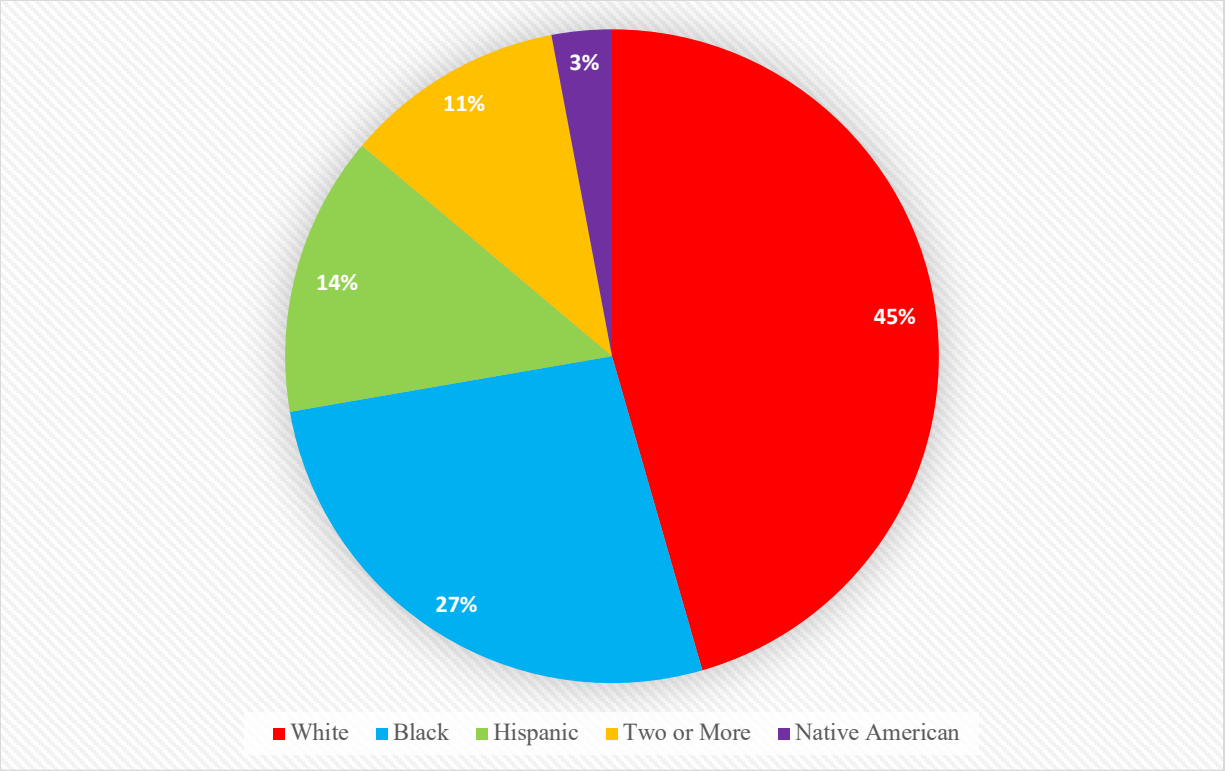


Figure 1. THS student race and ethnicity enrollment by percentage for 2023-2024.

This inquiry has the potential to impact every single student on the campus of THS. Each of our students takes math courses as part of North Carolina's Standard Course of Study and as a required course for graduation. Often, students come into high school unprepared and overwhelmed, including not possessing a basic understanding of math concepts and suffering from other deficits in their learning. For students wishing to attend a postsecondary institution, a lack of math knowledge and proficiency may exacerbate the difficulties many students already face when transitioning to institutions of higher education. Whether this is poor time management, a lack of organization, or an academic skills deficit, research shows a direct link between a lack of college preparedness and students' math ability (Thiry, 2019). When combined with classrooms that have vacancies or a teacher that is entering the profession uncertified, the utilization of peer tutors may change the trajectory of these students' educational journey by helping them achieve and feel capable in an area in which they all too often are frustrated and unsuccessful.

Inquiry Guiding Questions

The questions guiding this inquiry are as follows:

1. What effect does a peer tutoring program have on the improvement of students' attitude and mindset toward math?
2. How will the implementation of a peer tutoring program in Math 1 and Math 3 classrooms affect student growth toward math proficiency performance?
3. What effect does participation in a peer tutoring program have on the math self-efficacy of tutored students?

Multiple data collection instruments will be used to answer each of these questions thoroughly. For question 2, benchmark data, North Carolina Check-in data, EVAAS, EOC data

will be collected. This data will offer growth and proficiency data to allow me to determine if each student met their growth measure and if they are proficient for their age and grade. I will also collect focus group and interview data from all students and teachers involved to conclude what other factors, if any, other than peer tutoring led to the changes in the quantitative data. For questions 1 and 3, anonymous peer tutee surveys, teacher interviews, and focus groups of Math 1 and Math 3 students will be collected and analyzed. The inquiry partners will assist in the coding of data followed by thematic analysis.

Overview of Inquiry

This inquiry utilizes an explanatory-sequential, mixed methods design grounded in improvement science. I chose this method specifically as improvement science guides the implementation of strategies, in this instance peer tutoring, to remedy an issue that data shows exist (Perry et al., 2020). The explanatory-sequential, mixed methods designation is an apt descriptor of this inquiry as secondary quantitative math testing data serves as the impetus for the inquiry; however, qualitative data will need to be collected at the conclusion of the inquiry to fully determine whether the quantitative findings are the result of the peer tutoring program (Mertler, 2022).

To help with structuring and organizing this inquiry, I will conduct three phases of inquiry, with each phase driven by a plan-do-study-act cycle of continuous improvement. Plan-Do-Study-Act (PDSA) refers to a four-stage improvement model to assist in planning and carrying out a change, then continuing the cycle based on what is learned (Perry et al., 2020).

The first phase, Phase I, of the inquiry involved planning, secondary data collection, and selection of peer tutors and tutees. The second phase (Phase II) will entail the implementation of peer tutoring partnerships in the Math 1 and Math 3 classrooms, with ongoing support from the

administration and teachers. The final phase of the inquiry (Phase III) will involve the collection of post-implementation data and subsequent analysis.

Inquiry Partners

Several partners will play a crucial role in the implementation process of this inquiry. These partners will include those from both the district and the school level. The district partners consist of the following: the superintendent, the district Curriculum and Instruction Team (CIET), and the high school director. The school-level partners consist of the following: the School Improvement Team (SIT) members, the THS lead counselor, CARE Corps advisors, the THS administration team, the Math 1 and Math 3 instructors, and the student peer tutors. Engagement with inquiry partners throughout the inquiry will be documented through meeting notes.

Conceptual Framework

The Youth Mentoring Model

The Youth Mentoring Model is a conceptual framework that relies heavily on building positive relationships between two individuals in a mentor and mentee affiliation. In building affirmative rapport, the result is an increase in academics, positive behaviors, and social-emotional outcomes (Keller, 2005). Peer tutoring aims to improve students' math knowledge and achievement but to also help build students' confidence in the classroom and relationship-building ability.

Student Peer Assisted Mentoring

Student Peer Assisted Mentoring (SPAM) focuses on student engagement throughout the learning process. In this form of mentoring, it is theorized that if students act as teachers, and in doing so are assessing themselves and others, they will consistently remain engaged in their

learning (Duran, 2017). The framework closely follows Vygotsky's Zone of Proximal Development (ZPD). A student's ZPD is the actual level of understanding or ability compared to the potential understanding or development through guidance or collaboration with more capable peers (Eun, 2019).

Definition of Key Terms

The following terms will be used throughout this inquiry and are defined as follows:

Attitude – how a person responds to an event or something (Meral, 2019).

Average Daily Membership (ADM) – number of students enrolled in school within a specific time period (NCDPI, n.d.).

Cognitive Effect – of, relating to, being, or involving conscious intellectual activity (Baumert et al., 2010).

COVID-19 – a mild to severe respiratory illness that is caused by the coronavirus (Johns & Mills, 2021).

Curriculum – the courses that are taught by a school, college, etc. (Hilsdon, 2014).

Education Value-Added Assessment System (EVAAS) – Measures growth for school accountability and educator effectiveness (NCDPI, n.d.).

End-of-Course (EOC) Assessment – tool used to evaluate, measure, and document the academic readiness, learning progress, skill acquisition, or educational needs or students (NCDPI n.d.).

Growth – amount of academic progress that students make over the course of a grade or class (NCDPI, n.d.).

Highly Qualified – a teacher that has passed the PRAXIS II state test, has a graduate degree in content area, or is National Board Certified (NCDPI, n.d.).

Instruction – the act or process of imparting knowledge or skills to another (Dobbins et al., 2014).

Mindset – set of beliefs that shape how you make sense of the world (Cherry, 2022).

Professional Learning Communities (PLC) - made up of team members who regularly collaborate toward continued improvement in meeting learner needs through a shared curricular-focused vision (Reichstetter, 2006).

Proficiency - student has demonstrated competence in relation to a set of skills of identified standards (NCDPI, n.d.).

Standard - concise, written descriptions of what students are expected to know and be able to do at a specific stage in their education (NCDPI, n.d.).

Self-Efficacy – a person's belief in ability to achieve a goal (Cherry, 2022).

Assumptions

For this inquiry, it is assumed that math teachers are receptive to working with peers in their classrooms. Otherwise, teachers may wish to protect their instructional time, even when it is not utilized most effectively, and may not want anyone to invade that time. Additionally, it is assumed that teachers fully understand the content they are required to teach, and that the instruction is at a proficient level.

I assume that all math teachers align their instruction to the NCSCOS. Standards alignment ensures students are provided access to the appropriate curriculum required to experience growth and achievement. Finally, it is assumed that all participants, students and teachers, will be accurate, honest, and forthcoming in their responses.

Scope and Delimitations

The inquiry is intended to provide insight into THS math instructional challenges and the deficits many student learners face in Math 1 and 3. This inquiry will also provide potential benefits of allowing peer tutors to assist these students within these classrooms to help increase math growth in both areas toward proficiency.

To understand the effect of peer tutoring on student tutees' confidence, surveys will be administered anonymously to both the tutor and tutee. Students will be able to offer feedback on how the peer tutors helped them and if they felt more confident in their learning in class after being assisted by tutors. Tutors will be able to express truthful feelings on the tutoring process and the ease of building rapport with the classroom teachers and tutees. There will also be focus groups to include students in both Math 1 and Math 3 to gain feedback regarding the peer tutoring opportunity they have been given.

All students must take final assessments and End of Course state testing at the end of these courses, so the delimitations will not affect the inquiry. I will see the effect of peer tutoring on the growth of the students as evidenced by their growth measures in EVAAS, district benchmarks, and state check-ins.

Limitations

A possible limitation in the inquiry could include the lack of standard knowledge leading to a lack of effective knowledge for the student peer tutors. This will cause a direct negative effect on the instruction the student tutees receive while they are being assisted. In order to mitigate this limitation, I will require peer tutors to maintain a certain proficiency in classes, collect teacher recommendations prior to tutoring, and be fully proficient in the math course they are tutoring.

Another limitation is student attendance. THS currently has 690 students of the 740-student body missing a period of instruction during the semester. Attendance at the school is an issue. If the students not successful in Math 1 or Math 3 are not in class to receive instruction or assistance from the peer tutors, the inquiry results will be significantly limited.

Another potential limitation in the inquiry could be the student peer tutors' confidence and communication skill set. The peer tutors can be high achieving and knowledgeable of math content, but if they lack confidence when explaining to another or lack efficient communication skills, then the tutoring sessions will be less effective.

Significance of Inquiry

The purpose of this inquiry is to measure the impact of peer tutoring in both Math 1 and Math 3 classrooms, as these are state testing classes using End of Course assessments and are a part of the formula of student, teacher, and school accountability. These classes account for approximately 10% of the taught curriculum each semester. Pending successful outcomes, the future intention would be to expand this model to other areas in the school.

The results of this inquiry could offer strategies to assist students in the classroom to build confidence in struggling learners and increase math mastery. Other content area mastery could be increased should the strategy be extended to other courses.

Advancing Equity and Social Justice

Students come into the school building from all types of environments and learning capacities. Inequities are evident from one location to another regarding resources in classrooms and schools, the experience of teachers, mathematics knowledge of teachers, confidence of educators, or home internet. Some school systems lack the proper funding to equip teachers with the necessary resources and training to be successful in math classrooms. A structure such as

peer tutoring is a way to assist at-risk students while also increasing mastery of the peer tutees. (Morales et al., 2016) shows positive gains for both the peer tutor and peer tutee after several weeks at a high-poverty school where same-age peer tutoring was implemented.

The implementation of a framework with mentoring that focuses on building positive relationships to increase academic, behavioral, as well as social and emotional outcomes could possibly increase equity in a school that perhaps has deficits in these areas. Implementing a framework that focuses on the whole child and meets each child's individual needs is imperative to ensure equity in the classroom.

Advances in Practice

The findings from this inquiry may prove beneficial to increase math knowledge and scores for both the school and the district. This inquiry could increase the limited existent literature on the effects of peer tutoring at a secondary level and specifically on increasing mathematics scores. The inquiry may also advance our understanding of the impact of peer tutoring on the confidence of the peer tutees while assisting educators in classrooms and helping bridge deficits in math standards.

Summary

There are multiple advantages to the frameworks Youth Mentoring Model and Student Peer Assisted Model being implemented for students in high school while being peer tutored in math. The frameworks can contribute to higher student engagement and an increased desire to learn, even when that is difficult (Kirkham & Ringelstein, 2008). They can also reinforce positive relationships between mentor and student, whether that is peer to peer or peer to teacher (Keller, 2005).

The next chapter will elaborate more on the research underpinning the conceptual frameworks applied in this inquiry and offer more insight on the research-based reasonings of why students have academic struggles in the first place. The chapter will also focus on the existent literature of the curriculum, self-efficacy of students, and mindset of educators. Chapter 3 will move into the methods used in the inquiry and the Plan-Do-Study-Act cycles, while Chapter 4 will review the results of the inquiry, and the data collected. Finally, Chapter 5 will summarize the inquiry and establish the next steps based on the inquiry's determining factors.

CHAPTER 2: REVIEW OF LITERATURE

The purpose of this inquiry is to measure the impact peer tutoring causes on student growth and mastery in math as well as student self-efficacy and confidence. This chapter examines two conceptual frameworks that act as windows allowing for the inquiry to be explained and analyzed. The Youth Mentoring Model allows for the social and emotional needs of the youth involved in the inquiry to be met. The Student Peer Assisted Mentoring framework, like the Youth Mentoring Model is critical in the inquiry as it implements peers working alongside youth to assist in academics and social settings.

In addition to the frameworks, this chapter provides a review of literature on current math achievement crisis that also leads into a teacher pipeline issue. The role of environmental factors influencing education and mathematics is also examined, along with a deeper probe into self-efficacy.

Conceptual Framework

Two researched frameworks could prove beneficial in this inquiry. Youth Mentoring Model (YMM) and Student Peer Assisted Mentoring (SPAM) seek to develop skills in both the tutor and tutee in multiple facets (Kirkham & Ringelstein, 2008). By utilizing both YMM and SPAM in this inquiry, and allowing them to web into one another, students can develop a deeper level of their own understanding in math and school in general, while developing the necessary skill sets to become more successful in all aspects of life. If all inquiry partners understand each framework and how they coexist in this inquiry, they can look through the lens needed for students to become independent learners and become capable individuals.

Student Peer Assisted Mentoring

SPAM uses three overarching principles that the peer tutor or mentor can work with the tutee or mentee on. This could work directly from class on a certain skill set by utilizing a scaffolding reciprocal approach, self-help to ensure the learner is becoming an independent worker, and lastly, meeting to address a tutee's academic or emotional needs. Kirkham and Ringelstein (2008) state that SPAM has been highly effective in building student retention and learning at a much deeper level for both tutor and tutee as they are both held accountable for learning. The tutor is learning more leadership skills-based abilities, while the tutee is crafting the academic skill in a less threatening manner due to the strong rapport offered by a peer relationship. SPAM offers students a sense of belonging. They are both learning to be a teacher in a way and learning self-motivating ways to want to increase their success. One student may feel a lack of confidence, making them feel less likely to be involved in classroom or school activities, while another student may find it difficult to make friends due to their higher academic abilities. SPAM can build the confidence of both, increasing confidence and helping students find a sense of belonging (Pye et al., 2016). SPAM is like Vygotsky's Zone of Proximal Development. There is an actual level of understanding and a potential level of understanding that a student can certainly get to through the guidance or collaboration of a capable peer (Eun, 2019). The key is to keep students engaged in their learning, allow them to assess themselves and others, and feel as though they have the potential to mentor or teach others. This is what SPAM seeks to help students accomplish (Duran, 2017). Aside from possessing effective teaching strategies, the SPAM framework could help students increase their confidence in the school and in all of their classes. They will feel they have a person to really rely on and make them feel

comfortable, in turn making them more confident in their academics. Figure 2 illustrates Vygotsky's ZPD.

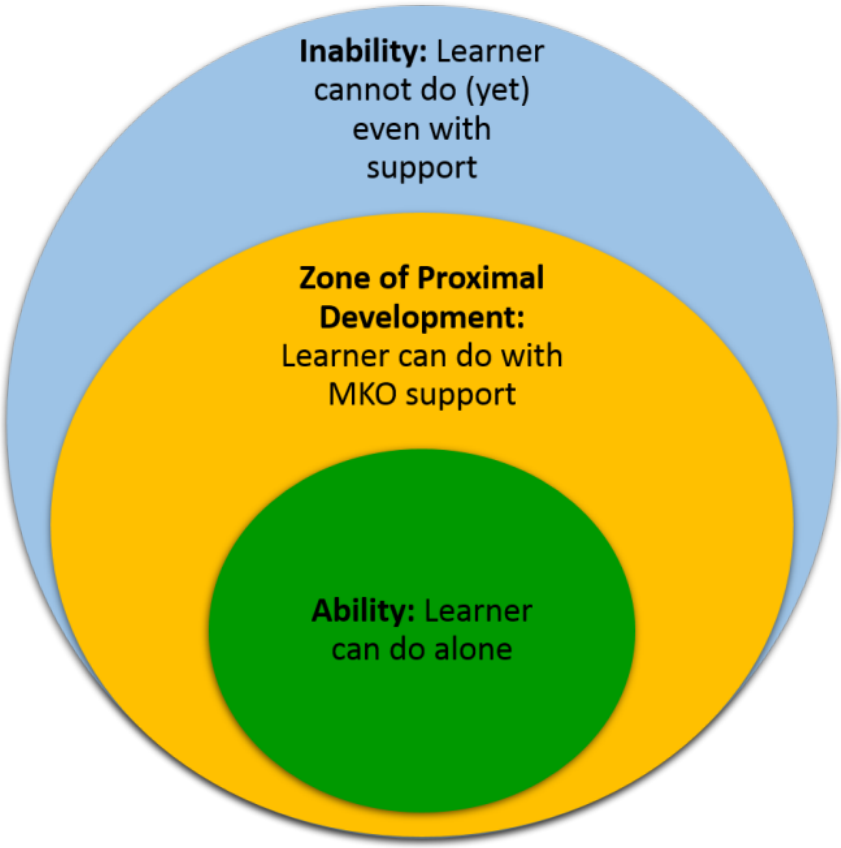
The Youth Mentoring Model

The Youth Mentoring Model (YMM), resembling SPAM, works through positive relationships and student engagement. YMM reinforces relationships that can be complex. This may be a network of relationships between a child and another child, or a child and an adult or mentor (Keller, 2005). This framework is built on the belief that through trust in a mentoring relationship, students will improve in their social-emotional development, academic development, and socially. By doing so, relationships will improve at home and at school causing better behaviors, grades, and emotional state (Dubois et al., 2011). Perhaps one of the most important aspects of YMM is that this framework in a realistic setting does not have to be huge moments full of success. Instead, it may be many small, boring moments, even frustrating moments, using humor, or vulnerable moments that help form bonds (Rhodes, 2005). Much like parenting, children need to feel that they can speak about things without feeling threatened by someone who is positive and models appropriate behaviors. Tutors can act as a security blanket for some students and help with other relationship matters students are dealing with.

Like SPAM, YMM can help increase students' confidence socially and emotionally, allowing them to feel that same confidence in the academic setting. Figure 3 illustrates the connections between building encouraging mentoring relationships and the positive outcomes in academics and social-emotional needs in students.

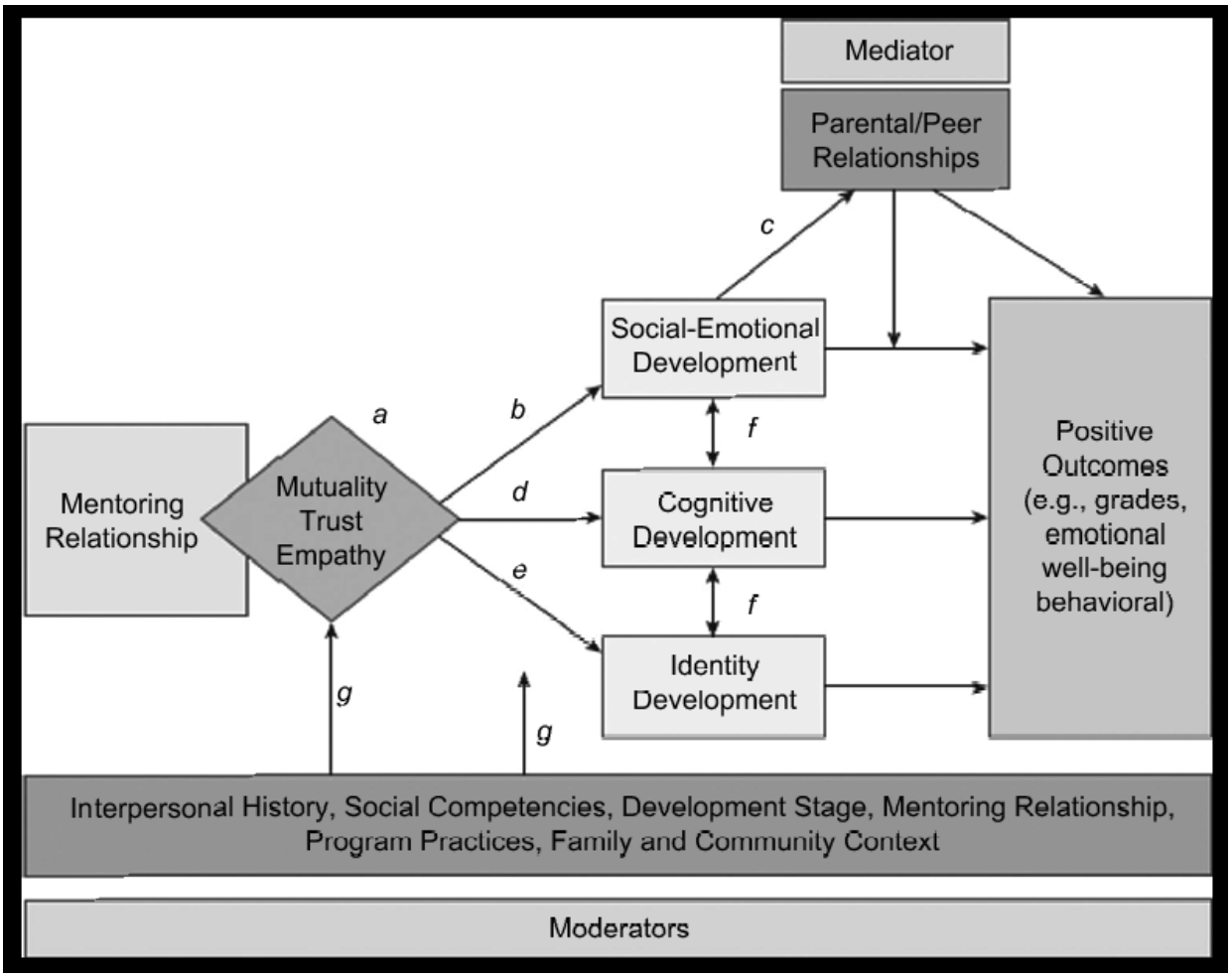
Understanding the Math Achievement Crisis

Multiple pieces contribute to the puzzle of the math crisis education is currently facing. The lack of trained teachers in classrooms, resources and funding in schools, single-parent



Note. (Salmon, n.d.).

Figure 2. Vygotsky's Zone of Proximal Development.



Note. (Dubois, 2011).

