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Co-Teaching Strategies and Student Engagement in a Secondary Math Class

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Co-Teaching Strategies and Student Engagement in a Secondary Math Class

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By

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This action research project, written under the direction of the candidate's master's project advisory committee and approved by members of the committee, has been presented to and accepted by the faculty of the Kalmanovitz School of Education, in partial fulfillment of the requirements for the Master of Arts in Teaching Leadership degree.

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Abstract

Co-Teaching Strategies and Student Engagement in a Secondary Math Class
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The purpose of this research study was to use differentiated instruction to increase student engagement and ultimately improve the achievement of high school math students. This study was conducted in a math classroom that was co-taught with a special education teacher due to the high number of students with learning complexities. Together, the researcher and co-teacher used station co-teaching strategies to support student learning. This study sought to discover the ways in which differentiated instruction could create a focused learning environment that supports all students. This action research study details one teacher's approach to creating an inclusive learning environment and establishing equity within mathematics instruction. This study was conducted during virtual learning due to the COVID-19 pandemic.

Dedication

I dedicate this project to my loving parents, Jean and Farhad, who worked extremely hard to give us everything. Also, to my little brother Pejman, who is my favorite person in the world.

This action research project is, of course, dedicated to my husband, Sam. Everyone was wearing masks, the stores ran out of toilet paper, the world was in lock down, and, for some crazy reason, you still supported my idea of entering a Master's program in the midst of all this. You encouraged me during this stressful year by reading all of my drafts, knowing all the words I wanted to say, making most of my meals, and pushing the necessity of naps. I could have never gotten through this year of teaching virtually, partaking in Master's classes, and being pregnant while chasing around our rambunctious baby girl if it wasn't for you.

I also dedicate this project to our adventurous, curious children. May this encourage you to always seek new learning opportunities and try things that are out of your comfort zone.

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Introduction

"I can't do math!" is a quote that is heard too often by math teachers around the world. It often emerges from students' false belief that they are incapable of comprehending mathematical knowledge. In the United States, this idea is born from years of inequities in mathematical teaching rooted deeply in the education system (Lewis & Diamond, 2015). This system is guided by policy but run by individuals in their classrooms. The way that these individuals, teachers, work within the system can determine the success of their students in school and alter their future.

Students with learning complexities are one group who are disproportionately hurt by the educational system. Neuro-diverse students are evaluated and monitored through Individualized Education Plans (IEPs) and 504 plans. An IEP is a federal legal document developed by a specific team for a student in special education which states the list of accommodations, such as extra time on tests, and modifications, such as curriculum adjustments a student requires to fit their learning needs as well as a list of goals and objectives. A 504 is similar to an IEP, although there is no formatted plan to attain measurable goals for a 504. A 504 spells out the accommodations the school can make to help the student. Unlike with an IEP, a student with a 504 can have a disability that impedes their learning ability but is not classified as a special education student.

Medically speaking, a disability typically means that a person needs assistance in order to accomplish tasks. Socially, having a disability has a connotation of being incapable or unable to do everyday activities (Solone, Thornton, Chiappe, Perez, Rearick, & Falvey, 2019). Due to this stereotype, people with disabilities are discriminated and segregated within society (Solone et al.,

2019). Students with disabilities are either segregated into self-contained classrooms, such as special day class, or are held to lower expectations within mainstreamed classrooms. Previous studies have identified how teachers skip problems that a majority of students might find difficult, such as operations with fractions, or they end up assisting students too much (Faragher & Clarke, 2020). Because of this, students have learned avoidant learning strategies from a young age, believing themselves helpless and unable to achieve without assistance (Faragher & Clarke, 2020).

Students with complexities suffer from a series of disadvantages inside of the classroom. When these students are put into mainstream classrooms, they often have general education teachers who are not equipped with the training, resources, or time needed to make appropriate and necessary accommodations and modifications for them to access the curriculum (Reese, Richards-Tutor, Hansuvadha, Pavri, & Xu, 2018). Often, neurodiverse students find the general classroom curriculum to be more difficult and less engaging compared to that of a resource class. Students also report getting less help from the teacher in a general classroom as opposed to a resource class which typically have smaller class sizes and often a special education teacher as well as a Para educator to assist students (Rexroat-Frazier & Chamberlin, 2019). In order to bridge this gap, more and more educational institutions are moving toward the co-teaching model (Moorehead & Grillo, 2013). Co-teaching is the practice of having two teachers in a classroom, one general education teacher and one special education teacher, in order to provide support and access for all students, with an emphasis on students who need individualized services. The purpose of this research project was to explore how *station co-teaching* strategies can assist in differentiating instruction for students with learning disabilities and impact student engagement in an Algebra 1 Enrichment 1 high school math class.

Statement of the Problem

It is becoming increasingly common for students with learning complexities to be instructed in a general education classroom. This shift is due to policies such as Individuals with Disabilities Education Act (IDEA) and Least Restrictive Environment (LRE). According the U.S. Department of Education, IDEA is "a law that makes available a free appropriate public education to eligible children with disabilities throughout the nation and ensures special education and related services to those children" (IDEA, 2020). The purpose of IDEA is to make sure that neuro-diverse students have the services they need to be successful such as speech, technology and media assistance, as well as educators and counselors who have been trained to support them (IDEA, 2020). Within IDEA, there are LRE requirements. The requirements state that children with disabilities, in both public and private institutions, must be educated with children who do not have disabilities (IDEA, 2020). The only way that students with disabilities can be placed in a special day class, or separated from mainstream instruction, is if the disability is severe enough that accommodations and modifications would not help the student be successful in class (IDEA, 2020).

Research has shown that an inclusive environment benefits all students in the class; neuro-diverse students report higher self-esteem and socialization skills, and general education students demonstrate more social and cultural awareness (Reese, 2018). However, there is a drawback to this new educational model. General education teachers are responsible for making accommodations and modifications to support special education students' understanding of the curriculum. Because of the wide range of diverse learning needs and minimal training, educators find this task daunting (Reese, 2018). This problem of not being able to provide all students with learning complexities the support they need to be successful, leads to lower confidence in the

students' own ability which affects their engagement, motivation, perseverance, and willingness to ask for help (Di Fatta, Garcia, & Gorman, 2009). Ultimately, a student's overall academic performance suffers.

Mathematics is essential; it teaches students perseverance, adaptive reasoning, strategic competence, conceptual understanding, and procedural fluency (CCSS, 2010). The Eight Common Core Mathematical Practices are principles that encourage students to think for themselves (Stephen & Smith, 2012). Instead of thinking of math as formulas to memorize, students can embrace the process of finding a meaning solution (Stephan & Smith, 2012). Students have to interpret the information they are given, using the knowledge that they have, then extend and apply this understanding to a given situation. According to researchers Stephen and Smith (2012), many students with learning complexities have previously relied on direct instruction, and therefore are not accustomed to the autonomy entwined with Common Core. The National Council of Teachers of Mathematics has emphasized the need for differentiation in mathematics, which can be challenging in high school due to large differences in students' skill levels and abilities (Ekstam et al., 2017). A promising practice to combat this problem is to adopt a co-teaching model, partnering a general education teacher and a special education teacher. A collaboration between the subject matter teacher as the "master of content" and the special education teacher as the "master of access" can lead to effective instruction for all (Sileo & van Garderen, 2010, p. 15).

I am a math teacher at a high school that serves an upper middle class suburban population. Due to early Response to Intervention (RTI) in my district, an intervention process coming from IDEA to monitor and assist struggling students (Johnson, Mellard, Fuchs & Mcknight, 2006), students that have been unsuccessful with math are put into a pathway that

breaks Algebra 1 into two years when they enter high school. This Algebra Enrichment series allows students the time to refine basic numerical skills before building on the foundation. The majority of the students are either learning English as a second language or have a learning complexity. Because of the need for differentiated instruction, the Algebra Enrichment classes are co-taught. I am the general education teacher of the Algebra 1 Enrichment 1 course and this is my second year teaching the class.

The *one teach, one assist* co-teach practice in my Algebra 1 Enrichment 1 (A1E1) class was not working. As the general education teacher, it was my responsibility to create the lesson plans but I did not feel that I designed the plans with the appropriate individualized services to help each student succeed. The 504s and IEPs focus on test day accommodations such as being allowed to take the test in an alternate location, extended time, the use of a notecard, and the use of a scientific calculator. Besides access to teachers' notes and preferential seating, there was not much information in the students' education plans that helped me with day-to-day instruction modifications and accommodations. Students did not get the differentiation they needed to understand the content, which led to lower confidence and disengagement. Disengagement led to no motivation to complete work, and as a result, students were not successful in mathematics as measured by performance on assessments and assignments. It was evident that the lack of engagement negatively impacted my students' achievement.

Purpose of the Research

The purpose of the research study is to examine the effects of station co-teaching strategies on student engagement in a high school math class with diverse learners. Inequity within education is present at multiple levels; however, the difficulties that students with learning complexities face are systemic. Students are regularly placed in environments that do not serve

their needs. Such practices create a multitude of challenges – social, emotional, and academic - that students may never overcome without the proper guidance and assistance (Reese et al., 2018).

Co-teaching is a practice that arose out of the need to reach a diverse set of students (Hersi et al., 2016). There are six co-teaching practices – *one teach one observe*, *one teach one assist*, *team teaching*, *station teaching*, *parallel teaching*, and *alternate teaching* (Carty & Farrell, 2018). The first three practices are large group models while the latter are used for smaller groups (Sachs, Fisher, & Cannon, 2011). For the purpose of this action research project, I implemented station co-teaching strategies. Scholars Carty and Farrell (2018) define station co-teaching as two teachers working independently to deliver differing content while creating the opportunity for independent practice, problem solving, as well as differential instruction.

In order to be successful, co-teaching partners must both actively engage in co-planning, co-instruction, and co-assessment, sharing the responsibility of all students (Hersi et al., 2016). Three threats to the success of co-teaching include availability, support of planning time, and the potential of conflict due to differing teaching philosophies between the general education teacher and special education teacher (Sileo & van Garderen, 2010). Teachers must be willing to collaborate and compromise. When implemented correctly, co-teaching can improve the academic, social, and emotional well-being of *all* students, especially those who are less likely to be engaged in traditional classroom settings. For instance, extant research has indicated that co-teaching methods have benefitted students who need more one-on-one instructional time to thrive academically (Sileo & van Garderen, 2010).

I was curious to research about the creation of co-taught classes. Currently, in my district, students that receive a D or below in Math 8 get placed into A1E1. The general education teacher

is notified late summer if they will co-teach a class based on number of special education students. A special education teacher is then assigned to the class. The general education teacher is assumed to be the leader because their name is the only one to appear on the schedule, and they are the only ones that can input grades or take attendance. This limits the role of the special education teacher to an assistant teacher in the eyes of the students.

Research shows that the creation of a co-taught classroom needs to be intentional. Co-teaching itself should be a choice of the teachers, as well as the partner they choose (Rexroat-Frazier & Chamberlin, 2019). Students should be purposely chosen to be in the class – there should be special attention to student relationships in the class (Rexroat-Frazier & Chamberlin, 2019). Moreover, scholars suggest that be no more than 30% of students with IEPs be present in the classroom (Rexroat-Frazier & Chamberlin, 2019). Additional best practices include focusing on group activities as opposed to whole class instruction, engaging in a multitude of technologies and manipulatives, and providing choices while maintaining order in the classroom (Rexroat-Frazier & Chamberlin, 2019). While differentiating instruction, it is important to keep in mind that researchers have found that students with disabilities preferred to receive the same assignments as the rest of the class (Rexroat-Frazier & Chamberlain, 2019).

Math builds on itself in terms of conceptual understanding. What a student did or did not learn in kindergarten can affect their mathematical comprehension in high school. Due to this, inclusion in math at the secondary level can be difficult (Rexroat-Frazier & Chamberlin, 2019). It is challenging to differentiate instruction in math for neurodiverse students due to their gaps of knowledge that increase at each grade level due to reasoning issues, perceptual limitations, and lack of memory (Rexroat-Frazier & Chamberlin, 2019). Co-teaching also declines at the secondary level because of the expectation of content knowledge. Specifically, teachers are

typically trained in one area of concentration at the secondary level (Rexroat-Frazier & Chamberlin, 2019). I am interested in researching ways to overcome these obstacles. As such, this research study will examine how the station co-teach model may improve engagement in a classroom with diverse learning strengths and challenges.

Action Research Question

The question for this action research project was: *What is the impact of the station co-teaching model on Algebra 1 Enrichment I students' engagement?* I hypothesized that by co-planning lessons with my special education co-teacher, we would be able to differentiate instruction to make the mathematical concepts reachable to all learners. Station co-teaching naturally create groups in the classroom. Research has shown that group work encourages students to be active learners who learn to articulate what they do and do not know (Dodd, 1992). It is often true that as students' engagement and confidence increase, so will their academic ability.

Limitations

I was lucky enough to have chosen to co-teach and to choose my co-teacher this year. This is not true of all teachers and thus my results and outcomes have limited reach. My co-teacher and I both identify as women and have been teaching less than 10 years. Although we both have co-taught different classes since we began teaching years ago, neither one of us has had explicit training on implementing a co-teaching model. The implementation of co-teaching strategies will be based on research that I have conducted.

Furthermore, I had only one class that was co-taught during the time of data collection, and there were only 29 students in the class - which, for research purposes, is a small sample size. Moreover, this study was performed during the 2020- 2021 school year. During this time,

the world was experiencing a global pandemic which caused some schools to be virtual, including mine. Although distance learning does not make co-teaching impossible, it made it more difficult to identify and provide the appropriate supports for students. Also, in the virtual setting, we were not allowed to enforce the use of video cameras, which made it more difficult to observe engagement. Distance learning allowed students the freedom to find answers to assignment and assessment questions from phone and internet applications which had the potential to skew data on student achievement.

Positionality of the Researcher

I believe that any student can learn math, as long as they have put in the time and effort required to understand the material. This idea grew from my father when I was young – whenever I did not understand something he told me to try harder. In my family, excuses were seen as a lack of effort. In my father's eyes, there was no challenge that could not be met with hard work and dedication. My father is a man who came to America without many resources when he was 18 and sometimes had to sleep in his car. He is now a general contractor in Los Angeles, working in areas where celebrities live and was able to put two kids through college. Because of this, I equate giving up with not caring.

My enthusiasm toward mathematics and my belief that all students can do math may lead me to interpret a student disability as lack of energy and motivation. I truly need my co-teacher to help me realize when I am expecting too much from a student and to help me meet the students at the level where they are at. I am a firm believer in the benefits of high expectations, but I worry that overreaching aspirations for my students can ultimately lower their confidence. I struggle to find a balance between high expectations and realistic expectations.

If I struggle with something, I strive to overcome it. When I was young, I had a speech impediment and an Individualized Education Plan (IEP) which made me self-conscious to speak in public. To get over that fear, I signed up for a leadership program that would force me to speak to hundreds of students. I failed my first physics midterm in college, so I decided to minor in physics. I realize that many students do not have this growth mindset: instead when the tough gets hard, they like to retreat. This is not a flaw; this is not the students not caring: this is just how some students cope. My reflection about my own learning has inspired me to become more aware of why students shut down and become disengaged and learn to help them.

I am a middle eastern woman who grew up in Los Angeles. My elementary school had a majority of White and Asian students, and both my middle and high schools had a majority of Black and Latino students. At all the schools I attended, there were very few teachers that were not White. I was lucky to be exposed to many cultures and ways of life at a young age. However, since I look White I did not encounter the same obstacles to learning that my friends of Color faced such as racial micro-aggressions, low expectations, as well as, being overlooked and hyper visible at the same time. Even though these were negative experiences, I also saw the positive impact of educators who went out of their way to support and mentor my classmates. I got into teaching because I believe that school should be a safe place for students to learn and grow as human beings; I wanted to help make that possible for everyone.

As a Noyce Scholar, I dedicated the first few years of my teaching career to being an educator in a Title 1 school, teaching students who were often overlooked because of their race and/or social economic status. Although I no longer teach at a Title 1 school, as the Algebra 1 Enrichment 1 teacher I have the opportunity to engage with students who have been discounted due to preconceived biases in their educational journey. I am constantly reflecting on my biases

and teaching practices to ensure that I am being the best teacher I can be for every student by remembering that each learner is an individual. I believe one of the most important jobs of being a teacher is to build relationships with students in order to better understand and support them.

Definition of Terms

Accommodations

Strategies that help students with disabilities to perform academic tasks that would be hard for them to accomplish otherwise. These strategies are required by law if stated in a student's IEP (Reese et al., 2018).

Co-Teaching

Co-teaching is a classroom instructional model where a general and special education teacher share responsibility of a classroom and its students including planning, assessing, and providing instruction (Sileo & van Garderen, 2010).

Co-Teaching Strategies

There are six co-teaching models: *one teach, one observe, one teach, one assist, Station Teaching, Parallel Teaching, Alternative Teaching, and Team Teaching Teaming* (Carty & Farrell, 2018).

