NEGOTIATING TEACHER ROLES IN THE COLLABORATIVE MATHEMATICS CLASSROOM

A Capstone Project

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The Faculty of the Curry School of Education

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Doctor of Education

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by

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APPROVAL OF THE CAPSTONE PROJECT

This capstone project, Negotiating Teacher Roles In The Collaborative Mathematics Classroom, has been approved by the Graduate Faculty of the Curry School of Education in partial fulfillment of the requirements for the degree of Doctor of Education.

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Dr. Susan Mintz

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Dr. Peter Youngs

_____Date

DEDICATION

This capstone is dedicated to the teachers and administrators who continue to make a difference in the lives of our students each and every day. May you continue the miraculous work of reaching unattainable goals with inadequate resources.

ACKNOWLEDGEMENTS

This journey would not have been possible without the endless support and encouragement of my family, professors, and friends.

Thank you to my wonderful husband, Ben. You have always believed in me and your encouragement has pushed me through to the end. I cannot wait to be the same source of strength for you as you begin your own doctoral journey. Thank you to the best parents in the world who have worked hard to provide me the opportunities in life to be where I am today. And thank you to my favorite little sister who inspires me to be the best I can be.

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EXECUTIVE SUMMARY

The 2015 Report to Congress on the Implementation of the Individuals with Disabilities Education Act (IDEA) indicated that 95 percent of students receiving special education services spent the majority of their day in general education classrooms. This is in response to trends and legislature mandating inclusive instruction and reiterates more children with special needs are educated in the general education classroom setting than ever before. Co-teaching is currently considered the most popular model for increasing opportunities for high quality instruction to students with disabilities (Friend & Bursuck, 2002; Friend & Cook, 1995; Murawski & Dieker, 2004; Vaughn, Schumm, & Arguelles, 1997). These classrooms are typically taught by a general education and a special education teacher. While the concept of the co-teaching model brings together two experts, one in the content and one in special education to make material more accessible to students, the literature on co-teaching reports substantial problems exist related to its implementation. In many cases, the special education teacher takes on a subordinate role in the classroom due to the greater content knowledge of the general education teacher (e.g., Feldman, 1998; Mastropieri et al., 2005; Morocco & Aguilar, 2002; Pugach & Wesson, 1995; Rice & Zigmond, 200; Rosa, 1996). Assuming a subordinate role inhibits the special education teacher from capitalizing on their expertise to adapt general education lessons for students with disabilities. This is problematic for the mission of providing *all* students access to the material and closing the existing achievement gap for students with disabilities.

Purpose

There is currently a lack of agreement in the co-teaching literature about the precise roles and responsibilities of the content area teacher and special education teacher in the collaborative classroom (Mastropieri et al., 2005). Additionally, there is a gap in the existing literature related to *how* each teacher defines his or her role, either implicitly or explicitly, in the collaborative classroom. Although researchers have determined special education teachers often assume the role of the assistant or observer, it remains unclear how the roles are unpacked between the teachers. The purpose of the study was to better understand this process and how collaborative teachers enact their roles in the collaborative classroom. A better understanding of this practice could help examine co-teaching more critically in order to make systematic changes to the implementation of the model to better meet the needs of the students, particularly students with disabilities. Enhancements to the current way educators view and implement co-teaching in the mathematics collaborative classroom could also begin the process of closing achievement gaps for students with disabilities on state and national assessments.

Methodology

This capstone utilized a case study approach to examine two collaborative classrooms, each co-taught by a mathematics and special education teacher. The study employed interpretivism to provide a framework for the data collection and analysis processes. The data were collected over a four weeks and included interviews and observations. A combination of analytic induction and systematic coding allowed several assertions to emerge and be confirmed. Erickson's validity criteria guided this capstone to warrant credibility, transferability, dependability, and confirmability. Ethical

considerations and a commitment to confidentiality remained at the forefront of the study.

Findings

The three findings of the case study are as follows:

1. Different stakeholders have different definitions of "Team Teaching" and different priorities/visions for the implementation of co-teaching.
2. The relationship between co-teachers strongly influences their roles in the classroom.
3. Content knowledge, which plays a role in the instructional activities each teacher takes on, is necessary to correctly interpret and respond to student error in the mathematics classroom.

Conclusions and Implications

Based on the implications of the findings, the recommendations to Central High School revolve around increasing coherence across the district regarding goals and expectations for co-teaching, fostering a positive relationship between the co-teachers, and providing both co-teachers with access to sustained professional development. The recommendations to the school district are as follows.

1. Engage all stakeholders in a joint discussion to develop a clear definition of co-teaching, a common expectation for the roles and responsibilities of each teacher in the collaborative classroom, and a vested interest in the visions for success of all students, especially students with disabilities.
2. Invite teachers to choose their collaborative partner or volunteer to participate in co-teaching. Foster "partner" relationships versus "co-worker" relationships.

Administrators should ensure both teachers feel a sense of ownership over students and classroom by guaranteeing each teacher is represented in the classroom and on communications with parents and students.

3. Develop and implement professional development tailored for a) special education teachers specific to the content area they are co-teaching, b) general education teachers to better apply accommodations and modifications for students with disabilities in the classroom, and c) best practices in co-teaching.

CHAPTER I: INTRODUCTION

According to the 2015 Report to Congress on the Implementation of the Individuals with Disabilities Education Act (IDEA), the U.S. Department of Education estimated that 95 percent of students receiving special education services spent the majority of their day in general education classrooms. This is a stark contrast to what education looked like for students with disabilities twenty years ago and underscores that the number of students with disabilities who spend most of their day in inclusive classrooms continues to grow. Many of these students are enrolled in classrooms comprised of a general education and special education teacher as co-teaching is considered the most popular model for increasing opportunities for high quality instruction to students with disabilities (Friend & Bursuck, 2002; Friend & Cook, 1995; Murawski & Dieker, 2004; Vaughn, Schumm, & Arguelles, 1997). Co-teaching is defined as an instructional delivery approach in which a content teacher and a special education teacher share equal responsibility for planning, delivering, and evaluation instruction for their students (Friend & Cook, 1992b). The goal of these co-teaching partnerships is to capitalize on the expertise each teacher brings to the classroom to support high quality learning in inclusive environments (Murawski & Dieker, 2004). Although existing literature (Friend & Reislin, 1993; Gately & Gately, 2001; Kroesbergen & van Luit, 2003; Montague & van Garderen, 2008; Pearl & Miller, 2007; van Garderen, Scheuermann, Jackson & Hampton, 2009) indicates co-teaching is an effective instructional delivery model for students with disabilities, a considerable achievement gap for the students enrolled in collaborative classes exists, particularly in mathematics.

The results from the 2015 National Assessment of Educational Progress indicated little progress from the previous 2013 administration for students with disabilities (U.S. Department of Education, Institute of Education Sciences, 2015). For the 2015 results, 54 percent of 4th-grade students with disabilities scored at or above basic (basic is defined by NAEP as partial mastery) while 85 percent of students without disabilities scored in that range. Similarly for 8th graders, 32 percent of students with disabilities scored at or above basic, while 76 percent of students without disabilities scored in that range (U.S. Department of Education, Institute of Education Sciences, 2015). State assessments reflect similar findings. In Virginia, 45 percent of students with disabilities failed the 2015-2016 Algebra I end-of-course Standards of Learning (SOL) test, and 53 percent of students with disabilities failed the Geometry SOL test (Virginia Department of Education, 2016). These results indicate a need to create optimal learning opportunities for *all* students in the collaborative mathematics classroom and pose the question: How does co-teaching support current visions for best practices in mathematics education? It is particularly important to find the answer to this question given students with disabilities might lack the required background knowledge and skills when compared to their peers (Swanson et al., 2014) and often have slower processing speeds than students without disabilities, resulting in increased time for comprehension (Cirino, Fuchs, Elias, Powell, & Schumacher, 2013). Particularly indispensible for the mathematics classroom, students with disabilities often have trouble discriminating key information in mathematical tasks and using metacognitive strategies, which suggest there may be barriers for access for these students (Maccini & Gagnon, 2002).

In an effort to maximize learning opportunities for all students (including those with disabilities), the National Council of Teachers of Mathematics (NCTM) outlined eight research-based teaching practices that are essential for a high-quality mathematics education in its publication of *Principles to Actions* (2014). These practices encourage teachers to promote reasoning and problem solving, use and connect mathematical representations, pose purposeful questions, and elicit and use evidence of student thinking and allow students to take a more active role in their learning. One of these practices states the role of the mathematics teacher is to facilitate meaningful mathematical discourse. While it stands as just one of the eight practices, it is difficult to tease mathematical discourse apart from the previously stated practices. The process of discourse in the classroom serves as a mechanism to promote reasoning and problem solving by encouraging students to share their answers, in turn allowing student thinking to become explicit. Discourse also functions as a way to elicit this thinking by the questioning of the teacher, as well as the students.

According to Cawley et al. (2002) instruction promoting these and other process goals has not generally been used when instructing students with disabilities, which could be a result of the content knowledge needed in order to effectively implement these teaching strategies. Special education teachers often teach across a number of disciplines, making it difficult for them to be trained in specific content areas. This creates a challenge for special education teachers because content knowledge affects a teacher's ability to approach an idea in a flexible way, make meaningful connections amongst different representations, explain clearly, and ask good questions (Lappan, 1999). Shulman (1986, 1987), highlighted the content-intensive nature of teaching and

postulated professional knowledge is divided into three categories: (1) content knowledge which includes facts and concepts and how/why the facts and concepts are true; (2) pedagogical content knowledge, which is also called subject matter knowledge for teaching and includes representations of content ideas; and (3) curriculum knowledge which involves how subjects are arranged within a school year and over periods of time. Hill, Schilling, and Ball (2004) sought to better understand how subject matter is structured and organized and found that subject matter content does play a role in this organization process. Hill et al. found that mathematical content knowledge must consist of more than just general mathematical knowledge in order for teachers to appropriately generalize representations, interpret student work, and analyze mistakes. Teachers' knowledge of mathematics must go beyond that of just understanding to facilitate the mathematical learning NCTM envisioned. The implementation and continued practice of meaningful mathematical discourse in the classroom is not an easy feat as discourse should be an ongoing practice. In addition to the pedagogy and content knowledge of the teacher, which is an important factor in creating successful discourse, classroom norms that support discourse must be established for students to feel safe to engage in talk surrounding mathematics. Creating conducive norms and implementing discourse becomes increasingly complex in the collaborative classroom. This is problematic as the utilization of collaborative classrooms continues to increase, making this a challenge for many schools.

Statement of the Problem

This discussion surrounding content knowledge is important because content knowledge has the potential to impact the role of the general education teacher and/or

special education teacher in the collaborative mathematics classroom. Although six distinct co-teaching models exist, much of the literature on co-teaching indicates special education teachers tend to take on the role of a teaching aide rather than co-teacher, especially in the secondary classroom where the subject matter is more specialized (Ashton, 2014; Bessette, 2008; Brusca-Vega, Brown, & Yasutake, 2011; Fenty & McDuffie-Landrum, 2011; Harbort et al., 2007; King-Sears, Brawand, Jenkins, & Preston-Smith, 2014; Mageira, Smith, Zigmond, & Gebauer, 2005; Mastropieri & Scruggs, 2001; Moin et al., 2009; Ploessl & Rock, 2014; Rice & Zigmond, 2000). There is currently a lack of consensus in the co-teaching literature about the precise roles and responsibilities of each teacher in the classroom (Mastropieri et al., 2005). Additionally, there is a gap in the literature surrounding *how* the teachers in a co-teaching partnership determine their roles, either implicitly or explicitly, in the collaborative classroom. A better understanding of this process could help examine co-teaching more critically in order to implement the model in the most effective way possible. Specifically in the mathematics classroom, this could lead to an exploration of establishing congruence between multiple teachers to increase discourse as a mechanism for students with disabilities' conceptual understanding of mathematics.

Purpose of the Current Study

Although the co-teaching model has proliferated following NCLB (2001) and IDEA (2004) in service of providing students with disabilities with a high quality education, there is evidence the content knowledge of the teacher(s) in the collaborative classroom may act as a barrier for best practices in mathematics education. The purpose of this study is twofold. First, it seeks to better unpack how co-teachers in secondary

mathematics classes define and enact their roles in the classroom. Second, this study examines how each teacher engages in and promotes mathematical discourse in order to determine coherence of instructional approaches. The following are research questions that guide this capstone in order to arrive at these understandings:

1) How do school and school division systems and policies influence the roles of the teachers in the collaborative classroom?
    a. How are co-teachers paired?
    b. To what extent to teachers get to choose their co-teaching partner?
    c. How do schools and school divisions envision the role of the mathematics teacher and the special education teacher in the collaborative mathematics classroom?
2) How do teachers determine teacher roles in the mathematics collaborative classroom?
    a. How does the mathematics teacher make meaning of and define his or her own roles in the classroom?
    b. How does the special education teacher make meaning of and define his or her own roles in the classroom?
    c. What does the process look like?
3) How are the instructional and pedagogical responsibilities divided between the mathematics teacher and special education teacher?
    a. How does content area affect these roles?
    b. How does the mathematics teacher support discourse in the mathematics classroom?

c. How does the special education teacher support discourse in the mathematics classroom?

Theoretical Frameworks

Two theoretical frameworks, Relational Trust and the Dynamic Model of Teacher Growth, provide a context for examining the research questions stated above. These frameworks serve as a basis for my research design, structure my definitions of concepts, and guide my interpretations and generalizations.

Relational Trust

Bryk and Schneider (2002) built upon Coleman's social capital theory to develop their own multilevel theory that describes the powerful influence trust plays as a mechanism for reform. Defined as *relational trust*, the theory states distinct role relationships characterize the social exchanges of schooling. These relationships include teachers with students, teachers with other teachers, teachers with parents, and all groups with the school principal. Each of these relationships maintains an understanding of their role and holds expectations about the roles of the other parties. In order for the school as a whole to work well, it must achieve synchrony in each of these role relationships regarding the understandings held about these personal obligations and expectations of others. All participants remain mutually dependent to achieve the desired outcomes of the community (Bryk and Schneider, 2002).

Relational trust differs from other types of trust in that it is based on beliefs and observed behavior. As teachers, students, parents and administrators interact with one another, they are constantly discerning the intentions embedded in the actions of others. Each member of the community might consider how other members advance their own

interests and ask whether the behaviors of other members align with the goals of the community. Ultimately, these trust relations should work in a way that they create change at the organizational level of the school and result in effective decision making, enhanced support, and increased efficiency (Bryk and Schneider, 2002). Figure 1 demonstrates how relational trust operates in a school.

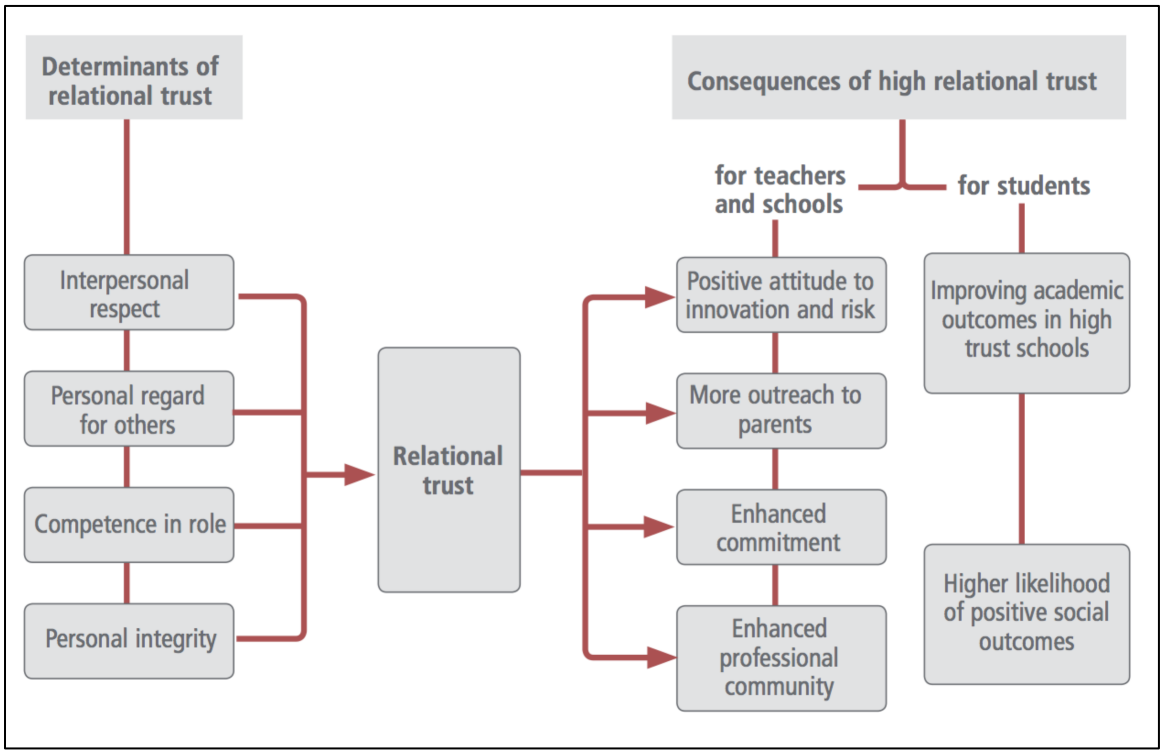

Figure 1. How relational trust operates in a school. From Robinson V., Hohepa M., and Lloyd, C., (2009) School Leadership and Student Outcomes: Identifying What Works and Why Best Evidence Synthesis. Wellington: Ministry of Education.

While this theory of relational trust was envisioned for the school community, it also holds true at the level of the classroom community. Bryk and Schneider identify four considerations for successful trust relations: respect, personal regard for others, competence, and integrity. These considerations directly map onto conditions for successful co-teaching in existing collaborative classroom literature. Figure 2 illustrates the alignment between the literature on co-teaching and the determinants of relational

trust. This capstone uses Bryk and Schneider's theoretical framework on relational trust as a lens to better understand the process through which teachers assume their roles in the classroom by specifically focusing on the determinant "competence in role". Content knowledge and competence in role are recurring themes in the literature on co-teaching and influence the relational trust between the co-teaching pairs in this study. I focus on how this determinant of relational trust affects the decision making inside and outside of the classroom (in terms of planning for and maintaining mathematical discourse) and how it influences each teacher's meaning making of his or her role in the mathematics classroom.

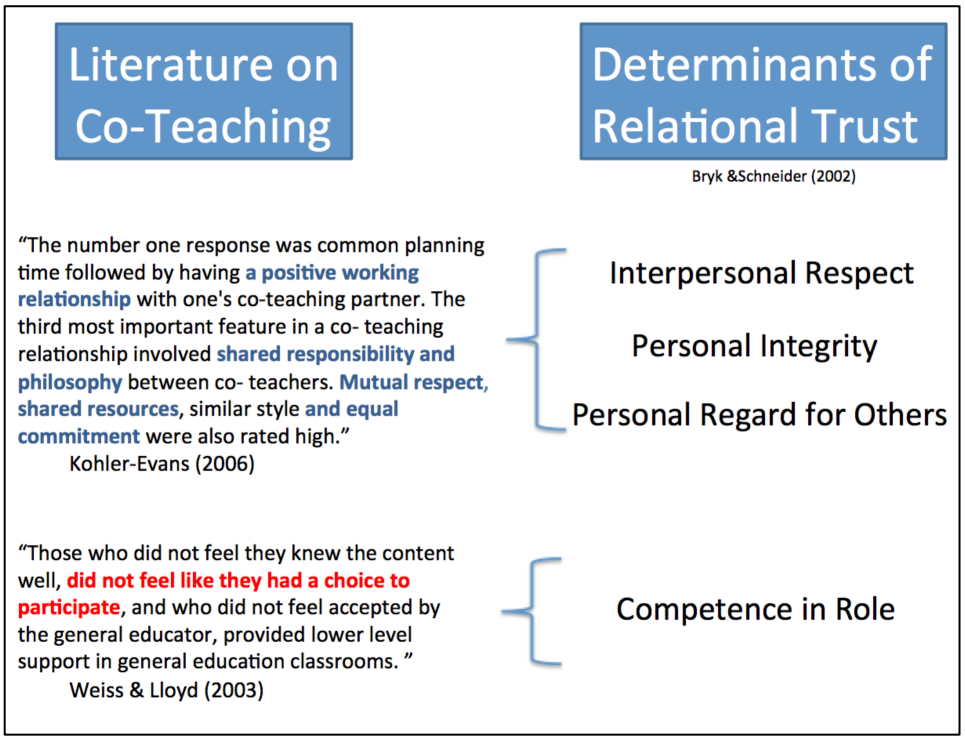

Figure 2. Alignment between literature on co-teaching and relational trust.

Dynamic Model of Teacher Growth

A model of teacher learning is also utilized to provide a better lens for how teachers might acquire the content knowledge needed for teaching. Clarke and

Hollingsworth's interconnected model of professional growth captures the complexity of this acquisition unlike other linear models that suggest a stimulus such as professional development will increase a teacher's ability to implement best practices which in turn will improve student learning (2002). The model for teacher growth emphasizes the exchanges between four key domains; external, personal, practice, and consequence (see Figure 3). The external domain encompasses the systems and policies that stimulate and shape teachers' learning. This could include pre-service teacher education, in-service teacher education (such as professional development), and school and school division policies. The personal domain signifies teachers' characteristics such as attitudes, beliefs, and knowledge. An example could be a teacher's teaching philosophy. The consequence domain represents students' learning and other outcomes interpreted by a teacher as a result of their professional actions. The practice domain represents a teacher's instructional practice. Clarke and Hollingsworth suggest that teacher growth is realized through the enactment and reflection amongst these domains. This theory provides a lens through which to better interpret teachers' instructional practices.