Figure 3. The Youth Mentoring Model framework.

homes, and discrimination toward minorities and female students are a few of the barriers presented in the research (Di Martino & Gregorio, 2019). Research states that by 8th grade, only basic math skills are taught and rarely mastered by students, leading to current educational reform agendas. Only 12% of high school seniors are considered proficient in math when they graduate and move to higher education or the workforce (Dobbins et al., 2014). Leaders are focused on Curriculum-Based Evaluation (CBE) and Curriculum-Based Measurement (CBM) tools in hopes to begin closing achievement gaps in mathematics, meaning schools progress monitor students' performance as well as hold teachers accountable for their teaching strategies through consistent, frequent assessment (Kelley et al., 2008). There is a strong relationship between science and math. Science is not fully and holistically taught in elementary settings, adding to the mathematics crisis. Pushing certain curricula aside has created a lack of engagement for students and caused a lack of creativity in planning from teachers. The demise of hands-on lessons, cooperation, participation and discussion, and beneficial field trips for students has contributed to less engagement for students. Perhaps this issue is due to the consistent budget fluctuations for math and science education. Federal budgets have ranged year to year from 13 million to 54 million, then from 4 million to 125 million (Di Martino & Gregorio, 2019).

The Impact of Curriculum and Pedagogy

Districts, schools, school leaders, and teachers are held accountable for students to meet all academic achievement goals as set forth by the state (Bal, 2016). Each day, teachers are expected to give students high-quality instruction and pedagogy, however, it must be considered that not all teachers are receiving the proper training before instructing students to successfully do this. Individual learning support for teachers' pedagogical content knowledge is needed for lower-than-desired student achievement (Baumert et al., 2010). Teacher content knowledge is

crucial. When teachers do not have a clear understanding of what they are responsible for teaching, or a focus of pedagogy, students show a lack of engagement. Student engagement is critical for success in mathematics. The direct relationship in decreased risk of dropout rates and student engagement is extraordinary (Duran, 2017). Multiple curricula have been researched to study the effectiveness of multiple teachers in different and diverse classroom settings. Some show more effectiveness than others, however, all with several criteria in common. The most effective curricula depend on the teacher's mathematics knowledge, teacher's attitude toward mathematics, and the need for differentiation in classrooms (Agodini & Harris, 2016).

One possible cause of the lack of standard knowledge is that there are teachers in classrooms that are not fully licensed. These teachers are more likely to be underprepared to instruct in certain subjects yet hired to teach students because a highly qualified teacher cannot be found. These teachers are in almost all schools nationwide, especially in high-poverty areas where highly qualified teachers are needed the most. These teachers may lack successful teaching strategies and lack profundity in lesson planning and their learning (Starr, 2012).

Teacher Pipeline

When a teacher feels they lack knowledge in their curriculum, they feel inadequate. They feel unprepared and are unprepared. They are unable to complete their assignment for students and be effective in their classroom. This can and will lead to frustration and further the academic learning gap, but is not the only existing issue in education that teachers face and that is causing teacher vacancies (Chappel, 2018). Not only is student achievement in mathematics a crisis, but there is also a crisis in the lack of qualified math teachers available to teach. We have schools filled with under-qualified staff and inexperienced administration overseeing instruction that continues to layer issues to our mathematics problem (Posamentier, 2003). Research does not

prove that we do not have enough teachers to replace those that retire. In fact, nationally there are enough when many states look at the numbers. However, education graduates site financial issues or lack of satisfaction in an internship as the largest reason for not entering the profession officially in some areas (Moeller et al., 2016). Many teachers, particularly in math and science, state there is no incentive to stay and leave the education field altogether (R. Ingersoll & Perda, 2009). Schools have had vacancies yearly in the past as the school year began. They may have had several within a district that they could not fill. However, there are currently critical areas that lack teachers in math, science, exceptional teachers, and English Language Learners.

COVID-19 created a larger deficit in vacancies as many teachers over 50 made the decision to retire, others could not handle the increase in discipline issues, and some realized they enjoyed the virtual setting. With teachers being skilled in so many areas, this made it simple to make a career change, most times being offered more money (Gunn & Latham, 2022). It is more critical than ever for districts to recruit math and science teachers to prepare students for future career options. The hiring crisis is leading many districts to hire part-time teachers and unlicensed teachers (Losi, 2005). Some districts are offering signing bonuses to retain or recruit often upwards of $20,000 in North Carolina. Universities are not only graduating less students in traditional teacher preparation programs but also in other program areas causing fewer alternative licensure teachers as well (Gunn & Latham, 2022). There is a significant decline in math graduates that are willing to become teachers. When surveyed, students state this decision is due to students' experiences during their own math instruction (Di Martino & Gregorio, 2019).

Mindset

The teacher mindset is most often the first step of success in a classroom. It can hinder or help create student accomplishment. When students are assisted with learning and motivation

through pedagogy in the classroom, they will feel as though they can meet their goals (Arco-Tirado et al., 2011). Perhaps one of the most beneficial outcomes of a positive mindset in the classroom is the optimistic relationships between student and teacher, and the self-esteem that is dramatically increased for the student (Morales et al., 2016). How teachers view curriculum, standards, and student success will determine how students achieve (Raymond & Reeder, 2020). Student growth is measured by how students communicate their feelings about their learning, their scores, understanding of their achievement, testing data, and motivation in school. If a teacher supports and utilizes peer reciprocal tutoring in class, both the tutor and tutee have the potential to improve in academics and emotional well-being. Appropriate communication can be modeled, social skills have the capability to improve, and understanding can grow, but it all begins with the teacher's willingness to accept this mindset (Ansuategui & Miravet, 2017).

In summary, multiple factors contribute to the mathematics crisis educators are currently facing. There seems to be no quick answer to the ongoing issue to help eliminate the achievement or hiring issues. Teachers must be well-trained, receive on-going support, and fully know and understand what they are responsible for teaching. Educators must keep the positive mindset and be open to unique pedagogy and strategies, such as peer tutoring structures, to help support student and remove barriers in classrooms to promote self-esteem and growth in math achievement.

Environmental Factors Impacting Achievement

Several environment factors impact achievement for all students. Environmental factors are most often those elements that are unavoidable. When such dynamics occur, students must keep learning, but often in simply the best way offered or available depending on the severity of the situation.

COVID-19

From teacher hiring to the student attendance issues, there is not much in education or the entire world that COVID-19 has not affected. Everything changed as the virus spread through the world and, even as things get back to a new normal, we are forever altered. TSD shut down in March 2020 for the remainder of the school year and set up online only. We reopened virtually in the Fall of 2020, then moved to two days a week for students. The following year we opened fully to all students. One change COVID-19 caused is the stress it put on educators. While schools tried to keep learning consistent online, most students struggled to keep up and to effectively learn (Johns & Mills, 2021). The most severe learning loss was in the lower grades where students are learning at a faster rate for math and reading. Schools are now leaning into intervention structures such as Multi-Tiered Support System (MTSS) to enable students to catch up, but many students are still at a detrimental point in learning (Wyse et al., 2020). While COVID-19 did help some students no longer be no-shows in their classes as they could join with just a click, it still did little to address their engagement in their learning and mastery of curriculum (Gregg & Shin, 2021). With the return to traditional learning formats, many students have still opted to stay online (Wyse et al., 2020). The data is still not clear on the general picture of how great the learning loss is, however, at THS is feels significant.

Non-Health Factors

During COVID-19, THS like most other schools across the nation had plans in place for online learning. That has not always been the case for missed instruction, nor is it the case now for days missed due to inclement weather or other events. Research suggests student absenteeism is likely connected to students not completing high school (Bennett, 2022). They get behind and it is too overwhelming trying to catch up. This creates detrimental effects for student

achievement, especially in math. There is a direct correlation with absences and instructional time being missed due to weather, such as snow, flooding, or tornados.

Beginning in the 2016-2017 school year, TSD did not have one uninterrupted school year until 2022-2023. Some school years received more devastating inclement weather than others pre COVID-19. For example, two years our district was out of school for several weeks and hundreds of students were displaced from their homes due to flooding. Local schools were damaged and THS was used as a Red Cross shelter for multiple weeks serving hundreds of community members and neighbors. Other years, we were only out for a week to two weeks for ice and snow.

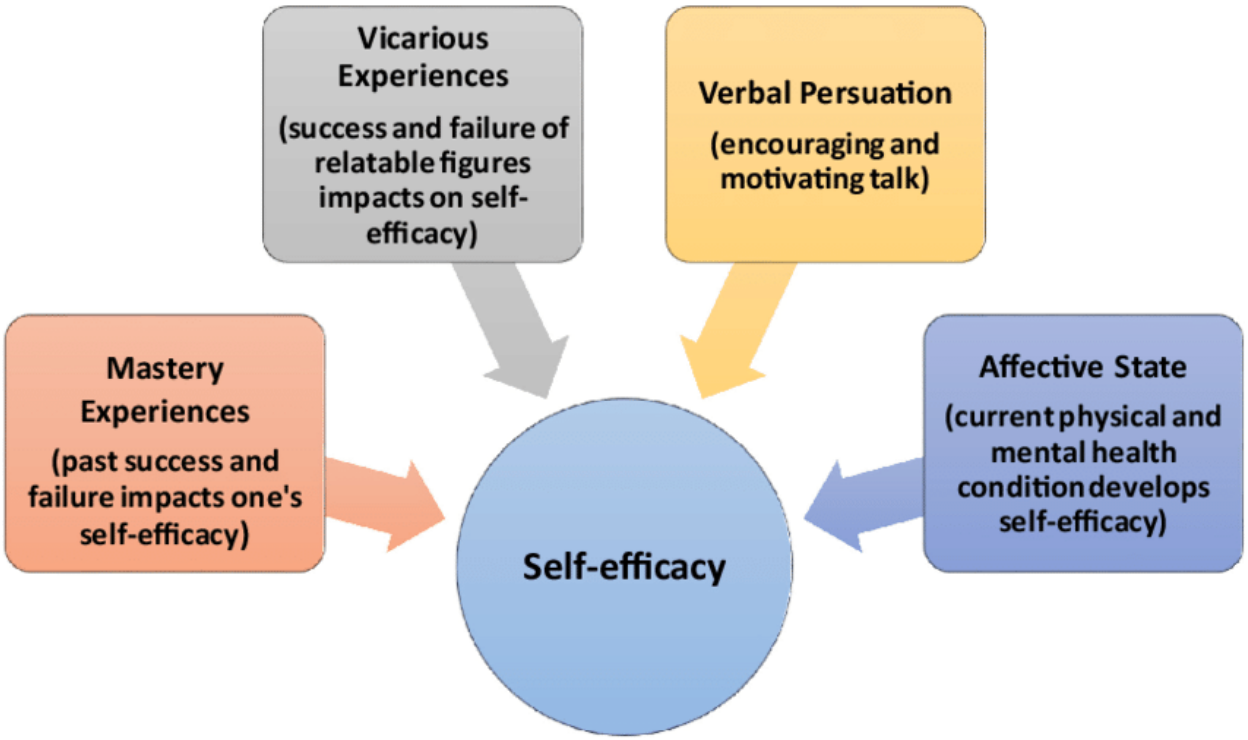
Aside from weather incidences, there are many other factors contributing to lack of achievement. There is a yearly fluctuation in education budgets. It can go from 13 million to 54 million to 125 million within three years' time. One in three students go home to no adult present to help with homework or to provide food. Many are in single family homes that lack resources. One out of five students live in a non-English speaking home (Almaguer, 2005).

Most youth lack creativity, interest in civic issues, and work ethic in comparison with previous generations (Twenge, 2013). According to Twenge, young students know what they want and have high expectations, however, lack the work ethic to obtain those goals. This could potentially present an issue in required school curriculum because some students simply feel that math is not necessary for real life regardless if it is required for a diploma (Dobbins et al., 2014). Students do not feel that certain curriculum is relevant or important for them and their future goals, especially if they find it difficult. Accompany that with how some teachers view their content and standards which creates a lack of alignment and less than desirable mindset, and a student is in for a no win and no learn situation (Raymond & Reeder, 2020).

Self-Efficacy

A student's self-efficacy is perhaps one of the strongest predictors of how he or she will attain a goal of achievement set forth by a teacher or for themselves (Heslin & Klehe, 2006). As seen in Figure 4, self-efficacy for a student can come through previous experiences, motivational conversations from a respected peer or adult, or positive social-emotional health. A student's self-efficacy in math is a significant determining factor of academic achievement. Self-efficacy can be compared to *The Little Engine that Could*. When a student believes he or she can succeed, oftentimes he or she will succeed. Students with high self-efficacy are not afraid of challenges, and do not turn away from more difficult work (Ahmad & Safaria, 2013). These students tend to show better work ethic in schools and do not give up just because work becomes difficult. In fact, a study showed that students with high self-efficacy scored higher on a math test even though all students had the same achievement level. Data of other studies have shown that the self-efficacy of high school students needs to be significantly increased in order to increase math achievement (Liu & Koirala, 2009). It is imperative to build the self-efficacy in students typically falling in the lower range of learning, as self-efficacy can determine what effects attitude, sense of self, and the emotional state of students have on academics (Robinson et al., 2005).

There are many future life and work plans that are directly determined by student math and science interests and achievement. Student confidence must be higher to compete globally. Students are bored and many do not believe math is important and will simply avoid it. Having effective pedagogy, possessing high expectations and equity for all, and teaching with real world examples decrease math anxiety and increase students' self-efficacy (Furner & Berman, 2005).



Note. (Kundu, 2020).

Figure 4. Self-efficacy in education.

Self-efficacy is one of several effective predictors of students' achievement success and motivation to learn in school. Students have a perception of how capable they are in certain areas of their academics and that is their motivation to be persistent and put in more effort (Zimmerman, 2000).

High School Student Self-Efficacy

High school student self-efficacy refers to a student's belief in their own abilities and competence to succeed in the various academic and non-academic tasks they encounter during their high school years (Bartimote-Aufflick et al., 2016). Self-efficacy is a crucial psychological concept that can greatly influence a student's academic performance, motivation, and overall well-being. Past experiences, whether positive or negative, can boost or lower self-efficacy. Supportive teachers, parents, and peers can directly contribute to a student's self-efficacy. Encouragement and constructive feedback from students' support systems are vital. Students must have modeling from others successful in similar tasks that can lead to mastery experiences to help them set and attain achievable goals and increase self-efficacy.

When high school students begin to increase self-efficacy, they begin to believe in their capacity to perform well in academic tasks in all subject areas, therefore influencing their willingness to tackle challenging coursework (van Rooij et al., 2017). Increased self-efficacy can impact a student's study habits. Students are more likely to use effective study strategies, manage their time efficiently, and seek help from others when needed. They are also more likely to set academic and personal goals as they believe their efforts can lead to achievement. Students with increasing self-efficacy tend to persevere in the pursuit of these goals, even when they encounter challenges or failures. Self-efficacy is not limited to academics, however. It can also influence a student's willingness to get involved in extracurricular activities such as sports,

clubs, or volunteer work, which can contribute to positive relationships with peers and adults (Forgeard & Benson, 2019). Fostering high school self-efficacy is important for overall development, motivation, and academic success. Teachers, parents, peers, and mentors can play a significant role in nurturing and enhancing a student's self-efficacy by providing support, setting realistic goals, and helping students build their strengths and successes.

Self-Efficacy and Math Performance

Math performance in high school can have a significant impact on a student's academic and career prospects (Froiland & Davison, 2016). Students' performance is measured by the grades received in math courses such as algebra, geometry, trigonometry, calculus, and other advanced math subjects. Good grades indicate a strong understanding of mathematical concepts. Standardized testing like the SAT (originally known as Scholastic Aptitude Test), the American College Test (ACT), and End of Course tests (EOC), often either include math sections or test students' knowledge of math concepts. High scores on these tests can open doors to college admissions and scholarships, making strong math performance critical for those planning higher education as many college majors and career paths require a strong foundation in math. High school math performance can determine whether a student is adequately prepared for their desired college major or career (Liu & Koirala, 2009). Math performance in high school has far-reaching implications for a student's academic and career trajectory. It is important for students to focus on building strong math skills, seek support when needed, and maintain a positive attitude towards math to excel in this area.

Math self-efficacy refers to an individual's belief in their own ability to perform math-related tasks and solve math problems. This concept is derived from Albert Bandura's social cognitive theory, which emphasizes the role of self-beliefs in shaping behavior and performance

(Ewen, 2010). Math self-efficacy influences a range of factors and can be developed to promote more positive and successful experiences with mathematics.

High math self-efficacy is often associated with greater motivation and effort in math tasks. When students believe in their ability to succeed in mathematics, they are more likely to invest time and energy in studying, problem-solving, and learning math concepts. This increased effort can lead to better math performance (Pietsch et al., 2003). High math efficacy can also cause students to be more persistent when faced with math challenges. They are less likely to give up when they encounter difficult problems and are more willing to persevere in finding solutions. This persistence can lead to improved math performance over time. Students with higher math efficacy are also more willing to take risks in math-related situations. They are not as afraid to make mistakes because they believe they can learn from them. This can also lead to a deeper understanding of math and better performance. Those with strong math efficacy are more likely to employ effective learning strategies. They actively seek out resources, ask questions, and practice regularly to improve their math skills, leading them to higher performance. Math anxiety is a common issue that can hinder math performance (Hoffman, 2010). High self-efficacy in math can help reduce math anxiety because individuals believe in their ability to handle math challenges. With these strengths allowed by higher math efficacy, individuals are more likely to choose advanced math courses and pursue math-related careers. This self-selection can lead to better math performance as they engage with more challenging and math-intensive content.

Self-efficacy is not solely determined by one's actual math abilities. It is a belief system that can be influenced by past experiences, feedback from teachers and peers, and the learning environment. Encouraging and nurturing math self-efficacy, particularly in educational settings,

can play a crucial role in improving math performance and fostering a positive attitude toward mathematics.

Peer Tutoring

Peer tutoring is an educational strategy in which students help each other learn and understand content. It involves one student, the tutor, providing assistance, explanation, and support to another student (Ali et al., 2015). Peer tutoring can be beneficial for both the tutor and the tutee, as it fosters collaboration and a deeper understanding of the subject matter. Peer tutoring can be very successful when students are paired correctly and with self-efficacy in mind. The social value of a tutor or peer depends directly on a student and his or her success (Madaio et al., 2017). Pairing correctly and with relationship building in mind have a direct effect on the achievement of students involved in peer tutoring models. A student's motivation and their belief in self is a strong predictor of if they will achieve a goal (Heslin & Klehe, 2006). One possible effective strategy is peer tutoring in the math classroom. This strategy offers collaboration and can lead to an increase in self-esteem and math confidence for both the peer tutor and peer tutee (Tang et al., 2022). Peer tutoring is a cooperative learning strategy with the potential to greatly benefit all students. The potential effects of tutoring in self-concept, attitudinal, and academic performance is outstanding (Ansuategui & Miravet, 2017). Peer tutoring can assist struggling learners to increase math knowledge and understanding as well as assist students in their ability to focus and engage and support behaviors (Capp et al., 2018).

Relationships are imperative for student success. Students assigned a peer tutor often feel less threatened and a sense of confidence that enables them to allow barriers keeping them from learning to be less present (Madaio et al., 2017). Instead of focusing on what they do not know, they can focus on just starting to learn. When paired appropriately, peers allow students a safe

space to not feel embarrassed or self-conscious, but instead just to be able to start digging into what they need for academic success. In most successful peer tutoring models, there is plenty of opportunity for interaction and communication between the peer tutor and peer tutee (Capp et al., 2018). When students feel like they have a rapport with someone at school, they feel like they have a reason to attend and do well. Many times, this will keep students in school and decrease dropout rates (Nazzal, 2002). Even if a student does not excel academically because of a peer tutor, if it helps a student socially or emotionally, it is still a successful investment. In fact, many students notice a decrease in behavior issues within themselves when working with a peer. Regardless of background, race, gender, or socioeconomic status, simply having a positive relationship helped decrease negative behaviors and increase engagement in classes (Enright & Axelrod, 1995). Students report an increase in response time, focus on read aloud, and enjoy being provided with immediate feedback from a peer. They also report fewer social issues in school when they work with a peer.

Peer tutoring is a cooperative learning concept for all students, however some groups, such as English Language Learners, can really benefit from a peer tutoring model when they are paired with another student that is able to remove language barriers and offer that support in class (Cole, 2013). This concept offers these students the ability to perform much better and have the access they would not ordinarily have. Furthermore, all students benefit from cooperative and collaborative teaching strategies, and that is precisely what peer tutoring is (Tang et al., 2022). Teachers find that by doing this strategy, they have more instructional class time.

A terrifying statistic is that only 12% of high school seniors are proficient in math when they graduate (Dobbins et al., 2014). It could be argued that students may not need geometry in real life, yet it is a requirement to receive a high school diploma. Students, especially with

learning issues, need support and unique methods of instruction to help them in their math instruction to learn. Group learning and peer mediated learning is one strategy that can be effective with these students. In some structures, students can even take turns being the learner and the teacher (Johnson, 2017). Peer tutoring is striving to have student centered learning versus teacher centered learning. Students can show significant growth when they are taught to be independent learners.

Peer tutoring allows for interaction and real world application in any area of curriculum (Gregg & Shin, 2021). Peers can talk to one another differently and without stress. They can offer supplemental instruction, be leaders in the classroom, help students benefit from social engagement, communication, and content knowledge. This can create an outcome of higher confidence in school, higher academic grades, and less stress. Education is expanding and growing, but the number of qualified teachers is not. Peer tutoring is an effective way to help this unbalanced issue (Falchikov, 2001).

The world is diverse, and everyone is different. We must cultivate those differences and help students learn from that diversity. Heterogeneity is reality. The world demands collaboration so that is what students need to learn to do in schools. Peer tutoring can assist in learning these skills with appropriate communication, social skills, understanding another, expressing feelings, and appropriately confronting (Ansuategui & Miravet, 2017).

Peer Tutoring in High School

Relationships with peers in high school play an essential role in the social, emotional, and academic development of students. The interaction and connections with peers can have a profound impact on a high school student's well-being, self-esteem, and overall experience (Swenson et al., 2008). High school is a time when students begin to form close friendships with

peers, and these friendships can be an important source of emotional support and companionship. Many adolescents often form or join social groups, such as clubs or sports teams. They often seek to define their identity and find like-minded peers who share their interests and values. Peer relationships can be complex and multifaceted. They contribute to students' social, emotional, and psychological development. Often, students lack the ability to form these vital bonds with peers, causing declines socially and academically. Peer tutoring can help support and increase students' success in forming these relationships with others by modeling effective social communication skills and creating a successful environment. Tutors often develop empathy, while tutees may experience an increase in confidence. Peer tutoring can reduce social isolation and promote inclusion while offering a sense of responsibility (Thurston et al., 2020).

Peer Tutoring in Mathematics

Peer tutoring in high school has several benefits. It provides students with additional academic support in courses where students face challenging coursework, fosters a sense of community, encourages active learning and teaching, and can lead to improved academic performance (Longwill & Kleinert, 1998). It also allows students to develop valuable teaching and interpersonal skills, which can benefit them academically and in their future careers. Peer tutoring in high school math classrooms is often beneficial as it allows tutors to break down mathematical concepts and skills for students who may be struggling in math (Gan & Hong, 2010). Students can learn content from their peers, often in a more relatable and understandable way. Tutors can show complex concepts and explain them in a manner that resonates with the tutee. Tutors develop their communication and teaching skills, which can be valuable in various aspects of life. They learn to convey information effectively, answer questions, and provide feedback. Tutees may experience a boost in confidence when they realize they can successfully

learn from a peer. They may be more willing to ask questions and seek help when needed. Tutors can adapt their teaching style to match the learning style of the tutee, providing more personalized support than a one-size-fits-all approach. By pairing students thoughtfully based on their needs in mathematics, personalities, and learning styles, a teacher can create an essential learning environment that is comfortable and conducive for learning. Tutors can regularly assess the progress of the tutees and the teachers can progress monitor both the tutors and tutees (Moliner & Alegre, 2020). This can foster a positive relationship between students and create a sense of community and support within the classroom. This dynamic often reinforces tutors own understanding of math as they teach, deepening their knowledge and skills.

Peer tutoring can be a valuable component of a comprehensive math program. It can help students overcome challenges, enhance their understanding of math concepts, and develop strong peer relationships within the classroom setting.

Summary

There are various causes for the math achievement crisis. Teacher pipeline shortages, curriculum issues, and learning loss all contribute to students struggling in math classrooms. To increase math achievement, student self-efficacy and confidence need to increase. One strategy implemented through the frameworks SPAM and YMM is peer tutoring. Chapter 3 will detail the mixed method approach of the inquiry, including the guiding questions, the rationale, the three phases including the pilot study, and instrumentation. It will also include data collection and analysis.

CHAPTER 3: METHODS OF INQUIRY

This chapter outlines the methods used for implementation, data collection, and data analysis for this inquiry. Each of the inquiry phases, instrumentation types, data collection, and analysis procedures are detailed. Assumptions, delimitations, and limitations are also addressed. To increase math growth toward proficiency, this inquiry examined the implementation of a student engagement framework along with a mentoring framework to encourage peer tutoring in math classrooms at a traditional high school.

Inquiry Guiding Questions

The questions guiding this inquiry were as follows:

1. What effect does a peer tutoring program have on the improvement of students' attitudes and mindset toward math?
2. How will the implementation of a peer tutoring program in Math 1 and Math 3 classrooms affect student growth toward math proficiency performance?
3. What effect does participation in a peer tutoring program have on the math self-efficacy of tutored students?