1. One teach, one observe – One teacher completes the instruction while the other teacher observes students and gathers data (State Education Resource Center, 2017).
2. Station Teaching – Teachers divide the students and content (State Education Resource Center, 2017).
3. Parallel Teaching – Both teachers are teaching the same content at the same time but split up the students into two groups to do it. (State Education Resource Center, 2017).

4. Alternative Teaching – One teacher takes the majority of students, while the other takes a smaller group (State Education Resource Center, 2017).
5. Team Teaching (Teaming) - Both teachers are teaching the same content at the same time together (State Education Resource Center, 2017).
6. One Teach, One Assist – One teacher takes the responsibility of doing the instruction while the other teacher monitors and provides assistance (State Education Resource Center, 2017).

Inclusion

When students with disabilities are among the general population at school and are provided supports needed in order to be successful whether that be academically, or socially (Reese et al., 2018).

Implications

Although there are many research-based practices on co-teaching and differentiating instruction, there are less studies on co-teaching and differentiating at the secondary level in mathematics. Researchers assert that this disparity is due to differences in students' mathematical level that develop in students' early years of education (Ekstam et al., 2017; Sileo & van Garderen, 2010). This action research project may shed some light on how to assist students with disabilities in math at the high school level.

If students with learning complexities and students who are English language learners in my class improve their academic performance due to the implementation of station co-teaching strategies, this research may serve as a study for how to use the co-teaching model effectively with various populations. If this research is successful, as the curriculum lead of the mathematics department, I can advocate to apply this method within other departments

across campus and serve as a liaison for other schools in the district looking to expand and improve their mathematical approach with neurodiverse students and students who are English language learners.

This study may also serve to improve teacher practice in a variety of ways. At the time of this study, co-teaching was a practice that was not nurtured with training or support at my school. With this new information, I may be able to convince my administration and other teachers to embrace this model and work to properly implement the approach in a wider setting. In all, this knowledge has the potential to improve the mathematical understanding of my students and act as a model to encourage positive change across my school site and potentially my district.

Chapter II

Literature Review

The purpose of this research study was to use differentiated instruction to increase engagement and ultimately improve the achievement of high school math students. This study was conducted in a math classroom that was co-taught with a special education teacher due to the high number of students with learning complexities in the class. Together, the researcher and co-teacher used station co-teaching strategies to support student learning. This study sought to discover the ways in which differentiated instruction could create a focused learning environment that supports all students. This action research study details one teacher's approach to creating an inclusive learning environment and establishing equity within mathematics instruction. I asked, *what is the impact of a station co-teaching model on Algebra 1 Enrichment 1 students' engagement*?

Overview of Literature Review

The purpose of this literature review is to provide the basis for this study, which explored the impact of co-teaching strategies in differentiating instruction for students – including youth with learning complexities - in order to improve engagement and thus academic performance in math. First, the literature review will cover the theoretical framework that informed this action research study: Anthony Bandura's self-efficacy theory (1977) and Carol Dweck's growth mindset (2012). Secondly, the research review includes a discussion of the research dealing with engagement in math, students with learning disabilities in the math classroom, and co-teaching in an inclusive environment. Research has been retrieved from ERIC, ProQuest, and Google Scholar databases. The key terms used in the searches for this study include *engagement in*

mathematics, mathematics teaching, special education, special needs or disabilities, co-teaching, team teaching, collaborative teaching, cooperative teaching.

Theoretical Rationale

A student's confidence in their ability to do math is directly related to their academic performance in the class (Dweck, 2014). A student who does not think they can do math will avoid engagement such as discussions, assignments, and assessments (Dweck, 2012). With this belief, a student can not only impact their performance, which can lead to lower grades, but can also decreases their chances of getting to higher education. Such influences are also limiting the potential of students as learners. This is particularly true for students with neurodiversity that have a "learned helplessness" (Faragher & Clark, 2020, p.136) due to the education system repeatedly failing to give them the supports they need to be successful.

This action research project is framed by principals of Bandura's Self-Efficacy Theory (1977). Bandura's theory helps to frame why particular co-teaching strategies were used in this study to increase student confidence in math. Additionally, the co-teachers of this study subscribed to Carol Dweck's Growth Mindset framework (2012) in order to encourage students to view their math ability as a muscle that they can make stronger instead of a genetic ability that they cannot change. This is particularly important to the researcher's focus on math achievement for students with learning complexities.

Bandura's Self-Efficacy Theory

Self-efficacy is a person's belief in their own ability; it is the belief that they have what it takes to accomplish a given task successfully. Bandura (1977) theorizes that a person's self-efficacy can affect their motivation, determination, decision making, as well as their ability to cope in situations that they find threatening. Bandura believes that self-efficacy is derived from

four different sources: 1. performance outcomes; 2. observation; 3. verbal suggestion; and 4. emotional state. It can be difficult to change a person's confidence in their own abilities but it is possible through these four sources (Bandura, 1977).

In regards to performance outcomes, Bandura argues, "Successes raise mastery expectations; repeated failures lower them, particularly if the mishaps occur early" (Bandura, 1977, p.195). Bandura (1977) states further that successes are more likely to increase a person's self-efficacy if they believe they accomplished a task on their own without any help. This trend is tricky when it comes to accommodations and modifications in the learning environment for students with learning disabilities. Students may believe that they could not complete the assignment or assessment without given tools such as a notecard or calculator.

Inversely, self-efficacy is a good predictor of outcomes (Bandura, 1977). People become anxious and avoid situations that they do not think they can handle and they volunteer for opportunities in which they believe they can accomplish (Bandura, 1977). The stronger a person's self-efficacy, the more resolve they are likely to have to overcome obstacles when they arise (Bandura, 1977). In this research study, the majority of students in Algebra 1 Enrichment 1 were students with learning complexities who had not been successful in math previously. Several students entered the class with a stigma about math and are not confident in their ability to do well. When material became difficult for the student, the result was a decrease in assignment turn in and completion because those students' self-efficacy in math was low.

According to Bandura, another source of self-efficacy is observation. Students observe their classmates conducting activities that they find anxiety provoking, such as responding to questions posed by the teacher, and can realize that nothing bad will happen, like being teased for an incorrect answer (Bandura, 1977). This modeling is a way that students are able to learn

behavior through observation (Bandura, 1977). Students are empowered by viewing others' success and raise their own self-efficacy beliefs to step out of their comfort zone. Although a less reliable source than one's own accomplishments, students rely on social comparison to determine their success (Bandura, 1977). Comparison is obvious, for example, when students inquire about the class averages on an exam.

The third source of self-efficacy is verbal suggestion. Words are powerful tools; they can engage and motivate. People can be persuaded into believing they can accomplish a task, increasing self-efficacy (Bandura, 1977). This method of increasing confidence can be ineffective and short lasting, however, if the authenticity of the speaker is questionable and if there is a possibility of disconfirming experiences (Bandura, 1977). In our class, we found it vital to scaffold and support students through problem solving to build their confidence. If teachers repeat that they believe their students can do it, sooner or later the students might believe it too.

The last self-efficacy source is emotional state. While positive emotions can create passion and engagement, negative emotions can be debilitating. Being stressed or anxious can have a detrimental impact on a person's self-efficacy (Bandura, 1977). Within this framework, if a person is overwhelmed with feelings, they will not be able to concentrate on the task at hand and their performance will suffer as a result. Individuals can enter a cycle of fear about an upcoming situation or their personal deficits and thus they can expect to perform poorly (Bandura, 1977). One must be careful to not avoid all fearful activities, or one will never learn to cope and increase their confidence by overcoming a scary situation (Bandura, 1977). In my Algebra 1 Enrichment 1 class, for instance, there were two students who struggled with anxiety. They did not turn on their cameras during distance or answer questions if called on randomly. An accommodation that we implemented was to foster inclusion and understanding of class norms,

this was accomplished through the following process: we would inform them in advance before asking them to participate to help them build their confidence and overcome their fears.

I have noticed that self-efficacy is essential in the classroom. It is what motivates students to work and learn in situations they may find stressful or have been unsuccessful in the past. Students use a wide variety of sources to self-assess their abilities such as their mastery in subjects, comparison to other students, verbal reinforcement, and emotion. It is the job of the teacher to help students build their confidence.

Carol Dweck's Growth Mindset

Carol Dweck (2015) defines mindset as how people assess ability. This can be a person's perception of their own ability to accomplish a task or it can be their perception of someone else's ability to change (Dweck, 2012). There are two types of mindsets; fixed and growth (Dweck, 2012; Dweck, 2015). A fixed mindset is the belief that people are born with specific personality traits or intelligence that cannot be changed (Dweck, 2012). A growth mindset is the belief that with time, motivation, and determination, a person can improve their intelligence or character (Dweck, 2012). Carol Dweck theorized that if one can change their mindset from fixed to growth in relation to a task, belief, or characteristic, then one can increase their achievement or success. A person with a fixed mindset might avoid challenges and call into question their ability or intelligence. On the other hand, a person with a growth mindset will embrace challenges as a learning opportunity (Dweck, 2012).

One reason that students may feel that they cannot do math is because they have a fixed mindset. Such a belief is clear when a learner states, "I am not a math person". When encouraging a student to persevere in the face of an obstacle, it is important to add the word "yet" to their fixed mindset statements, such as "I am not a math person…yet" (Dweck, 2015).

The word “yet” is a powerful growth term, showing that circumstances can always change and that the student is capable making that change, with support.

A fixed mindset could be a reason as to why students do not complete or turn-in their assignments in Algebra 1 Enrichment 1. Students often perceive that a grade tells them their worth as a learner. A student with the notion that they are bad at math may not turn-in an assignment out of fear that they will receive a bad grade that validate their beliefs. In regards to this action research project, I believed if I could change the mindset of students I might increase assignment completion and turn-in rates.

Dweck warns that rewarding effort is not the same as embracing a growth mindset (Dweck, 2015). Growth mindset focuses on learning and improving from errors, not just putting in effort and getting nowhere (Dweck, 2015). Students are often surprised that they are not earning top marks when they are turning in every assignment, but it is the accuracy of the work completed that is the focus. Dweck suggests that a teacher should set high expectations for students and not lower them merely because students are at first unsuccessful. The most important learning objective is that students are understanding each step of the process (Dweck, 2015). Dweck states, “That feeling of math being hard is the feeling of your brain growing” (Dweck, 2015). Knowledge and understanding do not come easy. Just like with strengthening a muscle, strengthening your brain also takes time, practice, and dedication.

There is increasing evidence that mindsets play a key role in the underachievement of women and underrepresented students in math and science, as well as their lesser tendency to pursue careers in math and science (Dweck, 2014). For instance, students of Color are more likely to be overrepresented in lower level math classes, such as the Algebra 1 Enrichment 1. One cause is stereotype threat - the fear of confirming a negative stereotype – which can lead

students to perform worse than predicted (Lewis & Diamond, 2015). Moreover, deficit mindsets that parents, counselors, teachers, and even students with learning disabilities themselves have is one reason that students with learning disabilities are also overrepresented in lower level math classes – they do not believe a student with a learning complexity can be successful in a high-level math class.

A growth mindset is essential when it comes to academic growth. Mathematics is a challenging subject, one in which failure is inevitable and continuous effort is necessary. Helping students to develop confidence and change their perception of math is a central goal of my teaching and a directive in my collaboration with the special education department in the school. I hope to make a difference by addressing challenges created by the educational system that hinders students daily.

Review of Related Research

The review of the related literature is divided into three segments: 1. engagement in mathematics; 2. students with learning disabilities in the mathematics classroom; and 3. co-teaching in an inclusive environment. Research on engagement focuses on the different types and levels of engagement as perceived by both students and teachers. The reviewed studies also sought to find the connection between engagement and student achievement. Additionally, this research review also focused on different types of instruction that cater to students with learning disabilities in the mathematics classroom - specifically active and traditional instruction, as well as differentiated instruction. Lastly, this review of related research investigates on co-teaching as a promising strategy for closing the achievement gap of students with learning disabilities in the general education math classroom.

Engagement in Mathematics

This section examined the research that defined engagement and its effect on both students and teachers' efficacy in the mathematics classroom.

The research on engagement is extensive due to the belief that there is a correlation between engagement and academic achievement (Fredricks, Blumenfeld, & Paris, 2004; Willms, 2003). In general terms, student engagement is defined as students' involvement in and feelings towards school, both academically and socially (Willms, 2003). Researchers often utilizes Fredricks' (2004) more precise definition which categorizes engagement into three categories: behavioral, cognitive, and emotional (Skilling, Bobis, Martin, Anderson, & Way, 2016; Watt & Goos, 2017). In the context of school, behavioral engagement pertains to participation and involvement, cognitive engagement focuses on what time and effort an individual puts forth to learn, and emotional engagement focuses on the reactions of a person to their environment and a person's sense of belonging (Fredricks et al., 2004; Skilling et al., 2016). The authors (2016) emphasize that engagement is a spectrum that can have different intensities – variable, substantial, and disengaged- and can change over time. When discussing engagement, it is important to consider all three parts of engagement because they are intertwined within a student's composition (Fredricks et al., 2004). Watt and Goos (2017) describe these types of engagement as "in-side out" because they focus on the student who is affected by the world around them.

The literature on engagement also discusses "outside-in" theories that focus on the environmental forces that affect the student (Watt & Goos, 2017, p.135). Willms (2003) lists economic stability, temperament, as well as learning and physical complexities to be factors that affect engagement. Race and ethnicity were also noted to impact emotional engagement,

specifically a person's sense of belonging, but have little effect on a person's behavioral engagement (Fredricks et al., 2004; Willms, 2003). This finding conflicts with authors Lewis and Diamonds' (2015) assertion that being exposed to racial injustice can lead a student to act out. Although there is not much research on how friend groups affect engagement, Willms (2003) emphasizes that students are likely to connect with others that have same engagement level. Willms (2003) goes on to suggest that future research should examine the impact of social connection has an impact on cognitive engagement.

It is important for a teacher to be able to identify and interpret different signs of engagement because perceived engagement is what informs instruction (Skilling et al., 2016). Researchers Skilling, Bobis, Martin, Anderson, and Way (2016) conducted a study involving 31 veteran teachers from 10 high schools in Australia. Teachers were interviewed about their perceptions of student engagement in mathematics and how these beliefs informed their instruction. Behavioral engagement can be measured by assignment completion, rule compliance, and participation (Fredricks et al., 2004). Emotional engagement is most acceptably measured by self-reports or surveys about a student interests and values rather than inferred by the teacher from observations (Fredricks et al., 2004). Cognitive engagement is difficult to measure because it is intrinsic to a person. It can be, however, concluded from behavior such as wanting to understand the work versus wanting to get a good grade or look smart, how individuals study and the effort that they put into learning the material, how learners justify an answer, and how they relate a task to prior knowledge. Researchers found that teachers tended to be more aware of behavioral and emotional types of engagement as opposed to cognitive engagement (Skilling et al., 2016). Teachers reported that disengaged students were often off-task, rarely studied, and were often chatting and disrupting other's learnings. Teachers reported

that variably engaged students completed the tasks required but did not engage in discussion and procrastinated. Substantially engaged students were described to be on-task, asking questions, and volunteering their solutions and explanations (Skilling et al., 2016).

The literature reports that how a teacher perceives student engagement can very well affect their relationship with the students and effort that the teacher puts into the class (Fredricks et al., 2004; Skilling et al., 2016). This can affect the amount of supports that a teacher provides such as "feedback and clarification, emphasis and support for mastery learning, pressing for understanding, providing formative feedback, nurturing students' interests and needs; and fostering collaboration" (Skilling et al., 2016, p. 546). A major theme of the reviewed research was that a teacher's self-efficacy impacts their ability to implement strategies to engage students (Skilling et al., 2016). If a teacher feels as though nothing will engage a student, they are less likely to try an intervention. If a teacher feels as though they can make a difference, they are more willing to adopt different practices to increase engagement. Fredricks (2004) found that teachers who supported students by creating a safe environment to make mistakes and grow as individuals had respected students invested in learning. This comes from the Self-Determination Theory which asserts that first students need to have choice, purpose, and to be cared about in order to be engaged and successful (Watt & Goos, 2017).

Mathematical engagement is important because of the impact it has on students' achievement in mathematics (Watt & Goos, 2017). Authors Watt and Goos (2017) mention the "STEM pipeline" which refers to the loss of careers, especially women careers, pertaining to science, technology, engineering, and mathematics. The researchers attribute the STEM pipeline to decreasing math engagement due to lack of interest, value, and students' self-efficacy. Expectancy-value theory (EVT) was developed to understand secondary math enrolment and

indicates that students make choices based on what they think they can do (Watt & Goos, 2017). Willms (2003) argues that it is low achievement that causes students to dissociate with school rather than engagement. Willms (2003) denies that there is evidence that engagement in school will affect a student after they graduate, although, Willms recognizes that if a student does not like school, they are less likely to continue in education.