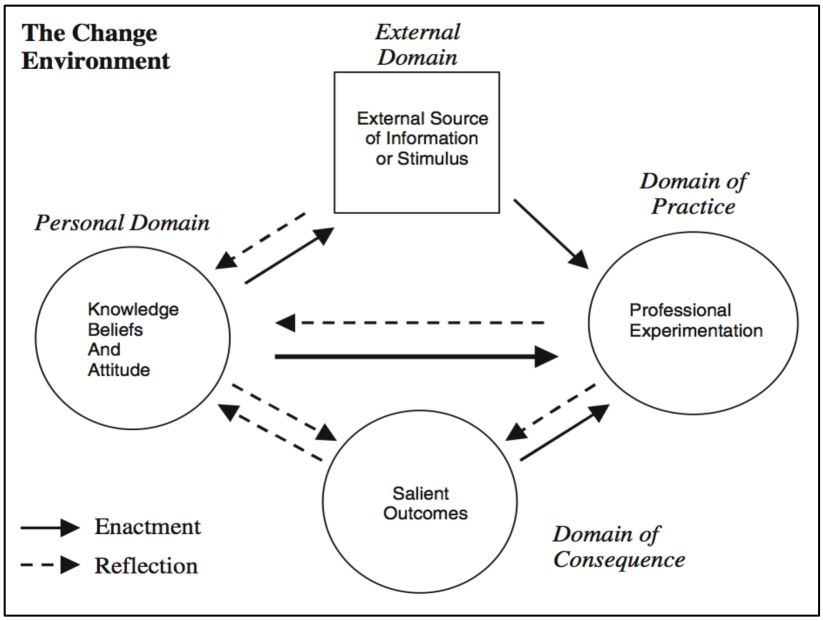

Figure 3. The interconnected model of teacher professional growth. From Clarke and Hollingsworth (2002).

Specifically, this study explores the exchange between the external, personal, and consequence domains on each teacher's instructional practice in the collaborative classroom and how these instructional practices intersect or interact with each other. Figure 4 illustrates explicitly how this model, along with elements of Bryk and Schneider's theoretical framework on relational trust is used to guide the current study. Because the focus of this study is on the interaction between the co-teachers and how it affects the meaning making of their own roles in the classroom, it is necessary to consider two teacher growth models simultaneously. Figure 4 demonstrates how these theoretical frameworks merge together to serve as basis for this capstone.

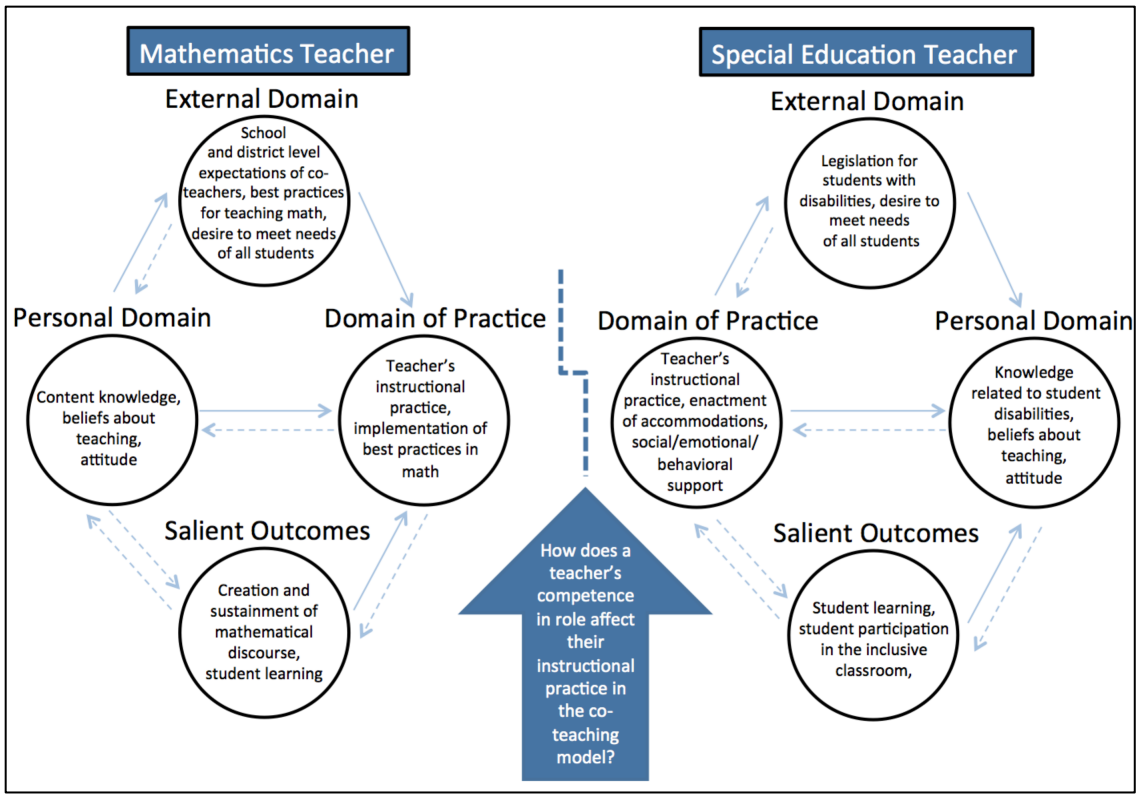

Figure 4. Theoretical framework for this capstone.

Definition of Terms

The following list includes the definitions to key terms used in the context of this capstone.

Definitions Related to Co-Teaching:

- *Inclusion*- the process and practice of educating students identified as having exceptional needs in general classrooms in their neighborhood school.
- *Co-Teaching*- two equally-qualified individuals who may or may not have the same area of expertise jointly delivering instruction to a group of students.
- *IEP*- the Individualized Education Program is a document developed for each public school child who meets the criteria to receive special education services. The IEP is created through a team effort, reviewed periodically.
- *IDEA*- the Individuals with Disabilities Education Act was originally enacted by Congress in 1975 to ensure that children with disabilities have the opportunity to receive a free appropriate public education, just like other children. The law has been revised many times over the years.
- *NCLB*- an Act of Congress which reauthorized the Elementary and Secondary Education Act. It supported standards-based education reform based on the premise that setting high standards and establishing measurable goals could improve individual outcomes in education. The Act required states to develop assessments in basic skills and the results of all students, including those with disabilities, would be a factor in determining the accreditation of a school.
- *Parity*- all members of a group have equal status within the group, as well as equal ability to make unique and valuable contributions.

- *Classroom Climate*- the classroom environment, the social climate, the emotional and the physical aspects of the classroom.

Definitions Related to Mathematics Instruction:

- *NCTM*- National Council of Teachers of Mathematics, an organization dedicated to improving the teaching and learning of mathematics.
- *Specialized Content Knowledge*- describes the knowledge that teachers possess for teaching a particular subject.
- *Pedagogical Content Knowledge*- the ability of a teacher to know how to assist students in achieving in a particular content area.
- *Research-Based Practices*- any concept or strategy that is derived from or informed by objective evidence.
- *Sociomathematical Norms*- the normative criteria by which students within classroom communities create and justify their mathematical work
- *NAEP*- the largest nationally representative and continuing assessment of what America's students know and can do in various subject areas. Paper-and-pencil assessments are conducted periodically in mathematics, reading, science, writing, the arts, civics, economics, geography, U.S. history, and in Technology and Engineering Literacy (TEL).
- *Virginia SOL*- a public school standardized testing program in the Commonwealth of Virginia. It sets forth learning and achievement expectations for core subjects for grades K-12 in Virginia's Public Schools.

Summary

This chapter serves as an introduction to the co-taught classroom, identifies the problem of practice, justifies the purpose of the capstone study, and presents the theoretical frameworks that serve as a lens for the interpretation of the results. Chapter two will present an overview of the existing literature on co-teaching and best practices in mathematics. Chapter three details the methodology for the study including an introduction to the participants, data collection procedures, and data analysis methods. Chapter four presents the findings and unpacks each of the assertions using data from observations and interviews. Chapter five discusses these findings and provides recommendations based on the results. The final chapter is an action communication written to the school district about the findings, implications, and recommendations.

CHAPTER II: LITERATURE REVIEW

The goal of this literature review is to explore the intersection between two lines of research, that of co-teaching and research-based instructional practices in mathematics (specifically classroom discourse), in order to position this study for why it is important to study the assignment of teacher roles in the collaborative mathematics classroom. This literature review begins with an overview of co-teaching to familiarize the reader with the model and the six variations that can be used in the collaborative classroom. It addresses current issues in the implementation of co-teaching, such as the overuse of models where the content teachers take the lead. Although there is a gap in the literature as to *how* teachers define their roles in the collaborative classroom, this review unpacks research studies that focus on the importance of content knowledge for teaching and will suggest content knowledge is a factor for defining one's role in the classroom. It also works to justify the importance of increasing the role of the student and classroom discourse in the mathematics classroom, especially for students with disabilities. Questioning and response to student error are two entry points for discourse that will be explored. These strategies, however, rely heavily on a teacher's mathematical content knowledge, which may act as a barrier for the special education teacher to take on lead roles in the co-teaching classroom.

An Overview of Co-Teaching

Co-teaching, sometimes referred to as collaborative or cooperative teaching, team teaching, or teaming, is defined as "two or more professionals deliver[ing] substantive instruction to a diverse or blended group of students in a single physical space," (Cook & Friend, 1995, p. 2). Co-teaching originated in the general education classroom and was

later built upon by Bauwens, Hourcade, and Friend (1989) to the concept it is today where general and special education teachers work collaboratively to meet the needs of their students. Although the co-teaching model is utilized for students who are English language learners (Bahamonde & Friend, 1999; Pardini, 2006) and those who are identified as gifted or talented (Hughes & Murawski, 2001), the following discussion of co-teaching will focus on its application to students with disabilities. Examples of disabilities in the inclusive classroom could include attention-deficit/hyperactivity disorder (ADHD), autism or Asperger's syndrome, dyslexia, emotional/behavioral disorders, and visual impairment.

Collaboration has long been an integral component of special education, however, it previously existed within the confines of the special education classroom (Friend, Cook, Hurley-Chamberlain, & Shamberger, 2010). Teams consisting of special education teachers, paraprofessionals, parents, and administrators, in addition to speech-language therapists, school psychologists, counselors, and occupational and physical therapists, worked together to support students with disabilities (Lerner, 1989; Lombardo, 1980). Even after the Education for All Handicapped Children Act of 1975 mandated students be served in the least restrictive environment (LRE), there was great debate over the extent to which the LRE connoted the general education classroom (Bauer and Shea, 1999). In the 1980s, however, principles of inclusive schooling began to gain traction and co-teaching between general and special education teachers began to emerge (Garvar & Papania, 1982; Will, 1986; Bauwens, Hourcade, & Friend, 1989). The Individuals with Disabilities Education Act (IDEA) of 1990 and its amendments in 1997 explicitly stated students with disabilities should be placed in the general education setting

whenever possible (Vaughn, Elbaum, Schumm, & Hughes, 1998). More recently, the passage of No Child Left Behind (NCLB) in 2001 required that all students, including students with disabilities, be taught general curriculum by highly qualified teachers and that students with disabilities be included in schools' measures for achievement accountability. In addition to NCLB, IDEA 2004 also challenged schools to provide evidence-based interventions to students with disabilities who display inadequate performance in the general education setting. This legislation led to the increase of co-teaching as a structure to meet the needs of students with disabilities (Friend, Cook, Hurley-Chamberlain, & Shamberger, 2010).

The intuitive appeal of co-teaching, that two heads are better than one, also contributed to the increase of its use (Cook, McDuffie-Landrum, Oshita, & Cook, 2011). Co-teaching capitalizes on the expertise of the general education teacher and special education teacher in order to better meet the instructional needs of the diverse learners in the classroom. According to Zigmond and Magiera (2001), the three main goals and potential benefits of co-teaching include: (a) increasing access to a wider range of instructional options for students with disabilities, (b) enhancing the participation of students with disabilities within general education classes, and (c) enhancing the performance of students with disabilities. Each of these will be addressed in the following sections. In addition to benefiting students with disabilities, co-teaching also supports to students without disabilities. Several studies have identified that the presence of an extra teacher in the classroom was academically advantageous for all students because it provided increased teacher attention (e.g. Luckner, 1999; Pugach & Wesson, 1995; Rice & Zigmond, 2000; Salend et al., 1997; Yoder, 2000). Co-teachers have also

reported co-teaching served as a social model for students on how to interact with one another in the classroom (Carlson, 1996; Frisk, 2004; Hardy, 2001; Hazlett, 2001; Trent 1998).

Instructional Models for Co-Teaching

Students with disabilities previously experienced fragmented instructional service delivery, frequent interruptions for pull-out classes, and social isolation when schools predominately utilized a pullout program to service them (Dove & Honigsfeld, 2010). Pullout programs resulted in lost time with their non-disabled peers and decreased access to the same instructional time as their peers on a daily basis in order to receive required supportive services. Another criticism of the pullout model is they were serviced by special education teachers teaching the content and not by teachers who had requisite content knowledge specific to the material being taught (Appl, Troha, & Rowell, 2001). Because of this, educational partnerships became especially critical in order to support high quality learning in inclusive classrooms. Research delineates three models for inclusive teaching (Fishbaugh, 1997; Pugach & Seidl, 1995). The consultant model is one in which the special education teacher serves as a consultant to the content area teacher and advises in areas of Individual Education Program (IEP) accommodations, adaptations to the curriculum, skill remediation, and assessment modification. This is different from the coaching model where the special education and content teachers take turns coaching each other in areas in which they are the acknowledged "expert". Finally, the collaborative model encourages teachers to share equal responsibility of lesson planning, implementation, and assessment. For the purposes of this study, the collaborative co-teaching model will be further explored as the teaching pairs in this

study follow this model. Beyond the site and sample of this particular study, co-teaching is the most utilized instructional model for increasing opportunities for high quality instruction to students with disabilities, making the collaborative model of inclusive teaching the most pressing to study (Friend & Bursuck, 2002; Friend & Cook, 1995; Murawski & Dieker, 2004; Vaughn, Schumm, & Arguelles, 1997).

Co-teaching provides an inclusive setting allowing students with disabilities to learn in the general educational classroom. Here, students with disabilities are not segregated from their non-disabled peers, and can simultaneously receive services from the special education teacher. A number of co-teaching models have been identified in the literature (Friend & Bursuck, 2009; Friend & Cook, 2003; McDuffie et al., 2008). What follows is an overview of six variations of co-teaching that capture the different approaches for planning and instructional delivery (2009). It is important to note no one particular model should be used exclusively (Cook & Friend, 1995). Cook and Friend made assumptions about each variation in terms of the content knowledge demand placed on the special education teacher and demand for collaborative planning between both teachers (2003). The models will be discussed in order from least demanding to most demanding for collaboration and content knowledge. The co-teaching strategies are not hierarchical in terms of meeting the needs of the students and can be used in any order. Figure 5 illustrates these six co-teaching variations.

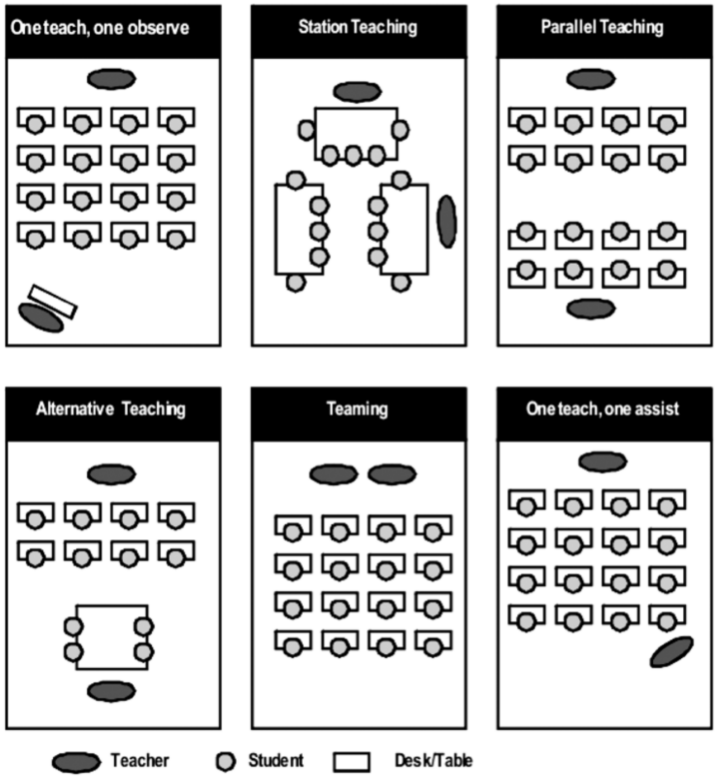

Figure 5. Co-Teaching Variations. From M. Friend & W. D. Bursuck, 2009, Including Students with Special Needs: A Practical Guide for Classroom Teachers (5th ed., p. 92). Columbus, OH: Merrill.

One teach, one observe. Both the general education and special education teacher are present in the classroom. While one or both teachers may have been involved in the planning of the lesson, one teacher, typically the content area teacher, leads the class in whole-group instruction while the other teacher gathers academic, behavioral, or social data on specific students or the whole class.

One teach, one assist. Similar to one teach, one observe, the content area teacher leads the class in whole-group instruction while the special education teacher offers individual assistance and support (typically for instructional and behavioral needs). The role of the lead and support teacher can change throughout the lesson. In this variation, the content teacher is normally responsible for the content knowledge while the special

education teacher draws their expertise about processes of learning and ability to provide accommodations to individual students in the class (Cook & Friend, 2003).

Station teaching. This model serves as an opportunity for differentiation within the class because students are split into smaller groups based on readiness, behavior concerns, or learning preferences. Although the content is delivered at the same time, the material is split between the general education and special education teacher. There are generally three distinct stations, two that involve teacher-directed instruction and one that is an independent activity for students. The students should rotate so that each student has the opportunity to work at each station. Because of the nature of this model, it works best when both teachers have expert content knowledge and can share responsibility in teaching the content knowledge (Murawski & Dieker, 2004). At a minimum, the special education teacher should possess an appropriate amount of content knowledge to effectively teach the lesson being taught (Cook & Friend, 2003).

Alternative teaching. In the alternative teaching variation, one teacher instructs the majority of the class while the other works with a small group. The purpose of this model is for the small groups to focus on preteaching, reteaching, enrichment, special projects, or assessment. While it may vary in terms of which teacher leads the small group, it is critical that both teachers possess equivalent content knowledge with regards to the content being taught. It is important that the small group does not consist solely of students with disabilities, especially when other students in the class could benefit from preteaching or reteaching (Cook & Friend, 2003).

Parallel teaching. For this variation, the class is divided in half. Teachers should plan jointly and will simultaneously teach one half of the class. It is important to

note that each teacher should have a heterogeneous group of students (i.e., the special education teacher should not have all students with disabilities in the class). Again both teachers should have equivalent content and learning process knowledge with respect to the topic being taught (Cook & Friend, 2003).

Team teaching. During team teaching, both the general education teacher and the special education teacher are present at the front of the classroom and share the instruction of the students. One teacher may lead the lesson through direct instruction or discussion while the other teacher models the concepts or demonstrates what the first teacher is saying. This model is heavily dependent on joint planning and requires both teachers to have mastery of the content knowledge relative to the subject being taught (Cook & Friend, 2003).

It is important to note that for each of these models, teachers should address the individualized education program (IEP) goals and objectives of students with disabilities while simultaneously meeting the needs of the other students in the class (Friend, Cook, Hurley-Chamberlain, & Shamberger, 2010). Also the specific model and duration of co-teaching may vary from class to class. Research in the co-teaching literature asserts that co-teachers overuse the one-teach, one-assist and one-teach, one observe models (Zigmond and Matta, 2004). Mastropieri et al. (2005) reported during these models, the special education teacher rarely took the lead. Harbort, et al. (2007) observed co-teaching in a high school science classroom, and reported that the science teacher presented information to students 30 percent of the time, whereas the special education teacher presented information only one percent of the time. Forty-five percent of the special education teacher's time was described as floating (assisting). This research

indicates a misalignment between the goals of co-taught classrooms, including that students with disabilities are exposed to more instructional options, and how co-teaching is actually implemented. Additionally, it is important the enactment of co-teaching meets the goal of enhancing the participation of students with disabilities by increasing their role in the mathematics classroom. This study hopes to better understand why these particular models are used continually and learn more about the impact content knowledge has on how teachers position themselves within the co-teaching model.

Increasing the Role of the Student in Mathematics Instruction

In 2000, the National Council of Teachers of Mathematics (NCTM) formulated the Principles and Standards for School Mathematics. These standards envisioned mathematics as a principled discipline based on the conceptual understanding of key ideas. Instruction promoting conceptual understanding and the process goals outlined by NCTM was not previously emphasized when instructing students with disabilities, but instead focused on procedural knowledge so these students could simply arrive at a correct answer (Cawley et al., 2002). Conceptual understanding occurs when students take an active role in their learning. In 2014, NCTM delineated eight research-based instructional strategies in order to engage students in mathematical thinking, reasoning, and sense making and increase their role in the classroom. These practices encourage teachers to promote reasoning and problem solving, use and connect mathematical representations, pose purposeful questions, and elicit and use evidence of student thinking. One of these practices charged teachers to facilitate meaningful discourse. While it stands as just one of the eight practices, it is difficult to tease mathematical discourse apart from the previously stated practices. Mathematical discourse can be

defined as "asking questions, making conjectures, and developing and evaluating the effectiveness of mathematical arguments" (NCTM, 2000) and is a critical component in this current vision of high-quality mathematics instruction (NCTM, 2014). Effective discourse gives students the opportunity to share ideas, construct convincing arguments, practice mathematical language, and learn to see problems from a different perspective (NCTM, 2014). One way to facilitate discourse in the classroom is to pose purposeful questions, which is another of the eight practices outlined in *Principles to Action*. The value of discourse and questioning are also reflected in the Common Core State Standards (CCSS) for mathematical practices, which explicitly define what students should be able to understand and do for each grade level. Characteristics of students who have successfully mastered this standard are their ability to justify their conclusions, communicate those conclusions to their peers, and respond to the arguments of other students (for a full summary of these practices, please refer to National Governors Association, 2010). NCTM's and CCSS's emphasis on discourse and questioning prove it is a critical focus of teaching today's students mathematics. For this reason, and the fact that discourse offers a way to substantially increase student participation in the classroom, discourse will be the focus of this study regarding the actions of the mathematics teacher and special education teacher in the classroom.

Increasing Discourse in the Mathematics Classroom

Simply increasing how much students are talking and contributing does not necessarily translate to increased mathematical understanding (Truxaw & DeFranco, 2008). Hufferd-Ackles, Fuson, and Sherin (2004) describe four different levels of a math-talk learning community in order to establish a framework to aid teachers in

navigating the implementation and maintenance of a discourse community. The levels, ranging from zero to three, delineate the teacher's role, type of questioning, mathematical representations, and student actions for each of the different levels. Level zero represents the traditional mathematics classroom, which is comprised of mostly teacher-centered activities and teacher talk. Level one describes a teacher who is beginning to seek student thinking, but still assumes the lead role in the classroom. It is not until level two that the students begin to take on a bigger role in the classroom and discourse is actually simulated. Finally, level three describes a classroom consistent with current visions of mathematical instruction in which the teacher is more of a coach and students assume lead roles in the math-talk learning community (Hufferd-Ackeles et al., 2004). In these roles, students share their ideas, construct convincing arguments, practice mathematical language, and learn to see problems from a different perspective allowing them to achieve a deeper understanding of the content. Figure 6 provides an overview of the action trajectories for the teacher and student in the math-talk learning community as detailed by Hufferd-Ackles et al.