The effectiveness of the inquiry was determined using the data collected from the implementation of the framework of student-peer relationships and student engagement through peer learning.

Context of the Inquiry

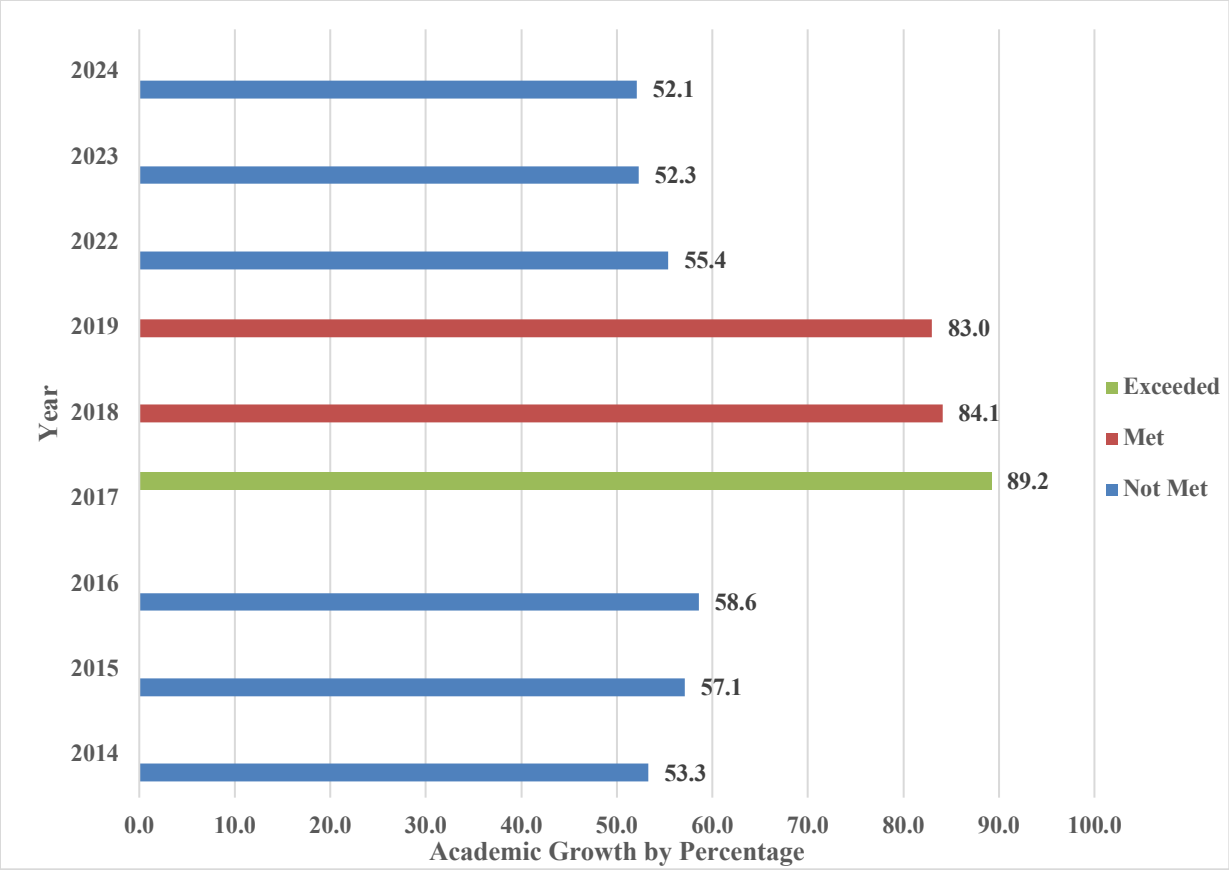
Deficits in student math performance have been an ongoing challenge for THS. From 2013-2022, THS has proven to have lower achieving scores as seen in Table 1. For several years, both academic growth and student performance hovered consistently at a C, as seen in Figure 5 and Figure 6 respectively. The grade of C was assigned by the North Carolina Department of

Table 1

THS Math 1 and Math 3 Proficiency Rates by Year

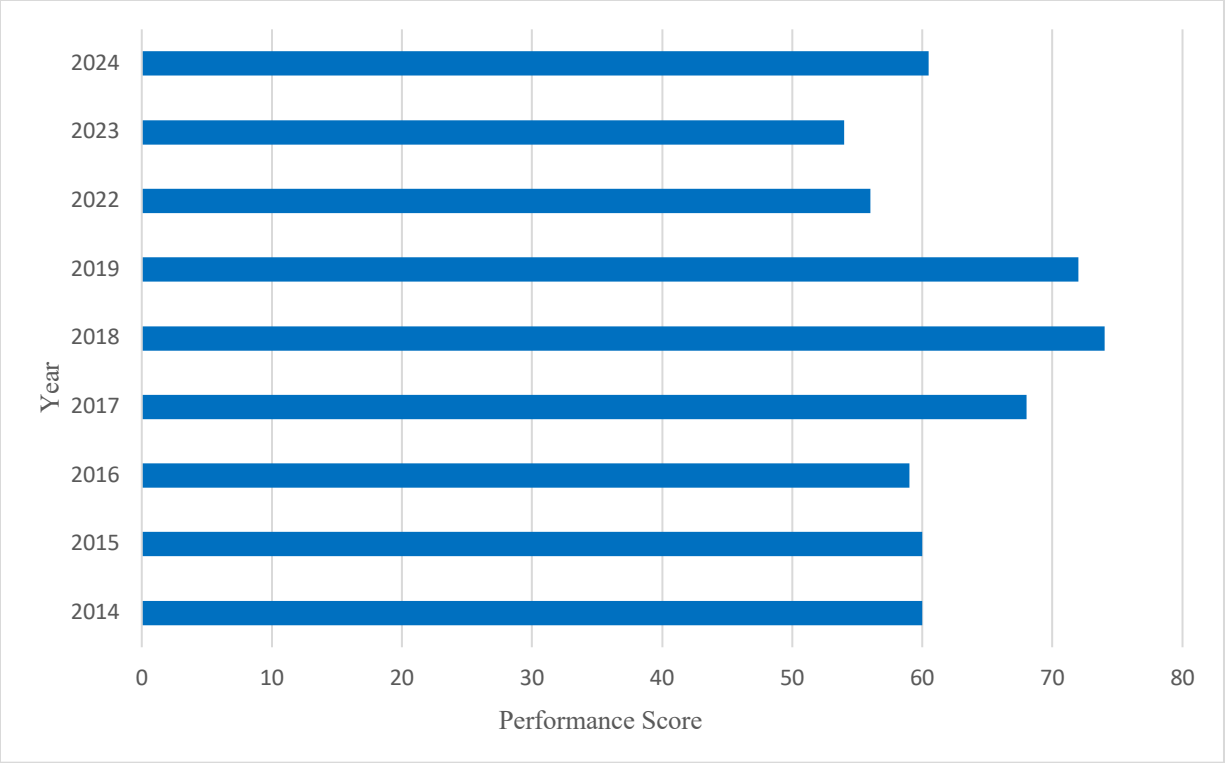
School Year	Math 1 % Proficient	Math 3 % Proficient
2013-2014	44.7	--
2014-2015	29.5	--
2015-2016	25.8	--
2016-2017	42.2	--
2017-2018	53.6	--
2018-2019	55	21.9
2019-2020	N/A: No data due to COVID	N/A: No data due to COVID
2020-2021	15.6 (Virtual/Hybrid)	11.9 (Virtual/Hybrid)
2021-2022	21.6	34.9
2022-2023	23.6	36.7
2023-2024	32.43	43.88

Note. (North Carolina Department of Public Instruction, n.d.).



Note. (North Carolina Department of Public Instruction, n.d.).

Figure 5. THS schoolwide academic growth by year.



Note. (North Carolina Department of Public Instruction, n.d.).

Figure 6. THS schoolwide performance grade score by year.

Public Instruction. Based on End of Course assessments in high school, along with multiple other academic indicators, all schools are assigned a performance grade given through a formula of student growth and achievement (Bietenbeck et al., 2018). In 2017, a surge in growth and performance moved the school out of relatively low standing, only leading to inconsistencies as the North Carolina Department of Public Instruction changed how Math 1 would count for students toward high school accountability. In 2017 the North Carolina State Board of Education allowed the flexibility of the Every Student Succeeds Act (ESSA) for the following school year 8th grade Math 1 scores to begin counting at the middle school level in place of the 8th grade Math End of Grade assessment. The scores would no longer be banked for the student's high school accountability score.

In 2016-2017 Math 1, students showed an improvement from 25% to 42% grade level proficiency. THS has shown extreme inconsistency in proficiency on the EOC as the numbers fluctuate from single digits to well over 50% proficiency. Nevertheless, THS did remain at a higher level of growth and performance until 2020 when COVID attempted to halt all learning. Since returning from the pandemic response, the math scores have been as low as 15% and rising to 22.5% in Math I, and a low of 11.9% rising to 36.7% in Math 3.

To close the gap in achievement for the students at THS, the school will continue the partnership with AmeriCorps/Collaborative Action Rural Education (CARE) Corps to assist in selecting qualified peer tutors. CARE Corps is through East Carolina University. They will run the selection process and then the training process of each peer tutor. For a student to be selected as a CARE Corps peer tutor, he or she must complete an application online. The application includes a motivational statement, skills and experience, educational resume, community services, employment history, criminal history, optional information that is relevant, and two

professional references. CARE Corps affiliates and school personnel then work together to sort the applications and schedule interviews. Only CARE Corps advisors conduct interviews. Once selected, the peer tutors receive Inspire and Harmony training as well as SAGA training which focuses on accelerating learning and educational equity through relationships.

The U.S. Department of Education (2019) highlights the fact that students not proficient in math and taking rigorous math courses by eighth grade, such as Algebra, are likely to not have a competitive edge in the workforce nor will be likely to attend college. Students enrolled in rigorous math classes tend to have a significantly higher income and education level into adulthood as compared to peers with poor achievement. There is a link between math achievement and later success in college and career (2019).

Student math performance is a primary area of focus for improvement at THS. Research shows that students performing poorly in math are less likely to exhibit organization and time management skills, have a more difficult transition to college, or are less likely to attend college at all (Thiry, 2019).

Inquiry Design and Rationale

This inquiry employed an explanatory sequential, mixed methods design grounded in improvement science. In this type of research design, the researcher collects and analyzes data as determined by the research or inquiry questions. The data that is analyzed then guides the next set of data collection and analysis to allow a deeper view into the inquiry questions. Each of these data collections were accomplished in phases allowing for the data results to be interpreted. In mixed methods design, qualitative and quantitative data help gain a broader perspective on an area (Mertler, 2022). The inquiry was outlined by three Plan-Do-Study-Act phases as shown in Figure 7, as well as a pilot study. By using improvement research and PDSA phases, the

Note. (Katowa-Mukwato et al., 2021).

Figure 7. Plan-Do-Study-Act cycle.

research was conducted in real life allowing data and theories to be tested by the researcher (Perry et al, 2020).

Collaborative Inquiry Partners

Collaborative inquiry partners were imperative for this inquiry. They will had an essential role in vetting instruments, data collection and analysis, and reviewing the inquiry results as seen in Table 2. The THS school district superintendent ensured the inquiry aligned with the district mission and goals. The Curriculum and Instruction Team (CIET) supported the administration by providing adequate resources and professional development to the peer tutors and teachers involved. THS district high school director provided access to CIET and other resources during the inquiry. School Improvement Team (SIT) members vetted resources and were a consistent strategic force throughout the inquiry. The lead counselor worked directly with peer tutors to support and guide them during the inquiry, while the administrative team ensured the peer tutors and teachers had the professional development and resources necessary to provide effective tutoring. Math 1 and Math 3 teachers ensured peer tutors are offering effective sessions during the inquiry, and student peer tutors actively engaged in peer tutoring sessions during classroom instruction throughout the day.

Ethical Considerations

To conduct this inquiry, several levels of approval were necessary. Additionally, ethical considerations had to be accounted for to ensure the privacy and protection of all participants involved in the inquiry. As such, I completed training in the ethical treatment of human subjects through the Collaborative Institutional Training Initiative (CITI). Additionally, I obtained the district approval. Once district approval was obtained for the inquiry, I submitted and received approval for the inquiry through East Carolina University's Institutional Review Board (IRB).

Table 2

Collaborative Inquiry Partners

Inquiry Partner	Role in Inquiry
THS School District Superintendent	Ensured the inquiry aligned with the district mission and goals.
THS District CIET	Ensured the administration had necessary resources and professional development access to provide the peer tutors and teachers for instruction during the inquiry.
THS School District High School Director	Ensured the administration has access to CIET and resources during the inquiry.
THS SIT Members	Vetted all resources and was a strategic force during the inquiry to support instruction.
THS Lead School Counselor	Worked directly with peer tutors to support and guided them during the inquiry.
CARE Corps	Ensured peer tutors were selected and had appropriate training.
THS Administration Team	Ensured peer tutors and teachers have the consistent professional development and resources needed to provide effective tutoring during the inquiry.
Math 1 and Math 3 Teachers	Ensured peer tutors are offering effective sessions during the inquiry.
Student Peer Tutors	Ensured peer tutoring sessions during classroom instruction throughout the inquiry.

See Appendix A.

All participants in the inquiry were provided confidentiality in their responses and had their identities masked in the reporting of results. Pseudonyms for the participants, district, and school were used throughout the inquiry. Each teacher and student who participated in the inquiry were informed of the inquiry, along with any inherent risks or benefits to participation. Teachers were provided a signature acknowledging consent. See Appendix B. Student informed consent was requested through parents or guardians and acknowledged with a signature. See Appendix C for an English-language version and Appendix D for a Spanish-language version of the student informed consent form. Additionally, students involved in focus groups were asked to acknowledge informed assent. See Appendix E for the English language version and Appendix F for the Spanish language version.

All electronic data collected specifically for the purpose of this inquiry was stored on my personal computer and locked by a personal passcode as well as in a digital folder, which is also locked by a passcode. No one else had or will have access other than myself. The data will be stored for three years and then destroyed.

Inquiry Procedures

This inquiry was implemented at THS in three phases involving Plan-Do-Study-Act (PDSA) cycles throughout each phase. Phase I was the planning and development phase and included the pilot study. The phase allowed for the collection of baseline data for the inquiry. Phase II implemented the conceptual frameworks for mentoring, Math 1 and Math 3 classroom peer tutoring, and leadership growth opportunities for peer tutors. This phase allowed for the collection of progress monitoring data mid-inquiry. Phase III allowed for qualitative and quantitative data collection and comprehensive data analysis post-implementation.

Phase I

Phase I included the pilot study to refine all instruments to be utilized in the actual data collection. I also began initial data collection through surveys, focus groups, and interviews to gain preliminary data regarding math, feelings about school and success in the classroom, and mindset about peer tutoring from all perspectives.

Plan

To validate all utilized instruments, I conducted a pilot study before implementation. No inquiry partners or others involved in the inquiry were a part of the pilot study. I had staff members who were assisting in our Summer Enrichment Academy (SEA) participate. The Digital Learning Specialist, a math teacher who teaches a prep other than Math 1 or Math 3, a Social Studies teacher, and an English teacher participated. I will also have students who were involved in the Honor Society that are aiding with summer programs as well as students gaining credit hours during SEA joining.

I expected to be able to conduct mock interviews and surveys with the teachers to craft the interview process for the inquiry and perfect the questions to collect the data that is the most beneficial for the inquiry. I also conducted mock surveys and focus groups with both the peer tutees and peer tutors to locate any deficits in my questioning and become more familiar with this data collection process and coding. I asked for feedback from all involved in the pilot study regarding the clarity of questions and feelings about the process.

Do

Instrumentation. Three instruments were utilized to collect necessary qualitative data from all involved throughout the inquiry. As seen in Appendix E, surveys for tutees involved in the inquiry were given pre- and post-inquiry. The initial survey served to obtain baseline data-on

the confidence in the math classroom and mindset toward peer tutoring. The same survey was given at the end of the inquiry to collect data on the impact it may have on each participant's mindset regarding confidence in their math ability and toward peer tutoring. Focus groups were used to strategically gain insight into how the inquiry progressed from those directly affected. I met with the tutees at the end of the inquiry. The focus group session aimed to have open conversations about their feelings about peer tutoring in math classrooms. I used interviews as the final method of instrumentation. Each semester, there are typically four to five teachers who instruct Math 1 and Math 3 courses. Since there are so few, interviews with those staff members were better to gain perspective and collect data on the peer tutoring process in their classrooms.

Pilot Study. I conducted the pilot study with several students and staff members not affiliated with Math 1 or Math 3 courses for the upcoming year. I began with an explanation of the purpose of the inquiry and the needs from them. I met with four students first. The student group consisted of one African American female rising junior, one White female rising sophomore, one White male rising sophomore, and one Hispanic male rising sophomore. I allowed them time to independently complete the student survey. I asked them to provide any feedback they felt would be beneficial to my inquiry. The main feedback was that the wording of two of my questions was somewhat confusing and they did not completely know the best way to answer. We then went through the focus group questions. They offered great suggestions that I had not thought of when they answered them out loud. I realized that I was only going to get vague responses in my choice of wording. Next, I had three staff members that are teachers answer the teacher interview questions. The main finding from piloting these instruments was that I was asking questions that could create negative feedback as I was not being strategic in my method of wording. Lastly, I asked colleagues to review my questions. They offered feedback

that allowed me to understand my instrument questions were not answering my inquiry questions and that I needed to add new questions while deleting others.

Study

Three instruments were used during the pilot study and pre-implementation. The first was an initial survey for Math 1 and Math 3 tutees with general questions regarding confidence in school, math, and peer relationships as well as teacher/student rapport. The surveys were completed by all tutees online using their iPad or laptops in a classroom setting. The next instrument in Phase I was initial focus groups. I met with selected student tutees to introduce them to one another and the focus group setting. I asked them to explain their feelings about school and classroom settings. The last instrument used were interviews of Math 1 and Math 3 teachers. I asked questions about their mindset of collaboration and leadership within the school setting. I offered insight to teachers as to the expectations set forth for them regarding peer tutoring in their classrooms and discussed any potential concerns. All feedback from the pilot study was reviewed by the inquiry and refined to suit the inquiry. I gained transcripts of all focus groups and interviews, cleaned and coded the data with inquiry partners, and identified themes in the data. The revised instruments were implemented for the students in the inquiry for initial data collection after consent was obtained.

Act

Phase I began with a pilot study to perfect the three instruments utilized in this phase and in the following phases during the inquiry. All feedback from the pilot study was reviewed and refined by the inquiry partners to suit the inquiry. The revised instruments were fully implemented, and the data was collected to move forward to the next phase.

Phase II

Phase II was the implementation phase of the inquiry. The selection process occurred for peer tutors, and instruction in the classrooms began. As seen in Table 3, the main data collection also occurred in this phase.

Plan

Peer tutors were selected through Collaborative Action in Rural Education (CARE) Corps as they reviewed applications in the Spring of 2023 and conducted interviews. CARE Corps, previously Ameri Corps is a STEMCorps that focuses on improving areas in STEM in K-12 schools. These students demonstrated a desire to grow in leadership ability, exhibit good citizenship qualities, and GPA of 2.5 or higher.

Do

Peer tutors received training on YMM and SPAM to ensure all tutors had a basic understanding of the importance of trust and empathy as they tutored and developed mentoring relationships with the tutees. I spoke extensively with each peer tutor regarding the framework of peer tutoring and expectations in the classroom as they worked with other students.

Study

The THS administrative team pulled the Measures of Academic Success (MAPS) scores of students being provided tutoring in the classroom setting. During the summer Professional Learning Communities (PLC) with staff and prior to the school year beginning, the administration assisted math teachers in dissecting the students' data to determine the largest deficits in learning and helped develop a plan for tutors pushing in the classroom. During this phase, students were assessed by district and state Check-ins to determine potential growth in math. Teachers were also given each student's EVAAS projection score so that there was a goal

Table 3

Matrix of Inquiry Guiding Questions, Data Collection, Phase of Inquiry, and Time

Inquiry Guiding Question	Data Collection	Phase & Timeline
1. What effect does peer tutoring have on the improvement of students' attitudes and mindset toward math?	• Student Survey Questions # 1, 2 • Tutor Interview Questions # 1, 2 • Tutee Focus Group Questions # 1, 2 • Teacher Interview Questions #1, 2	• Phases 1 and 3 Summer 2023, Spring 2024 • Phases 1, 2, 3 Summer 2023, Fall 2023, Spring 2024 • Phases 3 Spring 2024
2. How will the implementation of a peer tutoring program in Math 1 and Math 3 classrooms affect student growth toward math proficiency performance?	• Student Survey Questions 3, 4, 5 • Tutor Interview Question 2 • Tutee Focus Group Questions 3, 4 • Teacher Interview Question 1, 2, 3	• Phases 1, 2, 3 Fall 2023, Spring 2024 • Phase 2 Fall 2023, Spring 2024 • Phase 2 Fall 2023, Spring 2024 • Phase 2 Fall 2023, Spring 2024
3. What effect does participation in a peer tutoring program have on the math self-efficacy of tutored students?	• Student Survey Questions # 1, 2, 3, 4, 5, 6, 7 • Tutor Interview Questions # 1, 3 • Tutee Focus Group Questions # 1, 2, 3 • Teacher Interview Questions 2, 3	• Phases 1 and 3 Summer 2023, Spring 2024 • Phases 1, 2, 3 Summer 2023, Fall 2023, Spring 2024 • Phases 3 Spring 2024

set for each student for the end of the course.

Act

Phase II focused on implementing peer tutoring and data collection from focus groups and interviews. Implementing the Youth Mentoring Model and Student Peer Assisted Model, mimicking the Zone of Proximal Development, also occurred during this phase. Multiple collaborative inquiry partners engaged in the inquiry during Phase II to ensure students and teachers had the needed resources and tools for student learning.

Phase III

Phase III allowed for data analysis to determine if the inquiry was successful. This was determined based on the results of the instruments used throughout the inquiry.

Plan

Post-implementation data analysis occurred in Phase III. THS Math 1 and Math 3 peer tutees completed an exit survey to determine the qualitative data portion of the inquiry. The survey allowed me to notice if there are any changes in feelings about school, math, the process of peer tutoring, study habits, or relationship building with others. The interview for all teachers and peer tutors also assessed final thoughts on the peer tutoring process and mindset changes from the inquiry's beginning. The focus group was completed for peer tutees to discuss any changes in confidence in math, rapport with peers and teachers, and leadership ability.

Do

Quantitative data was collected as peer tutees were assessed by the district benchmark and the North Carolina EOC. That data was compared to each student's growth measure as reported in EVAAS. I was able to determine if each child met, exceeded, or did not meet growth. I was also able to determine if they met proficiency in math for the semester or year.

Study

Phase III was for collecting and analyzing post-implementation data. Both peer tutors and peer tutees were able to assess the process through either focus groups or a post-interview honestly. Collaborative inquiry partners were able to analyze how students felt about peer tutoring and if they felt they made internal gains during the year. Pre and Post assessment data determined if the students showed academic gains from the framework during the year.
All staff were able to offer feedback and thoughts through interviews to allow data collection from the teachers' perspective.

Act

As the final phase, all data collected determined the effectiveness of the inquiry. The outcome of the intervention determined next steps. Should students show an increase in growth and achievement, the inquiry will be adjusted as necessary and continued.

Inquiry Design Rigor

This inquiry utilized an explanatory-sequential, mixed methods design grounded in improvement science to bring both qualitative and quantitative data together for a more in-depth understanding of the topic (Mertler, 2022). To ensure the trustworthiness of the inquiry, I established credibility and dependability throughout the inquiry process. Credibility guarantees that the outcomes of the data collection and analysis of the entire inquiry were authentic. The dependability of the inquiry stresses that I must explain any changes that take place in the setting where I will completed my inquiry (Mertler, 2022).

I applied triangulation of the data by employing multiple methods of data sources to form a comprehensive interpretation of peer tutoring. Triangulation typically leads to a larger understanding of the topic researched as more information can be collected (Carter et al., 2014). I

specifically created triangulation through pre-and post-assessments, pre- and post-intervention data collection, and prolonged access to participants throughout the inquiry. Peer debriefing is another process that I used to ensure the credibility and trustworthiness of the inquiry. This process used colleagues who can critique the data collection and analysis and offer reflections (Mertler, 2022).

Action research aims to gather information at a specific site with a specific population (Mertler, 2022). A pilot study was implemented before three phases of actual implementation with collaborative inquiry partners available to assist in analyzing data and adjusting implementation if required. The pilot study in Phase I is imperative before implementation as it assisted in validating the instruments utilized with all students and staff members in Phase II and Phase III. The pilot study helped identify questions and formatting issues so that the data collected was specific and intentional to this inquiry. The CIET assisted in offering resources for the classroom teachers and peer tutors for effective tutoring in one-on-one settings. Each inquiry partner reviewed collected data to assist in theme development and refine questions prior to the actual inquiry. This inquiry was implemented at a rural eastern North Carolina traditional high school, THS, with students considered at risk for failing Math 1 and Math 3.