High school students know that math is important but resent the time and effort needed for such a challenging subject (Smalley & Hopkins, 2020). One way to overcome obstacles is to ask for help, a strategy with which many students struggle. Researchers Smalley and Hopkins (2020 sought to explore the connection between students' perceptions of the classroom and self and their avoidance of asking for help in a secondary math classroom. This study assessed 551 Australian students' perceptions of social climate, academic and social self-efficacy, and help-seeking behavior. Social climate measurement was divided into four types: task orientation, teacher support, cooperation, and investigation. Results showed that teacher support did not seem to have an effect on help-seeking avoidance, Investigation had a positive effect, while Task Orientation and Cooperation had a negative effect (Smalley & Hopkins, 2020). That is, if students understood what they needed to accomplish and were able to work with others, this increased students likelihood of asking for help.

Seeking help is an example of high investment and engagement (Skilling et al., 2016). Smalley and Hopkins (2020) state that students are more likely to ask for help if they have high self-efficacy and avoid help if they have low self-efficacy. Students are more likely to ask for help when it is a supported problem-solving strategy in the classroom and when they understand the learning expectations. Students are also less likely to avoid help from a peer compared to a teacher. This communication between students can also lead to increased self-efficacy (Smalley

& Hopkins, 2020). Teachers have the autonomy to create a collaborative environment that can encourage students to seek and give help to one another.

In conclusion, the research studies defined engagement as a spectrum with varying levels. There are two methods of interpreting engagement, "inside-out", individual focused, and "outside-in", contextually and socially focused. It is imperative that teachers can read and interpret the signs of engagement of students in order to make instructional decisions. Although there was some debate in the literature, a majority of research sources hold that engagement effects student achievement. Additionally, teachers have influence over the engagement level of the students. To optimize engagement, teachers should have clear behavioral expectations, encourage students to seek help and think outside of the box, and build curriculum that inspires interest.

Students with Learning Disabilities in the Mathematics Classroom

This section examined different types of instruction that cater and support students with learning disabilities in the classroom. The definition of learning disabilities (LD) includes three components: discrepancy, heterogeneity, and exclusion (Fletcher, Coulter, Reschly, & Vaughn, 2004). The United States Office of Education (1977) refers to discrepancy as the difference between ability and achievement, heterogeneity as the diverse settings in which it occurs, and exclusion of disabilities that come from "a sensory disorder, mental deficiency, emotional disturbance, economic disadvantage, linguistic diversity, or inadequate instruction". Donovan and Cross (2002) state that People of Color (POC) are overrepresented in special education (Fletcher et al., 2004). Such disparity, which can impact students' future, could come from the cultural difference between educators and students, where different from the "norm" is seen as wrong (Kreskow, 2013). Literature claims that the number of students with a LD can decrease

with improved instruction and identification methods (Fletcher et al., 2004). In many cases, special education is the only other option at schools to general education and so some students get placed in special education classes or programs without truly meeting the three components (Fletcher et al., 2004).

Due to the Individuals with Disabilities Education Act (IDEA), students with learning complexities are being instructed in the general classroom and receiving their services in the Least Restrictive Environment (LRE) (Zigmond, 2003). Because of this, teachers must plan lessons and curriculum to support all learners. One way that teachers are informing instruction in the mathematics classroom is by error analysis (Koriakin et al., 2017). The importance of error analysis arose in the late 1970s out of the need for differentiating instruction for each learner. The researchers note two types of errors: "slips" which are slight errors in computation and "bugs" which are conceptual misunderstandings (Koriakin et al., 2017, p. 156). Through error analysis, one can discover that the problem students have may not have to do with the actual math itself but cognitive skills that problem solving require (Koriakin et al., 2017).

Bishara (2018) asserts that math is perceived to be difficult to learn because of all the different ways in which it can be presented (e.g., illustration, word problems, symbols, numerically) and because of the fact that math builds upon itself. Students with learning disabilities may lack the visual and spatial perception, have auditory processing, memory retention, motoric and language deficiencies which makes it particularly difficult for them to learn math (Bishara, 2018; Shapiro et al., 2005). Neuro-diverse students that struggle with understanding numbers or quantities are said to have a math disability (MD) (Ashkenazi et al., 2013).

Direct instruction has been the method of math instruction when teaching students with learning disabilities; there was a focus on modeling and practicing basic skills with less focus on conceptual understanding (Stephan & Smith, 2012). When the 8 Mathematical Practice Standards came out, teachers of inclusive classrooms had to shift their way of teaching - questions became more open-ended and there was more of a focus on the process instead of the solution. The researchers recorded their experience with the shift in teaching in a seventh grade math class that had five students with a learning disorder that had a special education co-teacher. Stephan and Smith (2012) listed three key components to creating an environment that supports students embrace the Common Core State Standards: 1. choosing supportive problems 2. the role of the co-teachers, and 3. the role of the students. The first focuses on creation of problems that meet students where they are at, are real-word examples or can be modeled so that students can find meaning in the math, and are open-ended. The role of the co-teacher, the authors suggest, should be to support struggling students by sharing strategies, to challenge those who need to be pushed, and to encourage productive discussion. Students are expected to be active participants in their own learning, finding methods that work for them instead of being told how to solve a problem (Stephen & Smith, 2012).

Bishara (2018) also recognizes that a shift in instruction is necessary to engage neurodiverse students. He also calls for less teacher-led instruction and more collaboration between students. In his study, two different teaching strategies were examined - active and traditional teaching. The study included 40 students in special education classes (4th - 6th grade) at an elementary school in the Arab sector and seeked to discover the extent in which motivation is affected by teaching strategy and self-efficacy. The researcher insists that active teaching is beneficial for students with learning disabilities because it assumes that a group of learners is

heterogeneous versus the belief of traditional teaching in which learners are homogenous (Bishara, 2018). In Bishara's study, active teaching, which places an emphasis on collaboration between the learners and differentiated instruction, showed that it not only improved student self-efficacy in math but also motivation compared to traditional teaching (i.e., teaching a set, inflexible curriculum).

There is much research which indicates that with support built into the curriculum, students with math learning disabilities can be successful in the general education classroom. In contrast, Zigmond argues that differential instruction that supports each student is "not easily transposed into practices that can survive in a general ed classroom" (Zigmond, 2003, p. 197). The author believes that the pull out setting or resource classroom would be the more beneficial to teach students with learning complexities due to the heightened experience of the teachers working with the population and individualized instruction. Zigmond (2003) insists that resource rooms improve student academic improvement at a greater degree than the general classroom with students with learning disabilities. The author (2003) suggests that the general education teacher can make the specific accommodations and modifications each neuro-diverse student needs to be successful.

Eskstam, Linnanmaki, and Aunio (2017) conducted a study to find out if teacher efficacy beliefs, certification status, or teaching experience had an impact on whether a teacher practices differentiated instruction in lower secondary schools. Based on the 69 responses of math and special education teachers to an electronic survey, the researchers concluded that teacher efficacy that it was a significant factor in whether or not teachers engaged in differentiation instruction, especially in regards to teaching content, using manipulatives, and engaging in co-teaching strategies. Teacher efficacy beliefs are developed early and are very difficult to change. Their

research shows that differentiated instruction in mathematics, especially co-teaching, has a positive effect on student learning. Ekstam, Linnanmäki and Aunio assert, "Differentiated instruction requires teachers to have experience in different ways of teaching and learning, as well as strong knowledge of their students, including their backgrounds, experiences, interests and learning profiles" (Ekstam et al., 2017, p. 43). If teachers do not feel comfortable in differentiating instruction then the students are suffering, especially students with learning disabilities. To fix this, teacher preparation programs should seek to build teacher confidence by pairing math teacher candidates with special education candidates so they start building skills early on.

In conclusion, teaching strategies come and go. Direct instruction, in the era of Common Core, is no longer considered the best approach to teaching. Schools of thought are switching from teacher-led to student-led instruction, which can be confusing and frustrating to students with learning complexities who crave structure and consistency. With persistence, support, and encouragement, all can benefit from active teaching which differentiates instruction to meet students where they are at.

Co-teaching in an Inclusive Environment

This section examines the different components of co-teaching strategies, how to build a strong co-teacher relationship, and the important factors to make co-teaching successful for students in the classroom. The effectiveness of co-teaching strategies is also discussed.

Co-teaching, also known as collaborative or team teaching, is when two teachers, typically a general education and special education teachers, share responsibility in lesson planning, teaching, and assessing students in one classroom (Dieker & Murawski, 2003; Kloo & Zigmond, 2008). Co-teaching has increased in practice due to the pressure on schools to deliver

service to students with learning complexities in the inclusive classroom (Dieker & Murawski, 2003; Keefe & Moore, 2004; Kloo & Zigmond, 2008). Teaching students in a Least Restrictive Environment (LRE) not only benefits their academic well-being but also their social and emotional health (Diejer & Murawski, 2003). This practice has been more difficult to implement at secondary schools as compared to elementary schools due the specialized content, focus on assessments outcomes, and large class sizes (Dieker & Murawski, 2003; Keefe & Moore, 2004). However, when implemented correctly, co-teaching not only supports neuro-diverse students but all students in the classroom (Dieker & Murawski, 2003).

Literature often refers to the six co-teaching models as *one teach, one observe, station teaching, parallel teaching, alternative teaching, team teaching, and one teach, one assist* (Kloo & Zigmond, 2008; Sileo & van Garderen, 2010). According to Sileo and van Garderen (2010), no single strategy is better but each practice has a purpose such as pre-teaching, re-teaching, reviewing, enriching, and assessing. Kloo and Zigmond (2008) also discuss interactive teaching and alternative co-teaching as other less known co-teach models.

In order to make co-teaching successful, research emphasizes the importance of developing co-teaching partnerships and classes, and time to co-plan (Rextroat-Frazier & Chamberlain, 2019; Sileo & van Garderen, 2010; Tzivinikou, 2015). Researcher Tzivinikou (2015) conducted a study including thirty teachers from approximately fifteen classrooms in Greece. The classrooms had between eighteen to twenty-one students between first and fourth grade, with at least one student with a learning disability, and were co-taught with a general education and resource teacher. The researchers collected data by creating a rubric assessing the teacher partnership that included rating administrative support, collaborative planning, similar and different teaching strategies in regard to all students, responsibility of students, evaluation of

students, and interpersonal relationships that was completed both before and after training (Tzivinikou, 2015). This study demonstrates the importance of training and the necessity of continued communication and collaboration between co-teachers. A key factor that emerged in the effectiveness of teaching in an inclusive classroom was teaching efficacy. The author indicated that efficacy affects the amount of time and effort teachers invest, their expectations, and their ability to lesson plan.

The choice to engage in co-teaching is important as well as the ability to choose one's co-teacher. Co-teachers need to believe that students with learning disabilities are capable of understanding the content (Rextroat-Frazier & Chamberlain, 2019). Researchers emphasized the importance of discussing philosophies in the early stages of partnership and continued open communication and collaboration between co-teachers (Keefe & Moore, 2004; Rextroat-Frazier & Chamberlain, 2019; Sileo and van Garderen, 2010; Tzivinikou, 2015). Rextroat-Frazier and Chamberlin (2019) add that co-teachers need the support of their admin to co-plan and to ensure that their classes are created carefully, with no more than 30% of the students in the class having an IEP or 504. The authors acknowledge that there are mixed messages on if students prefer inclusion or if they prefer to participate in special education classes (Rextroat-Frazier & Chamberlain, 2019).

Identifying the roles of the co-teachers is essential to having a successful co-teaching partnership. In secondary mathematics, the general education teacher is typically seen as the "boss" while the special education teacher is often positioned as an assistant rather than a partner due to their lack of expertise in the specialized content (Rextroat-Frazier & Chamberlain, 2019). This is one reason why there is substantial research on co-teaching but limited research on co-teaching mathematics at the secondary level (Magiera et al., 2005). It is important for the special

educator to feel that the classroom is equally theirs. Magiera et al. (2005) depict the value of putting both teachers' names on everything including on the board, assignments, and communication to students and parents.

It is very difficult to differentiate mathematics at the secondary level because math builds upon prior knowledge going all the way back to kindergarten thus many students are at varied levels (Rextroat-Frazier & Chamberlain, 2019). This is another reason that research pertaining to co-teaching mathematics at the secondary level is limited. Co-planning time is crucial so that the general education teacher can introduce content to the special education teacher and the special education teacher can lead the general education teacher in differentiating instruction to fit the needs of the students (Dieker & Murawski, 2003). In many cases, teachers do not have time to co-plan purposefully and are doing much of the instruction and supporting on the fly (Keefe & Moore, 2004).

Kloo and Zigmond (2008) question if co-teaching is truly benefitting students with learning complexities. The authors report that although there have been increases of student academic achievement in reading in co-taught classrooms, this is not true for math co-taught classrooms. Researchers discovered that the grades of students in two Grade 8 inclusion classrooms were higher than those in pull-out programs but no difference was found on state testing (Kloo & Zigmond, 2008). They continue to state that if neuro-diverse students were unsuccessful in class, co-teaching will not make much impact on student achievement. Kloo and Zigmond (2008) assert that if here are two teachers in the room, there should be two lessons: the special education teacher should not be helping students complete their work but instead be teaching skills to increase participation. The authors (2008) assert that research on co-teaching,

especially at the secondary level, is still lacking and thus true effectiveness cannot be determined.

In conclusion, the majority of research positively discusses co-teaching as an intervention to support students with and without learning complexities in the general education classroom. The literature on co-teaching in mathematics at the secondary level is limited due to the complexity of curriculum and diverse skill levels of the students. Still, scholars purport that in order to have a successful co-teaching partnership, teachers should have choice and time to purposefully plan curriculum. There is some debate about whether co-teaching is *truly* effective and beneficial for neuro-diverse students, or, if it is a practice schools engage in to meet the requirements of a least restrictive environment.

Summary

Albert Bandura's (1977) self-efficacy theory and Carol Dweck's (2006) growth mindset pedagogy served as a theoretical foundation for implementing this action research project. Bandura theorized that a person's self-efficacy can affect their motivation and desire to accomplish tasks and overcome obstacles. Bandura believes that a person's self-efficacy can be affected by their successes and failures, acts and comments from others, and one's mental state. Dweck proposes that a person with a growth mindset focuses on learning and improving from mistakes while those with a fixed mindset are often afraid to try in fear of failure. Collectively, these theories emphasize the importance of an individual's belief in their own ability which can be positively and negatively shaped by outside forces.

The findings of the literature gathered for this action research project reinforced the important role of engagement on student achievement in the mathematics classroom. Self-efficacy was brought up time and time again in reference to both students and teachers. In

regards to students, researchers Smalley and Hopkins (2020) found that self-efficacy was a deciding factor when it came to students seeking help. Teacher self-efficacy impacted whether multiple motivational or differentiated learning strategies were used to engage students, especially those with learning disabilities (Ekstam et al., 2017; Skilling et al., 2016). Research regarding strategies to teach students with learning disabilities in the secondary math classroom focused on meeting students where they were academically, using real life examples, and providing feedback and support (Bishara, 2018; Stephan & Smith, 2012). Futhermore, extant literature suggests that co-teaching is a collaborative teaching strategy to support students with learning complexities in the general education classroom. The literature emphasizes the lack of current research regarding differentiated instruction and co-teaching mathematics at the secondary level. This is due to the fact that mathematical knowledge builds on a foundation that starts to grow in kindergarten and thus presents an obstacle for the secondary teachers to support all students at the level where they are at in one classroom (Rexroat & Chamberlain, 2019).

This research study was conducted during the era of COVID-19. It took place in Northern California, where most school districts were participating in distance learning in which instruction was delivered online. Because that was the first time in over 100 years that the world was affected with a pandemic, there has been no research regarding the topics above in regards to fully-online learning.

Based on the information from the research studies included in this literature review, this action research project used the theoretical framework of Bandura (1977) and Dweck (2015) to explore the themes of engagement, students with learning disabilities in the math classroom, and co-teaching in an inclusive environment. This action research project sought to add to the limited research conducted in the secondary math classroom in regards to differentiated instruction and

co-teaching. The next chapter elucidates the setting, methodology, data collection, and data analysis of the study.