	Teacher role	Questioning	Explaining mathematical thinking	Mathematical representations	Building student responsibility within the community
Level 0	Teacher is at the front of the room and dominates conversation.	Teacher is only questioner. Questions serve to keep students listening to teacher. Students give short answers and respond to teacher only.	Teacher questions focus on correctness. Students provide short answer-focused responses. Teacher may tell answers.	Representations are missing or teacher shows them to students.	Culture supports students keeping ideas to themselves or just providing answers when asked.
Level 1	Teacher encourages sharing of math ideas and directs speaker to talk to the class, not to the teacher only.	Teacher questions begin to focus on student thinking and less on answers. Only teacher asks questions.	Teacher probes student thinking somewhat. One or two strategies may be elicited. Teacher may fill in an explanation. Students provide brief descriptions of their thinking in response to teacher probing.	Students learn to create math drawings to depict their mathematical thinking.	Students feel their ideas are accepted by the classroom community. They begin to listen to each other supportively and to restate in their own words what another student said.
Level 2	Teacher facilitates conversation between students, and encourages students to ask questions of one another.	Teacher asks probing questions and facilitates some student-to-student talk. Students ask questions of one another with prompting from teacher.	Teacher probes more deeply to learn about student thinking. Teacher elicits multiple strategies. Students respond to teacher probing and volunteer their thinking. Students begin to defend their answers.	Students label their math drawings so others are able to follow their mathematical thinking.	Students believe they are math learners and that their ideas and the ideas of classmates are important. They listen actively so that they can contribute significantly.
Level 3	Students carry conversation themselves. Teacher only guides from the periphery of the conversation. Teacher waits for students to clarify thinking of others.	Student-to-student talk is student initiated. Students ask questions and listen to responses. Many questions ask "why" and call for justification. Teacher questions may still guide discourse.	Teacher follows student explanations closely. Teacher asks students to contrast strategies. Students defend and justify their answers with little prompting from the teacher.	Students follow and help shape the descriptions of others' math thinking through math drawings and may suggest edits in others' math drawings.	Students believe they are math leaders and can help shape the thinking of others. They help shape others' math thinking in supportive, collegial ways and accept the same.

Figure 6. Overview of the action trajectories for the teacher and student in the math-talk learning community. From Hufferd-Ackles, K., Fuson, K. C., & Sherin, M. G. (2004). Describing levels and components of a math-talk learning community. Journal for research in mathematics education, 81-116.

According to Piccolo, Harbaugh, Carter, Capraro & Capraro (2008), the above vision of mathematics instruction has become "a more democratic, collaborative, and conceptually based form of learning" (p. 376). This vision of how mathematical teaching should occur is quite different from the traditional mathematics instruction that limited the role of the teacher to transmitting information to students and validating their answers (Silver & Smith, 1996) resulting in a classroom dominated by teacher talk. Research around the turn of the century (NCES, 1999, 2000, 2001; Stigler & Hiebert, 1998; U.S. Department of Education, 2000) suggests that teachers in the United States predominately employed this transmission style of communication in the classroom instead of allowing students to justify, explore, and making meaning for themselves (Truxaw & DeFranco, 2008). Students should no longer be learning alone and in silence, but instead engaging with their mathematical learning through active participation with the classroom discourse community and their own contributions, which encourage students to justify their answers. Justification of answers is critical because it requires the critical thinking skills beyond solving a problem using a prescriptive procedure. The justification process enables students to communicate their process and check their work while simultaneously allowing the teacher to determine whether or not the student truly understands the mathematical concepts being taught.

It is important to note that mathematical discourse is an interactive process and not a learning objective (Lampert & Cobb, 2003). Lampert and Cobb (2003) argue that students who practice discourse in the classroom perceive it as a means to learn content. In order to achieve this, teachers need to employ discourse where students also have a voice in the classroom. Wertsch (1991) differentiates between univocal and dialogic

discourse. These serve two different functions. Univocal discourse is the communication between the speaker and the listener where the listener just receives information. The purpose of univocal discourse is to produce a "maximally accurate transmission of a message," (Lotman, 1988, p. 68). Instructional methods such as lecturing and direct instruction utilize univocal discourse. According to Estes and Mintz (2016), direct instruction is meant to "explicitly teach targeted knowledge, skills, or both," (p. 43). When considering the demands placed on the teachers and students in the direct instruction model, there is an imbalance of the workload at the beginning of instruction. For teachers, there is a high amount of work that goes into the planning and delivery of the lesson, which begins with predominately all teacher talk. As the lesson proceeds, the direct instruction model allows for a gradual release of responsibility to the students. Dialogic discourse serves more of a give-and-take relationship in which dialogue is generated between the participants to be used as a process for thinking. This form of discourse allows students to construct, reflect, synthesize, and justify mathematical concepts because connections are not explicitly stated for them. This type of discourse forces students to remain active players in the enactment of it. Dialogic discourse allows students to use their voice for meaning making in the mathematics classroom.

The Role of Questioning in Mathematical Discourse

Hufferd-Ackeles et al. highlighted the importance of questioning by the teacher as a means to increase meaningful discourse in the classroom. They stated questioning serves as a mechanism for determining what students know, how students think about math, and forcing students to justify their responses when challenged by others. Hufferd-Ackeles et al.'s focus on questioning is consistent with other literature on the importance

of making time for meaningful questioning to sustain discourse in the classroom. Mewborn and Huberty (1999) describe "high-press" questioning as asking questions that provoke deep thought and not just yes or no answers to stimulate discourse in a meaningful way in the classroom. These questions can occur in three ways: (a) the teacher asks questions requiring thinking processes for problem solving, (b) the teacher asks if there is another way to solve the problems, or (c) the teacher asks a question requiring more than just rote memorization (Piccolo, Harbaugh, Capraro, & Capraro, 2008). It is important to note the role of the teacher as a facilitator during discussions (NCTM, 2014). In the 2008 study conducted by Piccolo et al., the researchers found that teachers dominated the classroom conversation and student dialogue was simply in response to teacher questions. The researchers emphasized the need for continued research on how to empower students with the skills and mathematical competence to ask and engage in rich mathematical discourse with teachers and their peers. Piccolo et al. asserted that students need the opportunity not only to hear what the teacher is teaching, but also to converse and articulate their own understanding of the content being presented. They concluded that in order for teachers to attain rich mathematical discourse, the teachers needed to probe, guide, and initiate interactive dialogue by asking students "why" questions (Piccolo et al., 2008).

Equally important as the type of question asked is the *pattern* of questioning by the teacher. Herbel-Eisenmann and Breyfogle (2005) explored Initiation-Response-Feedback (IRF) and "funneling" patterns of questioning and examined whether these patterns allowed the discourse that was present to achieve the goals of the lesson. The IRF pattern of questioning is characterized by the teacher posing a question, the student

responding, and the teacher then evaluating the response (Mehan, 1979). Questions that encourage funneling are those that ultimately guide students through a desired procedure or to a correct response (Wood, 1998). "Focusing" patterns of questioning offer an alternative to IRF and funneling patterns, and provide an opportunity to increase the mathematical discourse in the classroom. This method of responding to student responses encourages the teacher to consider what the student has said and then recommends the teacher guide the students based on the student thinking versus the teacher's thinking. For example, a teacher might ask a student how they solved a particular problem. After the student's response, the teacher would unpack the response by helping the student further articulate his or her thinking. This would allow the student the opportunity to further their reasoning by having to explain and justify the thinking involved versus the teacher inserting their own way of reasoning. Focusing questioning allows student responses to enter the discourse space of the mathematics classroom and provide the opportunity for student responses to be assessed and built upon by other students.

Although "focusing" types of questioning may support current visions in mathematics education, changing teacher practice can be difficult for teachers who are used to the teaching-as-telling pedagogy or for teachers who doubt their own abilities to be effective mathematics teachers (Bursal & Paznokas, 2006). Hamm and Perry (2002) conducted a study in which they observed six first-grade teachers at five different urban elementary schools. The observations occurred across five consecutive lessons on place value. The researchers focused on three basic types of questions: answer known, requests for explanation, and requests for student ideas. Although teachers asked an average of 69

questions per lesson, Hamm and Perry found that the questions asked by the teachers were overwhelmingly questions with known answers (91.5 percent). Only 4.3 percent were requests for explanations and 4.2 percent were requests for student ideas. The results of this study suggest many teachers still utilize teaching-as-telling approaches. These approaches result in a passive role of learning mathematics for students, as they become merely recipients of instruction. Further, Hamm and Perry found that almost all student responses (96.5 percent) were simply verified by the teacher (e.g., "Very good") and not by the classroom community. Although teachers made statements such as, "Let's do it together," often the subsequent discourse was teacher driven.

Similarly, special education teachers may tend to provide more teacher-centered (i.e., command, suggest, question) than student-centered (i.e., elaborate, repeat, acknowledge) discourse (Kim & Hupp, 2005) and use funneling questions when working with students with disabilities. Kim and Hupp studied thirteen pairs of special educators and students to better understand student-teacher discourse during one-on-one instruction. Their findings indicate the special education teachers used more than twice as many directive versus responsive discourse verbalizations and rarely asked students to explain their thinking. It is important to note the nature of one-on-one instruction may have led to the overwhelming usage of teacher-centered talk. Regardless, these findings coupled with the fact that students with disabilities often have trouble discriminating key information in mathematical tasks and using metacognitive strategies, suggest there may be barriers for discourse for these students (Maccini & Gagnon, 2002).

Student Error as an Entry Point to Mathematical Discourse

Similar to questioning, another potential entry point to mathematical discourse is through the analysis of errors. Schleppenbach, Flevares, Sims and Perry (2007) sought to compare discourse and inquiry surrounding errors in elementary classrooms in the United States and China using a cross-cultural lens. More specifically, this study focused on teachers' responses to errors in hopes of isolating potentially effective practices to promote further inquiry. The researchers hypothesized the U.S. teachers would focus on correcting errors immediately while the Chinese teachers would emphasize student reasoning and explanation surrounding errors based on prior research.

In order to test their hypothesis, Schleppenbach et al. employed a mixed-methods research approach to analyze observation data from 46 total lessons taught in U.S. and Chinese first-grade classrooms. The lessons were videotaped, transcribed, and coded based on the teachers' responses. The researchers delineated between CLASS 1 responses where teachers responded to the student's error with a statement, and CLASS 2 responses where the teacher responded to the student's error with a question. Examples of CLASS 1 responses include: (a) telling the student the answer is incorrect, (b) giving the correct answer, (c) ignoring the error, (d) providing an explanation and direction, or (e) the student spontaneously corrected themselves. CLASS 2 responses included: (a) re-asking the question, (b) clarifying the question, (c) asking for an addition to the answer, (d) asking for certainty or agreement, (e) redirecting the question, or (f) asking for student explanation. The researchers also used teacher interviews to gather information.

For their sample, the researchers found that U.S. teachers were more likely to follow a student-made error with a statement while Chinese teachers more often

responded with questions, asking the student to explain or correct the error. These findings reaffirmed studies cited earlier in this paper that teachers are still engaging in univocal discourse and traditional, behaviorist styles of teaching. Several important implications arose from this study. The first was consistent with prior research that stressed teachers need to create an environment where students feel it is okay to make and discuss errors. Second, teachers should see errors as an opportunity to push student thinking further to foster mathematical inquiry. Finally, planning for student error (purposefully having "bug" problems) can facilitate the type of inquiry that has been linked to student achievement.

In 1994, Borasi conducted a teaching experiment that sought to use errors as "springboards for inquiry" in the mathematics classroom. This experiment was conducted in the School Without Walls, an alternative high school in Rochester, New York. The study focused on two 16-year-old female students who had not been successful in mathematics prior to the start of the experiment. The researcher designed an instructional unit whose goals were to provide these students with thought-provoking activities using specific mathematical vocabulary. The unit included ten lessons (approximately 40 minutes per lesson) and a take-home project. The researcher hoped the creation of this inquiry-based unit would allow the students to capitalize on the potential errors offered within it by having to unpack their reasoning aloud through discourse to further understand where or how the error occurred.

Borasi analyzed the data from audiotaping and transcribing each lesson session, interviewing the students, and the take-home projects. During the analysis process, the researcher decided to use "instructional episodes", such as an instructional goal or

activity, as the unit of analysis for the study. Each instructional episode was deconstructed into six dimensions: (1) the nature of the error, (2) the context in which the error activity developed, (3) the source of the error, (4) the students' level of participation in the error activity, (5) the educational goals of the activity, and (6) major results of the activity. It is important to note the critical role discourse played in helping the researcher uncover each of these dimensions, especially the first four, which are student-centered. Having students make their rationale explicit contributed to student understanding of the mathematical topics highlighted in the study.

Borasi concluded creating specific error activities enabled the students in the study learning opportunities such as reflecting on the nature of mathematics, engaging in mathematical problem solving, and communicating mathematical ideas. It would be remiss to not point out a major limitation of this study was that only two students were considered, making it difficult to generalize the researcher's results. These learning opportunities, however, are consistent with recent reform efforts in mathematics education. Borasi further identified other instructional uses of error in the classroom such as remediation, discovery, and open-ended inquiry. For teachers who need help incorporating student voice in their classrooms, error analysis may offer an entry point to discourse.

The Role of Teacher Content Knowledge in Discourse and Co-Teaching

Content knowledge is necessary to correctly interpret and respond to student error in the mathematics classroom. In order to make meaning out of a student's error, the teacher must go through several processes. First the teacher must determine what appropriate solutions and methods/processes are for the problem at hand. Second the

teacher must determine how and why a student arrived at an incorrect answer. In order to do so, teachers might use questioning as a way to unpack students' thinking and understanding. Third, the teacher must consider what misconceptions the student may possess to have made the mistakes they did to get the answer wrong (Ball, Thames, & Phelps, 2008).

Schilling and Ball (2008) developed a survey to identify what and how subject-matter knowledge is required for teaching. The researchers were able to successfully determine how teachers' mathematical knowledge for teaching is organized and whether the survey developed for the study was a reliable measure of the teachers' mathematical knowledge for teaching. The results from the study supported that the presence of specialized content knowledge for teaching is important. Further, this study was able to determine that common and specialized mathematical knowledge are related but not necessarily the same. The researchers emphasized that mathematical content knowledge must consist of more than just general mathematical knowledge in order for teachers to appropriately generalize representations, interpret student work, and analyze mistakes.

Content knowledge is a recurring theme in the co-teaching literature because of its impact on the role of the teachers and which co-teaching models are used the most. The literature states that special education teachers often take on the role of the subordinate teacher (e.g., Buckley, 2005; Hazlett, 2001; Magiera et al., 2005; Mastfopieri et al., 2005; Rice & Zigmond, 2000; Zigmond & Matta, 2004). This is largely due to the greater content knowledge of the general education teacher. A particularly powerful quote comes out of a study by Weiss and Lloyd (2002) in which a teacher stated, "'Do you think I would have the audacity to go in the geometry class and say I was a collaborative

teacher?’” (p. 65). Even when teachers themselves described their roles as equal, researchers noted a discrepancy between what they said and what occurred in the classroom. For example, Rice and Zigmond (2002) stated,

> “The two teachers described their practice as ‘an enmeshing of our abilities’ but they were clearly not equal partners in the instruction. In most cases, this disparity in roles was explained as necessity because the special education teacher lacked content knowledge” (p. 195).

Zigmond and Matta (2004) conducted observations of 41 secondary co-teaching pairs across 14 high schools and determined the special education teacher rarely took the lead in instructional activities. The special education teacher was seen as a “nice addition” to the classroom in terms of providing relief for the content teacher and giving students attention during individual or small group work (Zigmond & Matta, 2004, p. 73). Mastropieri et al. (2005) also concluded, "It was rare to observe special educators delivering instruction to the entire class" (p. 265). This imbalance in content knowledge leads to the implementation of co-teaching models that continuously position the general education teacher at the front of the room in charge of instruction. These models include one-teach, one-assist and one-teach, one observe where the demands of the special education teacher are the lowest when compared to other co-teaching models. With one of the goals of inclusive classrooms being that students with disabilities are exposed to more instructional options, this limited usage of different co-teaching models is problematic. It is important to note that although prior research establishes a connection between a teacher’s content knowledge and his or her role in the collaborative classroom, none of these studies have unpacked how teachers make meaning of and become situated

in these roles.

Prior Research on Discourse in the Collaborative Mathematics Classroom

Although there is a considerable amount of research on potential ways to increase discourse in the mathematics classroom, few researchers have examined mathematics instruction in the context of the collaborative classroom, and even fewer have focused on teacher and student discourse within this context. The following two studies sought to better understand student verbalizations for students with disabilities within the context of the mathematics classroom.

DeSimone and Parmar (2006) conducted a qualitative study to gain an understanding of the process of inclusion as it is implemented in the middle school mathematics classroom. The researchers conducted teacher interviews, surveys, and classroom observations for seven teachers, four of which had a special education teacher come into their classroom during mathematics. These teachers taught across three different suburban middle schools. Each teacher was observed for one class period (ranging from 39 to 60 minutes) and was interviewed following the observation. This study found students with disabilities were generally not provided opportunities to express their mathematical thinking or discuss their reasoning. The teachers in this study were observed doing most of the talking during discourse and provided minimal opportunities for students to explain their answers. During moments where students did have the opportunity to voice their answers, explain their work, or justify their thinking, students with disabilities often remained passive while students who succeed in mathematics dominated the discussion (DeSimone & Parmar, 2006). Although this study could have benefitted from multiple observations of participants' inclusive mathematics

classrooms, it provided valuable insight into the implementation of inclusive classrooms for mathematics. The researchers deduced students with disabilities remained passive in the classroom because the teachers did not adapt the curriculum or use instructional methods prior researchers have deemed effective for students with disabilities, such as breaking learning into smaller steps or offering pre-teaching.

These findings are consistent with those of Baxter, Woodward, and Olson (2001). These researchers observed mathematics instruction in five elementary school classrooms over the course of a year. Using qualitative methods, Baxter et al. examined the responses of sixteen low-achieving students during whole-class discussions and pair work. Seven of these students were receiving special education services for mathematics in the inclusive classroom, although the school did not use the co-teaching model to do so. The classroom norms of this study differed from those of DeSimone and Parmar because students were given ample opportunity for discourse in order to construct meaning. Despite this, across 34 observations, there were only three occasions where low-achieving students volunteered to speak during whole-class discourse. When these students did volunteer, they offered only one-word answers. The researchers reported instances where all five of the teachers in the study tried to involve these students in discussion, however, these students also offered one word answers or were asked questions where the answer was a memorized fact. During whole-class discourse moments, these students were often not engaged or off task. This is problematic because part of the benefit of discourse is that it allows students the opportunity to compare their own thinking with that of their peers and determine if they agree or disagree.

Although the discussion by Baxter et al. focused mainly on the student behaviors during discourse, it brought to light several important implications regarding the structure of the mathematics class. The first is students who were more proficient in the class tended to monopolize the discussion time, making it easy for students who were considered low-achievers to be silent the entire class. Even though the teacher created whole class opportunities for discourse, not every student had access to the benefits of participating. Additionally, Baxter et al. discussed that when low-achievers did have an opportunity to speak, their contributions were mostly low level. This could be a result of problems that low achievers and students with learning disabilities have in regard to metacognitive behavior (Wong, 1993). Baxter et al. suggest the cognitive and metacognitive processes required to engage in mathematical conversations could be challenging for these students resulting in difficulty following the comments of their peers and verbalizing their own mathematical processes and ideas.

In a follow-up study, Baxter, Woodward, and Olsen (2005) examined writing as an alternate form of communication in an attempt to engage all students in mathematically meaningful communication. In order to do so, the researchers conducted observations in a classroom where one-third of the students qualified for special education services and used a case study approach to learn more about four of these students. The students in this study all struggled in mathematics and were characterized by their teacher as having "large holes" in the mathematical understanding. The school had three levels for seventh-grade mathematics: pre- algebra, general math 7a, and general math 7b. Pacing differentiated math 7a and 7b, and the 7a classes typically completed more topics than the 7b classes. The researchers purposely studied a 7b

general math class because it had a higher proportion of students who qualified for academic assistance. The class met daily for 42 minutes and the researchers collected data from students' journals to determine what their writing revealed about the target students' conceptual understanding, strategic competence, adaptive reasoning, and productive disposition. The teacher utilized journaling to give all students the opportunity to relate to the topics taught, improve thought process awareness, and take ownership over their knowledge. Using the coding depicted in Figure 7, the researchers developed a system for analyzing the students' journals. I chose to include this table because these conceptual codes might inform my own study as students engage in discourse for the classrooms I observe. Baxter et al.'s results indicated that three of the four target students were able to communicate their mathematical thinking and move beyond recording and summarizing to generalizing. For students who have difficulty accessing whole class discourse in the mathematics classroom (such as students with disabilities), journaling may provide an opportunity for them to explain their thinking and justify their answers.

Conceptual Codes	
Recording (Level 1)	• Student transcribes information. • Student copies from board or quotes what teacher says. • Knowledge handed over from teacher to student
Summarizing (Level 2)	• Student states memory of concrete experience in his/her own words with no inferences. • Student repeats steps to solve a problem with no attempt to explain what is happening mathematically.
Generalizing (Level 3)	• Student identifies generalization, but organization and relationships not perceived. • Student attempts to use relevant mathematical ideas and representations to clarify the solution to a problem.
Relating (Level 4)	• Student notes relationships between generalizations, organized logically or hierarchically. • Student moves back and forth between mathematical ideas, asks questions, poses possible alternative solutions. • Posits connections among concepts.
"I don't know"	• Student writes, "I don't know" repeatedly.
Affective Codes	
Affective response	• Student writes about feelings, but does not try to engage teacher in dialogue.
Affective dialogue	• Student speaks directly to teacher about feelings and thoughts related to mathematics.

Figure 7. Conceptual codes for discourse through journaling. From Baxter, J. A., Woodward, J., & Olson, D. (2005). Writing in mathematics: an alternative form of communication for academically low-achieving students. *Learning Disabilities Research & Practice*, *20*(2), 119-135.