Delimitations, Limitations, and Assumptions

This inquiry was implemented in Math 1 and 3 classrooms at a traditional high school. Should it yield positive results, it could apply to other locations. No data on any other subjects was collected, nor was previous data in math. Peer tutors will only serve in Math 1 and Math 3 classrooms.

Attendance was an issue for many students and some staff members. If any staff involved in the inquiry or peer tutees or tutors were absent from several math classes, it would have a

direct impact on the results. Another limitation is any teacher hindering a peer tutor from assisting a student in class because of class instruction. Each teacher comes to the classroom with varied years of experience and knowledge. Most classrooms have an average number of students, although they all differ. Tutors also had different levels of understanding and social abilities, which create limitations.

It was assumed in this inquiry that the tutors and tutees would be present for the class at least much of the time during math. Another assumption was that the peer tutors selected had an acceptable knowledge of math concepts to assist in a student struggling with basic math skills in high school classes. It was assumed that everyone would be honest and forthcoming in their responses and that all participants would be consistent in effort and quality of instruction.

Role of the Scholarly Practitioner

My role as the scholarly practitioner was to lead the inquiry, including conducting and completing interviews, facilitating focus groups, and administering surveys to collect data regarding the inquiry and guiding questions while ensuring the framework for peer tutoring and mentoring is implemented with fidelity. I needed to communicate clearly with collaborative inquiry partners to make needed adjustments to the inquiry based on the outcome of collected data. As the principal of THS, I ensured that I worked closely with all inquiry partners for data collection and analysis, guaranteeing all instruments were clear and effective and that coding was efficient. As the principal of THS, I confirmed that all students and teachers always felt confident and safe in the procedures of the inquiry, welcoming all feedback.

Summary

Chapter 3 provided a detailed overview of the guiding questions and the methods of the inquiry. It also includes the data collection instruments and data analysis along with collaborative

inquiry partners. The inquiry utilized mixed methods in three phases utilizing PDSA cycles. The next chapter will provide the results of the implementation and data collected.

CHAPTER 4: RESULTS

This inquiry was conducted at a traditional high school in rural eastern North Carolina. Traditional High School, a pseudonym, is one of 17 schools in Traditional School District. THS is one of the five high schools and one of three traditional high schools in the district. The problem of practice faced is a consistent downward trend in math data for students at THS and the district for several years. This decline in math data was only heightened during the loss of instruction during the COVID-19 pandemic when schools were shut down or continued with modified days. The solution to the problem is the implementation of peer tutoring in all Math 1 and Math 3 classes to increase student achievement and confidence in mathematics at the traditional high school. This structure was intended to bridge the gap in students' learning and increase math knowledge and self-efficacy in the students.

The inquiry utilized an explanatory sequential, mixed methods design grounded in improvement science, framed around Student Peer Assisted Mentoring (SPAM) which closely mirrors Vygotsky's Zone of Proximal Development. The conceptual framework, the Youth Mentoring Model, establishes the inquiry's standard.

The questions directing this inquiry are as follows:

1. What effect does a peer tutoring program have on the improvement of students' attitudes and mindset toward math?
2. How will the implementation of a peer tutoring program in Math 1 and Math 3 classrooms affect student growth toward math proficiency performance?
3. What effect does participation in a peer tutoring program have on the math self-efficacy of tutored students?

This inquiry took place during the 2023-2024 school year. It involved all the Math 1 and Math 3 teachers and students. Both quantitative and qualitative data were collected to determine if peer tutoring increased math proficiency and improved math efficacy and attitude toward math.

Pilot Study

A pilot study was conducted with several students and staff members not affiliated with Math 1 or Math 3 courses for the 2023-2024 school year. I began with an explanation of the purpose of the inquiry and the needs from each member. I met with four students first. The student group consisted of one Black female rising junior, one White female rising sophomore, one White male rising sophomore, and one Hispanic male rising sophomore. I allowed them time to independently complete the student survey. I asked them to provide any feedback they felt would be beneficial to my inquiry. The main feedback was that the wording of two of my questions was somewhat confusing and they did not completely know the best way to answer. We then went through the focus group questions. They offered great suggestions that I had not thought of when they answered them out loud. I realized that I was only going to get vague responses in my choice of wording. Next, I had three staff members that are teachers take the teacher survey and answer the teacher interview questions.

The main finding from piloting these instruments was that I was asking questions that could create negative feedback as I was not being strategic in my method of wording. Lastly, I asked colleagues to review my questions. They offered feedback that allowed me to understand my instrument questions were not answering my inquiry questions and that I needed to add new questions while deleting others. All feedback from the pilot study was reviewed by the inquiry

and refined to suit the inquiry. The instruments were revised with the feedback obtained to implement in the following phase.

Data Collection

Within each phase of the inquiry, qualitative and quantitative data was gathered from four types of instruments.

Student Surveys

The first type was an initial survey for Math 1 and Math 3 tutees with general questions regarding confidence in math, peer relationships, teacher and student rapport, and overall feelings at school. The student surveys (See Appendix F) were conducted in the classroom via student iPads at the beginning and end of the inquiry. I created the surveys and pushed them out to all Math 1 and Math 3 students electronically. I requested that the teachers allow the students ample opportunity to complete them in the classroom after instruction was finished during the school day. Students completed these in one session, as the survey was only seven questions using a Likert-type scale. For absent students, they were given time the following day to complete the survey. Answers from the survey were collected anonymously through the tool it was created.

Student Tutee Focus Groups

The next instrument in Phase I was a protocol for initial focus groups. I selected and met with selected student tutees of diverse backgrounds. During the initial focus group, I introduced them to one another, myself, and the focus group setting. I also explained the criteria of the focus group regarding respect for privacy of others and to allow others to fully complete his or her thoughts before another person spoke. We discussed the need for full transparency and honesty as well as the fact that no information discussed would leave the group. I asked them to explain

their feelings about school, the classroom setting, and peer tutoring, through questioning. The purpose of the focus groups was to gather qualitative data on the students' perceptions of peer tutoring and the impact of the selected framework used. I guided the conversation and allowed the students to express their thoughts and views on peer tutoring in the math classroom. The focus group met two more times throughout the semester. We met in different places depending on what area of the school allowed for a quiet, confidential place to talk. We met on the stage in the auditorium where we could sit in a circle and see and hear one another, and in the annex where everyone had a place at a conference table to gather. This was all done during the school day and the students were pulled during their elective classes if possible. Each focus group took approximately 45 minutes to complete and was recorded using an iPad.

Teacher Interviews

A set of questions for interviews of Math 1 and Math 3 teachers was the next data collection set. Teachers involved in the inquiry were given EVAAS projections during PLCs for each of their students prior to the inquiry beginning. This helped them know where each student was starting in math at the beginning of their course and also helped them set a personal goal for each student to reach by the end of the course. This was also beneficial for the teacher as she worked with the peer tutor as they assisted students. Teacher interviews were conducted at the end of the inquiry. Four math teachers were interviewed. Two teach Math 1, and two teach Math 3. The teachers gave their thoughts to the peer tutor process and if they felt the implementation was successful and why. I interviewed the teachers in their classrooms as I wanted them to be as comfortable as possible and felt their rooms would be less intimidating. Each interview took approximately 35 minutes and was recorded.

Student Tutor Interviews

Student tutor interviews was a change from my original instrument, as I had planned to conduct focus groups with the peer tutors. Because the school schedule conflicts with the peer tutors, I decided to interview each of them after the inquiry. I asked questions about their mindset of collaboration and leadership within the school setting. I spoke extensively with each peer tutor regarding the framework of peer tutoring and expectations in the classroom as they worked with other students. I asked them each three questions regarding their experiences as a tutor and how they feel the process should differ moving forward. This provided a glimpse into each tutor's personal experience, the positive benefits of the processes, and as well as how procedures could improve in the future. I made separate appointments with each tutor depending on their class schedule and we met in the front office. I recorded each interview which lasted approximately 25 minutes each.

North Carolina End of Course Test Data

Lastly, North Carolina End of Course (EOC) test data was collected. End of Course tests are used to sample a student's knowledge of subject related concepts and provide an estimate of the student's mastery of the material in a particular content area (NCDPI, n.d.). Each student in Math 1 and Math 3 received a projection from the state at the beginning of the semester. Their goal was to meet that projection upon completing the course of either Math 1 or Math 3. The score of each student on his or her EOC determined whether that goal was completed. Both Math 1 and Math 3 are tested by the state at the end of the course. The state of North Carolina uses EVAAS to give each student in each public school a projection for each tested area. The purpose of that projection is to determine the goal that each student should reach at the end of the course. If a student reaches that goal, that is considered meeting growth in that area for that student.

Data Analysis

Student Surveys

In the beginning of the inquiry, the surveys gave a baseline for students' thoughts on school, self-efficacy, and appreciation for the curriculum in seven questions. The responses were used to identify a quantified increase or decrease between the beginning and end of the inquiry after the implementation of peer tutoring. I used descriptive statistics by organizing the frequency distribution to analyze the change in data given pre- and post-implementation. Students were asked to answer questions using a Likert-type scale. By giving the survey again at the end of the inquiry, my inquiry partners and I were able to examine whether the students' feelings on school, self-efficacy, and math had changed.

Student Tutee Focus Groups

Once all the focus groups were completed, I began working to develop categories within the data. This prompted me to begin to code by hand. I took some of the categories that NVivo had already separated the data into and began compiling them into groups and eventually I was able to allow themes to emerge. I involved my curriculum team inquiry partners during this process to assist in grouping categories and developing themes. It was interesting how the same wording was repeated from the students, even in different classes and different levels in math.

Teacher and Peer Tutor Interviews

Recordings of teacher interviews and peer tutor, much like focus groups, were also cleaned and coded this data by hand as well. By doing so, I felt that it allowed me to really connect and understand all that had been collected during the inquiry at a deeper level. I entered the interviews into a word cloud generator to create a word cloud as seen in to find themes in the answers provided by the teachers and peer tutors.

North Carolina End of Course Data

We tracked the students throughout their time in math utilizing their EVAAS projection. We then compared their projection to their EOC score to determine if the student had met, not met, or exceeded growth for their Math 1 or Math 3 course. I charted each student to show whether he or she met or did not meet according to the projection given by the state. I then tallied the total number of met and did not meet for each teacher of Math 1 and Math 3.

Demographics

The student participant demographics of the inquiry consisted of mostly freshmen at THS. There was a total of 94 students, 43 male and 51 female. Of those students, 24 were Black, 28 were Hispanic, four were two or more races, and 38 White. A breakdown of all students involved is shown in Figure 8.

Included in the inquiry were two teachers of Math 1, here forward referred to as Teacher 1 and Teacher 2, and two teachers of Math 3, here forward referred to as Teacher 3 and Teacher 4. All of the teachers taught a combined total of seven sections of Math 1 and Math 3 and 129 students. Teacher 1 taught 37 students, Teacher 2 taught 21 students, Teacher 3 19 students, and Teacher 4 taught 17 students. A total of 94 students participated in this inquiry. A White, female teacher taught each of those classes. The classes served an average of 18.4 students. Actual class sizes of students included in the inquiry are shown below in Figure 9.

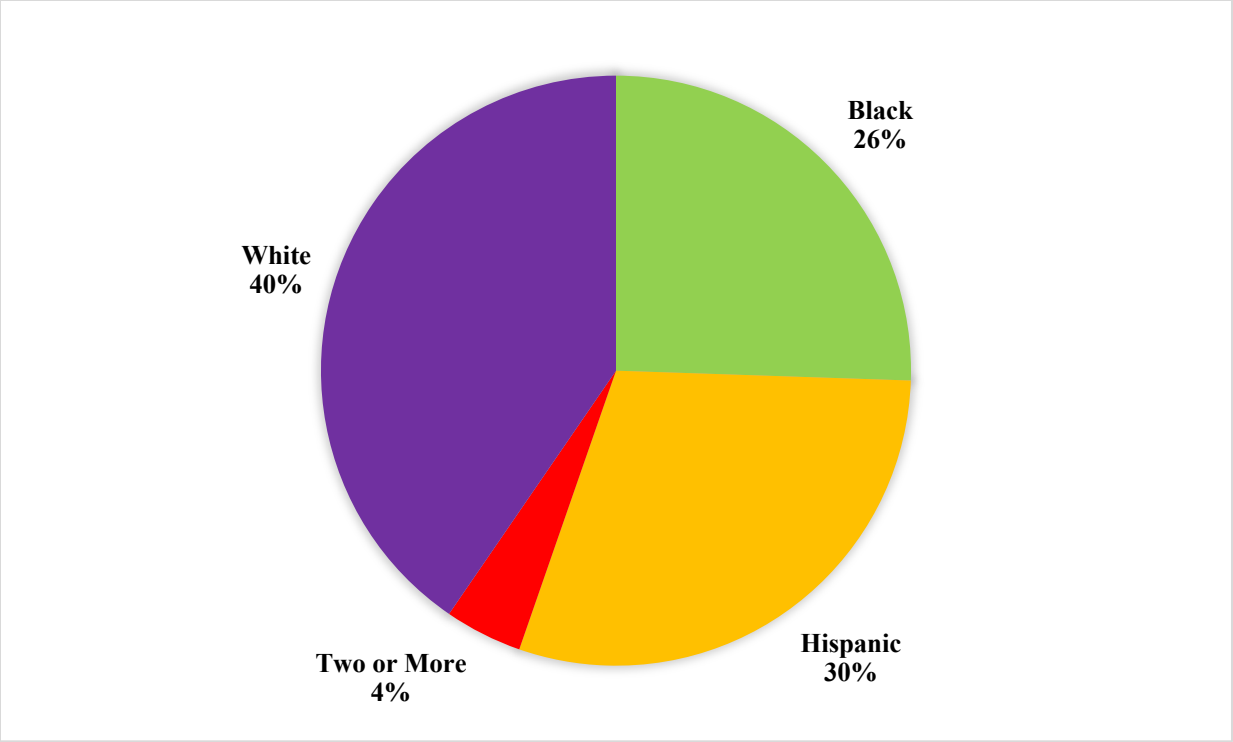


Figure 8. Race of student participants.

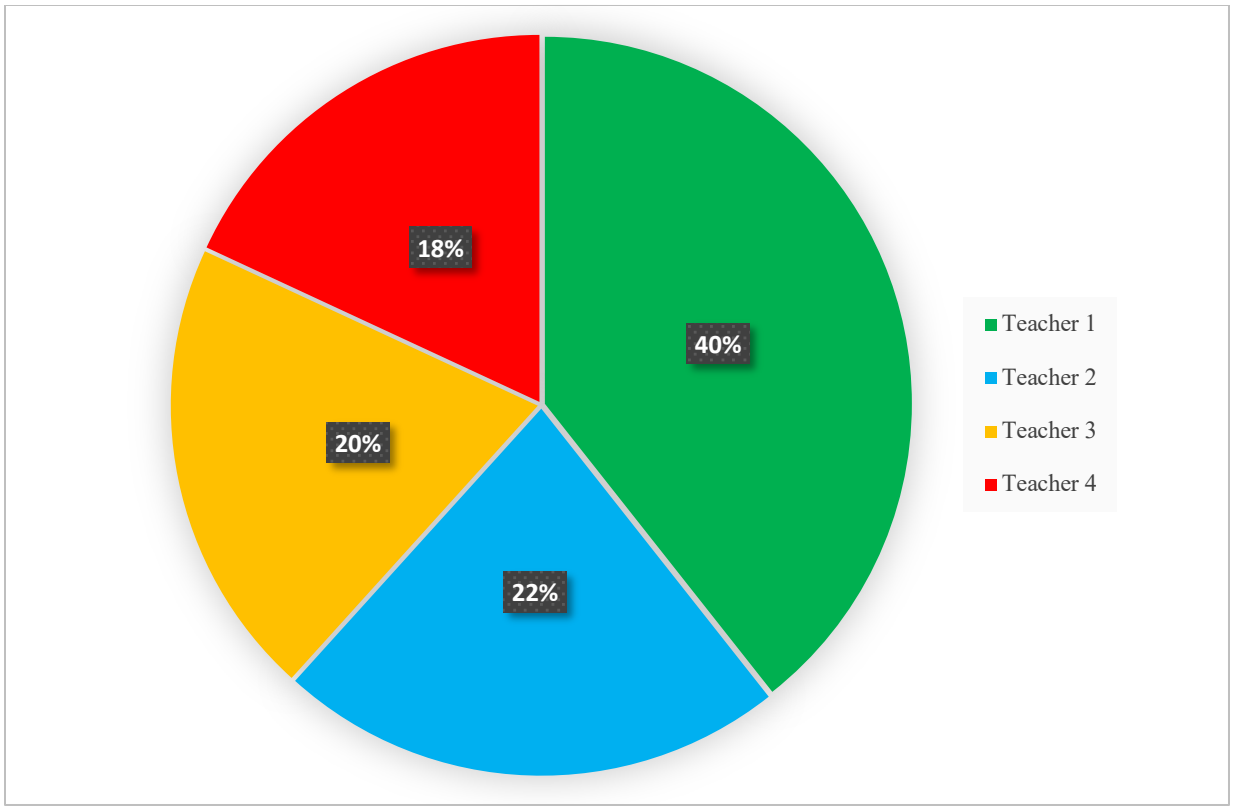


Figure 9. Teacher accountability by percentage of student participants.

The student focus groups contained a total of eight students. There were four male and four female students. Two female students were Black, one was Hispanic, and one was White. Of the male students, one was Black, two students were Hispanic, and one was White. This data can be seen in Table 4. Peer tutors involved in the inquiry consisted of three females and two males. Four of the students were White and one was Hispanic. Table 5 shows the demographics of the peer tutors.

Results

Quantitative and qualitative data were collected using multiple data collection tools to examine the effectiveness of the implementation of peer tutoring and to triangulate findings based upon these various data points. The results are organized by each data collection instrument.

Peer Tutee Surveys

Each question of the seven asked saw an increase in agreement from pre- to post-implementation except for Question 2. Question 2 showed a slight decline in the highest percentage answer, Neutral, in the pre-survey responses. Question 1 stated, “Math is an important subject to me.” Students in the pre-survey rated this overall with 31.3% at a 4 followed closely at 27.8% at a 3 as shown in Figure 10. This question increased in agreeance as it rose to 39% at a 4 in the post-survey. Figure 11 shows responses to question 2, which stated “I best learn math by using manipulatives, gaming, etc.” Of students, 38.3% were neutral as they answered this question at a level of 3 in the pre-survey and showed a slight decline in the post-survey at 37.2% in the post-survey. Question 3 which stated, “I enjoy it when other students help me understand math,” as shown in Figure 12, showed a high response of 4 at 32.2% in the pre-survey and jumped to 40% in the post-survey. Figure 13 shows responses of question 4 stated, “I

Table 4

Focus Group Student Demographics

	White Male	White Female	Black Male	Black Female	Hispanic Male	Hispanic Female
FG Student 1				X		
FG Student 2				X		
FG Student 3						X
FG Student 4		X				
FG Student 5			X			
FG Student 6					X	
FG Student 7					X	
FG Student 8	X					

Table 5

Peer Tutor Demographics

	White Male	Hispanic Male	White Female
Peer Tutor 1			X
Peer Tutor 2			X
Peer Tutor 3			X
Peer Tutor 4	X		
Peer Tutor 5		X	

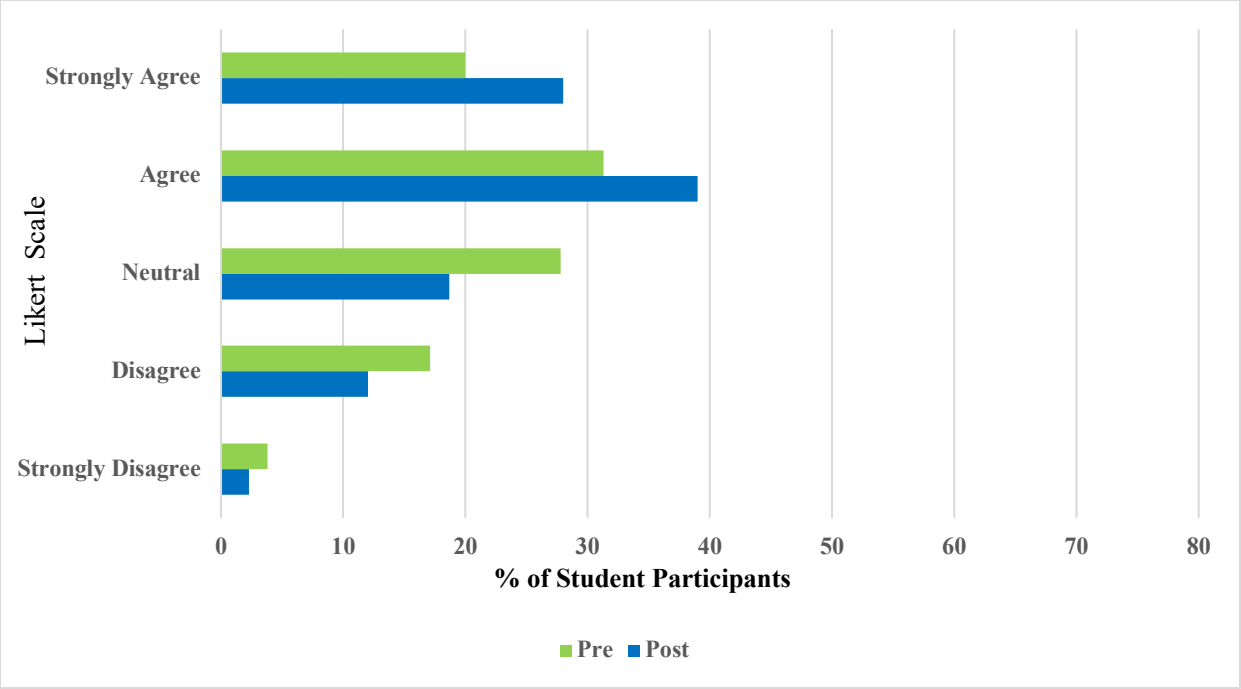


Figure 10. Peer tutee responses to Likert-type statement #1: Math is an important subject to me.

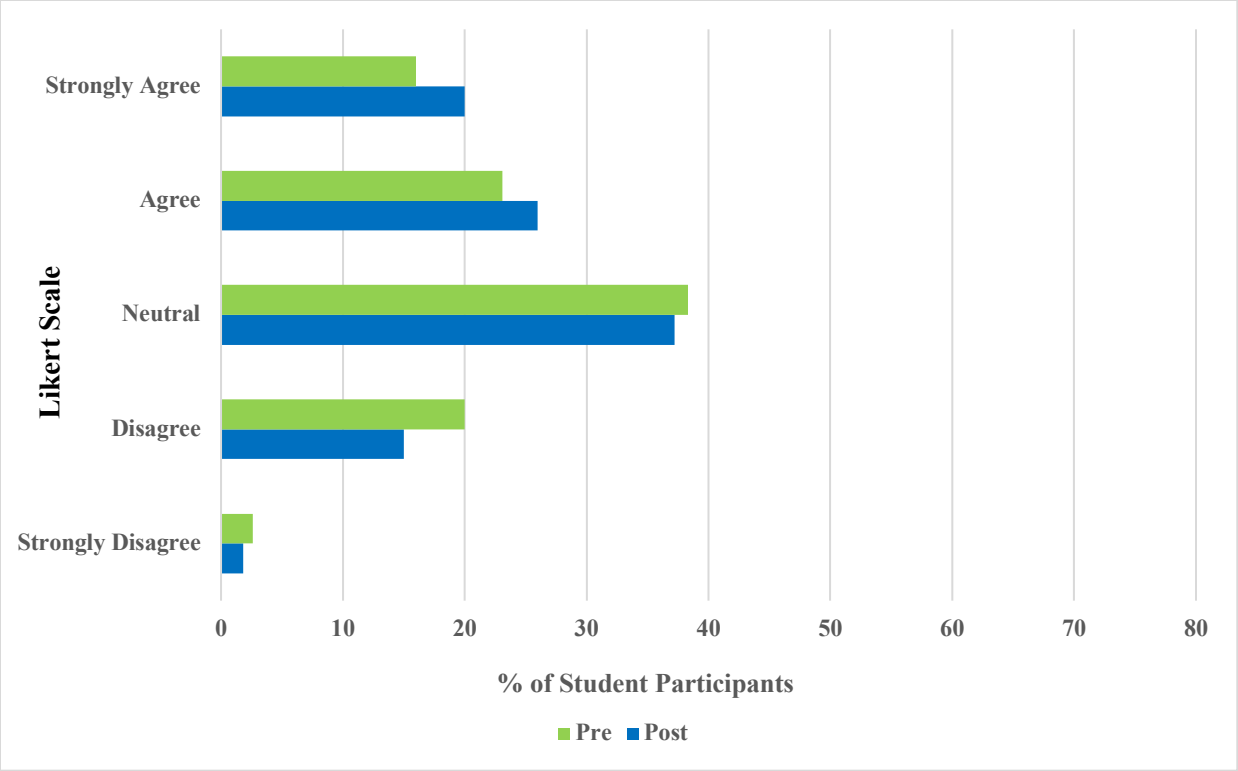


Figure 11. Peer tutee responses to Likert-type statement #2: I best learn math by using manipulatives, gaming, etc.