Chapter III

Methods

It is becoming increasingly common for students with learning complexities to be instructed in a general education classroom due to the Individuals with Disabilities Education Act (IDEA) and the least restrictive environment (LRE) requirements (IDEA, 2020). Research has shown that inclusive environments benefit all students in the class; neuro-diverse students report higher self-esteem and socialization skills, and general education students demonstrate more social and cultural awareness (Reese et al., 2018). However, research also reports that providing differentiated instruction for students at the secondary level in mathematics is challenging for teachers due to the wide range of ability levels that begins in elementary school and the divergence continues to grow into high school (Ekstam et al., 2017; Rexroat-Frazier & Chamberlin, 2019). Co-teaching is one promising practice, currently adopted widely in schools, to address the diverse needs of students in one classroom (Dieker & Murawski, 2003; Hersi et al., 2016; Keefe & Moore, 2004; Kloo & Zigmond, 2008). The *co-teach model* consists of two teachers in a classroom, typically a general education teacher and a special education teacher, sharing responsibility in lesson planning, teaching, and assessing students (Dieker & Murawski, 2003; Kloo & Zigmond, 2008). The purpose of this research study was to examine the effects of station co-teaching strategies on student engagement in a high school math class with diverse learners. Station teaching is a co-teaching practice which breaks up the class and the content into, usually, three groups and is typically used for re-teaching, independent practice, and promoting problem solving strategies (SERC, 2017; Carty & Farrell, 2018). Since research has found a relationship between engagement and academic achievement (Fredricks et al., 2004; Willms, 2003), I hoped that by focusing on engaging students, student achievement would be positively

affected. This chapter describes the setting, demographics, data collection strategies, procedures, and plan for analysis of data for the research project.

Setting

The high school in which this study took place was located in a dense suburban city in Northern California. The city is rather large geographically; a big hill divides the old part of town from the new. Once a person travels up the hill, the demographics of the city changes. More and more homes are being built, and this school was built to meet the demands of the increasing population. Being rather new, it is not surprising that, according to the 2018-19 School Accountability Report Card (SARC), the school facility received an overall rating of "exemplary." Nonetheless, the average class size in the core classes such as English, Mathematics, Science, and Social Science was more than 23 students, and a majority of the classes fell in the more than 33 students per section range.

At the time of the study, there were approximately 3,400 students enrolled at the school. It should also be noted that there were more than 100 additional freshmen compared to senior students. Approximately 52% of students identified as male, and about 48% of students identified as female. The California Department of Education reports that racial and ethnic breakdown was (approximately): 2% Black or African American, 0.5% American Indian or Alaska Native, 70% Asian, 6% Filipino, 5% Hispanic or Latino, 0.5% Native Hawaiian or Pacific Islander, 12% White, and 5% Two or More Races. DataQuest indicated that about 7% of the students were socioeconomically disadvantaged, 1.5% of students were English learners, 5% of the students had a disability, and 0.1% of the student population was homeless.

The California English Language Development Test (CELDT) was a required assessment that helped schools to identity English learners' proficiency levels in listening, speaking, reading,

and writing in English. This program is no longer administered by the California Department of Education and was replaced by the English Language Proficiency Assessments for California (ELPAC) in 2018. According to summative ELPAC results for the 2018-2019 school year, 15.5% of the school's English learners were minimally developed (level 1), 17% were somewhat developed (level 2), 33% were moderately developed (level 3), and 35% of students were well developed (level 4).

Student achievement results for the 2018-2019 California Assessment of Student Performance and Progress (CAASPP) showed that approximately 96% of 11th grade students met or exceeded the state standards for English Language Arts (ELA), and 88% of 11th grade students met or exceeded the state standards for Math on the Smarter Balanced Summative Assessments. It is worth noting that only 48% of students with disabilities fell into the *met or exceeded state standards* category for ELA and even less- 22%-fell into this category for Math. Nevertheless, these averages are considerably higher than both the district and state percentages. According to SARC, the percentage of students who met or exceeded state standards in grades 3 through 8 and in grade 11 ELA was 81% and 78% in Math. These percentages exceeded those reported by the state as a whole, where only 50% of students meeting or exceeding the state standard in ELA and 39% in Math.

Academic excellence is very important to the community, evidenced by high parent involvement and financial support in the schools. Consequently, students are under a lot of stress to do well. Approximately Almost all (99.5%) of students in 2018-2019 school year were enrolled in courses required for UC/CSU admission. There are more than 100 AP courses offered at the school, and about 47% of the student population enroll in the courses. Conversely, only 10% of students participate in Career Technical Education. The graduation rate is about 98%,

exceptionally higher than California's 83% graduation rate. Most residents of the city are in the work force, with the household median income close to $130,000. Approximately 6% of students enrolled at the school receive free and reduced-price meals, illustrating that the school is not a Title 1 school in which 50% of free and reduced-price meals is typical.

At the time of this study, there were about 140 teachers with a full credential, less than 5 teachers without a full credential, and only a couple of individuals teaching outside their subject area of competence, according to the SARC. In the 2017 – 2018 school year, EdDATA reported that about 67% of the teachers identified as female and about 33.3% of teachers identified as male. At that time, the average number of years of teaching experience of teachers at the school was six years. Teacher racial and ethnic makeup was as followed (approximately): 18% Asian, 1.5% Filipino, 6% Hispanic or Latino, 1% Two or More Races, and 73% White. These data suggest that the racial ethnic backgrounds of the teaching staff differ tremendously from the student population.

Demographics of the Classroom

The participants for the action research project were drawn from the general education Algebra 1 Enrichment 1 (A1E1) mathematics class that I taught during the 2020 – 2021 school year. Algebra 1 Enrichment 1 is the lowest level of general math offered at the high school level. The idea behind the class is that it slows down the pace of Algebra 1, making each normal semester a yearlong class. The expectation is that this reduced pacing allows students to build their foundational skills and understanding. The High School Course Catalog states the course is recommended for students who exit 8th grade below proficient in the 8th grade Common Core standards. Students are assigned to A1E1 if they receive a D+ or below in Course 3 (8th Grade Level math) in middle school or are put into A1E1 from Algebra 1 midyear if the student is

falling behind. The high school graduation requirement is Algebra 1 or equivalent, which means that students can complete this two-year sequence of Algebra 1 Enrichment 1 (A1E1) and Algebra 1 Enrichment 2 (A1E2) and still be eligible for graduation.

All 29 students enrolled in my section of the A1E1 class were invited to participate in this action research project. Parents were emailed an informational letter that detailed the purpose of the project. Of the 29 participants, 25 were 9th graders, three were 10th graders, and one was a junior. Fifteen of the students identified as male and 14 of the students identified as female. The racial and ethnic makeup was as follows (percentages have been rounded to the nearest tenth): 27.5% Asian, 21% Black, 17 % Hispanic, 10% White, and 21% Two or more races. Four of the students (14%) were classified as English learners. Ten of the students (34%) received Special Education Department (SPED) services and three additional students (10%) had personalized learning plans or 504 plans. Students who receive SPED services have a tutorial period in which they get extra assistance from a resource teacher. All students with an Individualized Education Plan (IEP), Personalized Learning Plan (PLP), or 504 Plan received accommodations or modifications such as extra time on assignments, assessments, and access to a calculator or note card. Due to the high number of students needing extra support services, this math class is typically co-taught with a special education teacher.

Over half of the students in A1E1 are labeled as *at-risk* due to their school performance. These data demonstrate that the racial and ethnic makeup as well as academic performance of the students in this math class differs from the overall population of the school. It is not surprising that most of them dislike school and disengage from their classes – a plight that has become easier to do in the time of distance learning. A huge benefit to having two teachers in one classroom is the ability to reach more students at a greater depth. Although the reason to have a

resource co-teacher is to support students with learning complexities, all students may benefit for another teacher's experience and expertise. Thus, I did not narrow the participants to only neuro-diverse students, but explored the impact of station co-teaching on the class as a whole.

Data Collection Strategies

In order to determine the impact that the implementation of station co-teaching had on student engagement, a variety of data collection strategies were used throughout the study. Based on research done by Fredricks et al. (2004), student engagement measured in this study was broken down into three categories – behavioral, emotional, and cognitive. Because certain types of engagement can be more difficult to measure than others, data were analyzed both qualitatively and quantitatively (Skilling et al., 2016). The *Engagement Observation Checklist* (Appendix A) offered both qualitative and quantitative data. Quantitative data were also collected by an *Engagement and Achievement Data Sheet* (Appendix B) on Google Sheets. I also collected qualitative data through field notes recorded on Google Docs after each class period.

Engagement Observation Checklist

This Engagement Observation Checklist (see Appendix A) was an observational tool that I created combining key elements from Lane and Harris' (2015) Observational Protocol Coversheet as well as Le Lant and Lawson's (2019) Student Engagement Checklist (SEC). Engagement is multi-faceted; and as the researcher, I wanted to collect data on all aspects of engagement. This study took place during the international pandemic COVID-19 which forced all instruction to be on-line. In order to successfully utilize station teaching, students were placed in a "break-out room" on the video conferencing platform, Zoom, with either myself or my co-teacher, a special education teacher. Because my co-teacher is not a trained researcher, I developed this checklist so that she could easily collect data when students were showing

varying levels of engagement throughout the class period. It also allowed for consistency and parity between our observations. Moreover, this checklist allowed me as a teacher-researcher to easily collect data while teaching the class simultaneously.

The engagement observation checklist included basic information such as the date of the observation, the observer's name, the course, number of students, notes on class environment, and a brief description of the instructional method. The last two pieces of information, class environment and instructional method, were particularly important because of their possible influence on engagement. The pandemic has caused so much uncertainty, and students felt the effects of the time such as the election and racial injustice; for this reason, I found it important to note the environment in which the class was taking place. The station co-teach model can be used to both instruct and review, and thus, it was important to note the purpose of the practice in order to compare and contrast the different situations.

The engagement observational checklist has a chart with key components of the three factors of engagement - behavioral, emotional, and cognitive. For the different levels of behavioral engagement depicted in class, such as being on-task, participating, not responding, or being disruptive, the observer put a tally in the appropriate box. The assessment of different levels of emotional engagement were considered to reflect student interest in the material, positive and negative interactions with other students and teachers, and the sharing opinions and feelings with other students and teachers. To demonstrate cognitive engagement or disengagement, data were collected on the number of students who ask questions, discuss the material with others, use problem solving strategies, or say "I don't know."

Engagement and Achievement Datasheet

For each assignment that was given throughout the duration of the study, the number of students who turned it in on-time, the number of students who turned in the assignment complete, and the average score of the assignment were all recorded (see Appendix B). According to Fredericks et al. (2004), behavioral engagement can be measured by turn-in rates as it pertains to the participation and involvement of a student. The completion rates and average scores helped me understand students' cognitive engagement which is tied to the individuals' effort in learning and mastering skills (Le Lant & Lawson, 2019).

Researcher Field Notes

Similarly, over the course of the study, the researcher kept field notes located on a personal Google Document. Field notes were written during or after each class period, about two to three times a week depending on the schedule. The field notes focused on depictions of engagement that did not fit easily into the checklist or data sheet such as descriptions of behaviors, explanations of problems, acts of self-regulation, and accounts of interactions between students or student and teacher. The notes were not written in complete sentences in order for the observer to quickly get her thoughts typed out before having to focus on teaching or the next class period. Notes were then revisited at the end of the day, and details were added to make the observations clearer if needed. Because my co-teacher and I were essentially in different "rooms" while participating in station teaching, any recounts she may have shared with me after class were also added to the field notes. At the end of the study, the field notes were analyzed qualitatively to determine patterns, themes, and obscurities.

Procedures

This study took place over eight school weeks between early January to early March. The school followed a bell schedule in which students have all their classes on Monday for 30 minutes, odd periods (1, 3, 5) for 75 minutes on Tuesday and Thursday, and even periods (2, 4, 6) for 75 minutes on Wednesdays and Fridays. Thus, students were only in the Algebra 1 Enrichment 1 class, on average, for a total of three hours a week. There were three 3-day weekends and one 4-day weekend that occurred during the time of the study, and during those weeks, students attended class twice a week for about 2.5 hours overall.

To begin, my co-teacher and I worked together to split the class into three groups. We tried to ensure that there was an equal split of math levels in each group as well as students requiring extra support, and we tried our best to separate the students who could be disruptive. As the study went on, we moved students from one group to another, if we felt the other group may be a better fit for them.

Station co-teaching involves each co-teacher teaching different material at the same time at different stations, or in this case, different break-out rooms on Zoom. To get used to the practice and running our stations efficiently, my co-teacher and I divided up a review exercise. My co-teacher took half the concepts on the study guide, and I took the other. Students rotated at 20-minute intervals between my co-teacher, to me, to individual time to work on the rest of the assignment while being supervised by my teacher's assistant, a student in their junior year who I previously had in my Precalculus/Trigonometry class. After students had participated in all three stations, we came back together to answer additional questions.

As the study unfolded, my co-teacher and I began to feel more comfortable with the practice and so it evolved. One group began with me teaching an extension to previous material

or new material, one group began with my co-teacher reviewing material from last class, and one group worked individually on the assignment with the teacher assistant. The engagement and achievement data from these lessons were collected and then analyzed quantitatively and qualitatively.

Plan for Data Analysis

Each data source was collected to address the research question, *what is the impact of the station co-teaching model on Algebra 1 Enrichment 1 students' engagement?* Both the general education and special education teachers completed engagement observation checklists (see Appendix A) on Google Docs noting environments and occurrences of each class period in which station teaching commenced. I also kept track of data regarding assignment turn-in rates and grades on an engagement and achievement datasheet (see Appendix B) on Google Sheets. As the researcher, I kept field notes on Google Docs recording observable instances and behaviors that occurred in the classroom after each class for the course of the study. These multiple data sources allowed me to triangulate the data to fully interpret the results of the study. Triangulation can illuminate different attributes of engagement that cannot be easily deemed from just one source.

Quantitative analysis was used for data that emerged from the engagement checklists and the engagement and achievement datasheet. Measures of central tendency – mean, median, mode – were calculated for each aspect of engagement on the checklist. The mean depicted on average how often a behavioral, emotional, or cognitive engagement trend occurred. The median exposed which types of engagement were less or more prominent in the classroom. The mode identified which behaviors occurred the most frequently during the study. Understanding the mode led me to search the other data sources for an explanation as to why those actions occurred the most

often. Scores from the engagement and achievement datasheet were analyzed for measure of variability in order to identify outlier assignments. Once outlier assignments were identified, I was able to look at the other data sources to examine reasons for the assignment scores to differ from the mean either negatively or positively.

Qualitative analysis was used for data that arose from the engagement checklist and researcher field notes. These data were reflected upon often to identify themes and create a picture of the classroom setting and participants. When examining the engagement checklist information, I focused on the notes on classroom environment and whether the material was being reviewed or taught for the first time during that lesson. As I reviewed the researcher field notes, I zoned in on the behaviors that students exhibited that showcased their level of engagement in the lessons and looked for patterns. Observation over a video conferencing platform created a lot of limitations, especially when participants chose to keep their cameras off or themselves muted. Thus, many notes were made from conversations and outputs in the chat or verbal responses. I compared and contrasted the data presented from the different sources and identified common topics that helped me understand the impact that station co-teaching had on the Algebra 1 Enrichment 1 students.

Summary

The focus of this action research study was to investigate the impact of the station co-teaching model on Algebra 1 Enrichment 1 students' engagement. Prior to conducting this study, I had noticed that some students disengage in math classes due to their own perceived abilities and past experiences, and I had hoped to use station co-teaching as a promising practice in order to increase student engagement. The station co-teaching model was implemented over eight weeks. I measured student behavioral, emotional, and cognitive engagement through the

Engagement Observation Checklists (see Appendix A), Engagement and Achievement Data Sheet (see Appendix B), and researcher field notes.

This chapter introduced the setting of my action research, the participated, data collection methods, and plan to analyze data. The next chapter will discuss the data that was collected from the study and its analysis.

Chapter IV

Findings

The purpose of this action research project was to study the impact of implementing station co-teaching on student engagement in an inclusive secondary math class. A review of literature has shown that direct instruction has been a promising practice method for instructing students with learning complexities in the math classroom (Stephan & Smith, 2012). With the transition to Common Core State Standards (CCSS), students are now expected to be more of an active participant in their own learning with an emphasis on collaboration between students and promotion of problem-solving skills (Stephan & Smith, 2012; Bishara, 2018). Research has also shown that differential instruction in a Least Restrictive Environment (LRE) has a positive effect on student learning (Diejer & Murawski, 2003; Ekstam et al., 2017). Co-teaching has increased due to the need to better support neuro-diverse students in the general education classroom, but the practice has been more difficult to implement at secondary schools due to specialized content (Dieker & Murawski, 2003; Keefe & Moore, 2004; Kloo & Zigmond, 2008). Because of this, research on the effectiveness of co-teaching at the secondary level, especially in mathematics, is lacking (Kloo & Zigmond, 2008). This action research project seeks to fill in some of these gaps and answer the question: *What is the impact of a station co-teaching model on Algebra 1 Enrichment 1 students' engagement?* This chapter will describe the overview of methods and data collection, demographics of the participants, analysis of the engagement checklist data, analysis of the engagement and achievement datasheet, and analysis of researcher's field notes.