The Impact of Co-Teaching on Students in the Collaborative Classroom

Chapter one highlighted current quantitative data on students with disabilities performance on standardized tests, which perhaps painted the impact of inclusive education in a bleak manner. Unfortunately, aside from these performance scores, there is little empirical evidence on the academic achievement and social outcomes of students with disabilities in the inclusive classroom (Rea, McLaughlin, & Walther-Thomas, 2002). One study, however, did try to unpack the impact of co-teaching on students with disabilities. Rea, McLaughlin, and Walther-Thomas conducted a study on 58 students

who were receiving special education services in two middle schools, only one of which utilized the co-teaching model. The other school offered pullout services during electives. The findings of this study offered several implications for the impact of co-teaching. First, students with disabilities who were provided services in the inclusive classroom achieved higher course grades in language arts, mathematics, science, and social studies than students with disabilities in pullout programs (Rea, McLaughlin, & Walther-Thomas, 2002). Second, students in the inclusive classroom demonstrated comparable scores to those in pullout programs on reading, writing, and mathematics subtests of a state proficiency test. This data could suggest a need to critically evaluate the current implementation and delivery of the co-teaching model in order to make it more effective in meeting the academic needs of its students, resulting in increased student performance on standardized tests.

Qualitative research, however, offers potential impacts of co-teaching beyond student performance on assessments. A metasynthesis on qualitative co-teaching research by Scruggs, Mastropieri, and McDuffie (2007) indicated across thirty-two studies, a commonly expressed benefit of co-teaching was the additional attention students with disabilities received in the classroom. For example, a study by Pugach and Wesson reported, "The students we interviewed felt as if their academic and social needs were being met better than had they been in classes instructed by a single teacher," (1995, p. 291). Dieker interviewed 54 secondary students (some with disabilities) and reported all but one student felt they benefitted from having two teachers in the classroom (2001). Teachers in several studies also described the positive impact the inclusive setting had on students with disabilities' behavior since they had peers to models appropriate behavior

for them (e.g., Carlson, 1996; Vesay, 2004; Ward, 2003; Walther-Thomas, 1997; Yoder, 2000). Although there is still work to be done for students to benefit academically from the co-teaching model, it is clear there are social advantages to the inclusive classroom.

Critical Factors in Co-Teaching

Although the focus of this capstone is related to how teachers define their roles in the collaborative mathematics classroom, it is important to examine factors that contribute to successful co-teaching as this may influence the meaning making and actions of the teachers in this study. The literature on the nature of collaboration offers three core values at the heart of collaborative relationships: parity, shared goals, and shared responsibility (Friend & Cook, 1992; Rainforth, York, & Macdonald, 1992; Thousand & Villa, 1992). Rainforth and England define *parity* as such that all members of a group have equal status within the group, as well as equal ability to make unique and valuable contributions. Each member of the collaborative team also maintains equal power in all decision making. *Shared goals* refers to the common interest of the collaborative teachers and the work that will happen to ensure successful completion of these goals. An example of a shared goal could be the content area teacher working with the SPED teacher, student, and parents to collectively develop an IEP for the student that everyone is committed to, rather than each party perusing different outcomes. Finally, *shared responsibility*, means that all members of the collaborative team are responsible for participation, decision-making, and the outcomes (Rainforth & England, 1997). The factors that enable co-teachers to build relationships based on these core values will be outlined below.

Administrative Support

Teachers in several studies (e.g., Carlson, 1996; Curtin, 1998; Frisk, 2004; Morocco & Aguilar, 2002; Norris, 1997; Thompson, 2001; Yoder, 2000) reported administrative support was the primary need that must be met in order for the teachers to view co-teaching as successful. When asked about essential needs for co-teaching, one teacher in Thompson's study that examined elementary teachers' perceptions of co-teaching stated, "'Administrative support would be number one. Number two--picking the right teacher,'" (2001, p. 129).

Administrators can provide support in a number of ways. First, they can provide professional development on inclusion, collaboration, and co-teaching…especially to new teachers or teachers who have not engaged in co-teaching before. A considerable amount of co-teaching literature describes instances where teachers were not given the opportunity to process or plan for their co-teaching partnership and how this negatively impacted the experience (Damore & Murray, 2009; Dieker & Murawski, 2003; Murawski, 2009; Villa, Thousand, & Nevin, 2013). In addition to ensuring teachers understand the co-teaching model itself, it is the role of the administrators to also help teachers engage in the paradigm shift (from teaching in silos to teaching in tandem) required for co-teaching to occur in their classroom. General education teachers may need help seeing the value of the co-teaching model in order for them to want to share their classrooms with the special education teacher (Murawski & Spencer, 2011). Professional development for special education teachers can also enable them to articulate their own areas of expertise so they do not assume the role of the general education teacher's aide (Murawski, 2009).

Administrators can also attend to the physical conditions that must be met before teachers can successfully engage in the co-teaching model. In order to foster the collaboration necessary to function, adequate time, such as a common planning time, must be available. Teachers are inundated with endless responsibilities and tasks so to expect them to meet outside of school on their own time is unrealistic. If common planning times are not a viable option, administrators could schedule planning time for co-teaching pairs using professional learning community time, having a substitute come in once a month, using banked time, organizing lunch meetings, or replacing lunch or recess duties with co-teaching planning time (Murawski, 2009).

Volunteerism and Compatibility

Teaching has historically been characterized as an individual profession where teachers operated within the silos of their classrooms. Because of this, teachers are often self-conscious or reluctant to have their peers watch them teach (Kohler-Evans, 2006). For teachers who are new to co-teaching, allowing voluntary participation could alleviate some of this stress. A study by Vesay (2004) examined three pairs of elementary co-teachers in the preschool setting using observations and in-depth interviews. The researcher concluded, “"the effect on their collaboration is positive when both teachers make a voluntary commitment to initiating the partnership" (Vesay, 2004, p.152). Several other studies echo this sentiment that co-teaching should not be mandated. Thompson (2001) reported that all of the participating elementary teachers "strongly advocated for voluntary participation" (p. 129). A teacher in Carlson’s 1996 study stated how critical it was “‘that the impetus for the team comes from the two individuals involved, that it's not imposed by administration’” (p. 154). The principal in this study

agreed that "'co-teaching cannot be forced. Rather, it is a way of doing things that the two teachers must choose, though it can be suggested. In other words, teachers have to pick their co-teaching partners'" (p. 45).

Compatibility is a big piece of why teachers feel the need to pick their co-teacher. Rice and Zigmond (2000) studied 17 secondary co-teachers in Pennsylvania and Australia and concluded, "Several of the teachers rated personal compatibility between partners as the most critical variable for co-teaching success" (p. 194). A quote by a teacher in Thompson's (2001) study offered the following stipulation for agreeing to co-teach: "'But make sure that it's with somebody that you get along with and that you have the same, you know, ideas about teaching and are equally motivated,'" (p. 128). Failure to allow teachers to choose their co-teacher or match teachers based on compatibility could result in a dissolution of the partnership and effect instruction in the collaborative classroom.

Collaborative Planning

In addition to teachers having access to collaborative planning time, it is important they actually use it for such purposes. Collaborative planning at the beginning of a co-teaching relationship is especially critical. It allows co-teachers to establish a rapport with each other and discuss their teaching styles to create a cohesive classroom and foster a compatible relationship. Planning allows co-teachers to consider what content will be taught, plan materials for the lesson, and determine which co-teaching model best fits the lesson. In addition to instructional needs, planning allows co-teachers to review assessment data and figure out how to support the students in the class. Failure to plan collaboratively could result in diminished success of the co-teaching model. In a

study of collaborative biology classroom, Curtin (1998) reported, “the special education teacher felt the barrier to co-teaching was a lack of planning time for collaboration with the regular education teacher” (p. 101).

Collaborative planning not only allows teachers to discuss what content should be taught to students, but also allows the teachers themselves to unpack the content and discuss what accommodations might be necessary to meet the needs of the students in the class. This is especially critical for the special education teacher in order to become familiar with the content. Dieker (2001) observed that the lack of planning time resulted in the special education teacher being unfamiliar with the material when it was presented to the class, which resulted in the special education teacher learning the material simultaneously with the students in class.

Special education teachers who co-teach may have other responsibilities in addition to providing instruction in the collaborative classroom, such as designing instructional interventions, providing accommodations and modifying student work, assessing and monitoring student progress, collaborating with other teachers, administrators, specialists, and parents; and managing the IEP process and the required paperwork (Eisenman, et al. 2011). The process of defining the roles and responsibilities of both the general education teacher and special education teacher need to be better understood in order to create an effective co-teaching mathematics classroom, to ensure the needed services and opportunities are provided to the included students with disabilities.

Summary

Legislation played a defining role in the call for collaborative classes in an effort to better meet the needs of students with disabilities. The passage of No Child Left Behind (NCLB) in 2001 required that all students, including students with disabilities (SWD), be taught general curriculum by highly qualified teachers and that students with disabilities be included in schools' measures for achievement accountability. Schools utilize the co-teaching model to satisfy requirements by the Individuals with Disabilities Education Act (1990, Am 1997, 2004). The literature on co-teaching points to three main goals, which include: (a) increase access to instructional options for SWD, (b) enhance the participation of SWD in general education classes, and (c) enhance the performance of SWD.

In order to directly address the first two goals, six variations of co-teaching were established to capture the different approaches for planning and instructional delivery. It is important to note that these were conceptualized with the mindset that teachers in the co-taught classroom would not use one variation exclusively. Unfortunately, the co-teaching literature indicates that in the collaborative classroom, especially at the secondary level where the content is more specialized, only models that position the content teacher exclusively at the front of the room are used (Zigmond & Matta, 2004).

An additional layer needed for success in the mathematics collaborative classroom is ensuring students with disabilities have access to participation in discourse and reasoning. When compared with their peers, students with disabilities might lack the required background knowledge and skills needed to thrive in the mathematics classroom (Swanson et al., 2014). These students often have slower processing speeds and more

trouble discriminating key information than students without disabilities, resulting in increased time for comprehension (Cirino, Fuchs, Elias, Powell, & Schumacher, 2013, Maccini & Gagnon, 2002). This emphasizes how critical it is that both expert teachers work together to ensure all students have the opportunity to succeed in the mathematics classroom and beyond.

CHAPTER III: METHODOLOGY AND METHODS

This chapter serves as a comprehensive look at my assumptions as a researcher and how these assumptions influence the research design for this study. Specifically, this chapter reviews the purpose of the study and the initial research questions, and addresses my interpretivist paradigm and assumptions, research approach, research site and participants, data collection and analysis methods, quality criteria, ethical considerations, and potential limitations of my capstone.

Purpose and Research Questions

A thorough literature review indicates the co-teaching model has become the leading instructional model in an attempt to provide students with disabilities with a high quality education (Friend & Bursuck, 2002; Friend & Cook, 1995; Murawski & Dieker, 2004; Vaughn, Schumm, & Arguelles, 1997). The Individuals with Disabilities Education Act (IDEA, 1997 and 2004) served as a catalyst for the rapid increase of the co-teaching model as the legislation required that children be educated with typical, same-aged peers, in a classroom taught by a highly qualified teacher. This mandate for the inclusion of students with disabilities added another layer of complexity for the general education teacher in the classroom to ensure these students were still receiving services, such as modifications to the general education curriculum. Co-teaching offers a way for a content area teacher and special education teacher to blend their expertise to better meet the needs of students with disabilities.

There is a lack of consensus, however, about the effectiveness of this model. Prior research suggests that co-teachers overuse the one-teach, one-assist and one-teach, one observe model (Zigmond and Matta, 2004) and that special education teachers rarely

take the lead. Content knowledge has been identified as a barrier inhibiting special education teachers from assuming lead roles in the classroom (Buckley, 2005; Hazlett, 2001; Magiera et al., 2005; Mastfopieri et al., 2005; Rice & Zigmond, 2000; Zigmond & Matta, 2004). There is a lack of research, however, about how teachers make meaning of their roles and whether co-teachers work to explicitly define these roles or if the roles are implied. This specific study examines the process through which co-teachers define their roles in the classroom and how these roles support or promote mathematical discourse in the classroom. The enactment and sustainment of discourse is the chosen focus of the study because of its role in promoting student reasoning, eliciting student thinking, advancing student explanation and justification, and creating opportunity for posing purposeful questions. Answers to the following research questions provide a picture of how the role defining process works and offer insight for how the co-teaching model supports mathematical discourse. These questions are grounded in prior co-teaching research and work towards filling existing gaps in the co-teaching literature.

1) How do school and school division systems and policies influence the roles of the teachers in the collaborative classroom?
    a. How are co-teachers paired?
    b. To what extent to teachers get to choose their co-teaching partner?
    c. How do schools and school divisions envision the role of the mathematics teacher and the special education teacher in the collaborative mathematics classroom?
2) How do teachers determine teacher roles in the mathematics collaborative classroom?
    a. How does the mathematics teacher make meaning of and define his or her

own roles in the classroom?

b. How does the special education teacher make meaning of and define his or her own roles in the classroom?

c. What does the process look like?

3) How are the instructional and pedagogical responsibilities divided between the mathematics teacher and special education teacher?

a. How does content area affect these roles?

b. How does the mathematics teacher support discourse in the mathematics classroom?

c. How does the special education teacher support discourse in the mathematics classroom?

Methodology

Qualitative Approach

According to Maxwell, qualitative research is intended to help the researcher better understand the meanings and perspectives of the people in the study and determine how these meanings and perspectives are shaped by the contexts around them (2012). Qualitative research is especially helpful in better understanding "the specific processes that are involved in maintaining or altering these phenomena and relationships," (Maxwell, 2012, p. viii). A significant body of qualitative research has provided a rich description about the implementation of co-teaching (Scruggs et al., 2007). Although these studies provide a wealth of information, they do not address the meaning-making co-teachers go through in order to determine their roles in the collaborative classroom. The nature of the research questions for this study compels a qualitative approach. This

capstone intends to better understand *how* teachers participating in collaborative pairings plan together to meet the needs of all students and *how* these teachers define their roles within the collaborative classroom. The research questions focus on phenomena that cannot be adequately explained using quantitative methods.

Interpretivism

More specifically, an interpretivist qualitative research framework guides this capstone. It is important to unpack the ontological, epistemological and methodological assumptions of interpretivism in order to better understand the nature of this framework and why it is appropriate for this study. Ontology refers to the philosophy of existence and any assumptions and/or beliefs about the nature of being. A dominant ontological assumption of interpretivism is the belief that there is no one reality (Erickson, 1986). Instead, there are multiple realities and these realities are relative, local, and unique to each individual. Lincoln and Guba (1985) explain that these multiple realities also depend on other systems for meanings, which make it even more difficult to interpret in terms of fixed realities. Because these realities and meanings are multiple and unique, researchers cannot impose their own reality on the participants in the study (Erickson, 1986).

Epistemology is focused more on the theory of knowledge and questions *how* do we know the world around us. Epistemological assumptions of interpretivism suggest that what counts for knowledge and meaning are not simply the behaviors that can be seen by the researcher, but also the meanings that participants attribute to these behaviors (Erickson, 1986). Erickson calls for interpretivist researchers to remember that the meaning one participant assigns to a behavior is not necessarily the same meaning that

another participant would assign to this behavior. The findings of this capstone are comprised of the meanings that the collaborative teachers ascribed to their behaviors while I observed them, layered with the meaning I made of their actions based on clearly described qualitative procedures.

Methodology refers to the process of *how* we gain knowledge. Erickson offers five tasks for the researcher that describe how an interpretivist should collect and make sense of data. First it is important for the researcher to examine his or her assumptions and the assumptions of the participants. Second it is critical for the researcher to determine what specifically is happening in the phenomenon. Erickson states it is important for the researcher to gain an understanding of what is happening in terms of actions and meanings. After doing so, the researcher needs to find the structure and organization of these actions and meanings and determine what are the patterns (if any). Once these patterns are discovered, the researcher needs to relate these meanings to the larger social structure. The final step is to then construct coherent, plausible accounts and establish warrants based on evidence (Erickson, 1986).

An additional methodological assumption of interpretivist research is that all methods are fallible. Interpretive researchers, therefore, must use multiple methods in their design to triangulate their findings. For this capstone, I rely on observations, interviews, and planning meetings as my triangulated data sources. It should be noted that these methods are not separate from me as a researcher. A description of researcher as instrument follows in a later section.

Case Study

A qualitative case study is utilized for this capstone. While many definitions of the case study exist, the definition put forth by Becker will be used. Becker (1968) defines the purpose of a case study as twofold, that is, "to arrive at a comprehensive understanding of the groups under study," and "to develop general theoretical statements about regularities in social structure and process" (p. 233). The purpose of this capstone is to better understand how co-teaching plays out in the mathematics classroom and how co-teachers go through the process of establishing their roles as a co-teacher so the case study is an appropriate method for this study.

Interviews and Observations

The interpretivist approach views reality as subjective and multiple since it is based on meanings and understanding. Interpretivist researchers believe that just as people cannot be separated from their knowledge, researchers cannot be separated from their research subject. Because the goal of qualitative research is understanding, rather than making predictions, interpretivist researchers do not take knowledge generated from a study as permanent. Instead they accept it as relative to the time, context, or culture in which the study was conducted. Interpretivist researchers are more interactive and participatory in their research studies making interviews and observations the primary data collection methods used (Erickson, 1986).

Analytic Induction

Analytic induction is a method of data analysis described by Znaniecki (1934) where the goal is to collect data that is used to make universal statements that are continually modified as new, conflicting evidence comes to light. Znaniecki outlines several steps in the analytic induction process. The first is to develop a hypothesis drawn

from an individual instance. Then the researcher compares that hypothesis with alternative possibilities taken from other instances. If the hypothesis fails to be confirmed, the hypothesis is revised so as to include the additional instances examined. The hypothesis is reformulated until there are no exceptions. This method of data analysis is used to make sense of emerging patterns of data for this capstone.

Research Site, Participants, and Access

Site and Sample

After requesting to conduct research in the school division of interest, Central High School[1] was assigned to me as a school available to study by the research coordinator in the school division. The school division itself was chosen out of convenience. CHS is located in a county with approximately 100,000 residents in the state of Virginia. While the county is primarily rural, it also has suburban settings. The school division itself serves close to 14,000 students. The demographic breakdown of those students include 11.0% Black, 10.7% Hispanic, 67.7% White.

The school.

Central High School serves approximately 1800 students. CHS's student demographic breakdown is 15% Black, 11.5% Hispanic, 60% White, and 7.4% Asian. In 2016, 26% of CHS's students qualified for free and reduced lunch. Students with disabilities make up 11.7% of the student population, while 14.4% of the students are identified as gifted. CHS is the largest school in the division and sees students who speak over 30 different languages from over 50 different home countries.

The teachers.

[1] All names of people and schools in this capstone project are pseudonyms.

Once receiving permission from the county and learning I would be assigned to CHS to conduct my capstone, I contacted the principal to obtain access to the school and inquire about possible co-teaching pairs I could observe. The principal put me in contact with the mathematics department chair that would have information about these pairings. The department chair was interested in the study and agreed to participate and offered me the names of two other mathematics teachers who taught collaborative sections. After reaching out to these two teachers with an invitation to participate (see Appendix A), both teachers agreed to participate. It is important to note there could be a difference in the type of teacher that would agree to have a researcher observe his or her classroom. All three of the participants were female teachers who had taken similar traditional routes to certification for teaching high school mathematics. After the study began, one of these teachers withdrew from the study due to a change in her teaching schedule in which she no longer taught a section with her former collaborative teacher.

Collaborative Pair 1: Mrs. Griffin and Ms. Caldwell

Mrs. Griffin is a veteran mathematics teacher with almost thirty years of teaching experience, sixteen of those being at CHS. She is a white female in her early 50s who serves as CHS's mathematics department chair. Mrs. Griffin has also taught adjunct classes at the local community college and is working on her administrative certification to eventually become a high school administrator. She received her undergraduate degree in mathematics from a four-year university and later returned to graduate school over the course of three summers to receive her Master's degree in mathematics. Mrs. Griffin values real-world connections regarding her mathematics instruction and used

food trucks as a way to get her students thinking about rate-of-change during the unit I observed.

Ms. Caldwell is a young, White female in her first year teaching on a provisional license. After graduating from college and working in several non-certified teaching positions, she decided to return to school to obtain her Master's degree in teaching with an endorsement in special education. Ms. Caldwell received a job offer (based on a lead from Mrs. Griffin) prior to completing her degree and is using her first year of teaching as her student teaching experience as well. She plans to also become endorsed in middle school mathematics by passing the Middle School Mathematics Praxis, a large portion of which tests Algebra I content knowledge. She has a high-energy personality and is constantly joking around with her students. It is clear from the classroom observations that Ms. Caldwell places a great emphasis on establishing and maintaining a positive classroom community.

Mrs. Griffin and Ms. Caldwell have an extremely close and professional relationship. Growing up, Ms. Caldwell attended the same church as Mrs. Griffin and for the past two years, both teachers have coached CHS's rowing team. Mrs. Griffin, who does the scheduling for classes as the mathematics department chair, admitted during an interview that she only agreed to teach a collaborative mathematics class once she found out Ms. Caldwell had been hired and she would have the opportunity to work with her. Prior to this year, Mrs. Griffin has taught only upper level courses such as Advanced Placement (AP) Calculus AB and AP Calculus BC, which requires eighteen credit hours of graduate level mathematics in order to teach. When asked to describe their

relationship, Mrs. Griffin defined it as a "true partnership" while Ms. Caldwell stated it was a "healthy collaboration".

Collaborative Pair 2: Ms. Graham and Mr. Hudson

Ms. Graham is a young, White mathematics teacher at CHS in her second year of teaching. She attended a five-year teacher education program where she simultaneously received her Bachelor's degree in mathematics and Master of Teaching degree for secondary mathematics. Ms. Graham has a very warm demeanor, even when her students act in challenging manners. She is organized and enjoys following a routine with her students every day. From the observations and her interview, it is clear Ms. Graham places importance on procedural and conceptual knowledge equally in her instruction. In addition to teaching a collaborative Algebra I course, Ms. Graham also teaches two sections of an Honors Math Analysis course. She serves on the school division's vertical alignment team for mathematics.