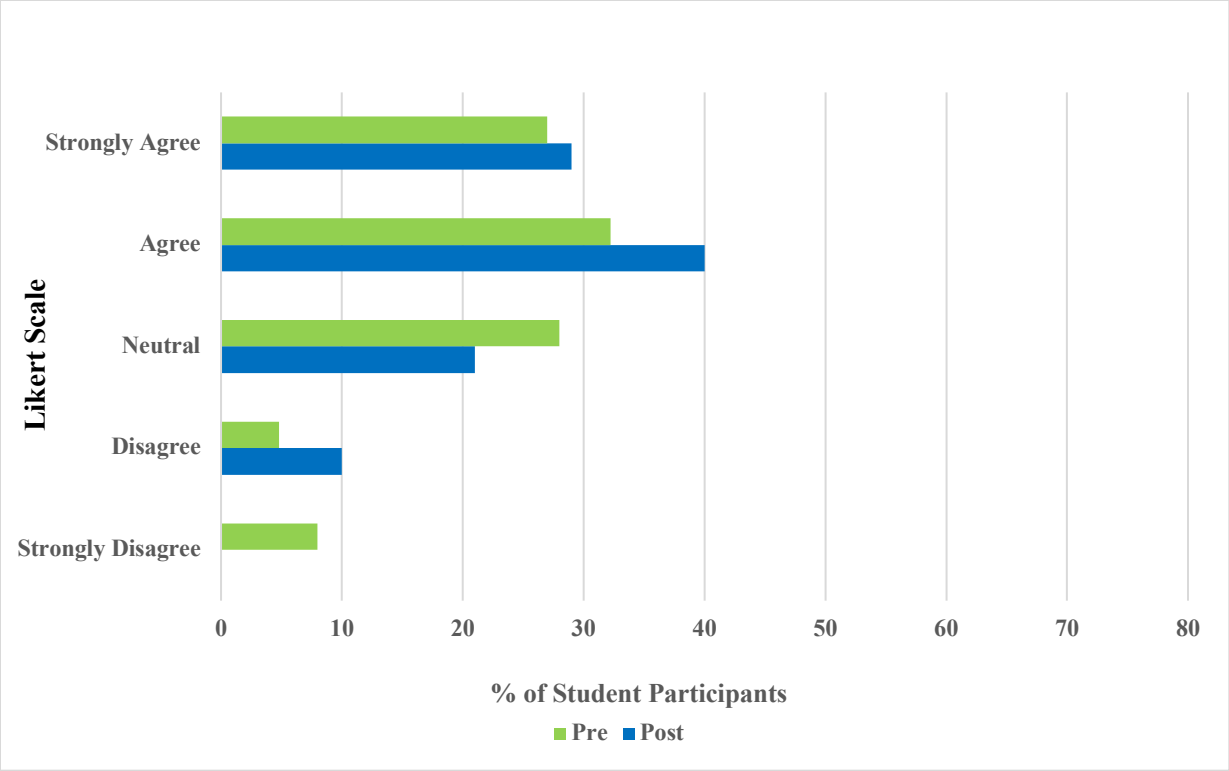


Figure 12. Peer tutee responses to Likert-type statement #3: I enjoy it when other students help me learn math.

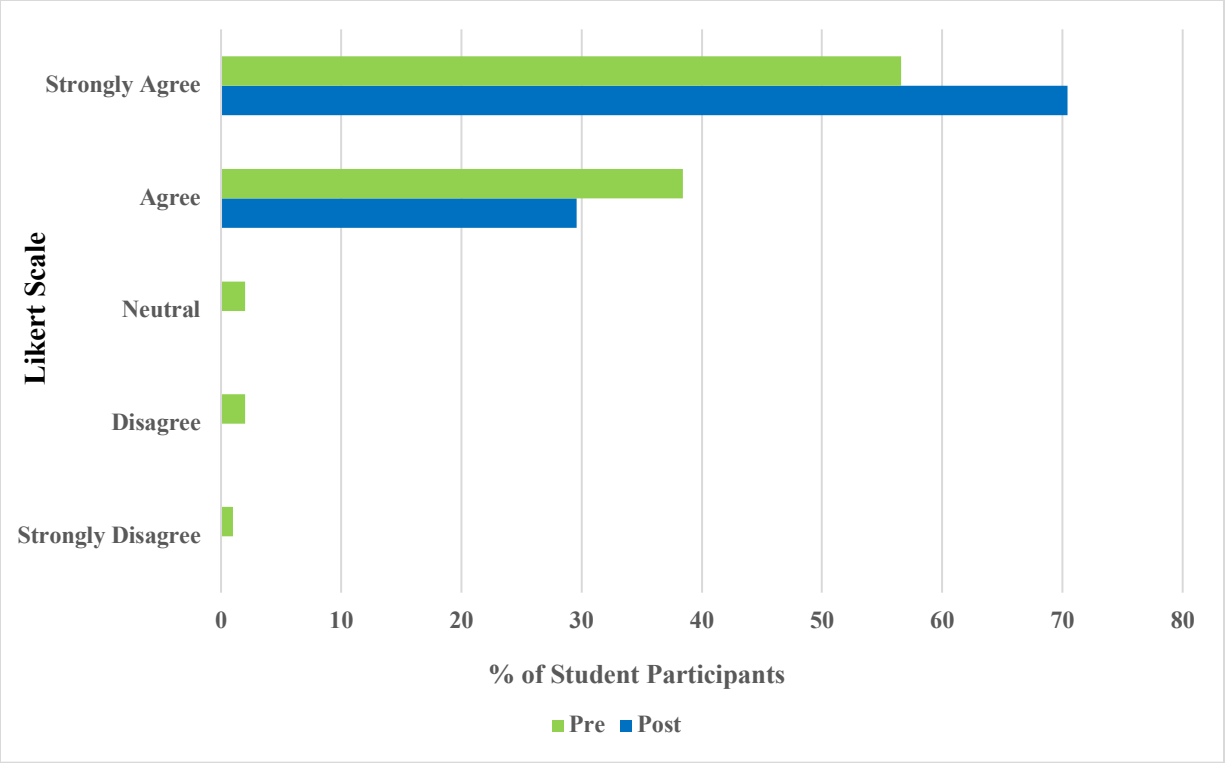


Figure 13. Peer tutee responses to Likert-type statement #4: I have friends at school.

have friends at school." During the pre-survey, 56.6% felt strongly that this was true with a 5, and over 70% answered with a 5 in the post-survey. "It is easy for me to ask a peer questions in class when I do not understand something" was question 5. Figure 14 shows that this question was evenly distributed in answers in the pre-survey, but 27.8% answered with a 4; however, just 74% answered the same way in the post-assessment. Question 6 stated, "I will use Math1/Math 3 content in my post-graduation plans." Over 32% answered the pre-survey with a 3 with that percentage rising to 35.7% in the post-survey as seen in Figure 15. The last question stated, "I am satisfied with my grades in math." Almost 30% answered with a 5 on the pre-survey with the post-survey answering at 44.5%, as shown in Figure 16.

Focus Groups

Participants in the focus group were asked five questions during each of our times together. From those responses, I was able to begin organizing raw data from the transcripts. I organized the data by hand. I highlighted the phrases that were repetitive in my first coding cycle. I was able to pull out descriptive codes as well as emotional codes by using the actual words of the participants as well as the emotions they expressed. The initial codes included mentoring and guidance, disposition, behaviors, student cognition, and synergy. From those codes, based on the words heard during the focus groups, I was able to begin developing categories. The categories included tutoring and teaching, student emotions and reactions, student actions and characteristics, learning and understanding, and group dynamics. I continued to sort phrases out of the recordings until I could identify final themes. The final themes derived from the focus group transcripts included: effective learning and instruction promote cognitive development, motivation and engagement can be influenced by both positive and negative social-emotional factors, and growth and development in learning are significantly

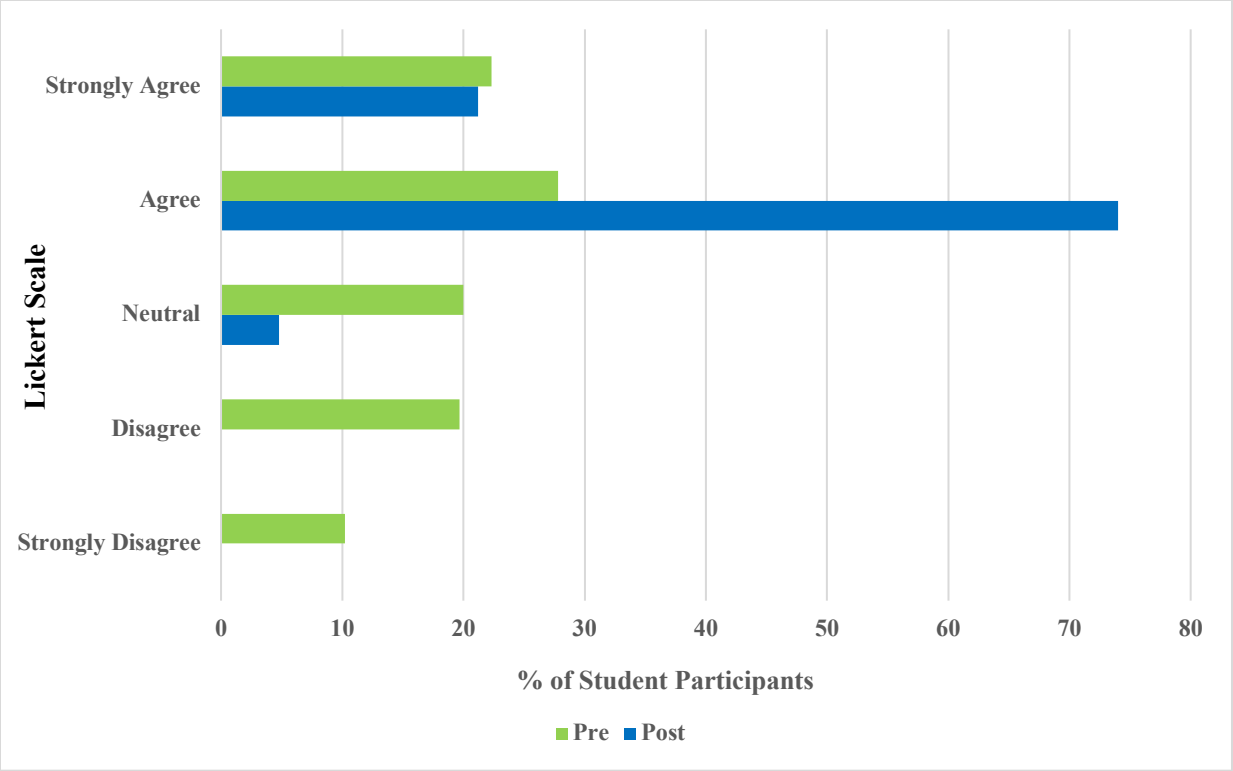


Figure 14. Peer tutee responses to Likert-type statement #5: It is easy for me to ask a peer questions in class when I do not understand something.

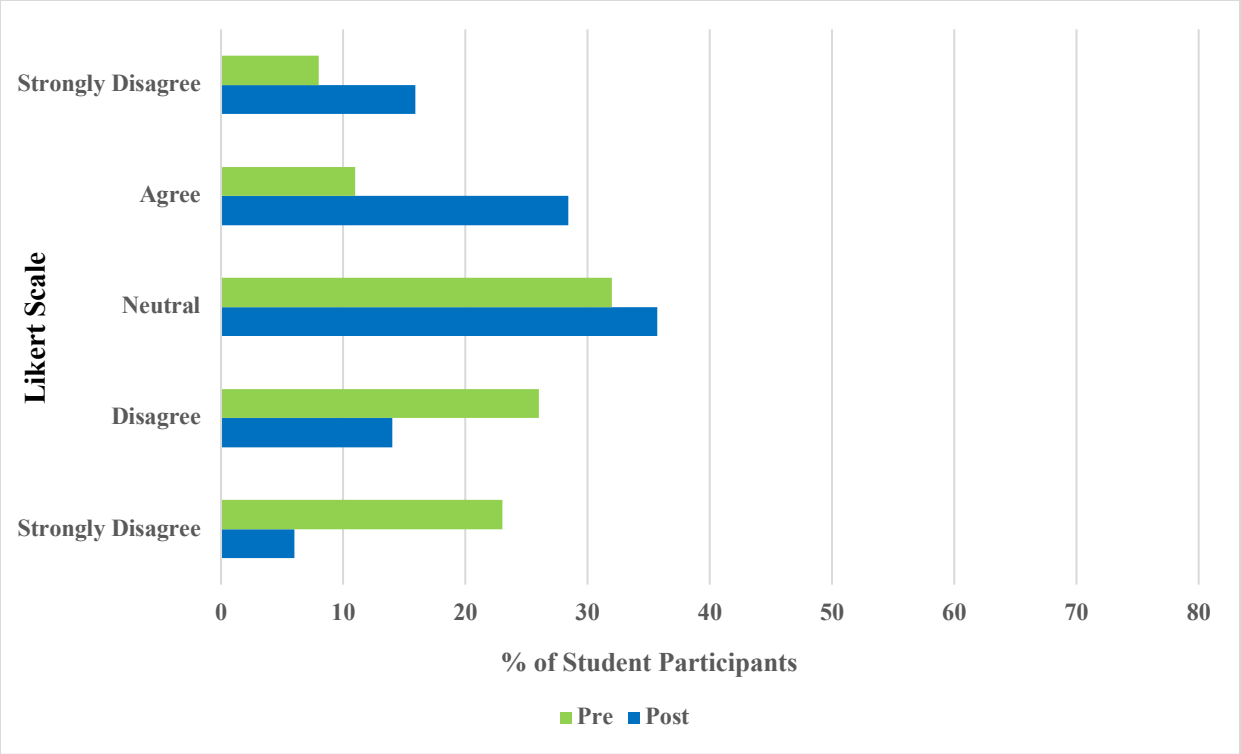


Figure 15. Peer tutee responses to Likert-type statement #6: I will use Math 1/Math 3 content in my post-graduation plans.

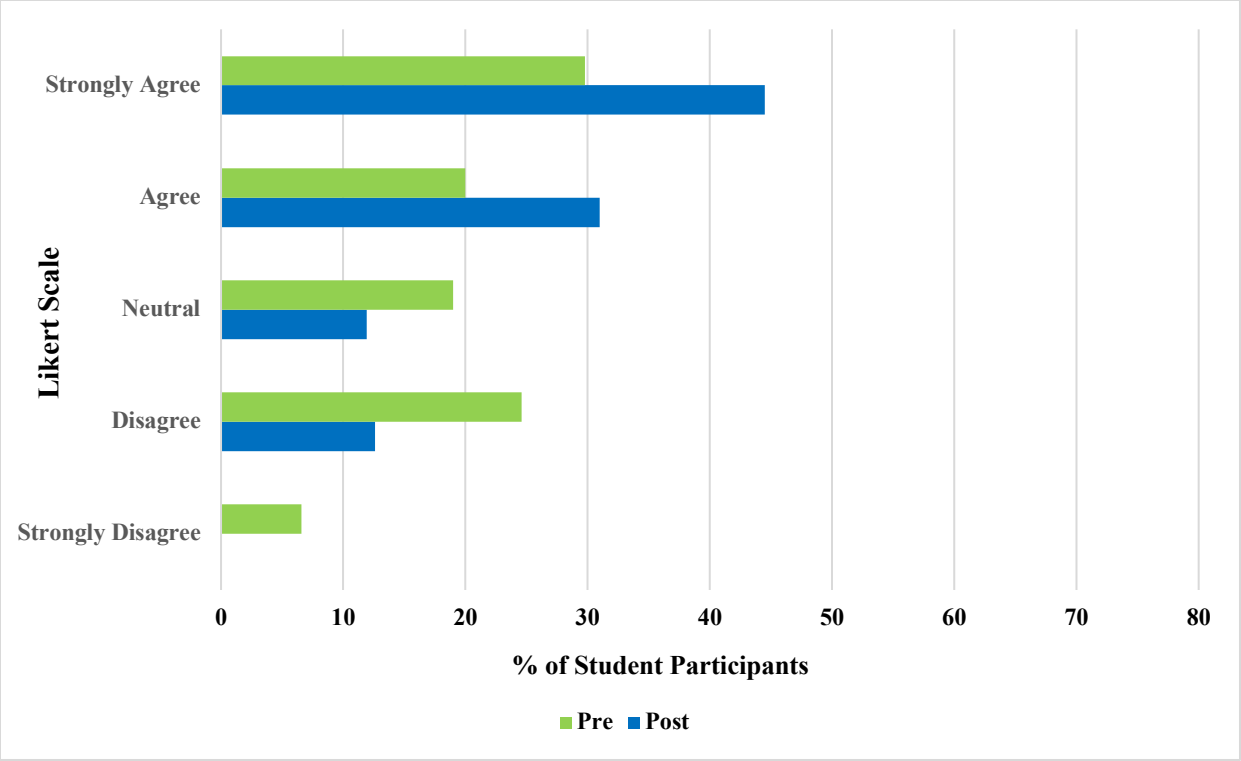


Figure 16. Peer tutee responses to Likert-type statement #7: I am satisfied with my grades in math.

influenced by the mentoring relationship. These scheme for the codes, categories, and themes derived from the focus groups are shown in Figure 17.

Effective Learning and Instruction Promote Cognitive Development

Some of the raw codes from the recordings in the focus groups that led to this theme were extra help, helping hand, explaining, restate, and teaching. During the focus groups, participants gave positive feedback regarding peer tutoring and the implementation of the framework. They felt overall that having a peer in the classroom allowed for someone to engage with them in a way that a teacher is not able to at times causing them to be more successful in learning math. Participant #2 shared, "The tutor in our classroom has a way of explaining a problem that is just different from my teacher." Participant #7 followed that comment with, "Exactly! I think they just learned it not too long ago and so it is easier for them to explain to me." When asked to share some of the reasons they like having a peer tutor in the room, Participant #1 explained, "The peer tutor slows down. Sometimes I feel like our teacher moves on even if we do not understand, but the tutor takes the time to help me understand what we are doing."

It was clear that the tutees felt more comfortable with the peer tutors as the tutors went at a more reasonable pace that matched the students learning ability and level. The students voiced that the peer tutors had a way of explaining the material that seemed easier to retain than when trying to understand the teacher's way of instructing.

Motivation and Engagement Can Be Influenced By Both Positive and Negative Social-Emotional Factors

The second theme from the focus groups was more pronounced than expected. While the extent of the growing social-emotional needs of students is evidence, I did not anticipate the severity. Words like comfortable, confident, excel, overwhelmed, embarrassed, worry, suffer,

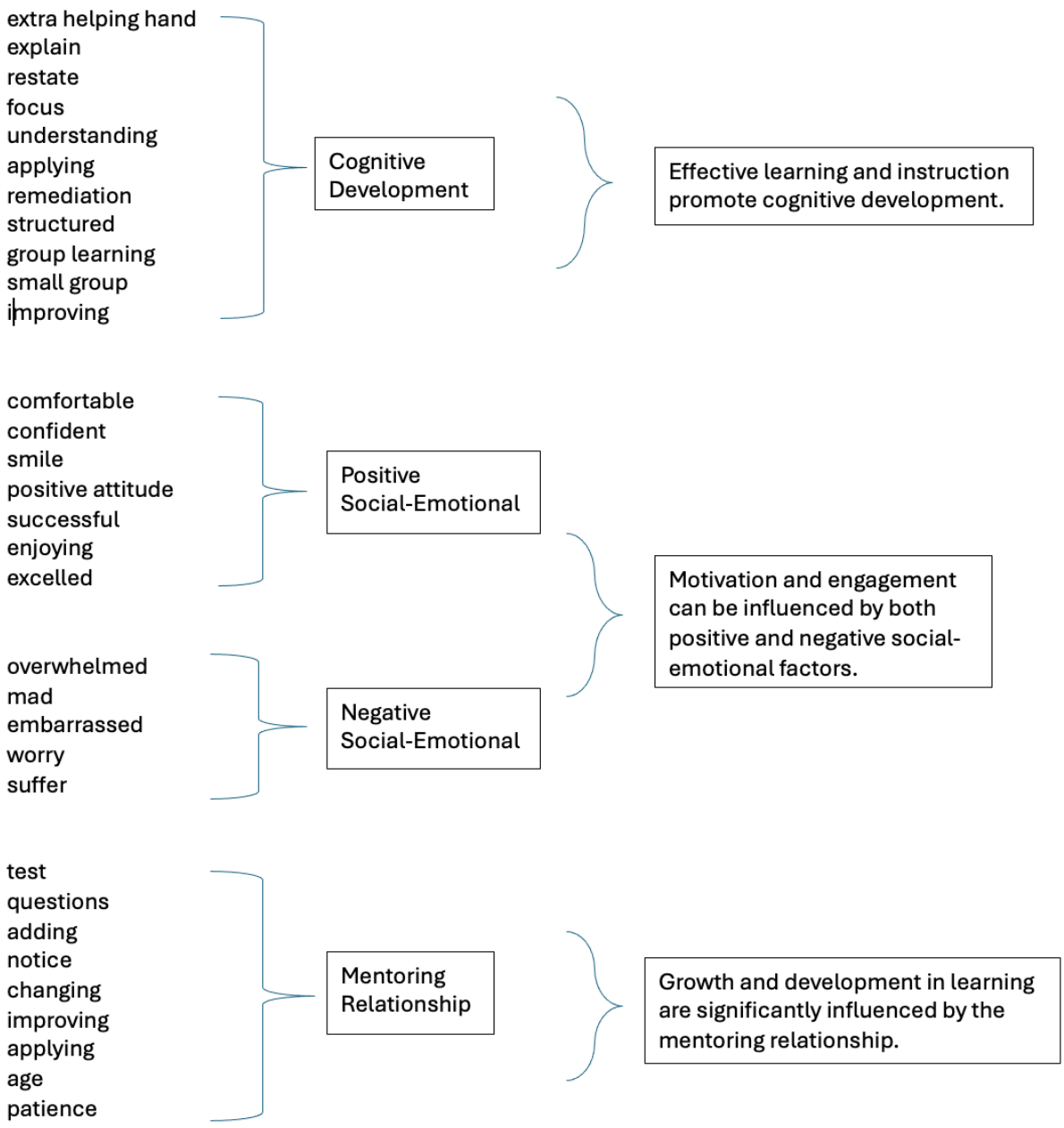


Figure 17. Codes, categories, and themes derived from peer tutee focus group transcripts.

are just some in the phrases students used that helped form this theme.

Participant #7 explained that he is easily embarrassed at his lack of knowledge in math class. Many other participants shook heads in agreeance. He stated,

> I hate worrying that I will be called on to give an answer in class that I know I will have wrong. I feel like the teacher kinda does it on purpose. But, if I can work it out with the tutor first, then I feel better about talking in front of the class.

Knowing that this student has this much stress each day going into this class lets me know just how overwhelmed and defeated he feels before he ever even tries to be successful.

Growth and Development In Learning are Significantly Influenced By the Mentoring Relationship

The third and last theme from the focus groups adheres directly to the necessity of the mentoring relationship for growth and development in learning to occur. Participant #3 described her experiences in math class as, "I feel much more comfortable asking my tutor for help than the teacher." Participant #5 replied to #3 stating, "Me too. I like my teacher, but I'm not as worried about the reaction I might get from my tutor." The participants went on to explain how the peer tutors show patience with them and work with them to improve their attitude toward the subject as well as their content knowledge. The frequency of words derived from the transcripts of the peer tutees show that the focus is on the student as it is the word with the highest frequency. With the next highest frequency are the words math, feel, helping, questions, motivation, and other similar words. This shows that assisting the students in math to be successful is how the students participating in the focus group view their experience with peer

tutoring. See Figure 18 for a word frequency cloud and Table 6 for a word frequency list from the focus group transcript of the peer tutees.

Peer Tutor Interviews

The peer tutor interviews offered insight and feedback that was extremely beneficial. Peer tutors saw the need for more time for one-on-one instruction and assistance for students. They also responded that students are desperate for someone who understands where they are in their learning and can make them comfortable to seek help. The themes from the peer tutor interviews were the following: Student motivation to learn tends to increase in small group learning settings, A positive and supportive tutor boosts students' willingness to engage with content, Students often fear larger environments for learning, Both tutors and tutees could benefit from additional one-on-one time. See Figure 19 for the scheme for the codes, categories, and themes derived from the interviews.

Student motivation to learn tends to increase in small group learning settings.