Overview of Methods and Data Collection

Data were collected over a nine-week period for this action research project. During each class period, 19 classes total, I completed an Engagement Observation Checklist (see Appendix

A) and after each class period I spent 10 – 20 minutes adding to my researcher field notes. I created the Engagement Observation Checklist combining key elements from Lane and Harris' (2015) Observational Protocol Coversheet as well as Le Lant and Lawson's (2019) Student Engagement Checklist (SEC). The field notes focused on depictions of engagement that did not easily fit easily into the checklist such as how lessons were adapted to fit the needs of the students, descriptions of behaviors, and accounts of interactions between students or student and teacher. For each assignment given during the study, I recorded the number of students who turned in the assignment on time, the number of students who turned the assignment complete, and the average score of the assignment on an engagement and achievement datasheet (see Appendix B). The purpose of collecting these data was to interpret students' behavioral and cognitive engagement as well as search for a correlation between engagement and achievement.

This study was conducted during the pandemic COVID-19 and thus all instruction was online. In order to utilize a station co-teaching model, students were placed in "break-out rooms" on the video conferencing platform Zoom. In most cases, three rooms were created – one with me, one with my co-teacher, and one with our teachers' assistant. However, on occasion, we were fortunate to have two tutors in class to assist and five different rooms were created. In all cases, the leaders would rotate after 10 – 20 minutes in order to review or teach each room a different concept. The station co-teaching practice was implemented in 10 of the 19 class periods in which data was collected. In those cases, my co-teacher also completed an Engagement Observation Checklist. When the tutors were available, each station was about six students, otherwise there were about eight learners in each group. My co-teacher, the two tutors, our teachers' assistant and I would all stay after class was dismissed to discuss what occurred in our break-out rooms and I would add the information to the field notes.

Demographics of the Participants

Participants for this action research study were drawn from my secondary Algebra 1 Enrichment 1 (A1E1) class during the 2020-21 academic year. Out of the 29 students enrolled in the class, 24 (82%) were included as participants. Of the five students not included, three students were added to the class after data collection had begun and the other two students on my roster had yet to attend class for the semester. Of the 24 participants, 12 (50%) were identify as young men, and 12 (50%) identify as young women. Their ages ranged from 14 to 16 years old. The racial and ethnic make-up of the participants were as followed: 25% Black or African American, 12.5% White or Caucasian, 17% Hispanic or Latino, 12.5% Asian Indian, 33% Asian American and Pacific Islanders. Additionally, 38% of participants had an Individualized Education Plan (IEP) and 17% of participants had a personalized learning plan or 504 plan. Four students (17%) were classified as English language learners and two of the students (8%) only spoke Spanish. Over half of the students in A1E1 are labeled as *at-risk* due to their school performance, meaning they have more than two D's or F's.

Analysis of Engagement Observation Checklist Data

The engagement observation checklist (see Appendix A) was completed by me each class period, as well as by my co-teacher on the days in which station co-teaching was practiced. The engagement observation checklist included basic information such as the date of the observation, the observer's name, the course, number of students, notes on class environment, and a brief description of the instructional method. The engagement observational checklist also included a chart with key components of the three sectors of engagement - behavioral, emotional, and cognitive. Aspects of behavior engagement included being on-task, participating, not responding, or being disruptive. Students showing interest in the material, positive and negative interactions

with other students and teachers, and sharing opinions and feelings with other students and teachers were observations of emotional engagement that we looked for. Cognitive engagement was demonstrated by asking of questions, discussion of the material with others, use of problem-solving strategies, or when a student said "I don't know."

The results were analyzed in three different ways. Measures of central tendency – mean, median, mode - were calculated for each aspect of engagement on the checklist. Figure 1 depicts, on average, how often a behavior, emotional, or cognitive engagement was observed during the nine weeks of intervention. The side-by-side allows for comparison of engagement during station co-teaching lessons and whole class discussion lessons. The data reveal that, as a whole, participants engaged more during station co-teaching instruction.

Figure 1

Comparison of average of types of engagement observed in station co-teaching and whole class dicussion.

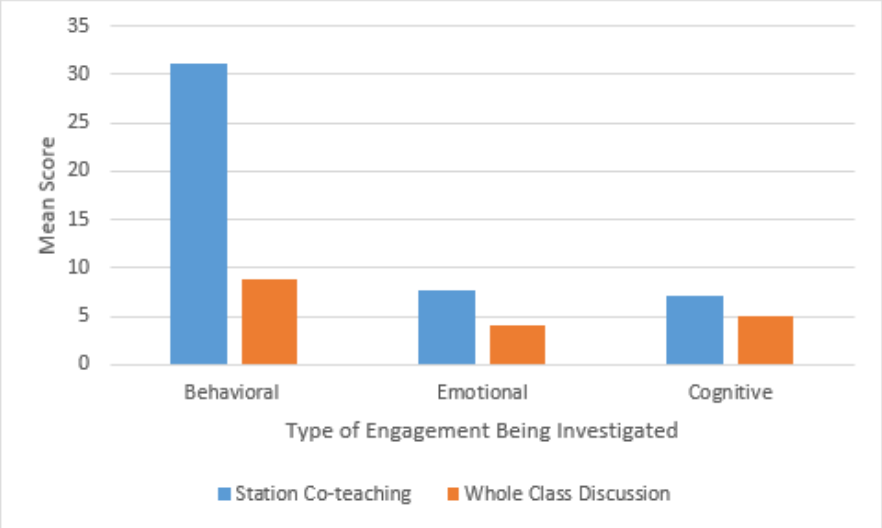
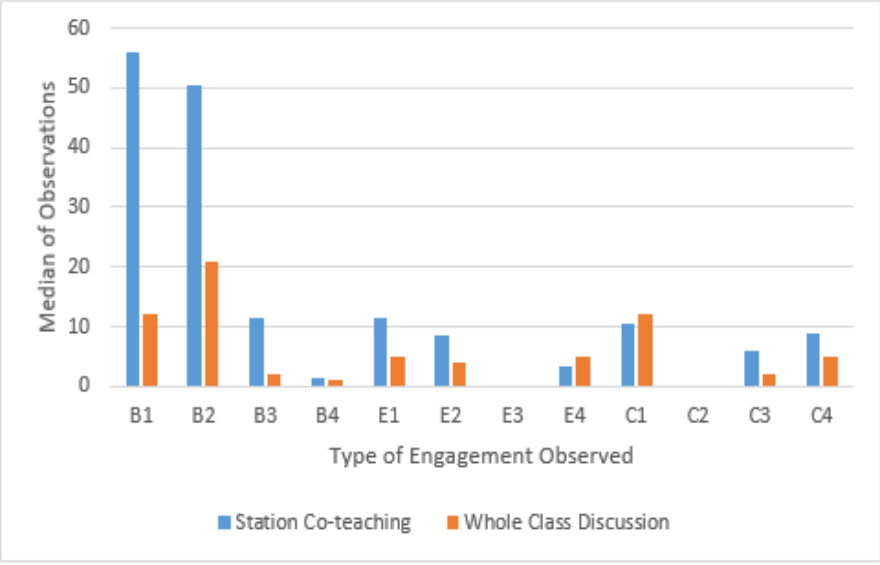


Figure 2 depicts the median for each type of engagement observed. I chose to use the median, rather than the mean, in order to minimize the effects of the skewed distribution. When comparing engagement during station co-teaching and whole class participation, engagement was higher or equal when participants were in stations for every case except two. In whole class

discussion, students shared their opinion/feelings with other students/teacher more than in small station groups. Students also tended to ask more questions during whole class discussion than during station co-teaching. Notably, in the nine weeks, there few, if any, negative interactions with other students/teachers in both teaching methods. There was also no discussion about material with other students; students demonstrated a lack of collaboration with one another as well as communication on how each individual were using problem solving techniques or prior knowledge to arrive at their solutions to assist other learners. Overall, there was a lack of student-to-student interaction. All three students have always had their camera off and only communicate through the use of the chat feature. Most chats were sent privately to the teacher instead to the whole class.

Figure 2

Median of the 12 types of engagement observed in both station co-teaching and whole class discussion setting

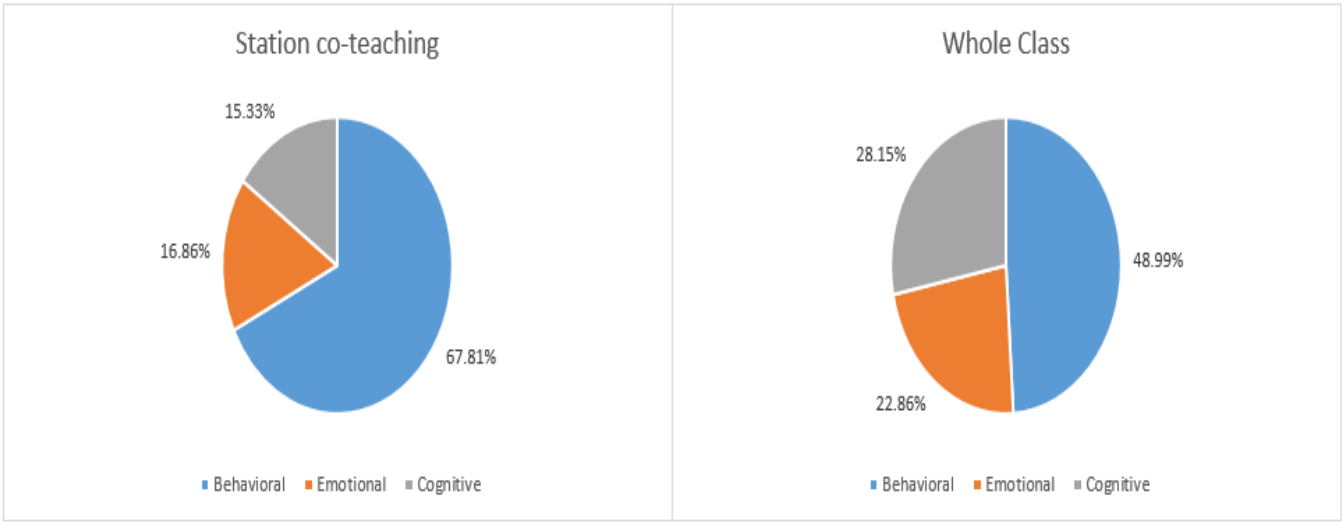


Note. Behavioral Engagement: On-Task (B1), Participates (B2), Does not respond (B3), Disrupts (B4)
Emotional Engagement: Shows interest in material (E1), Positive interactions (E2)
Negative interactions (E3), Shares opinion/feelings (E4)
Cognitive Engaement: Asks questions (C1), Discussion about material (C2)
Use of problem solving strategies (C3), Says "I Don't Know" (C4)

Figure 3 further analyzes the frequency in which behavioral, emotional, or cognitive engagement was observed during station co-teaching (n =1833) and whole class discussion (n =643). By analyzing the data nominally, I was able to determine the most common observed type of engagement. In both instances, behavioral engagement was observed the most, although at a much higher rate in the lessons that utilized station co-teaching. Whole class participation had more observations of cognitive engagement as opposed to emotional engagement. Conversely, station co-teaching led to occurrences of emotional engagement more than cognitive engagement. Overall, station co-teaching had more observable instances of engagement than whole class participation.

Figure 3

The percentage of behavioral, emotional, and cognitive engagement over nine weeks of observation.



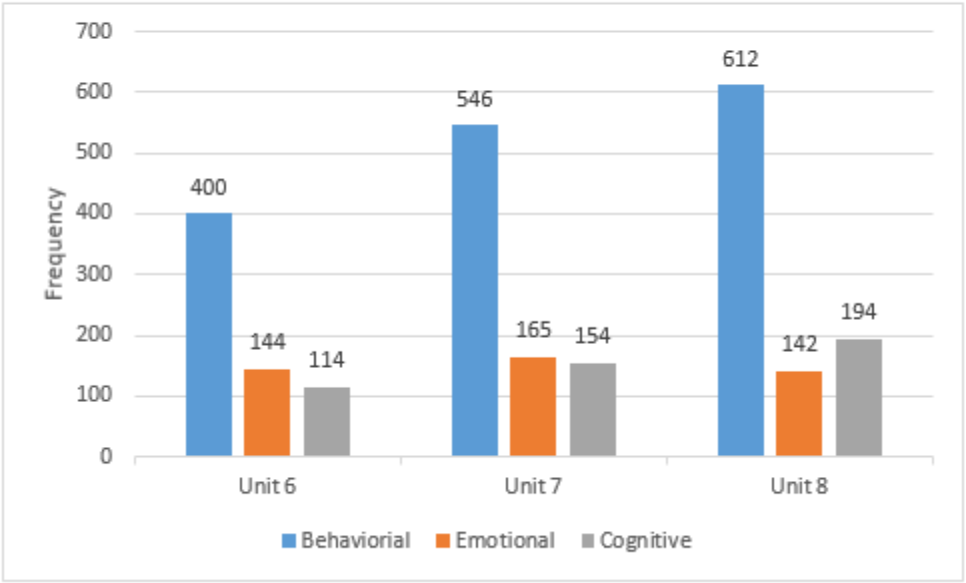
Note. Station co-teaching (n = 1833) Whole class discussion (n = 643)

During the nine-weeks of intervention, we covered three units of algebra. Unit 6, *Solving Inequalities*, was taught during weeks one and two. Unit 7, *Functions*, was taught during weeks three through six. Unit 8, *Linear Equations*, was taught during weeks seven through nine. Out of the four days of teaching in which data was collected for Unit 6, only one-day (25%) did not

incorporate station co-teaching. Unit 7 was covered in seven days in which three lessons (43%) did not use the station co-teaching practice. In the eight classes that concepts from Unit 8 were being taught, station co-teaching was modeled in three classes (38%). Figure 4 looks more deeply at each type of observed engagement with relation to each unit. Although there was a large difference between behavioral engagement and the other types of engagement in each unit, the contrast between emotional and cognitive engagement was less drastic. For Unit 6, emotional engagement was observed in 30 more instances than cognitive engagement. Unit 7 showed that disparity shrink to nine with emotional engagement being observed more. The dynamic switched for Unit 8 in which cognitive engagement was witnessed more than emotional engagement by 52 cases.

Figure 4

Frequency of engagement throughout the three units of study.



Lastly, I wanted to see if overall engagement had increased over the intervention period. Figures 5, 6, and 7 depicts how behavioral, emotional, and cognitive engagement has changed on a week – by – week basis. The amount of lessons (total, station, whole class) by week were as

followed: week 1 (3,2,1), week 2 (1,1,0), week 3 (1,1,0), week 4 (3,1,2), week 5 (2,1,1), week 6 (1,1,0), week 7 (3,0,3), week 8 (2,1,1), and week 9 (3,2,1). Comparing weeks 1 and 9, which had the same of total, station, and whole-class lessons, behavioral engagement was observed 44 more times in week 9 than week 1, emotional engagement was observed 37 less cases in week 9 compared to week 1, and cognitive engagement observations remain similar in the two weeks, 82 instances in week 9 and 81 instances in week 1.

The trend lines on each figure show the generalization of the data for each engagement type over the nine-week data collection periods. Figure 5 depicts a positive slope of 5.67, illustrating that, overall, observations of behavioral engagement increased over the time in which data were collected. Figure 6 further emphasizes the drop in emotional engagement, highlighting a decrease, -2.9 slope, as the intervention progressed. The positive trend over the nine weeks in regards to instances of cognitive engagement is smaller at a 2.7 slope.

Figure 5 depicts a large drop in behavioral engagement in weeks 3 and 5 compared to the weeks previous (-104 and -83 respectively), and conversely shows a large spike in weeks 4 and 8 (+142, +177). Weeks 2 and 3 are similar in number of lessons, station, and whole-class, however, week 2 was at the end of a unit and week 3 was at the start of a unit. Markedly, weeks 4 and 8 were both the second week of a unit. Notably, in all the situations, station co-teaching was only utilized once each week. Figure 6 also displays a drop in emotional engagement in weeks 3, 6, and 9 (-58, -22, -23) with a peak occurring in week 4. Figure 7 emphasizes decreases of cognitive engagement in weeks 2 and 3 (-48, -25), which are both weeks in which only one lesson occurred. Figure 7 also illustrates an increase in cognitive engagement in weeks 4 and week 9 (+52, +31).

Figure 5

Frequency of behavioral engagement over the nine-week period.