Mr. Hudson is a White, veteran special education teacher in his early forties. He started at CHS twenty years ago as a teaching assistant in the special education department and the in-school suspension coordinator. After two years, Mr. Hudson received his certification to become a special education teacher and spent his early years teaching in self-contained classrooms. In addition to teaching, he is also the head coach of the girl's Varsity softball team at CHS. Three years ago he obtained his Master's in Administration and Supervision in hopes of becoming an athletic director. Mr. Hudson places great emphasis on the state end-of-course standardized test and frequently discusses ways for the students in the collaborative class to be successful on it, as

evidenced in classroom observations and his individual interview. Table 1 reviews the demographics of the two collaborative pairs who participated in this study.

Table 1

Collaborative Teacher Demographic and Instructional Information

Teacher	Certificate Area/ Endorsement	Years of Teaching Inclusion Classes	Years of Collaboration with Current Co-Teacher	Common Planning Period?
Collaborative Pair 1				
Mrs. Griffin	Math (year 28)	1		
Ms. Caldwell	Special Education (provisional license)	1	1	Yes
Collaborative Pair 2				
Ms. Graham	Math (year 2)	2	1	Yes
Mr. Hudson	SPED (year 20)	10		

The classroom contexts.

Collaborative Pair 1: Mrs. Griffin and Ms. Caldwell's classroom.

The classroom sits at the front of the building and remains bright throughout the day as the back wall has windows that span the length of it. There is a SMART board located at the front of the classroom, along with a document camera that Mrs. Griffin and Ms. Caldwell us frequently in their instruction. Mrs. Griffin's desk is located in the front left corner of the room, on which she has placed family photos, student work, and instructional materials. A bulletin board is mounted behind her desk and is filled with graduation pictures of previous students. Ms. Caldwell's desk is located at the back of the room. Although the desk is clearly hers, there is nothing located on top of the desk.

The only indication that this desk is exclusively Ms. Caldwell's is during class when she references students to place finished work on "her desk". Student desks are organized in pairs and face the front of the classroom. The walls are adorned with three dimensional student projects that Mrs. Griffin's calculus students completed the previous semester. There is no Algebra I work hung around the room. There are posters hung specifically for this Algebra I Part I class which delineate what student behaviors should look like during the warm-up, direct instruction, partner work, break time, and individual work. For example, the poster for "Individual Work" states students should be sitting quietly at their assigned desk with all electronics put away unless otherwise told by a teacher. There is an emphasis that the room should be completely quiet during this time. Figure 8 depicts the general classroom layout for collaborative pair one.

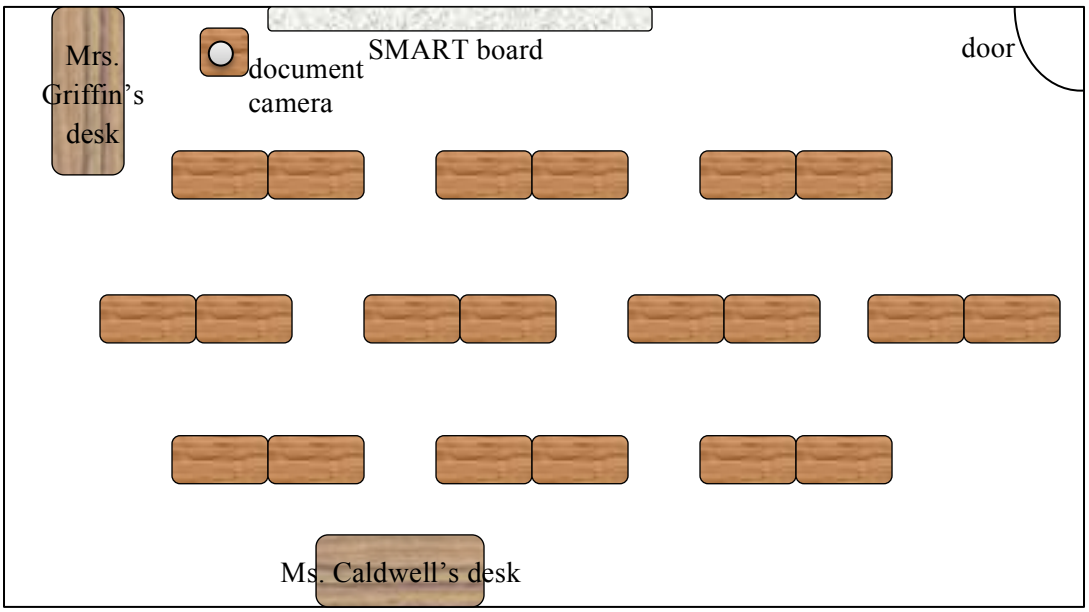

Figure 8. Classroom layout for Mrs. Griffin and Ms. Caldwell

The majority of the students in Mrs. Griffin and Ms. Caldwell's class are identified as students with disabilities. While the specific disabilities of particular students were not revealed, the class did consist of three students who have

emotional/behavioral disorders, one student with autism, and students with learning disabilities such as ADHD or dyscalculia, a learning disability involving difficulty calculating numbers or grasping mathematical concepts.

Collaborative Pair 2: Ms. Graham and Mr. Hudson's classroom.

When you enter the classroom you see several types of seating, such as regular student desks, high-top tables, and two upholstered chairs in an effort to create flexible seating in the classroom (a county initiative to promote student movement and provide students spaces where they feel they work best). The regular student desks are arranged in rows with a large path down the middle. There is a SMART board and document camera at the front of the room. Ms. Graham's desk is at the back of the room next to several filing cabinets. Student work is hung on the walls, but appears to be predominately work from Ms. Graham's Honors Math Analysis course. Mr. Hudson does not have a desk in the classroom and often unpacks his laptop on one of the high-top tables in the back of the classroom. Figure 9 depicts the general classroom layout for collaborative pair two.

Approximately half of Ms. Graham and Mr. Hudson's students were identified as students with disabilities. The disabilities of the students in their class seemed less severe than those of the students in Mrs. Griffin and Ms. Caldwell's class. Several of the students had ADHD and one student was labeled as "emotional/behavioral disorder". Students placed in this Algebra I Part I class who were not diagnosed or labeled with a disability did not pass their previous middle school mathematics course, and were therefore placed into the lowest level mathematics class CHS offered.

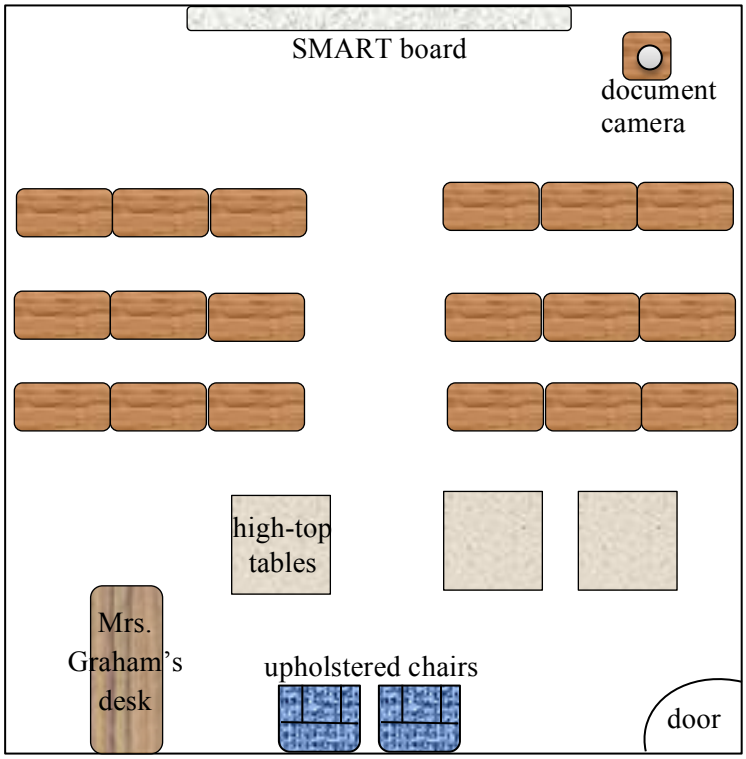

Figure 9. Classroom layout for Ms. Graham and Mr. Hudson.

Researcher Role and Access

After applying to do research within the school division, I was granted access to CHS. As previously stated, three mathematics teachers initially agreed to let me conduct observations in their classrooms. Upon receiving their approval via e-mail, I requested the names and e-mail addresses to reach out to each mathematics teacher's collaborative partner. Once permission was granted from all participants, a schedule was worked out with the teachers. I attended Ms. Graham and Mr. Hudson's first period, double-blocked Algebra Part I class every day and Mrs. Griffin and Ms. Caldwell's last period, double-blocked Algebra Part I class everyday in the month of January. There were three instances of no school in which I did not attend; two snow days and one teacher workday. I functioned as a silent observer for each of the nineteen 90-minute classes I observed for

each collaborative pair. This means I did not participate in any classroom activities, engage with students, or offer feedback to either of the teachers in the classroom. This role is necessitated by the interpretivist paradigm as this study focused on how teachers make meaning of their roles in the classroom and it was important to capture the teachers' voices, not my own.

Data Collection Methods

In order to better understand the meaning-making which teachers go through to define their roles in the collaborative classroom, data for this study were collected over the course of four weeks in January 2017 and include classroom observations, teacher interviews, and informal interactions such as conversations before and after class which served to supplement the formal teacher interview data. These multiple sources of data allowed for continuous triangulation via crosschecking, strengthening the credibility of the results of this capstone. Because data collection and data analysis occurred simultaneously through the utilization of analytic induction, the data collection timeframe was dependent on new cases continually confirming hypotheses that arose during initial observations.

Observations and Field Notes

Each collaborative pair was observed for 29 hours. The purpose of these observations is to better understand what each teacher's enacted role is in the classroom and to identify strategies each teacher might employ to encourage or sustain mathematical discourse in the classroom. These strategies could include the use of questioning to engage in discourse, using student thinking to propel discussions, or

asking students to explain or justify their work. Focal points for the observations included:

- The co-teachers' "typical" instructional routines or lesson structures and what these look like.
- The co-teaching models utilized by the pair.
- The strategies used to support classroom discourse.
- The role each teacher assumes each class period.
- The co-teachers interactions with each other during class.
- If and how the teacher's content knowledge plays a part in his or her role and ability to facilitate discourse.

Field notes were typed in raw form on my personal computer during class observations. Quotations were included as much as possible so the teachers' voices came through. In addition to observational data, these notes include the nature of my presence using the following inferential codes: Observer Note (ON), Analytical Note (AN), Methodological Note (MN), and Observer Comment (OC). Observer notes were not significant to the data, however, later aided me in the transcription process. A methodological note highlights how the research methodology is affecting the data collection. These included comments about how my own relationships with the teachers were developing, reminders of things I needed to do to continue the study, or ideas I was having about how to solve problems. Observer comments are low-level inferences that help capture nuances, such as tone, made by the participants in the study. This is in contrast to analytical notes which are high-level inferences related to my theoretical frameworks and served as the basis for my analytic memos during the analytic induction

process. More specifically, analytical notes included information about themes that were emerging, patterns that I saw in participants' experiences, connections between experiences, new ideas, and my interpretations of the meanings of events and teacher's comments. Figure 10 depicts an example of each of these codes being used in my field notes. Within 24 hours of the observation, these field notes were be transcribed and reviewed so the information would remain fresh. The field notes did not include any sensitive information that would identify any of the participants or the school they teach in.

T2: You have x in both top and bottom? What happens if you have x in top and bottom? Where are there more x at? Close…what does division mean when you make things smaller? When you divide exponents you subtract…when you multiply exponents you add them.

T2 walks over to a student who says he is done. T2 looks over his paper and moves on.

T2 tells T1 he wants to go over the warm-up [ON: Can't hear T2 because he is not facing me and talking quietly].

T1: "…you want to go over it? Ok." [MN: Need to add interview questions about informal planning; AN: Most of the planning between these two teachers seems to be quick, informal, and on the spot…I wonder how this might affect instruction].

T1 "Alright guys if you are done I will pick them [warm-ups] up."

[ON: Students switch papers and grade each other's]

T2: "Alright so take a look at this real quick guys [referencing the warm-up]".

T2: "This first one we haven't seen for a while." The problem is *Simplify* $(2x)^3(xyz)^{-1}$

T2: "This is a power to a power…. everyone is going to get a three".

T2: "What is 2 to the third power? What is x to the third?"

T2: "What happens when you have negative exponents? Everyone is going to get a negative one?" [OC: Students do not have time to answer T2's questions].

Figure 10. Sample of codes used in field notes.

Teacher Interviews

Each participating teacher was individually interviewed using a semi-structured interview protocol (see Appendix C for interview protocol). This protocol includes questions about how the teacher envisions his or her role in the classroom, school and district supports for co-teaching, and how the co-teaching model supports mathematical

learning for students with disabilities. It was my initial hope to interview administrators at the school or district level to learn more about the school or district vision for co-teaching, how teachers are paired, and what the district goals for the instructional model are. Although I did not receive a response from any of the administrators I contacted for an interview, I was able to learn more about these topics through the individual teacher interviews. Each teacher was interviewed one time. Interviews last between 40 minutes and 55 minutes and occurred during each teacher's planning period. These interviews were audio recorded to allow for an accurate record of what was said. The recordings also served as an opportunity for a peer to check the themes derived from the interviews to ensure no unsubstantiated assumptions are made. The interviews were transcribed within 36 hours of them occurring. During the transcription process, I kept a list of questions that arose from the teacher responses or instances where the teacher did not actually answer the original research question. Clarifications to teachers' interviews were made by informally asking follow-up questions to the teachers before or after class. The data generated from the interview, taken together with the classroom observations, formed the majority of the data used to make the assertions for this research.

Collaborative Planning Meetings

Another data point for how teachers define and enact their role in the collaborative classroom is their participation and actions during planning meetings. Incidentally, neither pair met to co-plan during the four weeks I observed them. Instead, all of the co-planning occurred in the brief moments before class began or after the bell rang before the next class entered the classroom. For these instances in which I was present, I was still able to focus on who took the lead for instructional planning, although

it was unclear from these quick interactions how the collaborative pairs decided which teaching methods to employ or which specific strategies should be used to meet the needs of all students in the classroom. Because formal meetings did not occur during the four weeks I was at the school, these micro-planning instances helped give a more complete picture of each co-teacher's enacted role.

Data Analysis Methods

Data Condensation

Analysis of the data occurred utilizing a mixture of analytic induction (Erickson, 1986) and coding methods. Employing this method, I first generated empirical assertions (hypotheses) based on the co-teaching literature and my conceptual frameworks. As the data (consisting of field notes, audio tapes, and interview transcripts) were collected, they were assessed on whether they confirmed or denied these assertions. For example, one of my initial assertions based on the literature was collaborative pairs that co-planned on a regular basis were more apt to use co-teaching models other than one-teach, one assist or one-teach, one observe. Over time, the data forged this assertion to focus more on how the relationship between co-teachers had a bigger part in the roles each teacher assumed during instruction, rather than the frequency with which teachers met and planned together. The data were also analyzed for any emerging patterns that were not part of the original assertions. These patterns were coded during a holistic and repeated reading of the data, both during the field research and after. Analysis of these codes, in conjunction with the inferential codes, allowed for the refinement of my empirical assertions. These assertions were conclusions about the data made through analytical induction and built upon themselves them from narrow in scope and low in inference to broad in scope and

high-inference. During the data collection and condensation process, existing and new data were continuously read and re-read, which did result in many changes to the original hypotheses. The assertions were continuously reworked until they accurately described the data. Once assertions were modified, I worked to confirm these assumptions. Data was re-analyzed to seek disconfirming evidence and I engaged in two peer debriefing sessions to ensure assertions are truly representative of the data. Figure 11 illustrates this qualitative data analysis process.

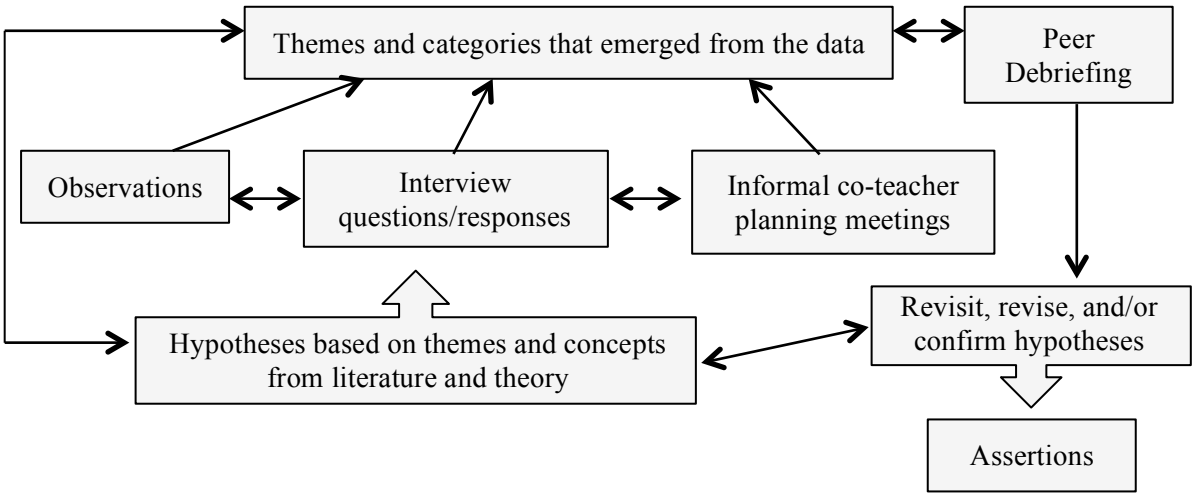

Figure 11. Model of data analysis.

Validity Criteria

Internal Validity

Erickson provides five criteria in terms of validity. The first is data should be as inductive as possible (1986). This requires the researcher to be in the field for an extended period of time (prolonged engagement) in order to have enough deliberate data for patterns to emerge. He refers to this process as "progressive problem solving"

(Erickson, 1986). In my initial planning, I hoped to attend each collaborative pair's class every other day (due to block scheduling) for four weeks. Once I was assigned to CHS and obtained participants for the study, I learned that CHS double blocks Algebra I Part I so the class meets every day. By having the opportunity to attend each collaborative pair's classes every day for four weeks, I was able to develop a deep understanding of the classroom norms, roles of each teacher, and how the teachers' roles affect the classroom discourse.

The second assumption is that there should be a variety of evidence. Erickson states it is necessary to triangulate the data across a variety of sources (1986). As described in the data collection methods section above, triangulation occurred through the cross verification of classroom observation data, interviews with the special education teacher, interviews with the mathematics teacher, and notes from the informal collaborative planning conversations between the co-teachers that occurred before, during, and after the classes I observed.

The third assumption is the researcher needs to be able to understand the complexity of the action between the participants and the meanings-in-action. Erickson states the meanings-in-action between two participants who continually interact are local in two senses. First, they are local in that these meanings are particular to these two teachers. Over time, these teachers form their own microculture where specific understandings and traditions are established. It is important interpretivists recognize these microcultures will differ for each collaborative pair, no matter the similarity between co-teaching pairs (Erickson, 1986). Second, the meaning-making occurring

between the participants is local in the sense that it is occurring in real time and that meanings formed today may be different than meanings formed yesterday.

The fourth assumption is that the researcher needs to constantly seek disconfirming evidence. Through the use of analytic induction, I inferred general conclusions from particular instances. Once I established themes or patterns, I sought disconfirming evidence through the observations and interviews so I did not become biased and stuck within my own assumptions. Doing so strengthened the overall plausibility of the findings. Lastly, in the fifth assumption Erickson states it is necessary to analyze discrepant cases. This can be done through careful comparative analyses. It is my job as a researcher to persuade the audience that assertions made do exist by providing sufficient evidence, which will be presented in the next chapter. According to Erickson, the point of the research process is to search for falsification, which acted as a guiding principle in my research methodology.

External Validity

It is important to note that this case study was not conducted with the intention of being generalizable. Instead it was simply meant to better understand the meaning-making processes of the teachers solely at this research site. According the Erickson (1986) "One discovers universals as manifested concretely and specifically, not in abstraction and generality" (130). Although my study is local and particular for this site, the next two chapters will display general properties through the use of rich, thick description. It is my hope that I have provided sufficient detail to readers so that they may have the opportunity to transfer the results to other settings, situations, and co-teaching partnerships if appropriate.

Ethical Considerations

Before beginning this capstone, plans for this case study were subject to approval by the University Institutional Review Board (IRB) and were approved on November 11, 2016. After receiving IRB approval, I completed and submitted an application to do research for the specific county I chose based on convenience. This approval was granted on December 6, 2016 and was accompanied by contact information for the principal of the school I was assigned to. At this point, I contacted the principal via e-mail to obtain further permission for conducting my study at CHS. Teachers who indicated they were interested in participating were given consent forms to sign. In addition to obtaining consent for every teacher participating in this study, I also kept the teachers informed of the purpose and activity of the study. This included making the potential risks explicitly clear to these teachers. Although there were no anticipated risks for the co-teachers who choose to participate, the possibility still existed that a participant could be identified by a member of his or her professional community (e.g., colleagues, administration, parents, or students). I strove to ensure this would not occur through any research materials related to the study, as pseudonyms were assigned to each teacher and the school/district from the beginning of the data collection period. Additionally, all files were password protected. In the event that there was a loss of confidentiality, it would not have put any participants at risk, as no personally identifiable information was collected during the observations or interviews. Finally, it was important to consider the relationship between co-teachers is based on trust so it was pertinent I took special precaution not to violate this trust in any way.

An additional risk to the participant may have included stress from being observed and/or interviewed. In order to minimize this stress, I frequently reminded teachers I was not evaluating them in any way and simply hoping to learn more about a meaning-making process. Furthermore, I openly communicated with teachers to ensure they understood they had the right to withdraw from the study at any time. I monitored each participating teacher for signs of stress during interviews (such as frequently checking the time, speaking quickly or giving short responses due to fatigue, a strained facial expression), however did not see any indication of such.

Researcher Bias and Assumptions

As a doctoral student in the Curriculum and Instruction department of the Curry School of Education and a former high school mathematics teacher with five years of teaching experience, it was impossible for me to remove myself from this topic as I have my own biases about collaborative teaching and mathematical discourse in the classroom. I was, however, aware of these biases and tried to be subjective while taking field notes and conducting my interviews. I have also worked with students of varying academic levels, students with disabilities, and English Language Learners so the class settings involving a collaborative teacher were particularly interesting to me. Using Erickson (1986) as a guide, I actively sought to make conscious decisions during my research project so my own prior assumptions did not mask assertions that should come through using the empirical data collected. Additionally, I used peer debriefing to have an outside opinion on whether the assertions made were appropriate given the data.