The peer tutors felt strongly that the students show a much better understanding then the content was simplified and was offered in a small group or one-on-one setting. Peer tutor #1 shared, "Students in the classroom really need small group or one-on-one help in math." Peer tutor #3, #4, and #5 all shared feedback similar to tutor #1. Peer tutor #4 went on to explain that he "remembers what it was like learning math and he did better in smaller group settings than with the entire class lecture style." He believed this helps him be a better tutor because he knows what it is like to need more personal attention in class. Peer tutor #3 stated that "often times there is embarrassment or even anxiety if you are asked to answer a question in a large group setting. It is much less scary to be with just a few people that you do not feel are judging you."

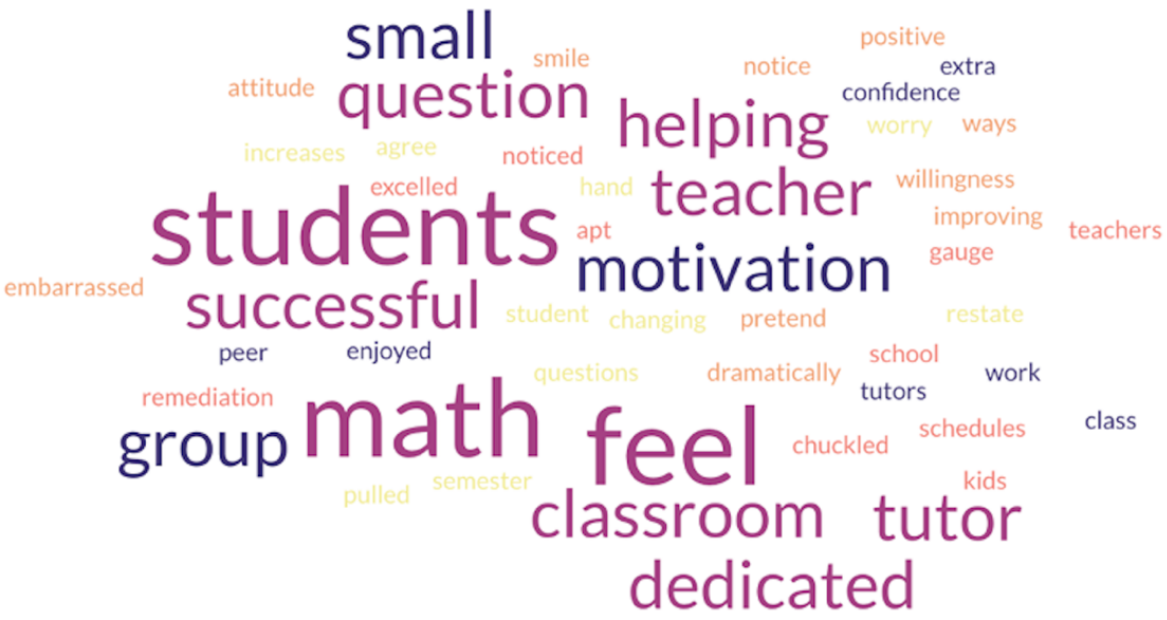


Figure 18. Word frequency cloud of peer tutee focus group transcripts.

Table 6

Frequency Word List from Peer Tutee Focus Group

Word	***Frequency***
students	27
math	25
feel	25
small	23
question	23
helping	23
teacher	23
motivation	23
successful	23
group	23
classroom	23
dedicated	23
tutor	23
confidence	18
extra	18
work	15
school	11
enjoyed	10
questions	8
embarrassed	8
attitude	8
smile	8
worry	7
improving	7
changing	6
agree	5
increases	5

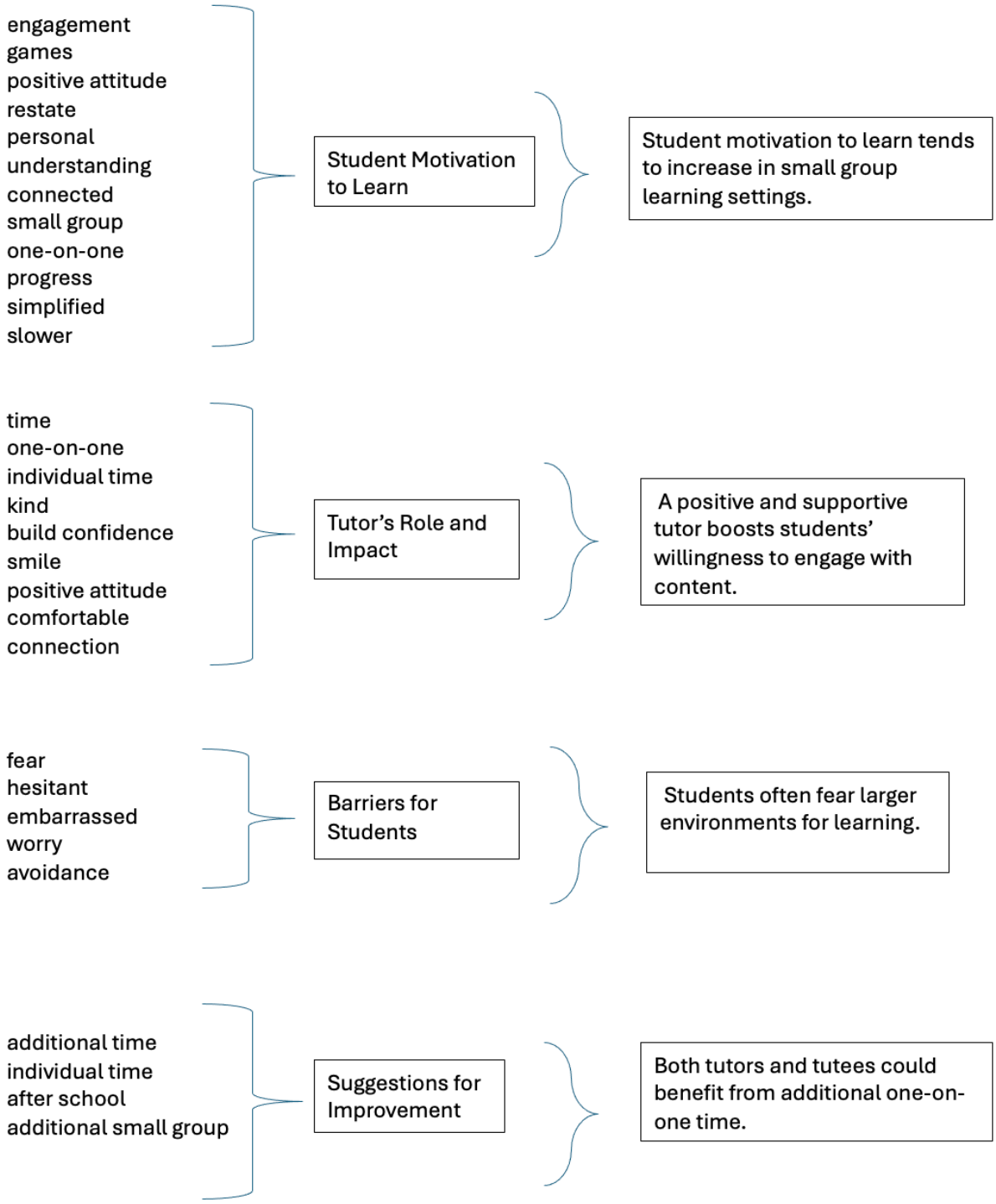


Figure 19. Codes, categories, and themes derived from peer tutor interview transcripts.

A positive and supportive tutor boosts students' willingness to engage with content.

It was seen in the data collected that engagement and motivation of tutees were found through excitement of the tutors. When students feel that they have a personal connection to a person helping them, they will engage in the content and be more willing to ask questions, learning to better comprehension. Motivation and engagement can be hard to find, especially in a content area where one finds learning difficult. Peer tutor #2 feels that tutoring can help struggling students with motivation in class. She shared, "Some students shut down quickly when they do not understand. Being there to walk them through work slowly helps the stress melt away." Peer tutor #5 followed, "There are times when a student just needs to walk away and take a break. Sometimes we can be there just to be a friend to them on a bad day." Peer tutor #1 followed up stating, "There are times when students just need someone to be nice to them and to just explain things in a way they can understand. Sometimes that is what we are."

Students often fear large environments for learning.

At times, students avoid asking questions out of fear and how they may be perceived. This fear can be heightened when in a large group setting versus a small setting or one-on-one. Peer tutor #3 explained that some students who are never speak in a regular classroom setting "would say hello outside of class" and would also "be more willing to ask questions to the tutor instead of the teacher." Peer tutor #1 followed this comment stating, "I do not think if we were not in class that these students would ever be willing to ask questions. They would just sit there and take the chance of never understanding." Peer tutors go on to say in the interviews that these same types of students will begin to really ask questions when put in a smaller group with them to work on a particular math concept.

Both tutors and tutees could benefit from additional one-on-one time.

Each of the tutors expressed a desire for more individual time with students to help improve outcomes in math**.** The tutors believe that tutee understanding of the content increase as students continue to engage in the tutoring sessions and tutors ability to help increases as well with each session. Tutor #2 states that for the tutoring model to improve "more time in the classrooms with the students individually would be ideal." Peer tutor #1 agrees stating, "The students need as must small group time with a tutor as they can get. It shocked me how much they were behind in math."

The word cloud in Figure 20 shows the words of the peer tutor interviews with the larger words appearing the most consistently in the data collection. Like the word cloud from the Focus Groups, the main word highlighted is students. Next in the list are the words tutors, time, help, one-on-one, asking, and motivation. The peer tutors word frequency aligned with the peer tutees as they felt that they assisted in the success of the tutees' success in the math classroom and created success for otherwise struggling students. The chart in Table 7 shows the word frequency list of the peer tutor word cloud.

Teacher Interviews

While cleaning and coding the data to develop themes from the teacher interviews, it was apparent that, similar to the focus groups and the peer tutors, teachers acknowledged the value of the peer tutors. Identical to the other collection instruments, I pulled out codes and categories by hand until I could see the themes emerge. The codes, categories, and themes derived from the teacher interview transcripts can be seen in Figure 21.

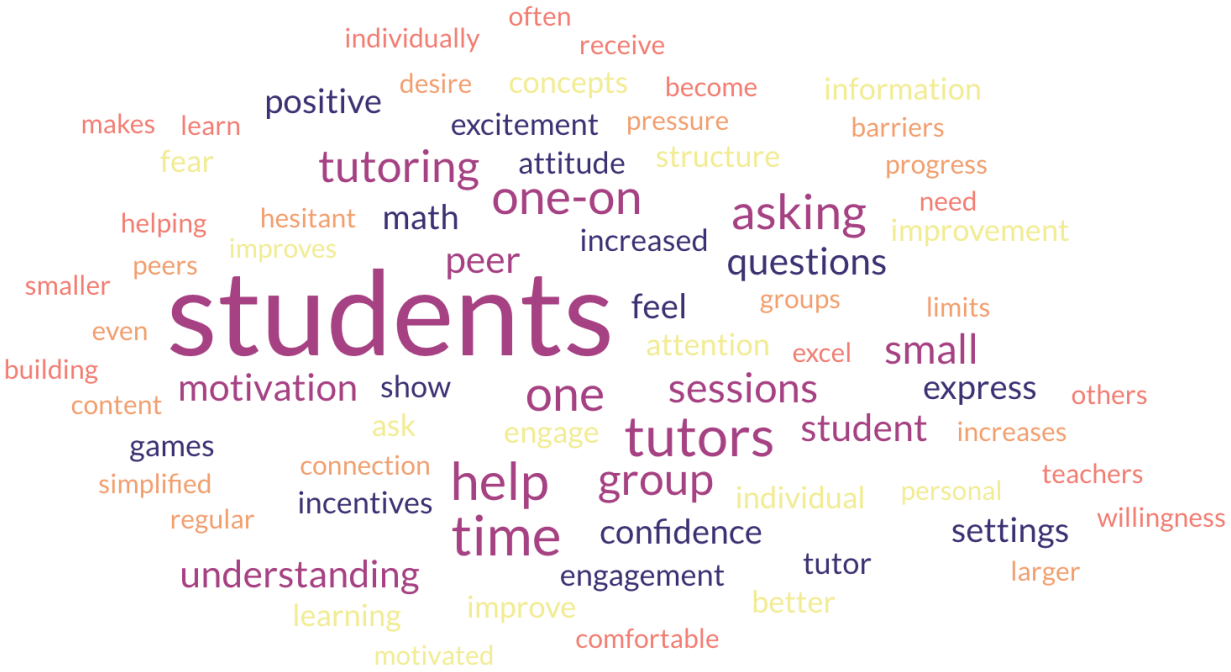


Figure 20. Word frequency cloud of peer tutor interview transcripts.

Table 7

Frequency Word List from Peer Tutor Interviews

Word	***Frequency***
students	27
tutors	10
time	10
help	9
one-on-one	8
asking	8
group	8
small	7
motivation	7
understanding	6
questions	6
positive	5
feel	5
setting	5
confidence	5
increased	5
engagement	4
incentives	4
attitude	4
excitement	4
better	4
fear	4
ask	3
improve	3
attention	3
learning	3
personal	3
simplified	3

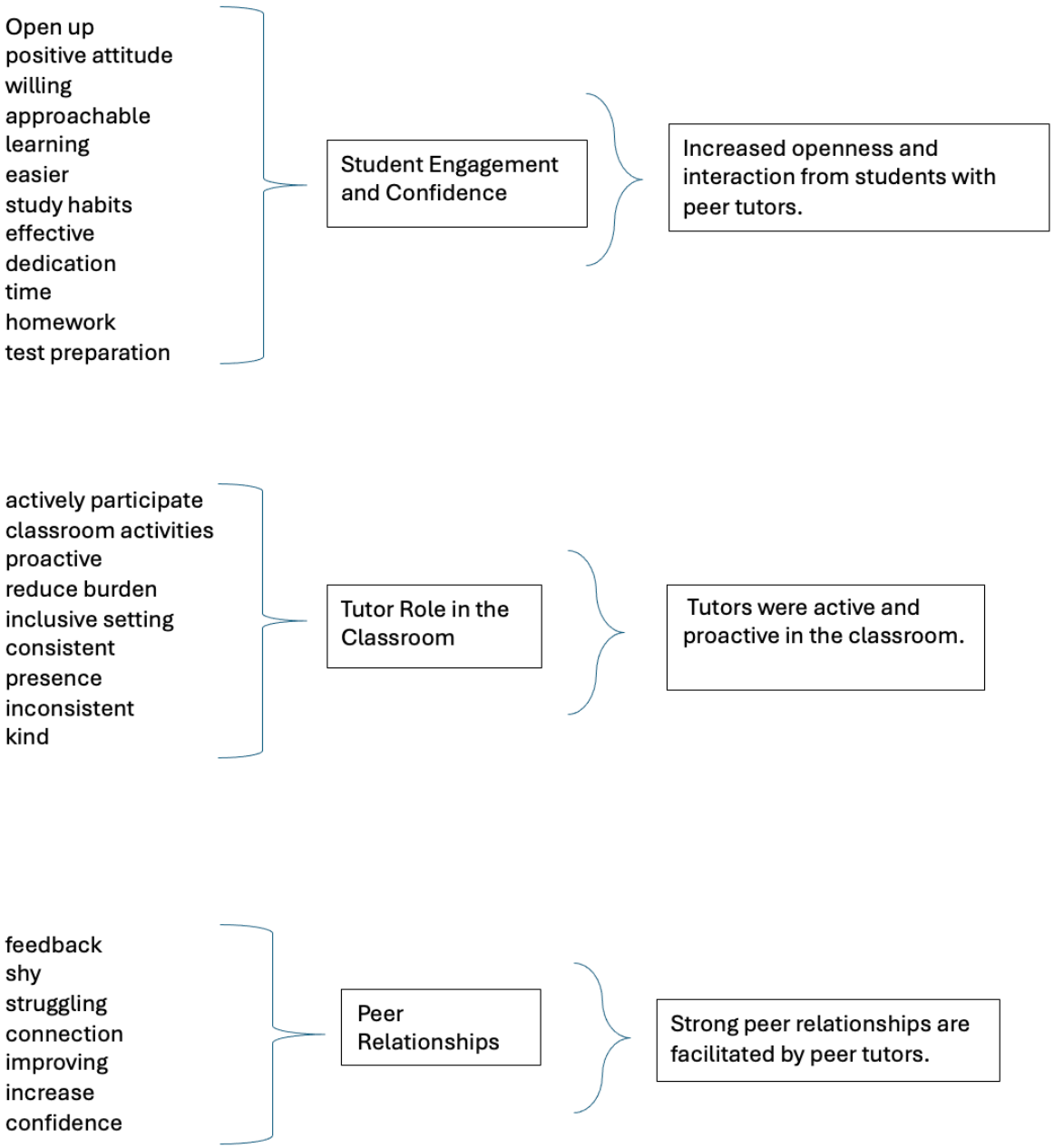


Figure 21. Codes, categories, and themes of Math 1 and Math 3 teacher interview transcripts.

Increased openness and interaction from students with peer tutors

Teachers involved in the inquiry were highly supportive of the peer tutors in the classroom, at least by the end of the inquiry. They felt that the tutors were able to have a rapport with the students that perhaps they could not. Instructionally, the tutors could restate the curriculum effectively in a way to help the students reach standard mastery, or at least get to a closer point of understanding. Teacher #2 shared,

> I was not as supportive in the beginning. I was concerned that I would have to almost babysit the tutors. I quickly realized they were the greatest instructional resource, especially for struggling students, or for students that would not normally participate in class. Students would much rather ask for help from a peer than me at times and the tutors were effective at explaining the content.

Teacher #1 shared, "I think the kids were more willing to open up to the peer tutors more than to me. It was more informal with them, and they were more comfortable." "Because of that openness students would ask questions and begin to understand content they may not otherwise engage in, therefor having success in math," according to Teacher #2.

Tutors were active and proactive in the classroom

Students come into the school with multiple problems and stressors before they can even begin a day of learning (Ansuategui & Miravet, 2017). Teacher #4 stated, "It was interesting to see how students that had never engaged with anyone in class pair up with the tutor and really show what they knew or did not know in class." Teacher #3 shared, "I was really able to know how to help a student based on the conversation or questions he or she would ask the tutor." Teacher #1 felt that during some points in class students would simply "need a friend

to discuss some things with and get it off of their chest, but that allows space for learning." Teacher #2 also shared that tutors were able to assist with appropriate "communication skills and how to handle certain situations that may arise in school." Teacher #3 also shared that she "rarely had to tell a tutor what to do or where to do. The tutor knew her role in the classroom and her purpose. She came in and worked hard for the students."

Strong peer relationships are facilitated by peer tutors

Teachers report during the interviews that growth and development were influenced by the mentoring relationships created during peer tutoring. Teacher #3 shared students working with tutors "communicated more positively about understanding what they were learning, scores, achievement, and motivation in school." Teacher #1 added that tutors added to "students' self-esteem and how to engage in cooperative learning with others." Teacher #5 stated that the peer tutor she had in her classroom enabled her to "maximize student learning by providing grouping and pairing with less academically successful students." By doing so, the students showed increases in math content knowledge. Teacher #5 reported that the students truly missed the tutors on days when they could not be in class. The students would ask when the tutor would be back as a true bond had been formed.

The word frequency cloud in Figure 22 was created using the words input from the teacher interviews. The words in Table 8 show the frequency of the words. Those used most frequently is willing, know, kind peer, time, and student. Aligning with the other word frequency charts, student was the priority of each group included in the inquiry. The other words of high frequency from the teacher interview indicate that they feel the peer tutors were an imperative part of the classroom setting, adding value to the learning environment for students.

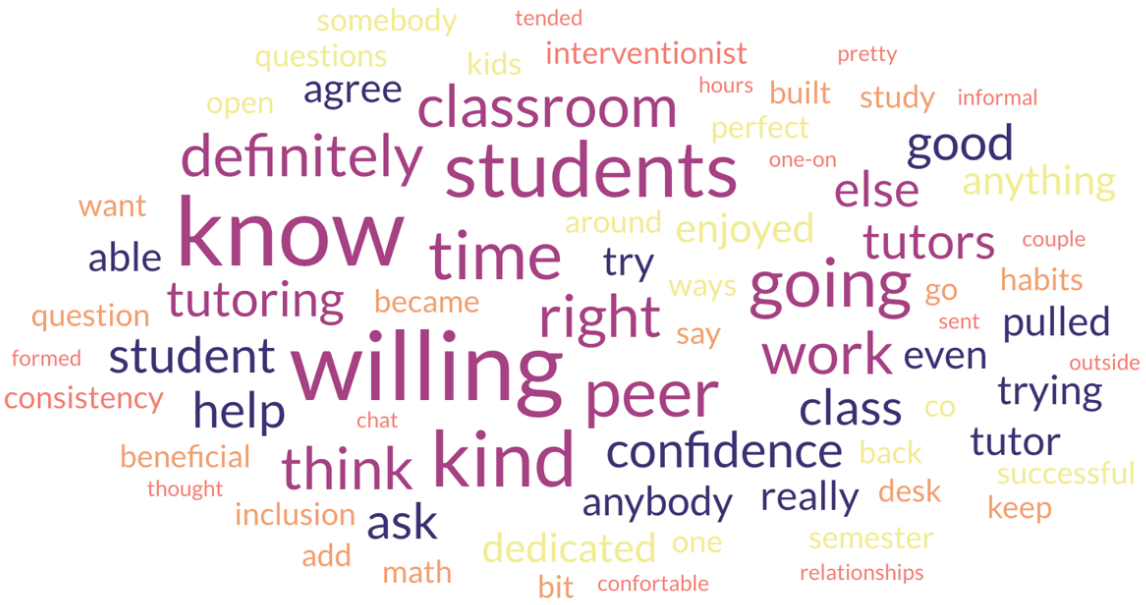


Figure 22. Word frequency cloud from teacher interview transcripts.

Table 8

Frequency Word List from Teacher Interviews

Word	***Frequency***
willing	11
know	11
students	10
kind	9
peer	9
going	8
time	8
classroom	7
think	7
right	6
work	6
tutoring	5
class	5
ask	5
confidence	4

North Carolina End of Course Assessment

As seen in Figure 23, the school was at 21.84% proficient in Math 1 in 2022-2023 and rose to 32.43% in 2023-2024. In Math 3 we were at 35.88% in 2022-2023 and increased to 43.88% in 2023-2024. While the did not meet overall expected growth for 2023-2024, it did increase a letter grade, bring the school out of its low performing status.

Table 9, Table 10, Table 11, and Table 12 show how students in the inquiry performed on the End-of-Course assessment. Teacher 1 taught only Math 1 and had 37 students complete the EOC. Eleven students did not meet growth while 26 met or exceeded growth as determined by EVAAS. Out of the 21 students that completed the EOC for Teacher 2, who also taught Math 1, seven students did not meet growth, and 14 students met or exceeded. Teacher 3 is a Math 3 teacher. She had 19 students complete the EOC. Two students did not meet growth, while 17 met or exceeded growth. Finally, Teacher 4, also an instructor of Math 3 had seven students that did not meet growth while 17 met or exceeded growth.

Summary

The inquiry utilized mixed methods, and action research that yielded positive outcomes from implementing peer tutoring through the SPAM framework. The inquiry was found to increase student self-efficacy and confidence in the subject of math and content knowledge. Students' level of proficiency was increased, and more students met their goal marker during the year than in the past previous data years since the learning loss of COVID-19. Students reported a connection to their tutor and felt more confident in learning strategies when engaging with a tutor versus their teacher. The next chapter will feature the interpretations of the findings and the recommendations for future studies. Lastly, I will offer my reflections on leadership growth and development because of completing this inquiry.