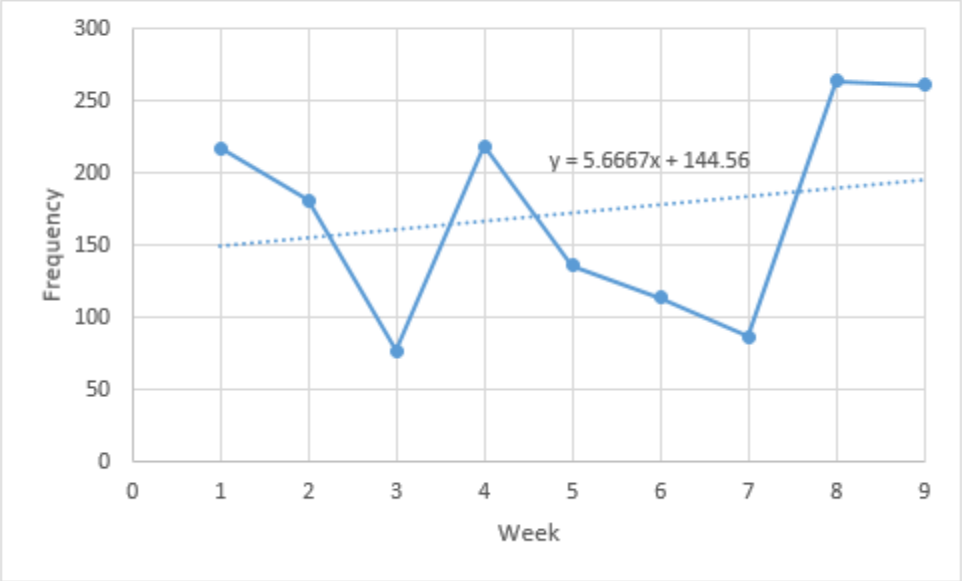


Figure 6

Frequency of emotional engagement over the nine-week period.

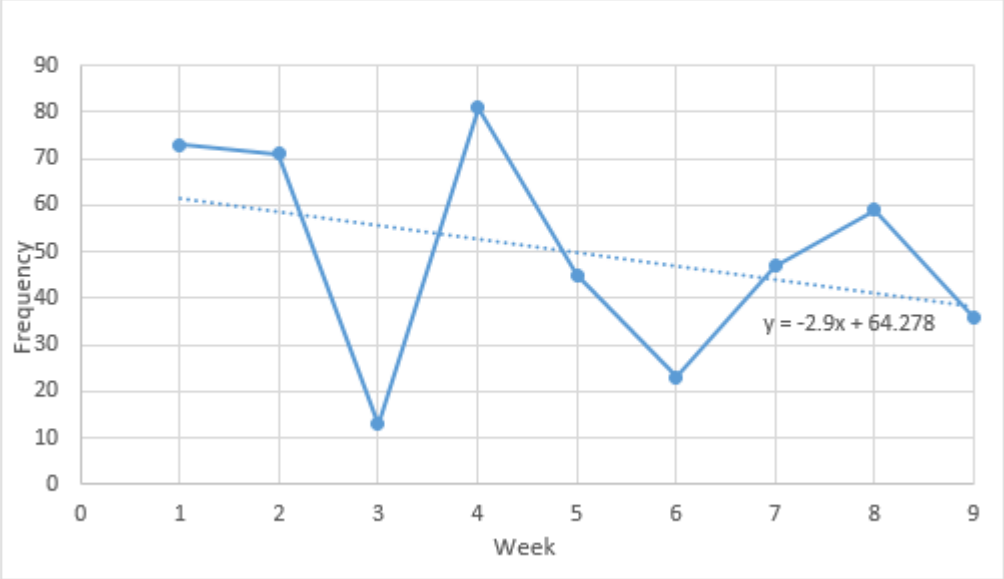
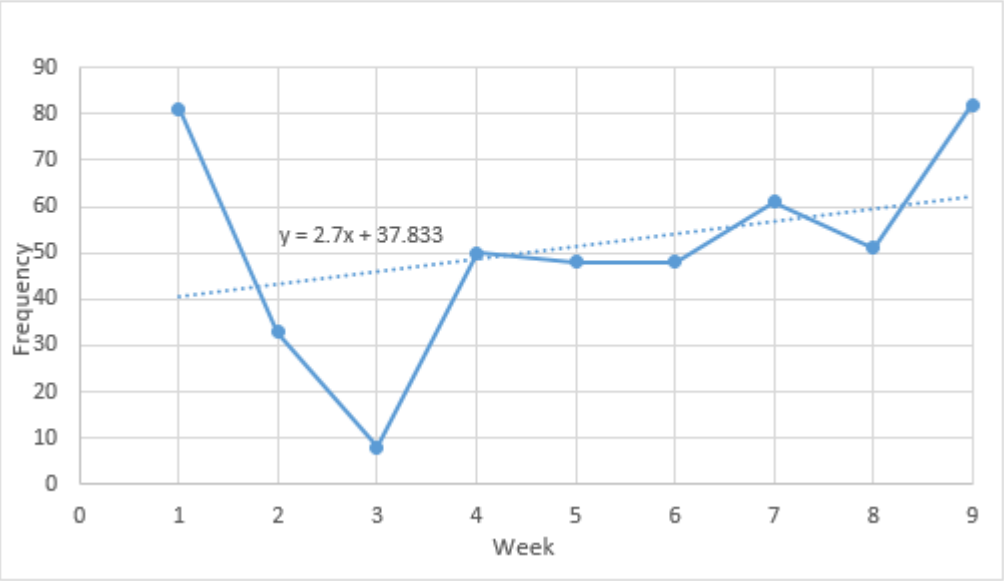


Figure 7

Frequency of cognitive engagement over the nine-week period.



Chapter 5 will analyze these data in greater context with relation to the other types of data collected in order to understand deeper connections. There are many factors that effected student engagement such as the unit concepts themselves, the class environment, and world events. The triangulation of all sources of data provided insight to how deeply engagement was impacted by different sources.

Analysis of Engagement and Achievement Datasheet

The engagement and achievement data were recorded for each assignment assigned during the nine-week data collection window of this action research project (see Appendix B). Data that were collected included the number of students that turned the assignment on-time, the number of students that completed the assignment (late submissions included), and the average score of the participants (including zeros). One purpose of the data sheet was to measure behavioral and cognitive engagement in another way; behavioral engagement can be measured by turn- in rates and average scores can give insight to students' cognitive engagement when is

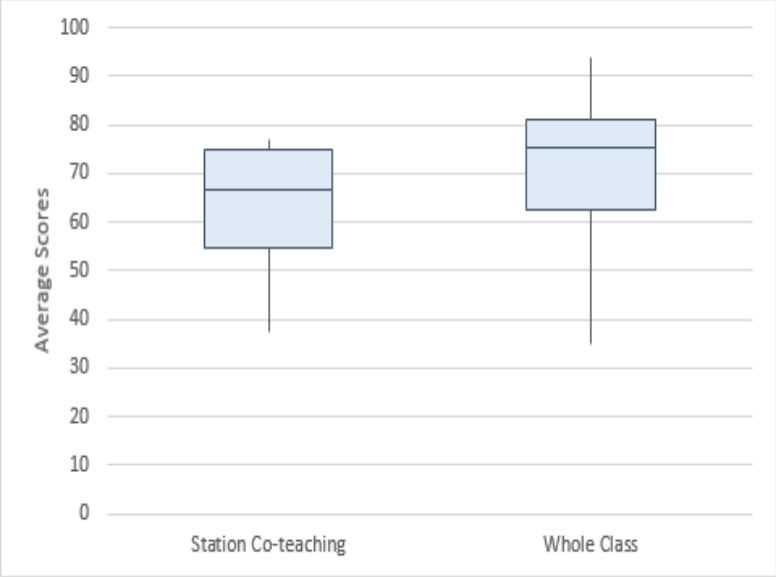
tied to effort and mastery. Another purpose of the data sheet was to see if there was any impact of station co-teaching on student achievement in regards to assignment scores.

The data collected from the engagement and achievement datasheet were analyzed for both measure of center and measure of variability. Notably, the median for number of students that turned-in on time (18) and completed assignments (20) were higher when the assignments were assigned on whole class discussion days compared to station teaching days (13.5, 19). However, the standard deviation was lower for completion (3.92) and average score (13.25) assignments for station co-teaching compared to whole class participation (4.3 and 18.07 respectfully), illustrating that the data were more spread in the second case.

Figure 8 further emphasizes this by displaying the five-number summary of the data as a box and whisker plot for average score (in percent) in both teaching practices, station co-teaching and whole class discussion. The range of the co-teaching scores is significantly smaller (-19.81%) for station co-teaching than whole class discussion. The short whisker for station co-teaching illustrates that the top 25% of the data is more clustered together around 75%. The longer whisker for whole class discussion shows that the bottom 25% of the data has a large spread ranging from about 35% to low 60s%. Although the data are more spread for assignments assigned during whole class discussion, the box and whisker plots indicate that the average scores are higher when assigned on whole class discussion days than when assigned during station co-teaching. There were no outlier assignments in terms of average score in either case. There were also no outlier station co-teaching assignments, but there was an outlier assignment (#13) in regards to number of students that turned in assignments on time as well as completed assignments for whole class assignments.

Figure 8

Box and whisker plot of the 5 number summary of the average score of assignments

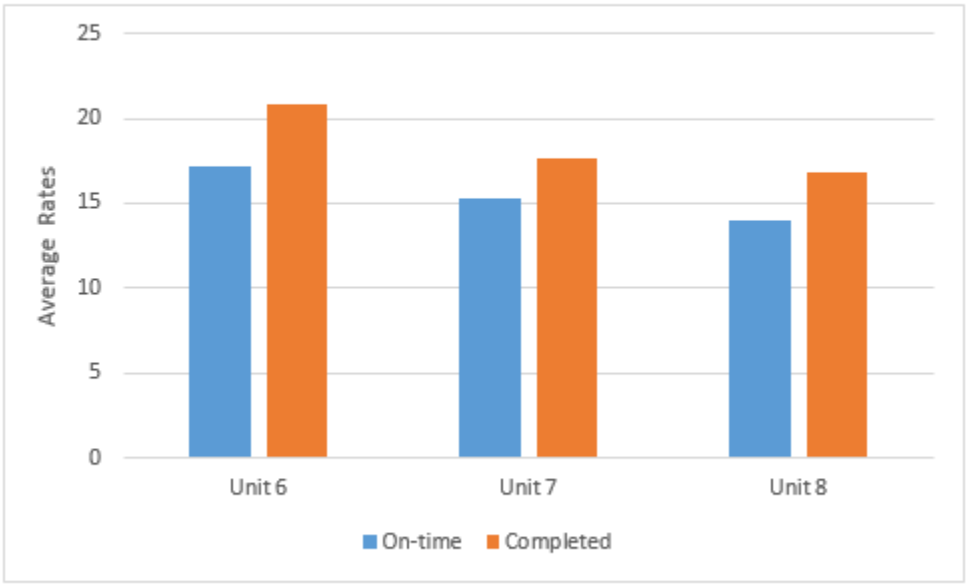


Note. Data collected over nine weeks on assignments completed during station co-teaching and whole class discussion.

Figure 9 depicts both the average number of students that completed each assignment on time as well as the average number of students the completed each assignment by the day of the assessment, which was the last day for students to turn in late work for the particular unit. During the data collection period there were 22 assignments: Unit 6 had five assignments, Unit 7 had seven assignments, and Unit 8 had eight assignments. In both cases, overall, turned-in on-time and completed rates declined unit to unit. Importantly, Unit 7 does contain both the overall minimum score (34.78%) and overall maximum score (94%).

Figure 9

Average on-time and overall completed assignments



Note. Based on 24 students' data.

The overall average score on assignments in Unit 6 was 76.60%. Unit 7 assignments had an average score of 65%. Sixty-three percent was the average score of the assignments completed during Unit 8. This shows an overall decrease in assignment scores over the nine-week period of intervention. Unit 6 was *Solving Inequalities*, which had no relation to the following two units, functions and linear equations. Unit 7 introduced concepts such as domain and range, and inputs and outputs, which were later built upon in Unit 8. Mathematics is a subject that builds on itself, with an unstable foundation, it is hard to achieve higher understanding.

Analysis of Researcher Field Notes

The researcher field notes were recorded in a Google Documents file. I recorded notes after each class period over the nine weeks of data collection. Classes met two to three times a week, depending on the schedule. There are 19 entries total, each ranging from a few sentences

to half a page. I recorded notes such as behavior of the students as well as myself, lesson reflections such as teaching strategies and musings on how to improve in the future, and student/teacher interactions. Data were also analyzed qualitatively to more thoroughly address the action research question. Specifically, I coded the entries and noticed that emerging patterns fell into five major themes. These themes included: *strategies to support students, shortcomings of online teaching, descriptions of material and skill that students struggled with, class bonding moments, and teacher personal reflection*.

The overarching themes showcased in Table 1 exemplify the many factors that can affect students' education. Because instruction occurred online, students had more responsibility in initiating and managing their participation. The district could not force a student to have their camera on and thus, for many reasons, students would attend class without joining by video. Without knowing if they were behind the black screen that said their name, it was a challenge to build a community. Often a student would not answer or say "I don't know" maybe out of fear of being wrong. My co-teacher and I would deliberately be silly and move conversations off on tangents to get students to feel more comfortable participating. The small group setting in the stations had its benefits. At times, students felt more comfortable interacting in this context as I noted on 1/29/2021, "a student looked really sad in the main room but as soon as we went into break out rooms they perked up, said hi, and volunteered".

Another common pattern noted in the researcher's field notes was the lack of note taking and homework completion. My co-teacher and my only assumption about this limited participation was that students struggled with the material and thus they did not complete the assignment. To address this issue, we would review concepts again and again until the assignment outcomes improved. Lesson planning was driven by my own assumptions of what

students did or did not understand through the limited interactions with students and assignment scores. But even then, it was difficult to truly decipher why the students struggled. As I stated on 3/12/2021, “It is just really hard seeing students struggle and not being able to help them in the same way you are able to in person.”

The excerpts from the researcher’s field notes noted in Table 1, demonstrate the academic and environmental challenges that hindered student engagement and thus comprehension of subject matter. My co-teacher, the tutors, as well as, our teachers’ assistant contributed to these findings in our end of class daily meetings. The excerpts from the researcher’s field notes in Table 1 also depicts the support and community building strategies participants received to combat those obstacles. Furthermore, Table 1 excerpts illustrates the impact of student engagement on teacher reflection and assumptions which affect both the teacher’s self-efficacy and efficiency.

Table 1

Common themes from researcher's field notes.

Theme	Example 1	Example 2	Example 3	Example 4
1. Strategies to support students	"We have noticed that students engage more if we are silly and talk about non math stuff in the beginning." - 1/ 20/2021	"We reviewed again slowly...even though we didn't go through all of them, green started to pop up showing students were getting the right answers." -2/3/2021	"...but the student we are most worried about was still disengaged and not focused so co-teacher ... will do one-on-one tutoring to see if that makes a difference." - 2/5/2021	"We do note checks to see their study skills and habits, we are trying to encourage them to improve these habits, we give techniques, we post our notes, etc." -3/10/2021
2. Shortcomings of online teaching	"I was distracted by getting a new student emailing me she doesn't have access...so had to take care of that". -1/15/2021	"The hw tells them if they are right or wrong so they could have just clicked through to get 100%." - 2/3/2021	"I have no idea if they are there or not without a response or camera on." -2/3/2021	"It is just really hard seeing students struggle and not being able to help them in the same way you are able to in person." -3/12/2021
3. Description of material and skill that students struggled with	"...at least 4 kiddos didn't know that a point is x and y...means they didn't do the asynchronous work." - 2/1/2021	"Students are struggling hard core with graphing. Only 8 students did their homework." -2/11/2021	"Even though they did well on the homework, they did not retain the information." -2/24/2021	"Some caught on quickly to point-slope but they get confused with the formulas." -3/4/2021
4. Class bonding moments	"We then went off on a tangent about sleep where a lot of students were talking in the chat about their poor sleep habits." - 1/13/2021	"...only two students spoke up and then one student asked a question about the street bike that another got because he is getting one for this birthday, and then everyone started to put their birthdays in the chat." - 1/20/2021	"We all sang happy birthday to a student and it was adorbs." -2/5/2021	"We started with a wellness talk, telling them that we are there for them if they need it and the resourced available to them if they need help." - 3/4/2021
5. Teacher Personal Reflection	"I might have been a bit snappy when it was the 6th time I have answered the same question." - 2/1/2021	"Today we had to call on students repeatedly to get them to answer, maybe they didn't want to be wrong infront of the whole class so they just pretended not to hear me..." - 2/3/2021	"It makes me really happy the students were asking questions." - 2/11/2021	"I feel like we accidentally enabled them instead of helping them." - 2/24/2021

The researcher's field notes allowed insight into interactions and events occurring the classroom. They give background and meaning to the quantitative data provided in the engagement observation checklists and engagement and achievement datasheet. Without context, numbers can only tell so much of a story.

Summary

The purpose of the action research project was to determine the effect of co-teaching on high school students' engagement and, therefore achievement, in an inclusive math classroom. An intervention consisting of a station co-teaching model to teach and review content was implemented for nine weeks. Engagement observation checklists, an engagement and achievement datasheet, and researcher field notes were all data gathering strategies used for triangulation in order to examine the effect of the co-teaching practice on participants' engagement.

This action research project was completed using a mixed-method approach. Quantitative data were collected by both the engagement observation checklist as well as the engagement and achievement datasheet. Qualitative data were also collected with the checklist and thorough researcher field notes. When synthesizing the data provided by these three sources, I determined that station co-teaching led to an increase in student engagement in most cases. However, the effect on student achievement was inconclusive.