Summary

This capstone utilized a qualitative case study approach to examine two collaborative classrooms comprised of a mathematics and special education teacher. The study employed interpretivism to provide a framework for the data collection and analysis processes. The data, collected over a period of four weeks, included interviews and observations. A combination of analytic induction and systematic coding allowed several assertions to emerge and be tested. Erickson's validity criteria guided this capstone to warrant credibility, transferability, dependability, and confirmability. Ethical consideration and confidentiality remained at the forefront of the study.

CHAPTER IV: FINDINGS

The purpose of the study was to explore the meaning-making behind how teachers define their roles in the collaborative classroom and the potential impact these roles have on fostering and maintaining mathematical discourse for students. This study focused on two pairs of collaborative mathematics and special education teachers who were in their first year of co-teaching an Algebra I Part I, double-blocked class together. Through observations and semi-structured interviews, I attempted to explore answers to the following research questions:

1) How do school and school division systems and policies influence the roles of the teachers in the collaborative classroom?
    a. How are co-teachers paired?
    b. To what extent do teachers get to choose their co-teaching partner?
    c. How do schools and school divisions envision the role of the mathematics teacher and the special education teacher in the collaborative mathematics classroom?
2) How do teachers determine teacher roles in the mathematics collaborative classroom?
    a. How does the mathematics teacher make meaning of and define his or her own roles in the classroom?
    b. How does the special education teacher make meaning of and define his or her own roles in the classroom?
    c. What does the process look like?
3) How are the instructional and pedagogical responsibilities divided between the mathematics teacher and special education teacher?

a. How does content area affect these roles?
b. How does the mathematics teacher support discourse in the mathematics classroom?
c. How does the special education teacher support discourse in the mathematics classroom?

Each section details my resulting assertions based on analyses of individual teacher interviews, classroom observations, and/or collaborative planning instances. The findings and recommendations that resulted from this case study will provide the participating teachers, Central High School, and the school district with information about the observed co-teaching practices to help them make informed decisions for the future. Before introducing the findings I will present two vignettes, based on observation data and field notes from the study, which represent a typical day in each of the collaborative pairs' classrooms.

Vignette One: Mrs. Griffin and Ms. Caldwell's Classroom

Students are filing into the classroom, taking their assigned seats after they enter. Mrs. Griffin is standing outside the doorframe in the hallway, greeting students as they enter. Ms. Caldwell is inside the classroom and engages with students about their weekends. As she speaks with students, she goes over to a filing cabinet and grabs some graphing calculators to distribute to students. There are two other adults in the room who are each assigned to monitor two specific students and travel with these students throughout the school day. The bell rings and Mrs. Griffin comes inside the classroom and begins to distribute a warm-up worksheet to the students. Some students begin working on the problems as others talk with each other or continue to look at their

cellphones. A student enters the classroom tardy and Mrs. Griffin asks, "Kim, do you have a pass?" The student ignores her and goes to take her seat. Ms. Caldwell makes her way over to Kim and whispers quietly to her.

After a couple minutes of circulating and helping students get started, Mrs. Griffin says to the class, "Alright, how are we doing? Do you guys want to do an example together?" The students reply "Yes!" in unison and Mrs. Griffin goes to the front of the room to work out the first two problems with the class.

"What is it called when we give this number to both numbers in the parentheses? Good, we are distributing!" Mrs. Griffin continues to ask questions to the students as she works through the first two problems. "Negative four times positive five?" Students yell out "Twenty!" "Is it positive or negative?" Mrs. Griffin asks. "Good…that should be your answer to part A".

"What is that?" Ms. Caldwell exclaims. "An answer? Maybe you should be writing it down!" she says to students who have blank papers. Ms. Caldwell joins Mrs. Griffin at the front of the room for a moment before she begins circulating to see which students are still in need of help.

After the warm up is complete, Mrs. Griffin goes around with a clipboard to check off which students will receive full credit based on completion. As she does so, Ms. Caldwell connects with students by asking, "Did anyone go anywhere cool over the weekend?" Some students are excited to share their answers. As Mrs. Griffin walks by Ms. Caldwell, Ms. Caldwell whispers to her, "Do you want me to go over expectations?" Mrs. Griffin responds, "Yes, and I will go over grades." The two spend about ten minutes in total reminding students of expectations during warm-up, independent work,

direct instruction, quizzes and tests, group and partner work, and their five-minute break they receive at the halfway point of class. They are both standing side-by-side at the front of the room and although Ms. Caldwell has taken the lead on expectations, Mrs. Griffin interjects at times to reiterate certain points. Similarly, Ms. Caldwell does the same thing when Mrs. Griffin talks about grades on the exam the students just took.

Mrs. Griffin and Ms. Caldwell continue to both stand at the front of the room as Mrs. Griffin introduces the new unit on slope. She has decided to tie in food trucks as the theme for the unit and explains that students will be designing their own food trucks in groups of three or four as they learn about slope. She gives students the directions for the rest of the day, which include finding a group, picking a specialty item they will sell (e.g., ribs, empanadas, or pizza), and finding a recipe for their food item. While Mrs. Griffin gives the directions, Ms. Caldwell often chimes in with examples or stories. The students are then released to go work on their assignment.

Vignette Two: Ms. Graham and Mr. Hudson's Classroom.

School is just starting and students are rushing into the classroom to beat the tardy bell. As it rings, the morning announcements come on and students stand for the Pledge of Allegiance and observe the minute of silence. A couple of students are whispering during this time and Mr. Hudson's voice booms from the back of the room, "Minute of silence please! Thank you!"

Ms. Graham is at the front of the room and is trying to hook up the document camera. Once it is time for class to begin, she greets the students. "Good morning everyone! We are going to start class today by looking at two of the most commonly missed problems on your midterm!" Some students groan and Ms. Graham and Mr.

Hudson begin to pass back the midterms to students. Some students flip through their responses while other students leave the midterm closed. Ms. Graham begins, "Ok so the first one we are going to look at is number thirty which was a free response problem." Mr. Hudson has moved to the back of the room and says sternly, "Phones need to be put away and everyone needs to be looking at the problems Ms. Graham is about to do. You need to see why you got the problem right and why you got it wrong."

Ms. Graham begins going over the problem which states, "Solve $\frac{5m-6}{2} = -5$*". She calls on a student, "Anna what does 'solve' mean?" The student responds, "Isolate". "Good, what are we going to isolate here?" Another student replies, "M". "Great, and if we have a fraction, what do we need to do first?" Ms. Graham continues working out the problem in the front of the room and calls on students to state the next step. Mr. Hudson is perched at a high-top table in the back of the room and is on his laptop. After Ms. Graham finishes the problem she states, "What's more important is learning from the mistake than the mistake itself".*

Ms. Graham begins the second problem which says, "Simplify $x^4y^3 \cdot (2y^2)^0$*. Some students are not paying attention and Mr. Hudson stands and yells from the back of the room, "So everyone talking got the problem correct? We are not doing this for our benefit…we are doing this for your benefit because these were the most common problems missed on the midterm." The classroom goes quiet and Ms. Graham agrees, "Mr. Hudson is right. I know it is hard but we need to remember everything we did last unit."*

Ms. Graham continues working out the problem, calling on students to state what to do during each step of the simplification process. After she finishes, Mr. Hudson

states, "How could you have checked that? [Mr. Hudson makes his way to the front of the classroom next to Ms. Graham]. How could you check that problem in your calculator? [Does not leave time for students to answer]. That's just one you gotta realize and remember… 'Two carrot zero has to give you one'. Don't just guess something. Ms. Graham and some of you did that on the midterm…If you don't know that is a great strategy. If you do know what to do, plug it in your calculator and then do it because that takes less time."

Ms. Graham shifts uncomfortably but says in an optimistic voice, "Okay guys. Today we are going to start a new unit so we are going to begin by playing a little game." She pulls up a PowerPoint and shows students the following image (see Figure 11).

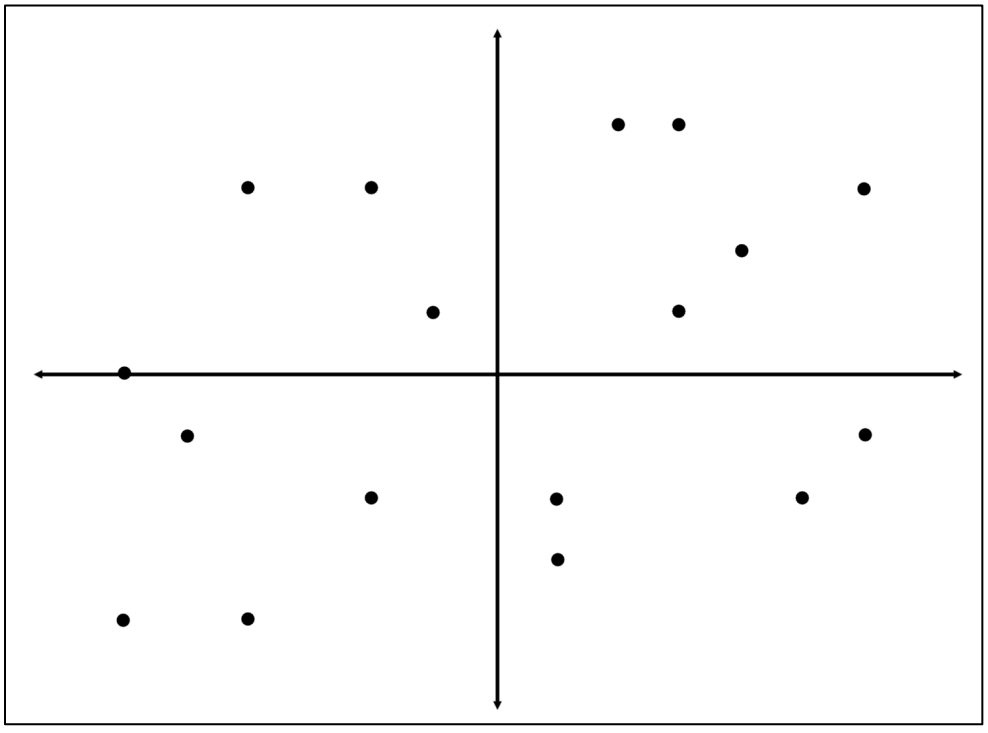

Figure 11. Image from lesson during observation on January 3, 2017.

Ms. Graham continues, "I want each of you to pick a point in your head. Once you and your partner each have a point, I want you to take turns describing where you point is to your partner to see if they can guess which one you were thinking about." During this time, Mr. Hudson has resumed his seat at the back of the room and is sending e-mails from his computer. Students work to guess each other's point and this continues for about three minutes.

"Okay, now I want you guys to look at your point." As Ms. Graham says this, she clicks a button on the computer and a coordinate grid appears behind the points (See Figure 12). "Now! I want you to pick a different partner and take turns explaining where you point is to them". Students use the grid to have their partner locate their point and directions such as "go left four spaces and up three" can be heard.

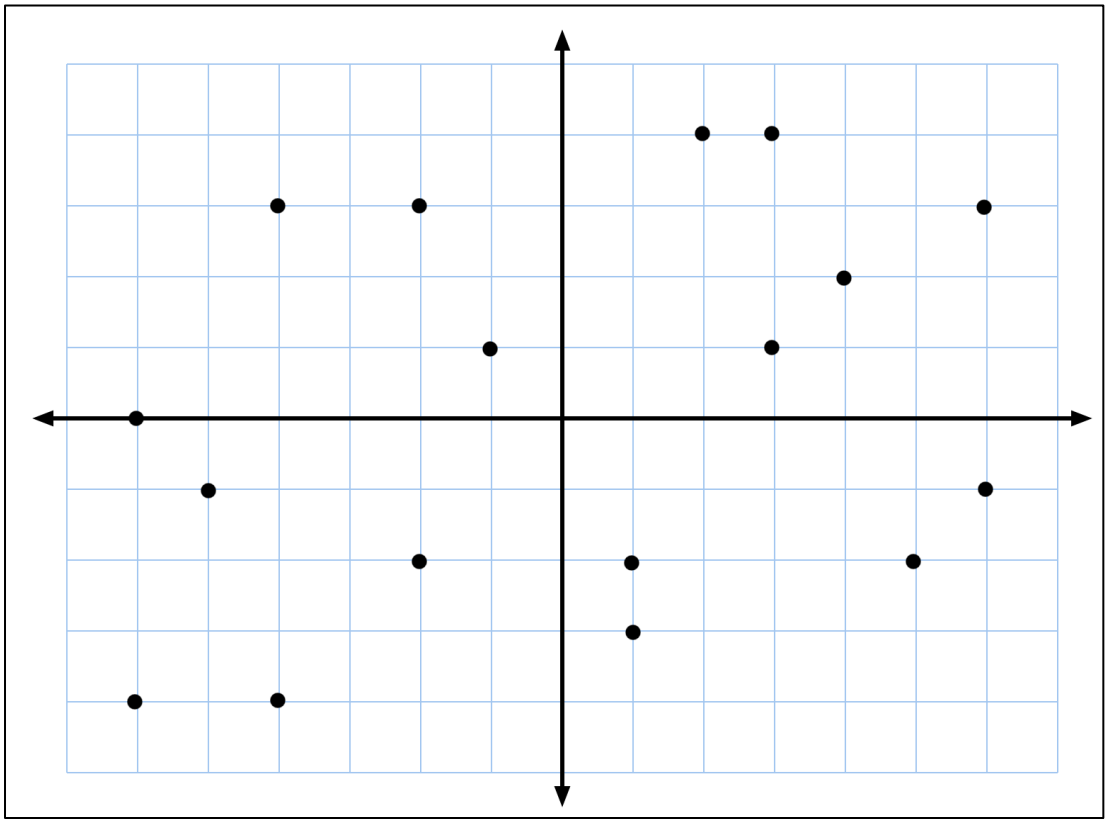

Figure 12. Image from lesson during observation on January 3, 2017.

Ms. Graham brings the class back together and asks students which picture was easier to describe where their selected point was. Students unanimously agree on the second image. "So what did the coordinate grid give us?" Ms. Graham asks. Students offer several responses such as "the distances away from the middle" and the "coordinate pair". Ms. Graham enthusiastically nods her head, "Yes! The coordinate grid allows us to have an exact location so we can easily describe where the point lies in relation to the x-axis and the y-axis. Does anyone remember what the very middle point is called?" She continues to talk about the coordinate grid. Mr. Hudson offers from the back, "Guys, this is just like a map. How many people have been on a boat? How do you think they knew where to go?"

Ms. Graham tells the students they are going to practice naming some points on the coordinate grid and begins to pass out a worksheet. Students begin and can be heard double-checking points with their partners. Mr. Hudson gets up from his seat at the high-top table and begins circulating the room to see if students need help with the worksheet. "Be careful which one you say first," he states. "Don't say over…you need to say left or right." After Ms. Graham hears this, she goes back to the front of the room and addresses the class. "Alright guys listen up! Let's say we have a point here [she puts her finger on $(-3,2)$*. Since we are moving to the left, this is going in the NEGATIVE direction so we need to say NEGATIVE three. Okay?"*

The students continue to work on their worksheet and begin handing them in to Ms. Graham as the class comes to a close. Mr. Hudson instructs students to make sure their area is clean before they line up at the door to leave class.

These vignettes offer a look inside two collaborative classrooms at CHS. When considering the types of co-teaching that occur in each classroom, each teacher's physical position and enacted role became important for analysis.

Mrs. Griffin and Ms. Caldwell's observations consisted of mostly Team Teaching with instances of the One Teach, One Assist model during the lesson. During an instructional episode, most of which were direct instruction, both teachers stood in the front of the room in close proximity of each other for the entire duration of the instruction. In the fewer instances when the collaborative pair utilized the One Teach, One Assist model, Mrs. Griffin took the lead more frequently when it involved introducing new material, however Ms. Caldwell often led the students through the warm-up or review material. This was consistent across the observations for this collaborative pair.

Two co-teaching models characterize Ms. Graham and Mr. Hudson's collaborative teaching style: One Teach, One Observe and One Teach, One Assist. Ms. Graham was the lead teacher during instruction for all but two observations, one of which was because she was absent from school. In the other instance, Mr. Hudson took the lead during the introduction of new material because he said he "loves teaching the students how to find the slope of a line". Although Ms. Graham was the lead teacher during daily instruction, Mr. Hudson would occasionally lead the warm-ups. After instruction of new material concluded, both teachers would circulate the room and assist students.

The remainder of this chapter consists of three sections that outline the assertions made from the data. These assertions are related to teacher perceptions of stakeholder definitions of Team Teaching, the influence of the collaborative pair's relationship on the

enactment of co-teaching, and the importance of content knowledge for questioning and response to student error in the classroom. Chapter five will frame how the assertions help to answer each research question and will discuss the findings.

Assertion 1: Different stakeholders may have different definitions of "Team Teaching" and different priorities/visions for the implementation of co-teaching.

The formal definition of Team Teaching from the co-teaching literature is, "both teachers working together to deliver instruction to the same group of students at the same time" (Cook & Friend, 2003). Early in the data collection period, it became apparent different stakeholders had different definitions for the Team Teaching model of co-teaching and how co-teaching in general should be enacted in the classroom. These differences contributed to a lack of coherence amongst each stakeholder's priorities and visions for co-teaching in the collaborative classroom. Table 2 outlines these differences, which will be unpacked further in the subsequent sections.

Table 2
Teacher Perceptions of Different Stakeholder Definitions and Priorities for Team Teaching Model

Stakeholder	Definition	Priorities
Teachers		
Mrs. Griffin	Division of planning (with peer review) Team Teaching instruction	Providing high quality content knowledge to students (Mrs. Griffin)
Ms. Caldwell		Providing access to content for students with disabilities (Ms. Caldwell)
Ms. Graham	Division of planning (without peer review) Division of instruction	Inquiry-based instruction (Ms. Graham)
Mr. Hudson		Standardized test preparation (Mr. Hudson
School-level Administrators	One content and one SPED teacher teaching in the same physical space	Convenience scheduling Individual teacher evaluations Parent and student perceptions of collaborative classes
District-level Administrators	Both teachers always delivering instruction simultaneously at the front of the classroom	Parent and student perceptions of collaborative classes Parity in responsibilities

The Teachers

Definitions/Interpretations of Team Teaching.

The school district mandated a professional development (PD) for all teachers who were assigned a collaborative class during the teachers' pre-service week. This included content area teachers and special education teachers. All four participating teachers attended this mandatory PD session in August. This PD session lasted approximately an hour and a half and was led by one of the instructional coaches for the division. The teachers in this study stated that during this PD, collaborative pairs were instructed they should use Team Teaching as the dominant co-teaching model in their classrooms. When interviewed, none of the teachers could remember the exact reason the school division was focused on this particular model, however during his interview Mr. Hudson offered, "I think the administrators want to make sure both teachers are working and that the [students] don't know who the SPED teacher is." Although all four teachers stated this district directive *did* directly affect how they envisioned their role in the collaborative classroom during their individual interviews, Team Teaching was only observed in Mrs. Griffin and Ms. Caldwell's class.

During Ms. Caldwell's interview she reiterated her perception of the intent of the PD she received by stating, "This [division] focuses a lot on Team Teaching and the idea is that both teachers [are] working together to deliver instruction to the same group of students at the same time…I think [Mrs. Griffin] and I are successful in this most of the time…We are always leading things simultaneously so I feel there is no way the students would know I am the SPED teacher."

Although Mr. Hudson and Ms. Graham both attended the same PD for collaborative teaching during the pre-service week, the district's emphasis on Team Teaching functioned differently in defining their roles as it did for Mrs. Griffin and Ms. Caldwell. During an interview with Ms. Graham she said,

> So at the beginning of the year [the district] had a pre-service meeting for all teachers to come and they were supposed to sit down and kind of like define the rules. They really emphasized the like equal partnership and so on. And so yeah we kind of just trade off who is going to do the planning. Like some days he plans us, but I probably plan more. That's not because he doesn't want to…I just do it because I enjoy it.

Although Ms. Graham stated she and Mr. Hudson take turns planning the lesson, she did say this planning happens outside of school and not during the common planning period. Mr. Hudson admitted that special education team meetings, IEP meetings, or meetings with recruiters for the sport he coaches take up most of his planning period time.

It's important to note the two collaborative pairs interpreted team teaching in two very different ways, even though they attended the same training. The first pair, Mrs. Griffin and Ms. Caldwell, understood Team Teaching in the way the literature presents it; that both teachers plan and deliver instruction to the whole class together at the front of the room. The only deviation in their enactment of Team Teaching was they do not physically sit down and plan lessons together. Instead, each teacher plans certain days and they engage in peer review via e-mail before the implementation of the lesson occurs. While there is still division of labor during co-planning, each teacher has the opportunity to see what the other teacher has planned prior to the lesson so they are prepared to

participate in the instruction. This peer review also allows for changes to be made to strengthen the content of the lesson or make the content more accessible to students with disabilities in the classroom.

Ms. Graham and Mr. Hudson liken Team Teaching to equal work, and divide the responsibilities of teaching to lessen the work of each person. This became especially apparent in an interview with Ms. Graham where she said laughingly,

> Usually it's like…I am so glad for someone else to be planning…they can do whatever they want! Even if it's not exactly how I would do it…even if it's not close to how I would do it…I'm just like "someone else is doing it today"!

This implies that when Mr. Hudson plans the lesson, she does not participate in the planning. In addition to differences in definitions amongst county and building-level administrators, these findings indicated substantial differences between the co-teaching pairs as well.

Division of labor.

Planning. Both co-teaching pairs in this study engaged in division of labor, although how they split the responsibilities looked very different for each partnership based on the aforementioned differenced in interpreting Team Teaching. While planning is necessary for implementation of the Team Teaching model, neither of the co-teaching pairs in this study formally met to co-plan during the month of observations. In the case of Ms. Graham and Mr. Hudson, Ms. Graham indicated the two normally sit down and plan the upcoming unit at once:

> So we have fallen off of this a bit in the last couple of weeks, but ideally we sit down together and plan the whole unit out…like the goals and objectives…and we try to

> split it up and get a rough, rough day-by-day schedule which always ends up changing. And for each lesson, we usually just trade it off. We try to have both of us in front of the classroom everyday and sometimes that works, and sometimes it doesn't. So usually if I plan the bulk of the lesson, then [Mr. Hudson] will review the warm-up or vice versa…sometimes we don't stick to that but that's the idea.

Although Ms. Graham spoke about her and Mr. Hudson trading off planning and instruction, Mr. Hudson only led the class during two of the nineteen times I observed. One of these instances, Ms. Graham called out sick and e-mailed Mr. Hudson a quiz and worksheet to do with the students. The other time, Mr. Hudson planned a lesson on how to calculate the slope of a line given the graphical representation of the line.