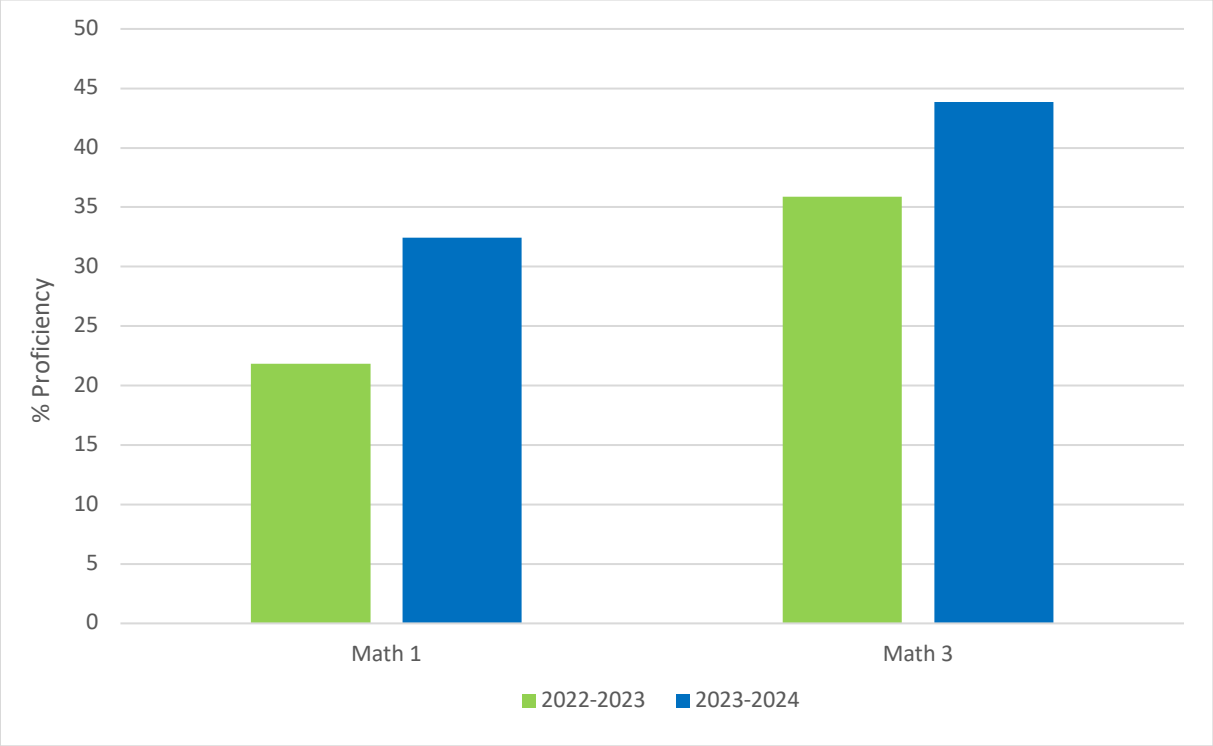


Figure 23. Math 1 and Math 3 End-of-Course tests proficiency for 2022-2023 and 2023-2024.

Table 9

Growth Projections to EOC Scores for Teacher 1 Math I 2023-2024

Student #	EVAAS Projected EOC Score	EOC Score	Percentage Difference Between Projection & Score
1	54	68	14
2	60	66	6
3	57	68	11
4	41	72	31
5	48	55	7
6	66	81	15
7	48	58	10
8	50	72	22
9	35	55	20
10	66	85	19
11	48	66	18
12	38	22	-16
13	30	27	-3
14	32	11	-21
15	54	85	31
16	48	78	30
17	60	68	8
18	66	81	15
19	45	3	-42
20	30	27	-3
21	57	74	17
22	66	89	23
23	50	58	8
24	45	55	10
25	70	72	2
26	50	58	8
27	26	2	-24
28	48	48	0
29	60	48	-12
30	41	44	3
31	70	95	25
32	35	3	-32
33	26	81	55
34	65	44	-21
35	26	16	-10
36	41	11	-30
37	66	72	6

Table 10

Growth Projections to EOC Scores for Teacher 2 Math I 2023-2024

Student #	EVAAS Projected EOC Score	EOC Score	Percentage Difference Between Projection & Score
1	45	38	-7
2	48	38	-10
3	26	16	-10
4	73	91	18
5	38	51	13
6	41	27	-14
7	32	38	6
8	35	48	13
9	35	44	9
10	26	27	1
11	12	1	-11
12	21	33	12
13	41	33	-8
14	60	74	14
15	16	58	42
16	32	48	16
17	12	22	10
18	21	16	-5
19	45	66	21
20	35	48	13
21	48	82	34

Table 11

Growth Projections to EOC Scores for Teacher 3 Math I 2023-2024

Student #	EVAAS Projected EOC Score	EOC Score	Percentage Difference Between Projection & Score
1	62	69	7
2	66	83	17
3	77	92	15
4	77	92	15
5	66	63	-3
6	73	86	13
7	51	83	32
8	59	79	20
9	59	75	16
10	59	69	10
11	48	59	11
12	82	96	14
13	59	75	16
14	48	69	21
15	51	53	2
16	10	2	-8
17	41	63	28
18	38	45	7
19	44	59	15

Table 12

Growth Projections to EOC Scores for Teacher 4 Math I 2023-2024

Student #	EVAAS Projected EOC Score	EOC Score	Percentage Difference Between Projection & Score
1	59	63	4
2	55	69	14
3	38	41	3
4	38	36	-2
5	5	24	19
6	35	9	-26
7	38	56	18
8	41	56	15
9	22	63	41
10	44	6	-38
11	66	72	6
12	44	56	12
13	55	41	-14
14	62	56	-6
15	18	9	-9
16	33	33	0
17	73	72	-1

CHAPTER 5: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This inquiry endeavored to implement peer tutoring in a rural high school in Math 1 and Math 3 classrooms to increase student self-efficacy, positive mindset, and math achievement. Guiding frameworks included the Youth Mentoring Model and the Student Peer Assisted Mentoring model. Both were essential in building positive rapport with peers and increasing peer tutee confidence in mathematics. These conceptual frameworks guided the implementation of peer tutoring, causing positive impacts on student achievement and self-efficacy.

Math achievement has been on a rapid decline at this high school since the COVID-19 pandemic. Learning loss due to students not being in school and lack of instruction led to a significant decrease in engaging and effective instruction (Wyse et al., 2020).

The inquiry followed a mixed-methods action research design. Data was collected through different instruments to analyze. Peer tutors were assigned math classrooms to support student learning while establishing and building positive rapport with those students they served. The findings of the inquiry support the research of others who have studied peer tutoring in secondary classrooms and offers further discoveries in the findings.

Summary of the Findings

The findings for this inquiry are organized herein by each of the guiding inquiry questions.

What effect does a peer tutoring program have on the improvement of students' attitudes and mindset toward math?

Student survey questions 1 and 2 address this question. Question 1 stated "Math is an important subject to me." Students in the pre-survey rated this overall with 31.3% at a 4 followed closely at 27.8% at a 3. This question increased in agreeance as it rose to 39.0% in the post-

survey. Question 2 stated “I best learn math by using manipulatives, gaming, etc.” 38.3% of students were neutral as they answered this question at a 3 in the pre-survey and showed a slight decline in the post-survey at 37.2% in the post-survey. Questions 1 and 2 in both the tutor interviews and the tutee focus group also addressed this first inquiry question.

The peer tutee focus groups asked the tutees “How do you feel working with a peer tutor in math?” and “What do you like about it?”. The students replied positively overall in their responses. Students felt the peers added a helping hand in the classroom. They help them understand math and feel differently than their classroom teachers did at times. They made them feel comfortable and have more of a positive attitude by showing more patience in their instruction.

The tutor interviews supported this as well. In their first two interview questions, they were asked “In what ways did you notice student motivation toward math improving/changing?” and “In what ways did you notice student understanding of math improving/changing?” They responded much in the same way that they felt students were positively motivated by tutoring and they felt more comfortable working one-on-one or in small groups with a tutor. They also felt that the way they could explain math or a particular problem was more effective at times than the way a teacher may explain to the students.

The teacher interview questions 1 and 2 also contributed to answering inquiry question 1. The teachers were asked, “In what ways was peer tutoring successful in your classroom?” and “Can you talk about how students’ motivation and confidence in math change during the semester as they worked with the peer tutors?” Much like the peer tutees and peer tutors, the teachers were positive in their responses. The teachers noticed that the students working with people more their age was helpful, and the quality of our tutors was fantastic. They noticed

students engaging in learning and being willing to ask questions when they do not have a firm understanding of concepts. The rapport that they build with the peer tutors created a successful environment of learning.

The implementation of the framework resulted in positive overall outcomes regarding students' attitudes and mindsets toward math. Peer tutees confidence in math and rapport with peer tutors showed significant increases as evidenced by student surveys and interviews with the math teachers and peer tutors and the focus group transcripts. The main words emerging from the word cloud created from both the interviews of the teachers and tutors are students, motivation, group, successful, and dedicated. That encompasses the thoughts and similarities of the interviews showing strong indicator of success.

How will the implementation of a peer tutoring program in Math 1 and Math 3 classrooms affect student growth toward math proficiency performance?

Inquiry question 2 was answered by questions 3, 4, and 5 of the student survey; question 2 of the tutor interview; questions 3 and 4 of the tutee focus group; and questions 1, 2, and 3 of the teacher interviews.

Question 3 of the student survey which stated, "I enjoy it when other students help me understand math", showed a median response of 3 at 32.2% in the pre-survey and jumped to 40.0% in the post-survey. Question 4 stated, "I have friends at school." During the pre-survey, 56.6% felt strongly that this was true with a 5, and over 70.0% answered with a 5 in the post-survey. "It is easy for me to ask a peer questions in class when I do not understand something" was question 5. This question was evenly distributed in answers in the pre-survey, but 27.8% answered with a 3, however, over 74.0% answered the same way in the post-assessment.

Question 2 of the tutor interviews asked, “In what ways did you notice student understanding of math improving/changing?” Each tutor answered that they felt students really began to respond well to the tutors, perhaps even more than they did to their classroom teachers at times. They were more willing to ask tutors questions and more confident in smaller settings with peers than with the rest of the class. They were not as easily embarrassed to try and fail so they were able to learn more.

Tutee focus group questions 3 and 4 asked, “What are you 2-3 favorite reasons you enjoy working with a peer and 2-3 reasons why you do not enjoy working with a peer?” and “Does working with a peer make you feel more confident about your work or learning in math class?” These questions gave way to an extremely insightful conversation in the focus groups. The students felt strongly that classroom teachers “teach too much, too quickly” but the tutors slow things down for them and teach the material in a way that is much easier to understand. They felt much more confident and aware when they were with a peer tutor. The students did not worry about making a mistake, and when it happened, they continued on with learning. The tutees felt they were able to really focus on just the math and not panic on what they could not do or not figure out.

Each of the teacher interview questions were imperative to answer this inquiry question. The teachers were asked “In what ways was peer tutoring successful in your classroom?”, “Can you talk about how students’ motivation and confidence in math changed during the semester as they worked with the peer tutors?”, and “In what ways did students’ study habits and time dedicated to work change during their time with peer tutoring?”. The teachers all felt they had strong tutors that took the initiative in the classroom. If a student or group of students needed assistance, they helped without being told. The teachers felt that the students heard things in a

different way and that was extremely beneficial more many of them as sometimes the way the teachers teach may not be how they learn. They also felt that many students began to feel successful when working together with a tutor and that built their confidence so that they were willing to put more time and effort into the subject causing them to be even more successful.

THS was able to come out of low performing due to an increase in proficiency. The school failed to meet growth, however that was not due to lack of growth in the tested math areas. Math 1 and Math 3 had strong indicators of growth for all students, including students that participated in the inquiry. Of the 94 students that participated in the inquiry, 66 met or exceeded their projection given by EVAAS while 28 did not.

EOG data showed an incredible increase in student achievement. Math 1 had an overall increase of 10.6% and Math 3 increased 8.0% from the year prior. Unfortunately, math is only one part of a highly complex equation that goes into the growth model for a school. Three subject areas, Math 1, Math 3, and English 2, are calculated for growth. The state uses the projected scores and also compares what students score on the EOC tests to other students in the state to determine if the student makes growth. This in turn causes the teacher to meet growth, then the school, and next the district. Math scores were not the cause of THS not meeting growth for the school year. Another subject area was significantly down in all subgroups hindering our growth substantially. Math 1 and Math 3, however, was a large part of why we were able to grow six points in proficiency. While growth makes up 20% of the equation for school accountability, the remaining 80% is grade level proficiency. This is a combination of the above content areas, plus Biology, 4-year graduation cohort percentage, ACT and WorkKeys assessments, and other school accountability factors. Because math showed such an increase in grade level proficiency

this year, it was a large part of why THS was able to increase the school accountability letter grade from a D to a C.

What effect does participation in a peer tutoring program have on the math self-efficacy of tutored students?

Each of the questions in the student survey helped to answer inquiry question 3. The second question of the tutor interview; each question of the tutee focus groups; and question 2 and 3 of the teacher interview also assisted in answering the last inquiry question.

Question 1 of the student survey stated, “Math is an important subject to me.” Students in the pre-survey rated this overall with 31.3% at a 4 followed closely at 27.8% at a 3. This question increased in agreeance as it rose to 39.0% in the post-survey. Question 2 stated “I best learn math by using manipulatives, gaming, etc.” Of students, 38.3% were neutral as they answered this question at a 3 in the pre-survey and showed a slight decline in the post-survey at 37.2% in the post-survey. Question 3 which stated, “I enjoy it when other students help me understand math”, showed a median response of 3 at 32.2% in the pre-survey and jumped to 40.0% in the post-survey. Question 4 stated, “I have friends at school.” During the pre-survey, 56.6% felt strongly that this was true with a 5, and over 70.0% answered with a 5 in the post-survey. “It is easy for me to ask a peer questions in class when I do not understand something” was question 5. This question was evenly distributed in answers in the pre-survey, but 27.8% answered with a 3, however, over 74.0% answered the same way in the post-assessment. Question 6 stated, “I will use Math1/Math 3 content in my post-graduation plans”. Over 32.0% answered the pre-survey with a 3 with that percentage rising to 35.7% in the post-survey. The last question stated, “I am satisfied with my grades in math.” Almost 30% answered with a 5 on the pre-survey with the post-survey answering at 44.5%.

Tutor interview questions 1 and 3 asked “In what ways did you notice student motivation toward math improving/changing?” and “What do you feel should change about your experience with peer tutoring to make it more successful?” The tutors felt that students they tutored had a major increase in motivation throughout their time tutoring. They thought they were successful in increasing self-efficacy and the students truly wanted to work hard and do well in their class. The tutors did state that they would change a few things. They wanted more designated time with those students that were struggling during independent work time in the class, or a time to pull small groups versus rotating the room to assist students. They also had scheduling conflicts at times with their college class schedules and when math classes on campus were scheduled.

Each tutee focus group question assisted in answering this inquiry question. They consistently stated that they really enjoyed their time with a tutor as their confidence grew in math and intrinsically. They felt that they had more ambition and excelled in an area they never thought possible. That may not mean they made straight As, but they made better grades than ever, and the hard work really paid off.

The teacher interview questions 2 and 3 were also utilized to answer inquiry question 3. The teachers acknowledged that tutors were able to reach students in ways that they did not or could not and it was extraordinary to watch. They could have tutors work with students before they reached a place of overwhelming frustration. By doing so, students were able to keep emotions in check and grow confidence, not anger. They were able to keep focus and learn math instead of thinking only on what they were not accomplishing.

From the student survey given to each peer tutee, each question regarding self-efficacy saw an increase in agreement from pre- to post-implementation except for Question 2. Question 2 showed a slight decline in the highest percentage answer, Neutral, in the pre responses.

Students in the focus group spoke to how they felt they could accomplish more successfully in math when working with a peer tutor as the content was easier to comprehend and they chunked it in more consumable pieces for them to better understand. Classroom teachers agreed during their interviews. They acknowledged that the peer tutors could reach the students and teach them more effectively at many math skills better than they could.

Interpretation of the Findings

The findings from this inquiry were intended to determine if peer tutoring in the Math 1 and Math 3 classrooms improved student self-efficacy, confidence in math, and achievement in math. This inquiry explored literature of peer tutoring at the secondary level, efficacy in learning, youth mentoring intervention, and differentiated teaching approaches. Aligned with Youth Mentoring Model and Student Peer Assisted Mentoring, this inquiry was designed to place peer tutors with peer tutees. The findings support much of the existent literature and assist in future inquiries.

The first inquiry question asked about the effect of peer tutoring on the improvement of students' attitudes and mindset toward math. There are benefits of peer tutoring with regard to attitude and emotional outcomes toward school and sense of self (Robinson et al., 2005). Tutors may be security blankets for some students in social and cognitive turmoil and they may depend on the bond with a peer (Rhodes, 2005). Peer tutoring can very much be utilized as an instructional tool that may increase student learning simply by improving students' attitudes towards instruction (Li et al., 2021). The inquiry supported this literature as students involved had a positive mindset when working with peer tutors. They preferred working with peers as they felt more confident to ask questions when there was a lack of understanding causing them to learn more.

The next inquiry question asked how the implementation of a peer tutoring program in Math 1 and Math 3 classrooms affect student growth toward math proficiency performance. Like the first inquiry questions, students have to have a positive attitude and math set to feel confident to ask and learn. That creates an environment conducive to learning. Students, especially with learning issues, typically need a unique method of instruction to help them in learning. Group learning and peer learning are key intervention for struggling learners (Dobbins et al., 2014). For a student to learn and grow as much as he or she is capable, educators need to close the learning gap, giving students immediate feedback, and giving students social support (Tang et al., 2022). Peer tutoring, or working with peers during learning, can cause less stress, high confidence, and higher academic grades in school. Supplemental instruction by peer leaders help students with engagement in learning and content knowledge leading to better scores (Gregg & Shin, 2021). Again, the inquiry supported the literature as the peer tutees' EOC scores and proficiency showed significant increases.

The final inquiry question asked what effect participation in a peer tutoring program has on math self-efficacy of tutored students. The implementation of the frameworks, SPAM and YMM proved beneficial for peer tutors and peer tutees. Like Vygotsky's Zone of Proximal Development, SPAM focuses on guiding students, making them feel a part of a group, and acknowledging that student engagement is critical for success (Duran, 2017). YMM focused on the relationships built between peer tutee and peer tutor that can increase the math self-efficacy to give the learner the confidence of knowing he or she is capable of success. This is a large factor in academic achievement (Motlagh et al., 2011). The students, both tutor and tutee, shared that they saw self-efficacy raise throughout the inquiry as they felt accomplished and competent in math and able to perform well on assessments.

Limitations of the Inquiry

There were several possible limitations of the inquiry. During the year, two of the Math 1 teachers were out on maternity leave. During those weeks out, the classes were put together for the other teacher of record to instruct, along with the peer tutor, substitute, interventionist, and an inclusion co-teacher for two of the sections. While this was not an ideal situation, it was thought to be a better option for instruction rather than having a long-term sub with no teaching background in the classroom. I am the building administrator at THS. That is a possible limitation as it could skew responses from staff members and students. Another limitation is the scheduling of the peer tutors for each of the math classes. Each tutor has his or her own class schedules for the community college as they are dually enrolled. Some could offer more time to TMS than others meaning some Math classrooms received more peer tutoring time than others. That was thought through very strategically, however, the exact same time was not given to each math class each day. Also, some of the math classes also had a co-teacher present as they were an inclusion section. This meant that particular sections may have had another adult present for the duration of the class while others did not.

Implications of the Findings for Practice

When I look at the word cloud created from qualitative responses by the student participants in the inquiry, the most frequent words used are: feel, motivation, successful, helping, dedicated, students. When I look at these words together, it shows me that we have to address students' needs to enable them to engage in their learning. What the world demands of a person socially and emotionally must be met in school to effectively prepare them (Moliner & Alegre, 2020). We have to meet students' needs for them to be able to then learn. YMM allows students to have small moments of success while being vulnerable with peers who are positive

and walk them through conflict (Rhodes, 2005). Students will not reach his or her full potential if we are not fully meeting his or her needs. By having the tutors work alongside the tutees, consistently observe in the classrooms, and collecting and analyzing data, I was able to see how effective peer tutoring could be for instruction often because of the relationships built between tutor and tutee. The tutor was able to reach the tutee in a way that an adult could not. The tutee felt safe to speak out, ask questions, and receive help without fear or hesitation.

This is a tremendous positive of the inquiry, as it leads to greater questions. What happens when a peer tutor is not readily available? Why are our teachers not able to reach students like a peer tutor? What happens in classrooms where there is a vacancy? Having access to peer tutors and creating an environment where we are promoting this as a useful intervention for students helps monumentally when there is a vacancy. Students need peer tutors then more than ever. Peer tutors can offer stability and math knowledge when a substitute for a teacher possibly cannot (Chappel, 2018). Whether it is needing more assistance for multiple learning levels in a classroom or ensuring all students receive the help they are asking for during a lesson, peer tutors can assist in a significant amount of classroom needs.

This inquiry began with implementing peer tutoring as a means to improve learning and growth both academically and socially for struggling students. As I principal, I never imagined I would see the necessity and power of relationships as strongly as I did from student to student. I found such a need to ensure the adults in the building do not forget how imperative it is for students to feel confident in learning and welcomed in classrooms. Only then will they be emotionally and mentally open to learning, helping with their actually achievement.

Recommendations for Practice

Students will higher self-efficacy tend to not fear challenges, are willing to enroll in tougher courses, causing them to earn better paying jobs in the future (Ahmad & Safaria, 2013). The findings from this inquiry suggest that intentional implementation of peer tutors in the math classroom creates confidence and self-efficacy in students as they learn and grow in math. Peer collaboration benefitted not only the tutees, but also allowed the teachers to have assistance by dedicated, knowledgeable tutors. This consistent structure for each classroom ensured students is received more small group or one-on-one time with a peer tutor to increase imperative math skills.

Further practice in other settings could be extremely beneficial for other students in different age groups. Expansion to peer tutors at a middle school or elementary school could help students increase knowledge in fundamental skills to prepare them prior to more complex course work. The application process for the peer tutors could look the same, however, peer tutors could be vetted for different age groups and different content areas. This could also be the case for secondary content areas outside of just Math 1 and Math 3. By teachers collaborating or instructional coaches in different buildings collaborating to share peer tutors and peer tutoring plans, more students across the school system could benefit from peer to peer learning.

Beyond the process of finding and assigning peer tutors to areas, it would be highly recommended to focus specifically on student confidence, social emotional needs, and building relationships initially as it was clearly seen throughout the inquiry that students craved a connection with peers more than anything. They main reason they were able to attain the information given in class was because the peer tutor began to erase the fear of not knowing and being wrong. Peer interaction caused students to have significantly less stress while learning so

that they could actual demonstrate learning (Gregg & Shin, 2021). Students have such great social-emotional needs that, at times, that is the largest hinderance from learning. Peers can begin removing that barrier and allow them to begin learning.

Recommendations for Future Study

This inquiry was specifically designed to identify the impact of peer tutoring in the math classroom. Future studies would benefit greatly from frontloading more professional development for involved teachers and peer tutors for the social-emotional needs of students to create a conducive learning environment. While the frameworks implemented addressed social-emotional needs, a more comprehensive approach of the needs of students would greatly benefit this type of inquiry. By doing so, I feel that even more academic growth and a greater increase in tutee self-efficacy would be tracked.

Additionally, future inquiries could also identify the impact of peer tutoring in other content areas and other specific age ranges. For example, high school students acting as peer tutors in the middle school content areas or even the elementary school age group. As peer tutors begin to work with other age groups or in other content areas, it would be interesting to analyze the impact. Peer tutoring could help assist in elementary students learning foundational skills needed for middle school and middle school for high school. An inquiry about the impact of peer tutoring at either of those lower levels could be telling of this intervention. Implementation of peer tutoring in another content area, such as English, could also prove to be successful. If students have difficulty in math, it could be assumed that students find it difficult to grow in the area of reading.

Conclusions

The teacher shortage felt in many areas across the state and nation may not go away soon. The responsibilities of educators may not lessen in the near future. Incentives for youth to enter into this career path may not be at all what it once was. However, most of us are powerless with regard to the growing list of the difficulties of education. What we do have control over is what we do inside of our classrooms to offer the best education to the students that enter each day. This inquiry and the existing research literature show that peer tutoring is a strong intervention of support that can make a strong difference in math classrooms and to students that have learning struggles.

Students' math attitude and mindset, self-efficacy, and math achievement all showed increases per the data findings as a result of peer tutoring. Although we will continue to have effects from COVID-19, the demands placed on educators, and teachers leaving the profession with fewer teachers to replace them, peer tutoring is one pathway to assist in eliminating several of these issues. Most importantly, however, created a culture that is conducive to learning in the school building.

Scholarly Practitioner Reflections on Leadership

I began this inquiry to increase student achievement in mathematics as there has been a steady decline consistently in the past several years. What I did not expect was how much I would learn about myself and the deep dive that I would take into instruction. I have considered myself an instructional leader as I feel that is my responsibility as a principal. I have also felt that I had a talent for that when it came to leading the adults in the building and really giving them a voice and listening to what was going on in the building and classrooms. I also have always felt that I have always been a building leader that heard by students. However, it was evident during

the inquiry that I have not executed perhaps the most critical component. It seems so obvious that as a principal of a school setting that I speak to students all the time, guiding them in so many different situations and scenarios. However, this showed me that more time needs to be given directly to the students and their learning experiences, needs, and reflections. I ask teachers so often to adjust teaching strategies or lesson planning to the needs of the students they serve. This inquiry taught me to slow down in my day and really take inventory of what the students can communicate that they need in the learning settings. They are exceptional in so many ways and this is yet another way that they can advocate for what they need if we just listen and adjust.

This was an experience that was one of the most beneficial I have every had professionally that has now become a common practice. I have committees with student leaders to not only grow students, but help our staff grow as educators. If I want students to have a strong sense of self-efficacy, that begins with them communicating needs about his or her educational experience. Not only am I responsible for building teacher capacity, but I must strive to build that in my students as well.