In the next chapter, I discuss the results of the study. I will compare and contrast the results of this action research project to studies discussed in the literature review. Furthermore, I will explore the limitations and implications of my study. Chapter V will conclude with plans for my future work as a transformative teacher leader.

Chapter V

Conclusions

A focus and goal of many educators is to increase student engagement due to the perceived correlation between engagement and achievement (Willms, 2003; Fredricks et al., 2004). But what is engagement? And what does it mean to be engaged? Researchers often defer to Fredricks' (2004) descriptions of engagement which is threefold: behavioral, emotional, and cognitive (Skilling et al., 2016; Watt & Goos, 2017). In reference to education, behavioral engagement is demonstrated by student participation and involvement, cognitive engagement is confirmed by the time and effort an individual puts forth to learn, and emotional engagement is revealed by the reactions of a person to their environment and a person's sense of belonging (Fredricks et al., 2004; Skilling et al., 2016). This action research project was conducted via the online platform Zoom during the COVID-19 pandemic. The incredible task of engaging students over the computer seemed more important and urgent than ever.

The participants of this study were learners in a secondary inclusive math classroom. Because of the wide range of ability levels, the class was co-taught with a special education teacher. The *co-teaching model* involves two teachers in one classroom, typically a general education teacher and a special education teacher, sharing responsibility in lesson planning, teaching, and assessing students (Dieker & Murawski, 2003; Kloo & Zigmond, 2008). Two teachers in one class with differing specializations, one a "master of content" and the other a "master of access", created the unique opportunity to support all students by implementing station co-teaching (Sukei & van Garderen, 2010, p. 15).

Station teaching is a co-teaching practice which breaks up the class and the content typically into three groups and is often used for re-teaching, independent practice, and promoting

problem solving strategies (Carty & Farrell, 2018; SERC, 2017). My hope was that by building in supports and breaking up the class as well as the curriculum, all students would have increased opportunities to engage. I was optimistic that if engagement increased, so would student achievement. The research on the effectiveness of co-teaching mathematics at the secondary level is scarce, thus I anticipated my study would supplement the little research already in existence (Kloo & Zigmond, 2008). The question that this study sought to answer was: *What is the impact of a station co-teaching model on Algebra 1 Enrichment 1 students' engagement?*

Chapter IV described the overview of methods and data collection, demographics of the participants, and the analysis of each dataset collected. The triangulation of the data showed that station co-teaching led to an overall increase in student engagement, but the effect on student achievement was inconclusive. This chapter is organized by the summary of findings, interpretation of findings, limitations, plan for future action, and summary sections. The summary of the findings dives into the data collected from the engagement checklist, engagement and achievement datasheet, and researcher's field notes. The interpretation of the findings is where the data confirms or conflicts the findings of previous studies mentioned in my literature review. The third section will describe the possible limitations of this action research study. The plan for future action will include desired outcomes and possible next steps in my pursuit to increase engagement for all students through differentiated instruction. The final section will summarize the entirety of my action research project.

Summary of Findings

In order to examine the impact of station co-teaching on engagement in the Algebra 1 Enrichment 1 class studied, data were analyzed using a mixed-methods approach. An engagement observation checklist (see Appendix A), an engagement and achievement datasheet

(see Appendix B), and researcher field notes were all tools used to measure engagement throughout the study. Quantitative data were collected by both the engagement observation checklist and the engagement and achievement datasheet. Qualitative data were collected using the engagement observation checklist as well as the researcher's field notes.

Participants for this action research study were drawn from my Algebra 1 Enrichment 1 (A1E1) class. Out of the 29 students enrolled, 24 individuals were included as participants. The exclusion of data from five participants was due to the fact that the students either entered the class after data collection began or did not attend any class during the nine-week study. Fifty-five percent of the participants had an Individualized Education Plan (IEP), personalized learning plan, or 504 plan to support their learning. Notably, over half of the students in A1E1 were labeled *at-risk* due to their overall academic performance. Students are labeled *at-risk* if they have not passing two or more classes in one grading period. The specific needs of this group inspired my belief that focused instruction could benefit all of the students in the class.

During the nine-week of study, the implementation of station co-teaching practice occurred in 10 of the 19 class periods. Students were divided into three groups, or five if we were fortunate to have tutors join us, and put into a "station' (break-out room) with an instructor. Each group had between five to eight students. The instructors – my co-teacher, our teachers' assistant, the two tutors, and myself – would then rotate from room to room every 10-20 minutes to cover different material with each group of students. Station co-teaching was mainly used to review material and introduce new material. Engagement observation checklists were completed by both me and my co-teacher on days we used the co-teach model. Whole-class discussion, in which I would walk through examples and content using class participation, was used for the

other nine class periods in the study. This practice was used to dive deeper into the material. I was the only one to complete engagement observation checklists on these days.

Additionally, after all classes, I reflected in my researcher field notes. I jotted down what occurred or the overall feeling of the class as well as experiences and observations of my co-teacher, teachers' assistant and tutors that were shared with me. Each assignment that was assigned during the study was added to the engagement and achievement datasheet. Information for each assignment that was recorded included: the number of students who turned in the assignment on-time, the total number of students who completed the assignment, and the average score of the assignment.

Engagement Observation Checklist Data

Observation over the online platform Zoom proved to be rather difficult. Students were not required, for legal reasons, to turn on their cameras. Only three students chose to have their cameras on for the entirety of each class during the nine-weeks of study. Most students would choose to type in the chat, sometimes privately to the instructor instead of the whole class, rather than unmuting. The data collected were derived from the conversations spoken aloud, input in the chat, or demonstrated over the assignment platform GoFormative, which showed in real time a student completing their work.

Engagement was analyzed in three different ways – behaviorally emotionally, and cognitively – in order to address all aspects of the students (Fredricks et al., 2004). Analysis of the data gathered from the engagement observation checklist data demonstrated that the participants engaged more, overall, during station co-teaching as opposed to whole-class discussion (see Figure 1). Stations provided more opportunities for each student to engage, although most students only responded if they were called on. Behavioral engagement such as

being on-task, participation levels, and disruption, were observed the most in both teaching practices, followed by emotional engagement, and cognitive engagement was observed the least. This trend parallels the findings by researchers Fredricks, Blumenfeld, and Paris (2004) that cognitive engagement is more difficult to measure because it is intrinsic to a person. Skilling, Bobis, Martin, Anderso, and Way (2016) would argue that cognitive engagement was observed least because teachers are more aware of what it looks to be behaviorally or emotionally engaged. It is harder to observe how much time and effort a student puts into the work, especially online, but it can still be measured by the students' *effort* to understand the material and relate the concepts to prior knowledge (Fredricks et al., 2004).

Borrowing from Fredericks and colleagues' (2004) methodology, in this study, both ends of behavioral engagement, substantial and disengaged, were observed through the checklist by observing if the student was on-task (B1), participating (B2), not responding (B3), or disrupting (B4) (Fredricks et al., 2004). Emotional engagement was recorded if the student showed interest in the material (E1), had a positive interaction with another student or the teacher (E2), had a negative interaction with another student or the teacher (E3), or if the learner shared their opinion or feeling with others (E4). Cognitive engagement was observed when a student asked a question (C1), discussed the material with others (C2), used problem solving skills (C3), or said "I don't know" (C4). Participation was the most observed aspect of behavioral engagement in station co-teaching. For whole-class discussion, being on-task was behavior most observed. In both cases, disruption was observed least. Students were mainly called on, there were not many volunteers, so the lack of disruptions is logical. Showing interest in the material was the trait of emotional engagement most observed while negative interactions were the least witnessed. Students

displayed the highest rate cognitive engagement by asking questions to the teacher but they did not discuss the material with other students (see Figure 2 and Figure 3).

Additionally, the engagement observation checklist's data were broken down by the three units of math learned over the study – Unit 6, *Inequalities,* Unit 7, *Functions,* and Unit 8, *Linear Equations* – in order to determine if the concepts learned affected engagement (see Figure 4). Data depicted a significant difference between behavioral engagement and the other types of engagement. The contrast between emotional and cognitive engagement was less stark. Similar to overall data, emotional engagement was identified more often in Units 6 and 7; however, cognitive engagement was observed at a higher rate during Unit 8.

Lastly, the engagement checklist data was analyzed to see if engagement in Algebra 1 Enrichment 1 increased over the intervention period. Figures 5, 6, and 7 illustrated increases and decreases, as well as the overall trend, of the instances of engagement throughout the nine-weeks of study. Taking a closer look week-by-week, week 3 and week 4 showcased the most drastic changes in engagement. Week 3, the start of Unit 7, showed drops in engagement. Week 4, the second week of Unit 7, showed increases in engagement. Overall, behavioral and cognitive engagement had a positive trend showing increased occurrences while emotional engagement appeared to decrease over the intervention and data collection period.

Engagement and Achievement Datasheet

All assignments during the study were completed on Go Formative, a platform that allows teachers to see students input their work and solutions in real time. All assignments were graded out of a score of 10 points, 5 points for completion and 5 points for accuracy. For accuracy, five random problems were checked for correctness. In order to be marked as correct, the work had to match the answer. Data collected on the engagement and achievement datasheet

included the number of students that turned the assignment in on-time, the number of students that completed the assignment overall (including late submissions), and the average score of all participants on that assignment (including zeros). I call this datasheet the engagement and achievement datasheet because not only does it inform about how students are performing but it also reveals insight to students' behavioral and cognitive engagement. Behavioral engagement can be measured by turn-in rates and average scores can give insight to students' cognitive engagement when tied to effort and mastery. Another purpose of the datasheet was to examine if station co-teaching, which demonstrated to increase engagement, had an impact on achievement, as research suggests (Fredricks et al., 2004, Wilms, 2003).

Although overall engagement was higher during station co-teaching, the median number of students who turned in assignments on-time and completed assignments was higher when assigned after whole class discussion lessons (18, 20 respectfully) compared to assignments assigned on station co-teaching days (13.5, 19). This finding provided insight to the level of behavioral engagement of the students being more varied than substantial, most learners will complete the assignment, just not on-time. Notably, this finding could imply that students' cognitive engagement is higher than one would assume. Students took longer to complete the work possibly because they needed more time to understand and master the material (Fredricks et al., 2004).

When comparing the average scores of the work assigned during station co-teaching and the average score of assignments completed after lessons utilizing whole-class discussion, the range of scores was smaller (-19.81%) for station co-teaching than whole class. Figure 8 illustrates that the average scores on assignments were higher when assigned on whole-class discussion days than compared to station co-teaching days, although the data are more spread in

the whole-class discussion case. This contradicts the assumption that if a student is more engaged then they will perform better.

As previously mentioned, math builds on itself conceptually. For this reason, students with learning complexities struggle with math (Bishara, 2018). In order to examine if it was the content itself that effected achievement outcomes, data were broken down by unit. In all cases-on-time, overall completion, and average score – all decreased over the nine-week study (see Figure 9). Notably, content taught in Unit 6, *Solving Inequalities,* was not revisited in Units 7 and 8. Unit 7, however, which focused on *Functions,* introduced concepts, such as domain and range, that were built upon in Unit 8, *Linear Equations.*

Because school was online and accountability was low, there was an increase in students using applications such as Photomath of Symbolab to finish their assignments. These applications, as well as many others, show the solutions of problems that students scan with their phone or type in with all of the work included. Not being in person meant that many students could get away with using dishonest methods of arriving at their solutions, even if they had their cameras on. Such instances became obvious when my co-teacher or I asked a student to explain how they arrived at their answer. Unit 7, *Functions,* and Unit 8, *Linear Equations,* focused more on conceptual understanding and presenting work in a certain way, which made it difficult for students to cheat. Students, who had gotten used to using applications to finish their work in previous units, struggled to learn the new material without assistance from the internet and this could be one reason for the lower scores in later units. Another reason could be because those units focus on graphs. Researcher Bishara (2018) states that neurodiverse students sometimes struggle with math due to the different ways the material can be presented. Unit 8 also provided four different formulas – the slope formula, slope-intercept form, point-slope form, and standard

form – that students had to use as well as different procedures depending on the type of problem. Although we did not require students to memorize the formulas, students may have struggled in choosing which equation to use in which case due to lack of memory retention (Bishara, 2018).

Researcher Field Notes

The purpose of the field notes was to provide a greater picture of what the students were experiencing and expressing in the classroom that did not fit into the rigid boxes of the checklist. The field notes provided for an open-ended look at the classroom, allowing for deeper analysis of how students expressed engagement in the classroom as well as how engagement was affected by different scenarios that the students encountered over the nine-weeks of study. The researcher field notes were recorded after every class period for about 10 – 20 minutes for the entirety of the study, 19 class periods. After lessons in which station co-teaching was practiced, I would meet with my co-teacher, teachers' assistant, and tutors (if they were in attendance that day) and their input was also recorded. After looking for patterns and coding the entries, five major themes emerged. These themes included: *strategies to support students, shortcomings of online teaching, descriptions of material and skill that students struggled with, class bonding moments, and teaching personal reflection.*

Strategies to support students was the most common theme likely due to the positionalities of both my co-teacher and myself. We both understand that each student is unique and supports are not one size fit all. We constantly reflect on what is working and how we can adjust curriculum to better support all students (see Table 1). We noticed that students engaged more if we were silly, so we began to start class with check-ins. If students were disengaged in a bigger group setting, we would try a one-on-one session. We noticed that students did not remember previous lessons and so we instituted note checks to ensure students were taking

notes. The idea was that if they took notes, they would be able to refer to the information later. We would also post videos, attach links to additional resources, and post teacher notes in order to appeal to varying types of learning.

The next most prominent theme was shortcomings of online teaching. The biggest frustration recorded was my feeling of helplessness. On March 12th I stated, "It is just really hard seeing students struggle and not being able to help them in the same way you are able to I person". It is much easier understand if a student is having a difficult day or struggling with the material by reading their expressions. Because student cameras were mostly off and their microphones muted, we often were unable to see or hear students talk out their thought processes, and it was challenging to discover the best way to assist them. Students chose to communicate through the chat feature on Zoom. When calling on a student and they would not respond automatically, it was difficult to determine if the delay was because they were away from their computer or if they were just typing a response. Everything took longer for that reason. Many students were recorded saying (or typing), "I don't know", displaying cognitive disengagement. We wondered, "Did they really not know? Or did they not want to try? Or was it too difficult to type out what they really wanted to say?" We will never know. Due to the nature of being a low-level class, moreover, it was a common occurrence to get a new student throughout the year. These learners were either new to the school or they were students needing to drop from Algebra 1 to receive more support. Unfortunately, getting new students acclimated and onto the online platforms took time away from multiple lessons.

The third theme focused on the materials and skills with which the students were struggling. There were days during the study in which teachers were required to assign asynchronous work or tasks that students complete on their own time instead of logging on for

class. Our students, a majority of which needed extra support, would not complete the asynchronous assignments – especially if the assignment was reading or taking notes. This propensity became clear when students struggled to distinguish between x-values and y-values to plot points. We quickly learned that we had to build in review for these asynchronous days. Students, overall, also struggled with graphing, using formulas, but most of all, retaining information. For this reason, we began to give the learners the formulas for each assignment and assessment, a support that is only usually offered as an accommodation for students with an IEP. We realized that if the students had a starting point with the given formulas, they were more likely to attempt problems.

Class bonding was the fourth theme that arose during the coding process. I believe that building and developing relationships with students and nurturing building of relationships between the students is one of the most important aspects of teaching. Fostering these relationships was particularly difficult in the online learning environment. Our efforts to do check-ins at the beginning of class led to fun tangents and students engaging with us and each other in the chat. We talked about birthdays, even singing happy birthday, bikes, and sleep habits. We spoke to the students about improving overall wellness and how important it was. We gave them resources and worked to constantly remind them how much we care about them as individuals. When two students were caught cheating, instead of coming from a place of anger, we dug deeper to find out why they cheated. This conversation actually made us closer to these two students and they began to reach out more for help.

The last theme that emerged from the data was personal teacher reflections. The pandemic caused struggles for many people, including both teachers and students. As hard as I would try to come to class positive and encouraging, the faults of online learning sometimes

made it difficult. I was honest with myself in my entries about becoming snappy and reflecting on why. I would grow frustrated when I would call on multiple students to answer a question and they would not answer. It made me wonder if they were even there or if they were afraid of answering incorrectly in front of the entire class or station. My entries were very upbeat when students were engaged, answering questions or chit chatting with others in the chat. I struggled internally with how much support to provide students as I did not want to enable them and do all their work for them but I did want to assist them when they struggled (Faragher & Clarke, 2020).

Interpretation of Findings

After triangulating and thoroughly examining the data, I reached the following conclusion: the intervention of station co-teaching lead to an overall increase in engagement in Algebra 1 Enrichment 1 students. Evidence corroborating this statement is derived from engagement checklists, an engagement and achievement datasheet, as well as my researcher's field notes. I was unable, however, to conclude that an increase in engagement led to an increase in student achievement as measured by assignment scores.