Ms. Caldwell and Mrs. Griffin also spoke about sitting down together before a new unit starts to co-plan. In her interview, Ms. Caldwell attributed their planning as one of the successes in their partnership:

> I think we were pretty successful most of the time. So for me that means that we plan together, and we might not be able to sit down together all the time but we like to talk about what the lesson is going to be. We're on the same page. We edit each other's work. And we're open and honest about what needs to happen on any given day.

Mrs. Griffin had similar sentiments about their ability to plan together:

> Typically I always plan Monday and Tuesday and then [Ms. Caldwell] plans Wednesday and Thursday. She will kind of play off of what we've done for the first two days. Friday is normally kind of a catchall where we try to do something fun with the kids. But even when the other person is planning, we e-mail each other the lesson several days before so we know what is happening ahead of time.

Although Mrs. Griffin and Ms. Caldwell might not always plan in the same physical space, this notion of editing each other's work and looking at lesson plans prior to the day of instruction is an element missing in Ms. Graham and Mr. Hudson's co-planning. This opportunity for peer review and contribution of expert knowledge is not present between these two teachers which could influence the quality and ability for students with disabilities to access the material

Both collaborative pairs also engaged in on-the-spot decision making regarding who would lead a particular activity or portion of the lesson. Vignette one illustrated what this quick decision making often looked like when Mrs. Griffin and Ms. Caldwell determine who will go over expectations versus exam grades.

Instruction. As stated earlier in this chapter, the majority of Mrs. Griffin and Ms. Caldwell's instruction followed the Team Teaching model as it is defined in the literature. Even when Mrs. Griffin led the introduction of new material, Ms. Caldwell would be at the front of the room as well. She often acted as a note-taker and would write what she thought was important on the white board for students to copy into their own notes. Sometimes, she would interject and help make the concept more relatable for students. Other times she would offer suggestions to make the lesson more accessible for the students with disabilities. For example, during one lesson after a snow day, Mrs. Griffin presented her students with the following worksheet (see Figure 13). Students were to determine the slopes for each pair of points and match them with the lines on the graph.

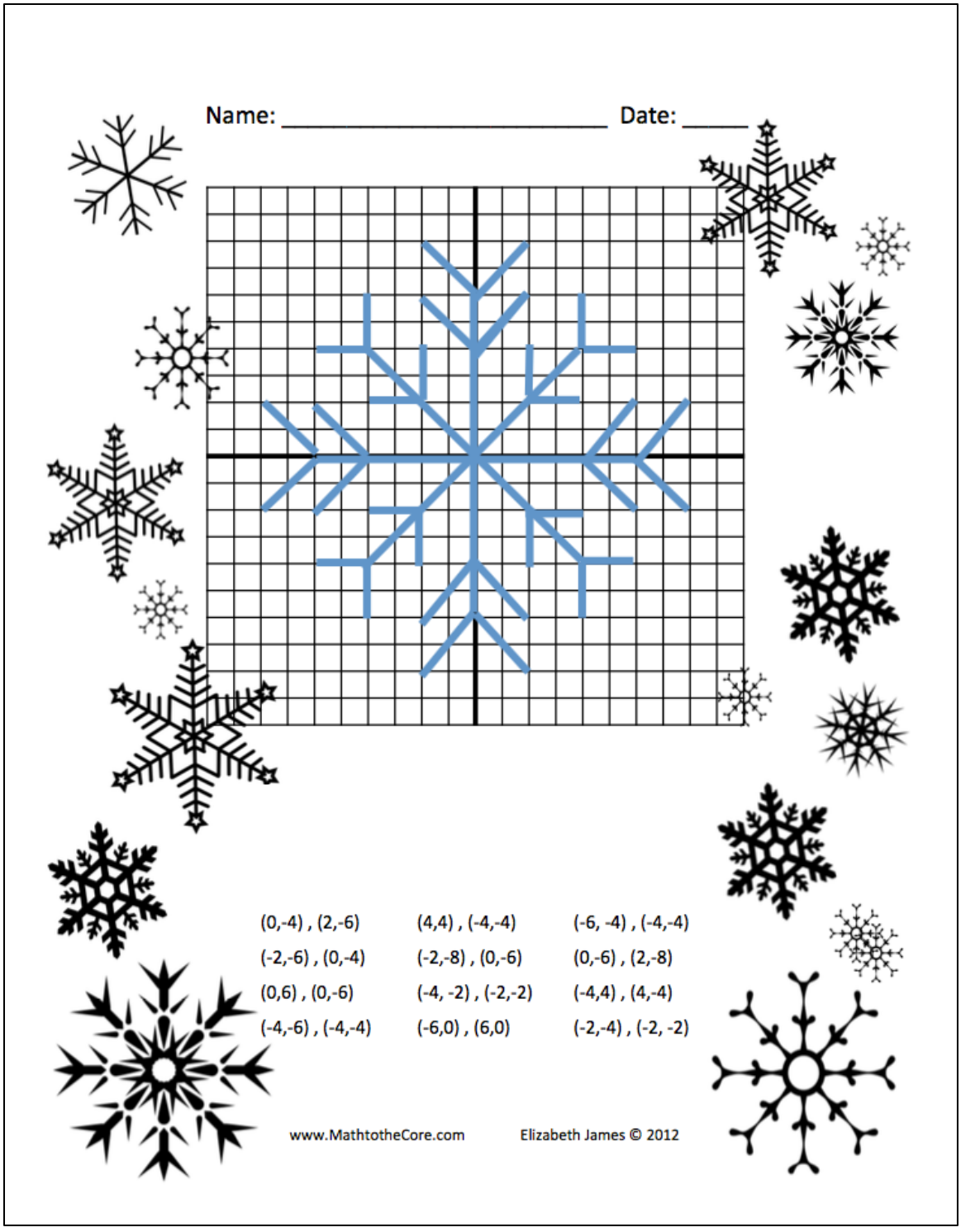

Figure 13. Worksheet image from lesson during observation on January 13, 2017.

As Mrs. Griffin is going over the directions, Ms. Caldwell says, "Hey guys…I am going to pass out some colored pencils and markers so you can keep track of which points go to

which line." She instructs students to trace the line with the corresponding color before moving on to the next set of points so they can keep track of everything. Similarly, when Ms. Caldwell would review content and lead lessons, Mrs. Griffin would also stand at the front of the room during instruction. She often helped answer content-related questions or spoke about potential misconceptions to warn students of them ahead of time.

Although Ms. Graham led the majority of the instructional episodes in their classroom, Mr. Hudson would often interject with real-world comparisons to try and make the content more relatable for the students. One example of this occurred during a lesson on intercepts. Ms. Graham asked the class where the x-intercept was for a particular line. None of the students in the class raised their hand or offered an answer. Mr. Hudson said, "Think about in football…the intercept is where someone crosses in front of you. Just like on the graph, it's where it crosses the axis. What is the y value where it crosses?" Some students say "zero" (correct answer) while other students are confused and look at the y-intercept and say "four". Despite this, Mr. Hudson says, "Good! If you are confused…think about it in football terms!" Although he did not address some of the students' misconception about where the x-intercept is located, Mr. Hudson was able to help some students arrive at the answer.

Behavior management. Research (Bessette, 1999; Buckley, 2005; Feldman, 1998; Rice & Zigmond, 2000; Rosa, 1996; Trend, 1998; Yoder, 2000) indicates the special education teacher typically assumes responsibility for any problem behaviors that arise in the co-taught classroom. The findings of this study are consistent with the prior research. The following vignettes and interview excerpts illustrate these findings.

Vignette three: Mrs. Griffin and Ms. Caldwell's classroom. Students are working on a warm-up at their seats. Ms. Caldwell has not entered the classroom yet although the tardy bell has rung. Several students are arguing about their assigned seats and Mrs. Griffin is trying to calm them down. As this is happening, Ms. Caldwell enters the classroom and says, "Alright, it is way too loud in here…I can hear you guys down the hall…also, there are several people who have music turned on…I can hear the music."

The students seem to settle down and Mrs. Griffin begins reviewing the warm-up. Ms. Caldwell goes to join her at the front of the classroom. "Ok, so at Walmart it costs $10.33 for five pounds of chicken and at Sam's Club it costs $8.99 for four pounds of chicken. I want to know how much it costs per pound," Mrs. Griffin states. None of the students respond. Ms. Caldwell says, "Guys! Let's figure it out…how do we find out how much one pound costs for each?" Several students offer answers and Mrs. Griffin records them on the board. Mrs. Griffin then asks students to compare the price per pound of chicken for Kroger and Wegmans. The students immediately get off topic and begin discussing the new Wegmans in town. Mrs. Griffin begins, "Which store is the cheaper…" but can hardly be heard over the students. Ms. Caldwell steps in and says, "GUYS! [Mrs. Griffin] can't get more than one sentence in because everyone is yelling! The expectation is that you raise your hand." Mrs. Griffin continues with the lesson.

It is clear from this vignette that Ms. Caldwell takes the lead on the classroom management and she stated so in her interview:

> One challenge for us is that I think discipline has to be equal. Mrs. Griffin has a hard time with it and I tend to be the bad guy. And that's because I step into that role because it's hard for me to step back and let someone else handle something. So we both are continuously working on handling discipline in the classroom.

Mrs. Griffin recognizes this challenge as well and stated:

> I have a hard time enforcing the classroom expectations whether that's ensuring students are sitting for five minutes quietly doing a warm up or whether that's raising their hand to ask a question. When we first started the school year, they would just completely act out like they didn't know how to ask for help. So that was the biggest challenge in the beginning…how to ask for help without screaming or getting frustrated. You I didn't know how to do. Initially I thought I did. But it's one thing to read about all these strategies for them, which I did before, and to be in the moment. That's what's really hard here. That's the biggest challenge [referring to behavior management].

Mrs. Griffin and Ms. Caldwell agree that both teachers should be managing behavior even though Ms. Caldwell takes on the role of the enforcer in the classroom. Part of this is her dominant personality but Ms. Caldwell also feels like it is partly due to the fact to Mrs. Griffin has taught higher level courses for so long, she has forgotten about the behavioral challenges teachers face in the classroom. This seems to be a point of frustration for Ms. Caldwell as she stated in her interview:

> Sometimes I get frustrated when student behavior gets really poor or disrespectful. I'm sure she gets frustrated with me about things too. I've had to say, "I need you to back me up more explicitly". Like when I'm like laying down

> the law or making an expectation clear, I want verbal agreement on it…like some kind of indication that she is on the same page because the students see that. It's like the good cop, bad cop thing. And it's gotten better but it's still not perfect. And I think that's probably the hardest thing about a relationship is like how do you get on the same page all the time?

Although Mrs. Griffin and Ms. Caldwell are successful in other aspects of their collaborative teaching, the imbalance of behavior management responsibility is a point of tension in their relationship. This point of friction was also a component of Ms. Graham and Mr. Hudson's relationship as well.

> *Vignette four: Ms. Graham and Mr. Hudson's classroom. The students are working on an activity where they have to draw a graphical representation a person being shot out of a cannon in relation to their height versus time. Ms. Graham is trying to get their attention to clarify the directions but students are not quieting down for her to speak. Mr. Hudson bellows from the back of the room, "GUYS! LISTEN UP!". The students quiet down just long enough for Ms. Graham to re-explain the directions. The students continue working on the task for about four or five more minutes before they start getting frustrated that they can not get their line to match the motion of the cannon person. The class quickly gets out of hand with students laughing and moving out of their assigned seats to go visit with friends across the room. Mr. Hudson, who has been perched at a high-top desk, hops down and yells, "Be quiet and return to your seat. Y'all are out of control and we are not continuing like this. If you guys can't handle these activities that Ms. Graham has planned then we are just going to do*

> *worksheets!". The volume of Mr. Hudson's delivery initially started Ms. Graham but as he speaks, she starts to nod her head in agreement. The class continues to work in silence.*

In her interview, Ms. Graham discussed how often, she would let behavior go longer before addressing the issue. During the observed classes she seemed more tolerant of noise and movement in the classroom and sometimes seemed surprised when Mr. Hudson would yell at the students to calm down. She identified differences in behavior management as a challenge in her co-teaching relationship with Mr. Hudson:

> And I think the challenge for us, and this has been our challenge the whole year, is just we have very different classroom management styles and also very different experiences. I mean he's obviously had ten times as much experience as I have, but these experiences we have had has been different from each other. And just trying to balance our different styles and our different preferences has been hard.

Mr. Hudson reiterated this sentiment in his interview when he said:

> I think we are just different with some things…I try to knock things out early to nip them in the bud…you know I can tell what is going to happen from my experiences in the past…she's not really big on doing that. Our age difference might have something to do with it. I am very disciplined and strict and I think at times she is more lenient on allowing things to happen.

Both special education teachers viewed themselves as the "bad cop" and spoke about how they were stricter than their counterpart when it came to behavior management.

Their lead on managing students in the classroom is consistent with reported roles of special education teachers in the literature presented in chapter two.

Focus on Test-Taking Strategies for Virginia SOL Test. The previously presented sections on how the co-teachers in this study divided the responsibilities in the collaborative classroom are consistent with recurrent themes in the co-teaching literature. The use of coding revealed an additional theme regarding standardized testing not cited in prior studies. In the state of Virginia, students take an end-of-course test for Algebra I. Equipping students will test-taking skills became an additional responsibility Mr. Hudson took on in the classroom. Although Mr. Hudson frequently assumed the role of the assistant or observer, when he did contribute during a lesson, he often spoke about test-taking strategies or how the problem could be solved in the calculator (without much thinking on the part of the student), specifically in relation to the Virginia Standard of Learning (SOL) end-of-course test. The following vignette helps illustrate this component of his role.

> Ms. Graham puts up a problem on the board and asks students how to begin solving it. The problems asks students to solve $4(2a + 3) = -3(a - 1) + 31$. After Ms. Graham has walked students through the problem Mr. Hudson makes his way to the front of the classroom. "Hey guys, if you don't know the answer…Plug it in!" "Yes, you can do that if this is a multiple choice problem," Ms. Graham starts, "but if it is a free response"…Mr. Hudson starts verbally telling students how they would plug in the answers choices to determine the correct answer. "This is one of the most difficult problems on here!" Mr. Hudson

exclaimed. "Try! Don't just guess something…this is a test taking strategy for the SOL". With that he returns to his seat in the back of the room.

The SOL is a subject he reiterated often when he addressed the entire class. For example, during a lesson on domain and range he stated, "Hey guys just a reminder when we talk about domain and range…remember on the SOL...you have to use those brackets…if you use parentheses it will be marked wrong…that would be a shame." Mr. Hudson is referring to interval notation. Although he is incorrect (brackets are used to include the number in the interval, while parentheses exclude the number), Ms. Graham just nods quickly and continues the lesson. In an informal interaction with Mr. Hudson, he said to me, "I mean these kids can't even show up to class with a pencil and they [the administration] think these kids can pass? They can't! Most of these kids are going to fail the SOL and then they can't graduate." According to Mr. Hudson, there is a lot of pressure on the special education teachers to get these students to pass. He talked about students who had "two labels", for example a student with disabilities but was also a minority, and how if these students failed the SOL, the school gets penalized in two categories. He attributed the SOL and the corresponding pass rates to a lot of the pressure he special education teachers feel. This theme was not part of Ms. Caldwell's observation or interview data, however, this could be due to her position as a first year teacher never having experienced an SOL testing season.

Perceptions of the School-Level Administrators

Convenience scheduling/pairing of co-teachers.

Research continues to find contradictory results related to the pairing of co-teachers (Damore & Murray, 2009). The main reason cited for these contradictions is

that co-teaching involves two people with distinct, complex, and dynamic personalities. Dieker and Murawski's (2003) work suggests administrators use surveys for thoughtful pairing to learn more about each teacher's learning preferences, multiple intelligences, personal dispositions, and relationship dynamics. Although the administrators at CHS do not look at these specific items when pairing their co-teachers, they do ask each teacher who they would like to work with and reasons why when they are planning for staffing the following school year. In her interview Ms. Caldwell stated:

> So I don't really know how they pair people generally. They did send out a survey for next year for the special ed teachers to request subjects that you want to collaborate and if you have any thoughts about specific teachers. So in mine I said that there's one teacher I prefer not to collab[orate] with…but if I did I'm sure we could make it work. Then there's a couple other teachers that I've been in meetings with where if they ask me to collab I would just flat out say no. And I might not be in a great position to do that as a first year teacher on a provisional license…but I just know that those wouldn't be healthy relationships. We are not on the same page and I wouldn't be able to support what they're doing. So they do take into consideration what we think…but as a first year teacher I don't think there was much to consider. So it's just kind of luck of the draw.

Ms. Caldwell had very strong views about teachers she would not work with based on interactions at department chair meetings and other all-staff events. She spoke a lot about hoping to stay with Mrs. Griffin the following school year. I later learned during a debriefing session with Mrs. Griffin that for the current school year, she handpicked Ms. Caldwell to be her collaborative partner. She stated, "With this being my first year

teaching a collaborative class, I wanted someone I knew I could get a long with." She referenced their success in coaching together and continued, "As the department chair, I will probably only give myself a collaborative class next year if I can make sure to have [Ms. Caldwell] back as my co-teacher". Mrs. Griffin and Ms. Caldwell have coached rowing together at Central High School for several years and have a long-standing relationship as Ms. Caldwell grew up attending the same church as Mrs. Griffin. They also coach adult and junior rowing at a local rowing club together outside of school. This prior relationship and experience of leading teams together provided a strong foundation for their partnership in the collaborative classroom.

In terms of pairing for the other collaborative pair, Mr. Hudson shared with me that one of the mathematics teachers he worked with the previous school year specifically requested to the administrators he did not return to work with her this year. In his interview he stated, "She said I interjected too much. So they didn't put me with her this year. I think they had to move another SPED teacher when they put me with [Ms. Graham]." He also spoke a lot about another male mathematics teacher that he co-taught with for several years that he felt administrators purposely moved him from this year even though they got along well. He believed the administrators thought they joked around too much and that was the main reason for the switch. Ms. Graham seemed relatively indifferent about the pairing of co-teachers and said, "I mean it's my job so I am going to happily work with whoever they give me." She spoke about her co-teachers the previous school year and remained neutral about those relationships stating, "I've never had a collab teacher where we totally didn't get along…and I guess I haven't had

one where I felt the need to ask admin if we could stay together next year…I'm pretty indifferent I guess!"

Although the teachers at CHS offer their input by way of a questionnaire about whom they would like to co-teach with for the following school year, it is unclear how much of the pairing decision is based on compatibility versus convenience. Accommodating the schedules of students on may take precedence and result in co-teachers who are not as compatible having to work together. Because it was not possible to interview an administrator, it was unclear if the pairings were based more on convenience and less on the compatibility of the teachers. For future work, this is an important idiosyncrasy to uncover because deciding on collaborative teams in this manner would not support a district's directive for utilization of the Team Teaching model where the focus is on the compatibility of the two educators.

Lack of building-level enforcement for co-teaching.

Administrative observations for teacher evaluations arose as a potential factor for hindering Team Teaching in the collaborative classroom. During an informal conversation with Ms. Graham she stated,

> Even though they [school district] told us we have to use team teaching, no one really forces it on us. Even when they [administrators] come observe, they are only observing one of us because we have different administrators. We try to let the other person teach if we are getting evaluated since it doesn't matter if we are teaching together.

The fact that they did not have the same administrator conducting their evaluation was consistent for all mathematics and special education co-teaching relationships at CHS

because the mathematics department had a different assistant principal conducting their observations than the special education department. Ms. Graham's comment insinuated the administrators did not evaluate teachers on their ability to collaborate or lead a co-taught classroom. If the administrators do not appear to place value on Team Teaching, the collaborative teachers might not feel the any sense of urgency to implement the co-teaching model.

Along similar lines, the administrators do not enforce co-teachers actually use the common planning periods to co-plan their collaborative classes. Ms. Caldwell referenced the common planning as a school-provided resource but said she often has an IEP meeting during that time or has to meet with other teachers she collaborates with. Content area teachers may need their planning times to plan for non-collaborative classes, grading assignments and assessments, or for meeting with parents. The teachers in the study stated the administrators might not be aware of how much actually goes on during a planning period and discussed how there is often not enough time to co-plan in person with their co-teacher. During the observation interval, there were two snow days, one two-hour delay, and one teacher work day (in order to prepare end of semester grades) which took away opportunities to co-plan.

Perceptions of the District-Level Administrators

Expectations of Parity in Collaborative Classroom

The participants in this study believed the reason the district administrators expected co-teachers to engage in Team Teaching was twofold: a) to warrant equal work amongst the two collaborative teachers and b) to ensure the students did not know who the special education teacher was in the classroom. Although neither of the co-teaching

pairs enacted the Team Teaching model with complete fidelity, both pairs described that a balance in the workload did exist.

In her interview, Ms. Caldwell discussed what she lacks in content knowledge, she makes up for in strategies that provide students access to the material:

> So I've never taught math before. And [Mrs. Griffin] has been teaching math for 20 years. And while I'm not an experienced like a licensed math teacher, I have a lot of experience working with kids with disabilities or kids with behavioral problems in different contexts so I'm more comfortable with that aspect of things. And I'm good at making things explicit in the way that kids with special needs need so we complement each other really well. I'm actively learning the math from her while she's teaching it sometimes and I'm like "oh okay, well here's how we can explain it better to these kids". I get it.

Ms. Caldwell felt that her contributions to the co-teaching relationship were equal to Mrs. Griffin's contributions even though she was not the content expert. She indicated that during the planning process, she would often look at what Mrs. Griffin had planned and would pare it down to fit the needs of the students in their class. During the delivery of instruction, she felt her role in the behavior management aspect of the lesson was just as important as Mrs. Griffin's role.

Mrs. Griffin's interview data supported Ms. Caldwell's statements. Mrs. Griffin defined her role as the content leader and stated:

> We support each other and she is much stronger in her knowledge of behavior. So I follow her lead and I'm stronger, you know, in my knowledge of mathematics so

she follows my lead… Whenever either of us plan, I try to bring a real world example to it. That's the part that [Ms. Caldwell] has a hard time with.

While Ms. Graham's lack of content knowledge may hinder the flexibility of their enacted co-teaching since Ms. Graham admits she does not feel as confident with the content, Mrs. Griffin and Ms. Caldwell's collaborative relationship still demonstrates a feeling of equal partnership by both co-teachers.