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APPENDIX A: INSTITUTIONAL REVIEW BOARD APPROVAL

EAST CAROLINA UNIVERSITY
University & Medical Center Institutional Review Board
Willis Building · Mail Stop 682
600 Moye Boulevard · Greenville, NC 27834
Office **252-744-2914** · Fax **252-744-2284** ·
rede.ecu.edu/umcirb/

Notification of Exempt Certification

From: Social/Behavioral IRB
To: Elizabeth Pierce
CC: Travis Lewis
Date: 1/22/2024
Re: UMCIRB 23-002399
Utilization of Peer Tutoring

I am pleased to inform you that your research submission has been certified as exempt on 1/20/2024. This study is eligible for Exempt Certification under category # 1.

It is your responsibility to ensure that this research is conducted in the manner reported in your application and/or protocol, as well as being consistent with the ethical principles of the Belmont Report and your profession.

This research study does not require any additional interaction with the UMCIRB unless there are proposed changes to this study. Any change, prior to implementing that change, must be submitted to the UMCIRB for review and approval. The UMCIRB will determine if the change impacts the eligibility of the research for exempt status. If more substantive review is required, you will be notified within five business days.

Document	Description
Consent Form Tutor and Teacher(0.02)	Consent Forms
Elizabeth Pierce Dissertation Final Draft.docx(0.01)	Study Protocol or Grant Application
Informed Assent Tutee.docx(0.01)	Consent Forms
Parent Consent 1-11-24.docx(0.03)	Consent Forms
Peer Tutee Focus Group.docx(0.01)	Interview/Focus Group Scripts/Questions
Peer Tutor Focus Group.docx(0.01)	Interview/Focus Group Scripts/Questions
Student Survey.docx(0.01)	Interview/Focus Group Scripts/Questions
Student Survey.docx(0.01)	Surveys and Questionnaires
Teacher Interview.docx(0.01)	Interview/Focus Group Scripts/Questions

For research studies where a waiver or alteration of HIPAA Authorization has been approved, the IRB states that each of the waiver criteria in 45 CFR 164.512(i)(1)(i)(A) and (2)(i) through (v) have been met. Additionally, the elements of PHI to be collected as described in items 1 and 2 of the Application for Waiver of Authorization have been determined to be the minimal necessary for the specified research.

The Chairperson (or designee) does not have a potential for conflict of interest on this study.

APPENDIX B: INFORMED CONSENT FORM (ENGLISH)

Informed Consent to Participate in Research
Information to consider before taking part in research that has no more than minimal risk.

Title of Research Study: Increasing Math Proficiency Through the Utilization of Peer Tutoring

Principal Investigator: Elizabeth Pierce (EdD Student Name / Person in Charge of this Study)
Institution, Department or Division: Department of Educational Leadership, College of Education, East Carolina University
Address: 8852 NC Highway 41, Richlands, NC 28574
Telephone #: 252-717-1885

Researchers at East Carolina University (ECU) study issues related to society, health problems, environmental problems, behavior problems and the human condition. To do this, we need the help of volunteers who are willing to take part in research.

Why am I being invited to take part in this research?
The purpose of this research is to increase math knowledge and proficiency at a school level, in turn increasing math proficiency district-wide. You are being invited to take part in this research because you are enrolled in or instructing either a Math 1 or Math 3 course for the 2023-2024 school year at the traditional high school where the research is taking place**.** The decision to take part in this research is yours to make. By doing this research, we hope to learn increase growth toward proficiency in both Math 1 and Math 3.

If you volunteer to take part in this research, you will be one of about 60 people to do so.

Are there reasons I should not take part in this research?
I understand I should not volunteer for this study if I am a part-time teacher at the traditional high school. I understand I should not volunteer for this study if I am not willing to be honest in my thoughts and opinions about peer tutoring and instruction in Math 1 and Math 3.

What other choices do I have if I do not take part in this research?
You can choose not to participate. There will be no repercussions for doing so.

Where is the research going to take place and how long will it last?
The research will be conducted at South Lenoir High School. You will need to come to South Lenoir High School, room numbers 114, 116, 401, or 402 each day during your class or when you are assigned to be in that course. The total amount of time you will be asked to volunteer for this study will not exceed the time spent in the math course over a 6 month period.

What will I be asked to do?
You will be asked to do the following:

- Answer questions regarding your feelings about Math class and instruction
- Answer questions about the effectiveness peer tutoring
- Answer questions about the effectiveness of classroom instruction
- Discuss thoughts about opinions about math in focus groups with peers
- Understand that focus groups will be recorded for data collection purposes
- Discuss thoughts and opinions about math in a survey

What might I experience if I take part in the research?
We don't know of any risks (the chance of harm) associated with this research. Any risks that may occur with this research are no more than what you would experience in everyday life. We don't know if you will benefit from taking part in this study. There may not be any personal benefit to you, but the information gained by doing this research may help others in the future.

Will I be paid for taking part in this research?
Unfortunately, we will not be able to pay you for the time you volunteer while being in this study.

Will it cost me to take part in this research?
It will not cost you any money to be part of the research.

Who will know that I took part in this research and learn personal information about me?
ECU and the people and organizations listed below may know that you took part in this research and may see information about you that is normally kept private. With your permission, these people may use your private information to do this research:

- The investigator(s) conducting this study.
- The University & Medical Center Institutional Review Board (UMCIRB) and its staff have responsibility for overseeing your welfare during this research and may need to see research records that identify you.

How will you keep the information you collect about me secure? How long will you keep it?
The information collected during the inquiry will be kept confidential. It will be locked in a digital drawer with only the researcher having access via a password. The data will be kept for 3 years. Any recordings of focus groups will be destroyed at the conclusion of the research process.

What if I decide I don't want to continue in this research?
You can stop at any time after it has already started. There will be no consequences if you stop, and you will not be criticized.

Who should I contact if I have questions?
The people conducting this study will be able to answer any questions concerning this research, now or in the future. You may contact the Principal Investigator at 252-568-6161 Monday through Friday from 7:30am until 4:30pm.

If you have questions about your rights as someone taking part in research, you may call the University & Medical Center Institutional Review Board (UMCIRB) at phone number 252-744-2914 (days, 8:00 am-5:00 pm). If you would like to report a complaint or concern about this research study, you may contact the Director for Human Research Protections, at 252-744-2914.

I have decided I want to take part in this research. What should I do now?
The person obtaining informed consent will ask you to read the following and if you agree, you should sign this form:

- I have read (or had read to me) all of the above information.
- I have had an opportunity to ask questions about things in this research I did not understand and have received satisfactory answers.
- I know that I can stop taking part in this study at any time.
- By signing this informed consent form, I am not giving up any of my rights.
- I have been given a copy of this consent document, and it is mine to keep.

_____ _____

Participant's Name (PRINT) **Signature** **Date**

Person Obtaining Informed Consent: I have conducted the initial informed consent process. I have orally reviewed the contents of the consent document with the person who has signed above and answered all of the person's questions about the research.

_____

Person Obtaining Consent (PRINT) **Signature** **Date**

APPENDIX C: INFORMED CONSENT FORM (SPANISH)

Consentimiento informado para participar en la investigación
Información a tener en cuenta antes de participar en una investigación que no tenga más que un riesgo mínimo.

Título del estudio de investigación: Aumento de la competencia matemática a través de la utilización de tutoría entre pares

Investigadora principal: Elizabeth Pierce (Nombre del estudiante de EdD / Persona a cargo de este estudio)
Institución, Departamento o División: Departamento de Liderazgo Educativo, Facultad de Educación, Universidad de Carolina del Este
Dirección: 8852 NC Highway 41, Richlands, NC 28574
Teléfono #: 252-717-1885

Investigadores de la Universidad de Carolina del Este (ECU) estudian temas relacionados con la sociedad, los problemas de salud, los problemas ambientales, los problemas de comportamiento y la condición humana. Para ello, necesitamos la ayuda de voluntarios que estén dispuestos a participar en la investigación.

¿Por qué me invitan a participar en esta investigación?
El propósito de esta investigación es aumentar el conocimiento y la competencia matemática a nivel escolar, aumentando a su vez la competencia matemática en todo el distrito. Se le invita a participar en esta investigación porque está inscrito o está impartiendo un curso de Matemáticas 1 o Matemáticas 3 para el año escolar 2023-2024 en la escuela secundaria tradicional donde se lleva a cabo la investigación**.** La decisión de participar en esta investigación es suya. Al hacer esta investigación, esperamos aprender a aumentar el crecimiento hacia la competencia tanto en Matemáticas 1 como en Matemáticas 3.

Si te ofreces como voluntario para participar en esta investigación, serás una de las 60 personas que lo harán.

¿Hay razones por las que no debería participar en esta investigación?
Entiendo que no debería ofrecerme como voluntario para este estudio si soy un maestro de medio tiempo en la escuela secundaria tradicional. Entiendo que no debería ofrecerme como voluntario para este estudio si no estoy dispuesto a ser honesto en mis pensamientos y opiniones sobre la tutoría entre pares y la instrucción en Matemáticas 1 y Matemáticas 3.

¿Qué otras opciones tengo si no participo en esta investigación?
Puede optar por no participar. No habrá repercusiones por hacerlo.

¿Dónde se va a llevar a cabo la investigación y cuánto durará?

La investigación se llevará a cabo en South Lenoir High School. Tendrás que venir a South Lenoir High School, a los números de salón 114, 116, 401 o 402 todos los días durante tu clase o cuando te asignen para estar en ese curso. La cantidad total de tiempo que se le pedirá que se ofrezca como voluntario para este estudio no excederá el tiempo dedicado al curso de matemáticas durante un período de 6 meses.

¿Qué se me pedirá que haga?
Se le pedirá que haga lo siguiente:

- Responder preguntas sobre sus sentimientos acerca de la clase de matemáticas y la instrucción
- Responder preguntas sobre la efectividad de la tutoría entre pares
- Responder preguntas sobre la eficacia de la instrucción en el aula
- Discutir sus pensamientos sobre las opiniones sobre las matemáticas en grupos focales con sus compañeros.
- Comprender que los grupos focales se grabarán con fines de recopilación de datos
- Discutir pensamientos y opiniones sobre matemáticas en una encuesta

¿Qué podría experimentar si participo en la investigación?
No sabemos de ningún riesgo (la posibilidad de daño) asociado con esta investigación. Cualquier riesgo que pueda ocurrir con esta investigación no es más de lo que experimentaría en la vida cotidiana. No sabemos si se beneficiará de participar en este estudio. Es posible que no haya ningún beneficio personal para usted, pero la información obtenida al hacer esta investigación puede ayudar a otros en el futuro.

¿Me pagarán por participar en esta investigación?
Desafortunadamente, no podremos pagarle por el tiempo que se ofrezca como voluntario mientras esté en este estudio.

¿Me costará participar en esta investigación?
No le costará dinero ser parte de la investigación.

¿Quién sabrá que participé en esta investigación y conocerá información personal sobre mí?
ECU y las personas y organizaciones que se enumeran a continuación pueden saber que usted participó en esta investigación y pueden ver información sobre usted que normalmente se mantiene privada. Con su permiso, estas personas pueden usar su información privada para realizar esta investigación:

- El/los investigador(es) que realiza(n) este estudio.
- La Junta de Revisión Institucional de la Universidad y el Centro Médico (UMCIRB, por sus siglas en inglés) y su personal tienen la responsabilidad de supervisar su bienestar durante esta investigación y es posible que necesiten ver los registros de investigación que lo identifiquen.

¿Cómo mantendrán segura la información que recopilan sobre mí? ¿Cuánto tiempo lo conservarás?

La información recopilada durante la investigación se mantendrá confidencial. Estará encerrado en un cajón digital y solo el investigador tendrá acceso a través de una contraseña. Los datos se conservarán durante 3 años. Las grabaciones de los grupos focales serán destruidas al finalizar el proceso de investigación.

¿Qué pasa si decido que no quiero continuar con esta investigación?
Puede detenerse en cualquier momento después de que ya haya comenzado. No habrá consecuencias si te detienes y no serás criticado.

¿Con quién debo comunicarme si tengo preguntas?
Las personas que lleven a cabo este estudio podrán responder a cualquier pregunta relacionada con esta investigación, ahora o en el futuro. Puede comunicarse con el investigador principal al 252-568-6161 de lunes a viernes de 7:30 a.m. a 4:30 p.m.

Si tiene preguntas sobre sus derechos como persona que participa en una investigación, puede llamar a la Junta de Revisión Institucional de la Universidad y el Centro Médico (UMCIRB, por sus siglas en inglés) al número de teléfono 252-744-2914 (días, de 8:00 a.m. a 5:00 p.m.). Si desea presentar una queja o inquietud sobre este estudio de investigación, puede comunicarse con el Director de Protección de la Investigación Humana al 252-744-2914.

He decidido que quiero participar en esta investigación. ¿Qué debo hacer ahora?
La persona que obtenga el consentimiento informado le pedirá que lea lo siguiente y, si está de acuerdo, debe firmar este formulario:

- He leído (o me habían leído) toda la información anterior.
- He tenido la oportunidad de hacer preguntas sobre cosas en esta investigación que no entendía y he recibido respuestas satisfactorias.
- Sé que puedo dejar de participar en este estudio en cualquier momento.
- Al firmar este formulario de consentimiento informado, no estoy renunciando a ninguno de mis derechos.
- Me han dado una copia de este documento de consentimiento, y es mío para conservarlo.

_____

Nombre del participante (en letra de imprenta) Firma Fecha

Persona que obtiene el consentimiento informado: He llevado a cabo el proceso inicial de consentimiento informado. He revisado oralmente el contenido del documento de consentimiento con la persona que ha firmado anteriormente y he respondido a todas las preguntas de la persona sobre la investigación.

_____

Persona que obtiene el consentimiento (PRINT) Fecha de firma

APPENDIX D: INFORMED ASSENT FORM (ENGLISH)

Assent Form
Things You Should Know Before You Agree to Take Part in this Research

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IRB Study #_____

Title of Study: Increasing Math Proficiency Through the Utilization of Peer Tutoring

Person in charge of study: Elizabeth Pierce
Where they work: South Lenoir High School/Lenoir County Public Schools

Study contact phone number: 252-568-6161
Study contact E-mail Address: epierce@lenoir.k12.nc.us

People at ECU study ways to make people's lives better. These studies are called research. This research is trying to find out if peer tutoring increases growth toward proficiency in Math 1 and Math 3.

Your parent(s) needs to give permission for you to be in this research.

You may stop being in the study at any time. If you decide to stop, no one will be angry or upset with you.

Why are you doing this research study?
The reason for doing this research is to see if peer tutoring increases your success in math class at school.

Why am I being asked to be in this research study?
We are asking you to take part in this research because we want to help you increase your success in math.

How many people will take part in this study?
All students and teachers in Math 1 and Math 3 classrooms

What will happen during this study?
During this study, you will be asked to complete a survey about math instruction in your classroom as well as participate in a focus group with your peers. The focus groups will be recorded for data collection purposes.

- ***For studies that involve video or audio recording:***
  - *Any recording will be kept confidential by the researcher and password protected*
  - *At any time, video recording may be requested to be turned off*

Check the line that best matches your choice:

_____ OK to record me during the study

_____ Not OK to record me during the study

This study will take place at South Lenoir High School and will last approximately 6 months.

Who will be told the things we learn about you in this study?

The district superintendent, School Improvement Team, and administrators will be told what is learned from the study.

What are the good things that might happen?

Sometimes good things happen to people who take part in research. These are called "benefits." There *is a chance,* you will benefit from being in this research*. Potential benefits, include:* The benefits to you of being in this study may be increasing your success in math achievement and student peer relationships.

What are the bad things that might happen?

Sometimes things we may not like happen to people in research studies. These things may even make them feel bad. These are called "risks." You may or may not have these things happen to you. Things may also happen that the researchers do not know about right now. There are no known risks in this study. You should report any problems to your parents and to the researcher.

Will you get any money or gifts for being in this research study?

You will not receive any money or gifts for being in this research study.

Who should you ask if you have any questions?

If you have questions about the research, you should ask the people listed on the first page of this form. If you have other questions about your rights while you are in this research study you may call the Institutional Review Board at 252-744-2914.

If you decide to take part in this research, you should sign your name below. It means that you agree to take part in this research study.

_____ _____

Sign your name here if you want to be in the study Date

_____

Print your name here if you want to be in the study

_____ _____

Signature of Person Obtaining Assent Date

_____

Printed Name of Person Obtaining Assent

APPENDIX E: INFORMED ASSENT FORM (SPANISH)

Formulario de asentimiento
Cosas que debe saber antes de aceptar participar en esta investigación

---

Estudio del IRB #_____

Título del estudio: Aumento de la competencia matemática a través de la utilización de tutoría entre pares

Responsable del estudio: Elizabeth Pierce
Dónde trabajan: South Lenoir High School/Escuelas Públicas del Condado de Lenoir

Número de teléfono de contacto del estudio: 252-568-6161
Dirección de correo electrónico del contacto del estudio: epierce@lenoir.k12.nc.us

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La gente de ECU estudia formas de mejorar la vida de las personas. Estos estudios se denominan investigación. Esta investigación está tratando de averiguar si la tutoría entre pares aumenta el crecimiento hacia la competencia en Matemáticas 1 y Matemáticas 3.

Tus padres deben darte permiso para participar en esta investigación.

Usted puede dejar de participar en el estudio en cualquier momento. Si decides dejar de hacerlo, nadie se enojará ni se molestará contigo.

¿Por qué están haciendo este estudio de investigación?
La razón para hacer esta investigación es ver si la tutoría entre pares aumenta su éxito en la clase de matemáticas en la escuela.

¿Por qué se me pide que participe en este estudio de investigación?
Te pedimos que participes en esta investigación porque queremos ayudarte a aumentar tu éxito en matemáticas.

¿Cuántas personas participarán en este estudio?
Todos los estudiantes y maestros en las aulas de Matemáticas 1 y Matemáticas 3

¿Qué sucederá durante este estudio?
Durante este estudio, se le pedirá que complete una encuesta sobre la enseñanza de las matemáticas en su salón de clases, así como que participe en un grupo de enfoque con sus compañeros. Los grupos focales serán grabados para la recolección de datos.

- ***Para estudios que involucran grabación de video o audio:***
  - *Cualquier grabación será mantenida confidencial por el investigador y protegida por contraseña*
  - *En cualquier momento, se puede solicitar la desactivación de la grabación de video*

  Marca la línea que mejor se adapte a tu elección:
  _____ Está bien grabarme durante el estudio_____ No está bien que me graben durante el estudio

Este estudio se llevará a cabo en South Lenoir High School y tendrá una duración aproximada de 6 meses.

¿A quién se le dirán las cosas que aprendemos sobre usted en este estudio?
El superintendente del distrito, el Equipo de Mejoramiento Escolar y los administradores serán informados de lo que se aprenda del estudio.

¿Cuáles son las cosas buenas que podrían pasar?
A veces a las personas que participan en la investigación les suceden cosas buenas. A estos se les llama "beneficios". Existe *la posibilidad de* que te beneficies de participar en esta investigación. *Los beneficios potenciales incluyen:* Los beneficios para usted de participar en este estudio pueden aumentar su éxito en el rendimiento en matemáticas y las relaciones con los compañeros de los estudiantes.

¿Cuáles son las cosas malas que podrían pasar?
A veces, las cosas que no nos gustan les suceden a las personas en los estudios de investigación. Estas cosas pueden incluso hacerles sentir mal. A estos se les llama "riesgos". Es posible que te sucedan o no estas cosas. También pueden suceder cosas que los investigadores desconocen en este momento. No hay riesgos conocidos en este estudio. Debes informar de cualquier problema a tus padres y al investigador.

¿Recibirá dinero o regalos por participar en este estudio de investigación?
No recibirá dinero ni regalos por participar en este estudio de investigación.

¿A quién debe preguntar si tiene alguna pregunta?
Si tiene preguntas sobre la investigación, debe preguntar a las personas que figuran en la primera página de este formulario. Si tiene otras preguntas sobre sus derechos mientras está en este estudio de investigación, puede llamar a la Junta de Revisión Institucional al 252-744-2914.

Si decide participar en esta investigación, debe firmar con su nombre a continuación. Significa que usted acepta participar en este estudio de investigación.

_____ _____
Firma aquí si quieres participar en el estudio Fecha

_____

Escriba su nombre aquí si desea participar en el estudio

_____ _____

Firma de la persona que obtiene el consentimiento Fecha

_____

Nombre en letra de imprenta de la persona que obtiene el consentimiento

APPENDIX F: THS STUDENT SURVEY

THS STUDENT SURVEY					
	Strongly Agree (5)	**Agree (4)**	**Neutral (3)**	**Disagree (2)**	**Strongly Disagree (1)**
1. Math is an important subject to me.					
2. I best learn math by using manipulatives, gaming, etc.					
3. I enjoy when other students help me understand math.					
4. I have friends in school.					
5. It is easy for me to ask a peer questions in class when I do not understand something.					
6. I will use Math 1/Math 3 content in my post-graduation plans.					
7. I am satisfied with my grades in math.					

APPENDIX G: PEER TUTEE FOCUS GROUP PROTOCOL

Introduction:
Good morning/afternoon. I am Elizabeth Pierce, a doctoral student in Educational Leadership at East Carolina University. Thank you for being here today.

Informed assent has already been collected for participants:
I will call your name to ensure I have the necessary form for you to participate in our focus group today. Please say here when I call your name.

Overview:
I am researching peer tutoring and if that strategy helps improve math achievement in both Math 1 and Math 3. My hope is to develop a plan at our school and perhaps other schools in our district that will have a great impact on math growth toward proficiency.

Guidelines:
There are several things I would like to go over before we get started. I will ask a few questions today that I would like for each of you to answer. Please remember the following:

- Allow everyone to have their time to speak uninterrupted
- Anything discussed stays in the room and is not to be discussed outside of our group. This is a safe space.
- Be honest in your thoughts.
- Respect others, even if they have a different opinion than you.

I will be taking notes a recording the session. No one will have access to my notes or the recording. After I record all data from the session, the recording will be destroyed.

Questions:
I will now ask you a few questions regarding peer tutoring in math class.

1. How do you feel working with a peer tutor in math?
2. What do you like about it?
3. What are your 2-3 favorite reasons you enjoy working with a peer? What are your 2-3 reasons why you do not enjoy working with a peer?
4. Does working with a peer make you feel more confident about your work or learning in math class?
5. What are some things you would like to see changed about math that you feel would make you more successful?

Conclusion of Group:
Is there anything you would like to add to the discussion that was not discussed today? Please remember that anything we talk about is confidential. Thank you for your willingness to participate today.

APPENDIX H: PEER TUTOR INTERVIEW PROTOCOL

Introduction: Good morning/afternoon. I am Elizabeth Pierce, a doctoral student in Educational Leadership at East Carolina University. Thank you for being here today.
Overview: I am researching peer tutoring and if that strategy helps improve math achievement in both Math 1 and Math 3. My hope is to develop a plan at our school and perhaps other schools in our district that will have a great impact on math growth toward proficiency.
Guidelines: I would like to ask you a few questions today and get your honest feedback regarding peer tutoring.
Questions: I will now ask you a few questions regarding peer tutoring in math class. 1. During your time tutoring, in what ways did you notice student motivation toward math improving/changing? 2. During your time tutoring, in what ways did you notice student understanding of math improving/changing? 3. What do you feel should change about your experience with peer tutoring to make it more successful?
Conclusion of Interview: Is there anything you would like to add to the discussion that was not discussed today? Please remember that anything we talk about is confidential. Thank you for your willingness to participate today.

APPENDIX I: TEACHER INTERVIEW PROTOCOL

Introduction:
Good morning/afternoon. I am Elizabeth Pierce, a doctoral student in Educational Leadership at East Carolina University. Thank you for being here today.

Overview:
I am researching peer tutoring and if that strategy helps improve math achievement in both Math 1 and Math 3. My hope is to develop a plan at our school and perhaps other schools in our district that will have a great impact on math growth toward proficiency.

Guidelines:
I would like to ask you a few questions today and get your honest feedback regarding peer tutoring.

Questions:
I will now ask you a few questions regarding peer tutoring in math class.

1. In what ways was peer tutoring successful in your classroom?
2. Can you talk about students' motivation and confidence in math changed during the semester as they worked with the peer tutors?
3. In what ways did students' study habits and time dedicated to work change during their time with peer tutoring?

Conclusion of Interview:
Is there anything you would like to add to the discussion that was not discussed today? Please remember that anything we talk about is confidential. Thank you for your willingness to participate today.

APPENDIX J: CARE CORP TUTOR TRAINING

CARE Corps Tutor Training

Pre-Service Modules: Asynchronous online: Harmony
Relationship building

Ameri-Corps: On3Learn:
Prohibited Activities
AmeriCorps 101
Life after AmeriCorps

CARE Corps Workshops: In person with members
(Five 2-hour sessions)

Resiliency and Equality in Schools
Rural Cultural Wealth
Using Service as Professional development
Growth in Tutoring Strategies

SAGA: Asynchronous training
Effective Relationship Building and Tutoring

Optional Additional Training:
In Person: CPR Training
In Person: ACES Training from ECU TEDI Bear
Asynchronous Online: Phycological First Aid: App State Public Health Corps