Behavioral Engagement

It is unsurprising that occurrences of behavioral engagement such as being on-task, participating, not responding, and being disruptive, were much higher during instances of station co-teaching as opposed to whole-class discussion just due to opportunity (see Figure 1). Each group had about five to eight students, depending on the number of stations. All instructors rotated and thus had about 10-20 minutes completely focused on each group to complete a task to review or introduce a concept, which allowed each instructor to interact with each student in the class. Instructors called on one or more students for each problem and so every student had an opportunity to engage at least once each station. During whole-class discussion, although set

up so that students can freely contribute, being online led most students to be withdrawn and only respond if called on them. It was challenging to interact with all students in this setting. Additionally, whole-class discussion was a practice mainly used to cover a topic for the first time. Instead of a task on GoFormative, students completed examples in their notebook. It was impossible to determine if they were on-task except for weekly note checks. Looking at their note checks, a majority of students did not take their own notes, most likely because it was not a class requirement.

Researchers Fedricks, Blumenfeld, and Paris (2004) assert that behavioral engagement can be measured by assignment completion, rule compliance, and participation. Being on-task was the characteristic of engagement that occurred the most often (see Figure 2). Students were considered on-task if they were completing the work on GoFormative as their instructor and their classmates were going through the material. The high rate in which students were on-task shows students were substantially engaged in this circumstance, presumably because it was worth a grade. Disruption was observed the least, signifying that students were respectful but there were a few instances in which students did not respond at all when called on, indicating that they were not rule followers (see Figure 2). Participation was recorded as the next highest frequency of occurrence (see Figure 2). Students understood that they were expected to be active learners, working through the problems themselves, a strategy suggested by researchers Stephen and Smith (2012). Participants were counted as having participated if they responded when called on or if they added something to the conversation. Looking at the engagement and achievement data sheet, data shows that, on average, 15 of participants would turn their assignments in on-time, but 18 students would complete their assignment. Although rule compliance would be turning an assignment in on-time, completing an assignment is another aspect of behavioral engagement.

The higher rate in which behavioral engagement was observed compared to the other two types of engagement collaborates research that asserts that teachers are more aware of behavioral engagement (Skilling et al., 2016). In the context of behavior, Skilling, Bobis, Martin, Anderson, and Way (2016) report that teachers reported substantially engaged students to be on-task, asking questions, and volunteering their solutions and explanations. Variably engaged students were reported to complete tasks required but not engage in discussion and procrastinated. Teachers also reported that disengaged students were often off-task, disrupting other's learnings. Data in the researcher field notes support these reports. Literature believes that how a teacher perceives student engagement can affect the effort that teachers put into the class (Fredricks et al., 2004; Skilling et al., 2016). Researcher field notes parallel this conviction with multiple entries suggesting frustration with lack of response, blank screens, not asking for help, and the overwhelming feeling that students were not paying attention or giving a solid attempt. Toward the end of the study, I wrote "I feel like I am at a loss…I am burnt out", continuing a week later to say "It is just really hard seeing students struggle and not being able to help them in the same way you are able to in person".

Emotional Engagement

Emotional engagement, according to the literature, is best measured by self-reports or surveys, rather than inferred by teacher observation (Fredricks et al., 2004). Because surveys were not a source of data collection for this study, this could be the reason for low instances of emotional engagement (see Figure 2). Emotional engagement – showing interest in the material, positive and negative interactions, as well as sharing one's opinion and feelings with others – was witnessed more in lessons involving whole-class discussion as opposed to station co-teaching (see Figure 3). Station co-teaching was a practice that was focused on working together

to understand the material, it was structured and purposeful, and the time in each station was restricted. We embraced whole-class discussion periods as a time to bond as a class, starting the classes off with check-ins and silly questions such as “Doritos or Lays?”.

According to theorist Albert Bandura (1977), emotional state is a source of self-efficacy. Positive emotions can lead to interest and engagement while negative emotions, such as stress or anxiety, could be debilitating. If a learner is overwhelmed, they may not be able to concentrate and their performance will suffer (Bandura, 1977). This action research project was conducted during a time of severe civic unrest as a result of devastating acts of hate and violence toward Black, Indigenous, and People of Color (BIPOC) individuals. Literature has shown that race and ethnicity impact emotional engagement, specifically a person’s sense of belonging (Fredricks et al., 2004; Willms, 2003). My students were witnesses to individuals of the same race or ethnicity targeted, beat, and killed in the streets. Students were scared for their lives and the lives of their family members. Approximately 88% of this study’s participants identified as BIPOC. It is without a doubt in my mind that these injustices caused turmoil in their lives and decreased their emotional engagement over the time of the study (see Figure 6). My co-teacher and I discussed and addressed these injustices with the class, condemned them, and reminded our students that they are welcomed in our class and at our school. We did not feel like it was enough. Thus, we planned to join an Employee Resource Group (ERG) in order to learn how to better support our students. Students are not going to learn if they do not feel welcomed, like they belong in the classroom amongst their peers. It is crucial to remind them that they are.

Cognitive Engagement

Researchers state that cognitive engagement, the effort that students are willing to invest, is difficult to measure because it is innate to each individual (Fredricks et al., 2004). It is also the

type of engagement that teachers are less aware of (Skilling et al. 2016). Varying levels of cognitive engagement can be insinuated through behavior such as asking questions, discussion about material, use of problem-solving strategies, or saying “I don’t know”. Data from this research study just slightly contradict research findings, overall observations of cognitive engagement were .315% higher than instances of emotional engagement.

Cognitive engagement showed a positive trend over the nine-week intervention period (see Figure 7). This could be due to the combined efforts of my co-teacher and myself to cultivate a safe environment for learned to make mistakes and grow as individuals (Fredricks, 2004). Asking questions was the highest observation of cognitive engagement (see Figure 2). Research claims that seeking help is an example of high investment and engagement (Skilling et al., 2016). Smalley and Hopkins (2020) assert that students are more likely to ask for help when it is a support problem-solving strategy.

Saying, “I don’t know” was the second most observed instance of cognitive engagement (see Figure 2). Researcher field notes hypothesized this could be due to disengagement - students did not want to put in the time and effort to try. Other field note entries acknowledge that students may say “I don’t know” because they are scared to make a mistake (see Table 1). My co-teacher and I would then attempt to break down the question into a task the individual believed they could accomplish to build their confidence, a technique supported by theorist Bandura (1977). In station co-teaching, instructors were able to support a larger number of students through problem solving which likely lead to cognitive engagement instances being higher in those lessons compared to whole-class discussion lessons.

Students rarely discussed the material with others and they only conversed if prompted by instructors (see Figure 2). Researcher Willms (2003) asserts that students are likely to connect

with others that have the same engagement level. When creating stations, we created heterogeneous, mixed-level, groups. There were only three students in the class that felt comfortable having their cameras on and discussing the material aloud with the instructors. They were in different groups. The lack of conversations with others could have been due to different engagement, comfort, and skill levels. In the future, I hope to examine more closely the impact social connection has on cognitive engagement, a suggestion posed by Willms (2004).

Student Achievement

The majority of the students in Algebra 1 Enrichment 1 are labeled *at-risk* due to their overall academic performance. The research suggests that there is a correlation between engagement and academic achievement (Fredricks, Blumenfeld, & Paris, 2004; Willms, 2003). I believed that if I increased student engagement using station co-teaching strategies, achievement would follow. This was not the case although most of the aspects of engagement that increased were positive (see Figure 2 and Figure 8). I believe if there was a greater increase in emotional and cognitive engagement, then student achievement may have increased. Yes, students participated. Yes, a majority of learners followed the rules and turned in material. But participants' average scores indicate that they did not fully understand the material. Many of the learners did not invest the time and effort needed to master the concepts, instead they copied answers from the web, losing points for lack of work. Research field notes stated that a majority of students did not ask for help, a consequence of low self-efficacy (Smalley & Hopkins, 2020). Low self-efficacy could also be deduced from heightened stress or anxiousness illustrated by how few students felt comfortable having their cameras on and speaking aloud (Bandura, 1977).

Students need to feel safe and welcomed to thrive (Fredricks et al., 2004). Students need to believe they can learn and they need to want to understand the material (Bandura, 1977;

Skilling et al., 2016). Watt and Goos (2017) concur with their statement of Self-Determination Theory, which states that students need to have a choice, purpose, and to be cared about in order to engage and be successful. Through persistence, support, and encouragement, teachers can make a difference in their students' lives. I believe it is our job, ultimately, to try.

Limitations

The largest limitation to this action research study was that it was conducted online. Instead of in-person stations, stations were in break-out rooms. This made it challenging for instructors to communicate and adapt learning based on needs during the lesson. It also made it difficult to observe engagement. Another limitation was that students were not required to turn on their cameras or communicate orally. This hugely restricted the development of relationships between students as well as between students and teachers, which can affect engagement. Online learning also made it difficult to accurately assess students' knowledge, understanding, and achievement.

The results of this study cannot be generalized to other populations due its small sample size as well as the specific demographics of the participants. This study was conducted in a secondary math classroom co-taught with a special education teacher. The nature of the class allowed for us to be flexible with the content, move at a slower pace than a normal high school math class, as well as review and reteach often. Additionally, I was able to choose my co-teacher, which is not often the case for many teachers. Although we were able to meet to discuss students supports daily, due to other teaching and resource demands, it was difficult to co-plan. Our assignment and assessment platform, Goformative, made it simple to co-assess. We were both able to review each test at the same time and discuss feedback through Google Hangouts.

Another limitation was that my co-teacher and I were the only instructors to complete the engagement checklist on station co-teaching days. There were always three, sometimes five, stations running at once. Observations from the other stations in which our teachers' assistant and tutors rotated were not counted. It is possible that the students engaged with the teachers' assistant or tutors differently, who were also high school students themselves, then when the learners interacted with my co-teacher and I because of our position as teachers (Smalley & Hopkins, 2020). Although my co-teacher and I went through and discussed the checklist before we started collecting data to make sure both of us were on the same page as to what each aspect of engagement looked like, observations can be subjective. Thus, our numbers perhaps do not reflect the complete engagement of our students.

Another limitation is that I assumed both the roles of both teacher and researcher. Being the teacher could have affected how the students engaged with me as well as my co-teacher. Furthermore, with instruction, Zoom, and our checklists all being online and needed simultaneously, it was tough for my co-teacher and I to complete all aspects of the checklist, even though we both had dual monitors. We would also have to check multiple places for engagement such as the chat or the assignment platform, GoFormative, as well as record data as we were connecting with students. It was a bit stressful but I am proud of all the data that we collected during the study that informed the findings of this chapter.

Summary

The learning of math is essential; it teaches students perseverance, logical reasoning, and conceptual understanding (CCSS, 2010). However, math teachers often hear the question, "When are we ever going to use this in life?" or the statement, "I can't do math!" Lack of interest, value, and student self-efficacy are obstacles to learning and lead to the "STEM

pipeline" which refers to the loss of careers in science, technology, engineering, and mathematics (Watt & Goos, 2017). According to researchers Smalley and Hopkins (2020), secondary students understand that math is important but resent the time and effort needed to successfully understand the challenging subject matter. To combat this framework, teachers around the nation, such as myself, are embracing strategies to increase student engagement.

Before attempting to increase engagement, it was important that I first created an environment in which students felt safe to make mistakes and struggle in the interest of learning. The hope was that in the classroom, students would embrace a growth mindset. That is, they would believe that if they did not give up and put in the time and effort they would be able to understand the material (Dweck, 2012). Bandura (1977) theorized that it is an individual's self-efficacy, their belief in their own ability, that affects this motivation and determination. So, in order to help students embrace a growth mindset, we first had to support the students' confidence in themselves. Albert Bandura's (1977) self-efficacy theory and Carol Dweck's (2006) growth pedagogy were the theoretical foundation behind this action research project.

The setting of this nine-week study was a co-taught inclusive secondary math classroom in a dense suburban city in Northern California. The purpose was to explore how station co-teaching strategies can impact student engagement. A review of the literature supported the use of co-teaching as an intervention to support all students (phan & Smith, 2012). Research also emphasized the importance of engagement due to the belief that there is a correlation between engagement and academic achievement (Fredricks, Blumenfeld, & Paris, 2004; Willms, 2003). A mixed-methods approach was utilized to collect data through engagement checklists, engagement and achievement datasheet, as well as researcher field notes. Triangulation of the data lead to findings that suggested station co-teaching can increase overall students'

engagement, although, the data do not support that this increase in engagement also leads to an increase in student achievement. Much of the study was limited to the restraints of online learning due to the COVID-19 pandemic but, as the researcher, I aspired to add to the lack of literature regarding co-teaching mathematics at the secondary level. As a teacher and a researcher, I assert once again the power and importance of student engagement in transforming our learners and our classrooms.

Plan for Future Action

My philosophy is that a transformative teacher leader first seeks to understand those in their class as individuals so that they are then able to teach them as students. Every student is unique; they come into the classroom with different backgrounds, cultures, skills, and understandings. Students are not blank slates. Teachers build off of students' prior knowledge, break down their barriers, identify needs and strengths, and create opportunities to help them grow. Obstacles to student success, such as stereotype threat and microaggressions must be acknowledged through constant reflection and a culturally responsive pedagogy should be embraced (Lewis & Diamond, 2015). I believe that it is the job of the teacher to create a safe environment to nurture students' creativity and growth. This idea of understanding the *whole* student is why I chose, and will continue to choose, investigating engagement behaviorally, emotionally, and cognitively.

Algebra 1 Enrichment 1 (A1E1) is a class that is constantly evolving. While there is a set curriculum that must be covered, there is a time and freedom to slow down. Each year, each class, even each lesson's needs are different because they are based on the learners. Previous teachers have tried many different strategies to engage A1E1 such as a more hands-on approach with manipulatives and self-pacing with a technology program called Aleks. This year I tried

engaging students using the station co-teaching practice. Although overall engagement did increase, it did not seem to affect student achievement. I do think that there were other variables at play, specifically online learning, which became an obstacle for student success. Next year, we will be back to in-person learning. I plan to implement station co-teaching again because I think it can help all students be successful when they have the opportunity to interact with each other as well as have instant feedback from the teacher. Critical reflection is a key element of being a transformative teacher leader. I will constantly reflect on how learners are impacted by station co-teaching practice and make necessary adjustments as needed. I will also ask my students to reflect on the practice so that I am not just using my assumptions to make decisions.

I plan to share what my co-teacher and I experienced with my administrators as well as the other teachers that engage in the co-teaching practice. Currently at our school, teachers are put into co-teaching partnerships at the beginning of the year without time to learn each other's teaching philosophies, develop a relationship, or even co-plan. As researcher Dieker and Murawski (2003) state, administrative support for co-planning time is crucial so that the general education teacher can introduce content and the special education teacher can introduce differentiating instruction. Lack of co-planning tends to lead to the general education teacher being seen as the "boss" while the special education teacher takes the role as an assistant (Rextroat-Frazier & Chamberlain, 2019). My co-teacher and I implemented the suggestion posed by researchers Magiera, Smith and Zigmond (2005) to put both teachers' names on everything including the board, assignments, and communication to students and parents which led us to feel that the class was equally ours. We made sure that all students saw both of us as their teacher, as opposed to the default in which the resource teacher tends to only support the neurodiverse students. We hope that by sharing our experience in increasing engagement, we

will inspire other co-teachers to experiment with other co-teaching practices such as *station teaching*, *parallel teaching*, *alternative teaching*, and *team teaching* rather than the *one teach, one observe* practice or *one teach, one assist* practice that are currently being practiced (Kloo & Zigmond, 2008; Sileo & van Garderen, 2010). I believe that there is much to gain from having two experts in one classroom and the main beneficiaries are the students that need it the most. They key is that co-teaching must be implemented strategically in order to support the success of all students (Dieker & Murawski, 2003).

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Appendices

A. Engagement Observation Checklist
B. Engagement and Achievement Datasheet

Appendix A

Engagement Observation Checklist

Observation Checklist: Student Engagement

Date of Observation:

Observer:

Course:

Number of students:

Notes on class environment:

Brief description of instructional method:

Checklist: Put a tally in a box every time a behavior is observed. More than one tally can represent the same student.

Behavioral	Emotional	Cognitive
On-Task	Shows interest in the material (volunteers, types in the chat, expresses verbal interest)	Asks questions
Participates	Positive interaction with other students/teacher	Discussion about material with others
Does not Respond	Negative interaction with other students/teacher	Use of problem solving strategies
Disrupts	Shares their opinion/feelings with other students/teacher	Says "I don't know"

Other notable information that was observed:

Appendix B

Engagement and Achievement Datasheet

				Engagement and Achievement Data Sheet		
Assignment #	1	2	3	4	5	6
Week 1						
1/11 - 1/15						
# turn in on-time						
# completed						
avg. score (total)						
Week 2						
1/18 - 1/22						
# turn in on-time						
# completed						
avg. score						