Interestingly, content knowledge related to equal roles was not an inherent theme in the interviews or observation data for Mr. Hudson and Ms. Graham. This could be due to the fact that Mr. Hudson had been exclusively co-teaching in mathematics classes for the past ten years, allowing him to feel comfortable with the content. According to this collaborative pair, content knowledge was not a factor in how they define their roles. Despite this, Ms. Graham planned and delivered most of the lessons as Mr. Hudson rarely took the lead during instruction of new content.

Lack of Resources/Sustained Professional Development

The collaborative teachers in this study received one, one and a half hour session on co-teaching in the professional development at the beginning of the year and were expected to implement the most complex co-teaching model. Team Teaching requires a great deal of planning and that teachers have "one brain in two bodies" (Friend, 2008). Other resources, such a sustained professional development on collaborative teaching, were not provided by the school district.

Mrs. Griffin and Ms. Caldwell were interviewed separately about resources the school or district provided to help them implement the Team Teaching model or co-teaching model in general. According to Mrs. Griffin, "[Teachers] don't receive any kind

of formal training for co-teaching. As for professional development…I mean we had that one meeting before school started during our pre-service week where they say 'These are your roles!' but other than that…I have been here a long time and that was the first PD I have heard about collaborative teaching." Although Mrs. Griffin and Ms. Caldwell did not receive any kind of administrative support for implementing co-teaching, they attributed their success with the Team Teaching model to their prior relationship and work coaching the rowing team together. This relationship will be unpacked further in a later section.

It is clear from the interview and observation data the teachers in this study perceived each stakeholder to have different priorities and expectations for co-teaching. This incoherence in the teachers' perceptions of the expectations for what their roles should be in the classroom is problematic for establishing and reaching the goals of the collaborative classroom.

Assertion 2: The relationship between co-teachers strongly influences their roles in the classroom.

Although the school district and administration explicitly told co-teachers they should be engaging in team teaching in their collaborative classrooms, this directive did not seem to heavily influence the role of each teacher in the classroom. As Ms. Caldwell stated in an interview,

> The county [has] made pretty explicit that they don't want you to implement the one teach, one support model all the time and want us to be team teaching. But there are good models for providing remediation where you're pulling students for small groups and doing station teaching. And I think that's totally fine.

Interviews and observations suggest the relationship between the collaborative pair strongly influenced each teacher's role defining process. Specifically, whether the relationship was built on mutual respect and competence in role, whether both teachers saw value in the co-teaching model, and if there was a sense of equal ownership over the students.

Mutual Respect and Competence in Role

Respect was explicitly addressed in all interviews as necessary for positive and productive co-teaching relationships. Mr. Hudson stated,

> I feel that teaching has to be a partnership and a relationship with the person you are working with. In athletics, it's kind of the same thing. You know, a really weak relationship is one where people don't pull their weight equally. I find it very difficult at times with the people I get paired up with because they're "the content master" and they think I don't pull my weight because I focus on behavior management. As soon as I don't feel respected, it all [the relationship] goes downhill from there. Sometimes she does things that cause a hardship on our relationship…I mean, I try to respect her wishes as well she try to respect my wishes. It's very mutual.

In this interview excerpt, Mr. Hudson is referencing the fact that Ms. Graham often just plans lessons without him and sometimes uses "I" language instead of "we" language. He later reiterates this by saying, "You know sometimes she likes to do a certain things [planning and instruction] more often so she might go a couple of days in a row because she likes that thing. But I've noticed that sometimes, she just does it all and doesn't even consult me." By taking on the majority of the planning and instruction, Mr. Hudson felt

Ms. Graham did not appreciate his input, and therefore did not respect him as an educator.

Ironically, Ms. Graham stated she *did* respect Mr. Hudson and saw the fact that she often took on more of the co-planning as a nod to how much responsibility he has outside of the classroom. In her interview she stated, "[Mr. Hudson] has to teach with three other people, manage his caseload, coach, and be there for his family. He is pulled in so many different directions! I feel like I have more time to be thinking and planning!" Ms. Graham felt she was relieving Mr. Hudson's load by taking on more of the instructional responsibilities.

Mutual respect largely characterized Mrs. Griffin and Ms. Caldwell's co-teaching relationship. In Mrs. Griffin's interview, she discussed how Ms. Caldwell attended the same church as she did for many years before which is how the two came to know each other well. They eventually went on to coach the rowing team together where they experienced great success. Ms. Caldwell said in her interview, "So I think we are not a typical co-teaching case because we knew each other so well before working together. We already had a great deal of respect for each other so the foundation was already laid." The two teachers also held each other in high regard and often praised each other for the contributions the other person brought to the classroom. It was clear there was a mutual respect and mutual feeling of competence of the collaborative partner…a feeling that was not as clearly represented in Mr. Hudson and Ms. Graham's relationship. This respect was a factor for success in their enactment of the collaborative teaching model.

Two Heads are Better than One [Value in Co-Teaching]

The co-teaching model allows the collaborative teachers and students to capitalize on having two experts in the classroom; a content area expert and a special education expert. This notion that two heads are better than one was a persistent theme in the interviews with Mrs. Griffin and Ms. Caldwell as both teachers felt that they complemented each other well. In her interview, Ms. Caldwell stated:

> We both rotate and then we tend to differentiate for different students as well. So [Mrs. Griffin] differentiates up for the students that are achieving the most and I differentiate down for the students that are struggling with the material the most. And we might do both sometimes but especially because she has more math knowledge, she sort of knows where to go with the student.

Ms. Caldwell felt that by having both of them in the classroom, they were able to meet the needs of the students in the class in a more meaningful and purposeful way. Mrs. Griffin also addressed this notion that two heads are better than one in her interview.

> Having both of us in the classroom is nice because at any given time, either of us can address the academic need or behavioral need. [Ms. Caldwell] is learning the math because she's bright enough to learn. So if someone if the student needs math help, she can do it. Same thing with behavior…I've figured out what those cues should be to keep them calm. I think it's really important that both of us can serve in those roles at any time and having her in the classroom has helped me learn more about the behavior management piece. Like for example, she will calmly walk over kneeling down and gently putting her hand on the back of a student. All those things I am watching her do that and so I can have a better idea of how to do it. So we are definitely learning from each other.

Equal Ownership of Students and Classroom

The co-teaching literature often alludes to ownership of students and classroom as a persistent theme when examining co-teaching roles (Frisk, 2004). Buckley stated, "The regular education teachers saw themselves as the leader of their classrooms…all of them also said they wanted things to be done their way and wanted to maintain control," (2005, p. 179). Lack of ownership was a recurring idea in the analysis of Mr. Hudson's interview and actions during the classroom observations. The fact that he did not see himself represented as an equal teacher, although he felt he did an equal amount of work, acted as a stressor on his relationship with Ms. Graham.

At several different points in our interview, Mr. Hudson shrugged the same phrase, "I don't see my name anywhere." The first time he said this, he was referring to the physical classroom space itself. Outside of each classroom door at CHS is the teacher's name and room number. Many teachers also have a small, letter-sized poster that describes where they attended college, hobbies, favorite sports, and similar traits about themselves. Outside of the classroom where Ms. Graham and Mr. Hudson teach their collaborative class, only Ms. Graham's name appears, accompanied by her poster. Mr. Hudson may have also been referring to the interior of the classroom as well. On one wall a poster is titled "Ms. Graham's Classroom Rules". Mr. Hudson does not appear to be represented in the classroom at all. This includes the absence of a designated teacher's desk for him. During the observation period, Mr. Hudson would enter the classroom each day and set up his computer and backpack on a high-top student desk. As described in Vignette 2, he often sat at this student desk during the lesson and would get up periodically to assist students.

The second time he mentioned his name not appearing anywhere, he was speaking about the syllabus and *how* Ms. Graham welcomed the students on the first day of school. Although the teachers are supposed to be equal teachers in the collaborative class, Mr. Hudson's name did not appear on the syllabus for the course. Additionally, as Ms. Graham reviewed the syllabus on the first day of school, Mr. Hudson described how she used a lot of "I" language instead of "we" language. For example, she might have said, "I expect you to turn your homework in on time" instead of "we expect you to turn your homework in on time". Mr. Hudson felt these instances lessoned the sense of partnership with Ms. Graham.

Interestingly, Ms. Caldwell said the opposite during her interview when I asked her about the syllabus for the class she co-teaches with Mrs. Griffin. Ms. Caldwell spoke about how she felt like the class was equally hers since the beginning [of the school year] because her name was on the syllabus. She also indicated the amount of planning she and Mrs. Griffin engaged in during the pre-service week attributed to this feeling because they planned out how they would introduce the classroom rules and expectations together. She spoke about how this process was very scripted because Mrs. Griffin also had a student teacher; "it was almost like we each had our own lines to memorize." Ms. Caldwell felt the three of them had introduced themselves in a way that the students would not know who the special education teacher or student teacher was. Despite this, she acknowledges this sense of equal ownership might not be the norm in all collaborative classes and said,

> And if I were to collab with somebody different next year I think we'd have to have a very explicit conversation about what that would look like because it's hard for me to

> imagine stepping into a room with a teacher who has taught a class for like 10-15 years, or however long. I'm sure they have their lessons already made and have a certain way they want to do things. You know how, I'm not sure what my role would be at that.

A final example of lack of ownership is related to the online grade book for teachers, which students and parents can access as well. When Mr. Hudson referenced the grade book, he mentioned his name was noticeably absent. He stated:

> You know, we have to let everybody know that we're not just assistants or those kinds of things. But again we're not even on the report card. We [special education teachers] are not on the grade book either…I mean we can get on and access our classes through our own accounts but my name doesn't show up anywhere for students or parents.

Although Ms. Graham might not have any control over his name appearing on the grade book, Mr. Hudson did comment to me during an observation that he "wasn't allowed to update grades because it might mess up her system".

Assertion 3: Content knowledge, which plays a role in which instructional activities each teacher takes on, is necessary to correctly interpret and respond to student error in the mathematics classroom.

Response to Student Error

Both special education teachers in this study indicated they did not feel they took on a subordinate role in the classroom (for the collaborative pair observed). Parity of responsibility was achieved by each special education teachers taking on a greater role in the behavior management aspect of class or by readying students for the standardized

tests with test-taking strategies. It is important to note that the special education teachers assumed these roles for all students in the class, not just students with disabilities.

While these teachers did take on a bigger role in these two areas, they both still led whole group instruction. Mr. Hudson sometimes led the warm-up for his collaborative class with Ms. Graham. Although Mrs. Griffin would plan and lead the direct instruction for their students on Mondays and Tuesdays, Ms. Caldwell would lead the lessons she planned on Wednesdays and Thursdays. The format each week seemed to be Mrs. Griffin, who is the content expert, would frontload the new content in the beginning of the week while Ms. Caldwell would review and practice those concepts with their students during the lessons she took the lead on in the middle of the week.

This proved to be somewhat interesting because most of the opportunities for student error to occur were during the warm-up or homework review. Content teachers often taught new material through lecture or Direct Instruction. These teaching models do not inherently build in opportunities for student error, or discourse surrounding the error, the same way a more constructivist model for instruction would. Despite this, there were instances in every classroom observation where student errors did occur, followed by a response from either the mathematics teacher or special education teacher. After extracting these responses from my data, another pattern emerged. The teachers with a mathematics background usually followed student error with a question, while the special education teachers without a mathematics background usually followed student error with a statement. Table 3 compares the types of responses to student error by the two mathematics teachers that have extensive content knowledge versus the two special education teachers.

Table 3

Comparison of teacher responses (content knowledge v. limited content knowledge).

Type of Response to Student Error	Example
Teachers with content background	
Clarification request	"What do you mean by 'move x to the other side'?"
Comprehension	"How do you know this is a function?"
Application	"How could we use the notion of slope to explain the staircases we compared earlier?"
Analysis	"Let's look at what happened in the problem. Can anyone tell me where the mistake was made?...How did dividing by two first change the answer?"
Teachers without content background	
Explicit correction	"No x should equal four."
Rephrasing	"So the problem is simply asking us to figure out what the slope of the line is."
Recall	"Well remember that you first rise before you can run [procedural steps for calculating slope from a given line]."

Differences in Teacher Questioning

There was also a clear difference in the teacher questioning between the mathematics teachers and special education teachers in this study. Mr. Hudson and Ms. Caldwell often asked "funneling" questions (leading to one right answer) to their students instead of "focusing" questions (more open-ended and thought-provoking). An example

of a funneling question could be “Which line has a steeper slope?” versus “How do you know this line has a steeper slope?” (focusing). The majority of the questioning by the special education teachers did not require deeper level thinking for students. This is in contrast to Mrs. Griffin and Ms. Graham who, even with a relatively simple concept, challenged their students’ thinking. The following vignette from Ms. Graham and Mr. Hudson’s classroom helps illustrate these differences.

Ms. Graham introduces an Explore Learning simulation activity to her students. “Your job today is to try and get the path of your blue cannon man to match the path of the green cannon man. After you sketch your graph, play the simulation to see if the paths match. Notice, we are graphing time versus his height off of the ground [see Figure 14]. This is important to keep in mind.” Students begin drawing graphs in the white box. Some students are drawing random lines just to see what happens to the cannon man. Mr. Hudson begins to circulate and looks over a student’s shoulder. “You are a little off,” he says, “You want to try it again and see how you can match that guy.” A student yells “I got it!” from across the room and Ms. Graham responds, “I wanna see!” She goes over to the student and examines his simulation with a smile. “Hmm it is close but is it an exact match?” The student grumpily answers “No.” “How can you change your graph to get him to slow down?” The student just shrugs his shoulders. “Okay let’s play your graph again. At what point does he start going fast? [The student points to the screen] YES! So how can you change your graph to better match the green cannon man’s path?”

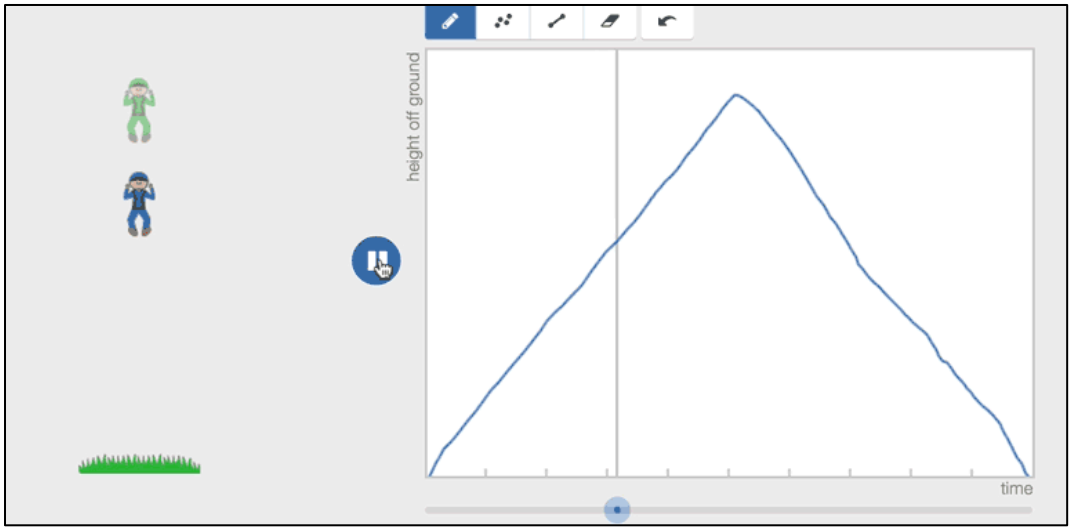

Figure 14. Screenshot from Explore Learning activity during observation on January 6, 2017.

From across the room Mr. Hudson yells, "[Ms. Graham] we have a great ending over here!" Ms. Graham moves towards Mr. Hudson and the student. Mr. Hudson is saying, "This is what you need to fix [pointing to the screen]…this is all perfect…right here is perfect…leave all that…we need to erase from here up…how can you get from here to here [does not leave time for student to answer]? He is starting on the ground right? Then he shoots out of the cannon, then he starts to descend….ohhhh a little bit too fast…but do you get the point? You have to start at the bottom and work your way up." Mr. Hudson walks away but Ms. Graham continues to work with the student. She asks, "How can you slow him down?" The student begins erasing his graph. Ms. Graham says, "Do you have to erase the whole thing? Let's think about how high he is going to be when he starts. You are starting him really high…the green guy didn't start from the top so you don't want your guy to start from the top either." The student does not seem to understand so Ms. Graham continues, "Here is what we are going to do…I am going to draw two lines on here…and you tell me which guy is going to go slower. Which guy is

going slower?" Ms. Graham pauses, "okay so now is your guy going too slow or too fast [student answers]? Good so how can we change the line to make it go faster?" The student makes some changes and smiles. Ms. Graham walks away.

This vignette is representative of the differences in both collaborative pairs' responses to student error and differences in questioning. The potential impact these differences could have on mathematical discourse in the collaborative classroom will be further unpacked in the next chapter.

Impact on Role

The literature on co-teaching indicates content knowledge, or lack thereof, is often a cause for the special education teacher to feel they have a subordinate role in the classroom (Antia, 1999; Buckley, 2005; Hazlett, 2001; Magiera et al., 2005; Mastfopieri et al., 2005; Norris, 1997; Pugach & Wesson, 1995; Rice & Zigmond, 2000; Zigmond & Matta, 2004). The findings of this study, however, do not support this assertion. Although both special education teachers referenced content knowledge as a weakness in their interviews, neither teacher indicated this lessened their role or workload in the classroom. As stated in the previous sections, content knowledge did influence the types of questions the teachers asked and how the each teacher responded to student error, however lack of content knowledge alone did not make the special education teacher feel they were subordinate to the mathematics teachers. The exception to this was the lack of ownership Mr. Hudson experienced.

In her interview, Ms. Caldwell discussed what she lacks in content knowledge, she makes up for in strategies that provide students access to the material. She felt that her contributions to the co-teaching relationship were equal to Mrs. Griffin's

contributions even though she was not the content expert. She indicated that during the planning process, she would often look at what Mrs. Griffin had planned and would pare it down to fit the needs of the students in their class. During the delivery of instruction, she felt her role in the behavior management aspect of the lesson was just as important as Mrs. Griffin's role. Mrs. Griffin's interview data supported Ms. Caldwell's statements. Mrs. Griffin defined her role as the content leader and stated:

> We support each other and she is much stronger in her knowledge of behavior. So I follow her lead and I'm stronger, you know, in my knowledge of mathematics so she follows my lead… Whenever either of us plan, I try to bring a real world example to it. That's the part that [Ms. Caldwell] has a hard time with.

Mrs. Griffin and Ms. Caldwell's collaborative relationship demonstrate a feeling of equal partnership by both co-teachers even though Ms. Caldwell admits she does not feel as confident with the content.

The findings indicate while the special education teachers did not feel they took on a subordinate role in the classroom due to content knowledge, it did impact which instructional activities they took the lead on. The mathematics teachers typically introduced new material to the students, while the special education teacher more often reviewed the warm-up or led review activities. The special education teachers who do not have a formal background in mathematics demonstrated differences in the types of questions they asked students and how they responded to student error.

Summary

Careful analysis of the observation field notes and interview data yielded the findings described in this chapter. Chapter five will discuss these findings using the theoretical frameworks presented in chapter one and will situate the findings in the literature presented in chapter two. While the findings are specific to Central High School and the district in which it is located, recommendations will also be presented in the next chapter.

CHAPTER V: CONCLUSIONS AND RECOMMENDATIONS

The purpose of the study was to explore the meaning-making behind how teachers define their roles in the collaborative classroom and the potential impact these roles have on fostering and maintaining mathematical discourse for students. This study focused on two pairs of collaborative mathematics and special education teachers who were in their first year of co-teaching an Algebra I Part I, double-blocked class together. Through observations and semi-structured interviews, I collected qualitative data that k-12 administrators and teachers can use to examine current co-teaching practices and begin to explore potential improvements at the local level. I structured my student around the following research questions:

1) How do school and school division systems and policies influence the roles of the teachers in the collaborative classroom?
    a. How are co-teachers paired?
    b. To what extent do teachers get to choose their co-teaching partner?
    c. How do schools and school divisions envision the role of the mathematics teacher and the special education teacher in the collaborative mathematics classroom?
2) How do teachers determine teacher roles in the mathematics collaborative classroom?
    a. How does the mathematics teacher make meaning of and define his or her own roles in the classroom?
    b. How does the special education teacher make meaning of and define his or her own roles in the classroom?
    c. What does the process look like?

3) How are the instructional and pedagogical responsibilities divided between the mathematics teacher and special education teacher?
    a. How does content area affect these roles?
    b. How does the mathematics teacher support discourse in the mathematics classroom?
    c. How does the special education teacher support discourse in the mathematics classroom?

The findings of this study both support and challenge existing literature on co-teaching. The results presented in chapter four were organized into three assertions: (1) Different stakeholders have different definitions of "Team Teaching" and different priorities/visions for the implementation of co-teaching; (2) The relationship with the other co-teacher strongly influences how each teacher defines his or her role in the classroom; and (3) Content knowledge, which plays a role in deciding which instructional activities each teacher takes on, is necessary to respond to student error in the mathematics classroom. The data that formed these assertions, and the assertions themselves, help answer the research questions for this study. Table 4 maps each assertion to a research question.

Table 4

Mapping of Findings onto Research Questions

Research Question	Findings
RQ 1	A1
RQ 1a	A1
RQ 1b	A1
RQ 1c	A1
RQ 2	A1, A2, A3
RQ 2a	A1, A2, A3
RQ 2b	A1, A2, A3
RQ 2c	A1, A2, A3
RQ 3	A3
RQ 3a	A3
RQ 3b	A3
RQ 3c	A3

It is clear the role defining process for teachers in the collaborative classroom (research question two) is multifaceted as there is not a clear one-to-one correspondence between the research questions and findings. For that reason, this research question and the findings will be discussed further below.

The intent of research question two was to determine how each of the co-teachers interpreted, and in turn enacted, their role in the collaborative classroom. This study attempted to make this implicit process explicit. The negotiation of roles proved to be complex as teachers had to make meaning of their role as defined by the district, their own beliefs about co-teaching, their teaching philosophies, their comfort levels with content/behavior management, and their interactions and interpretations of the relationship with their co-teacher. The conceptual framework for this study (Figure 4, p. 14) depicts how multiple domains might influence a teacher's role. The first assertion helps answer research question two because before a teacher can enact their role, they must define it. Since the there was confusion of the district's definition of co-teaching,

the teachers in this study enacted different definitions of Team Teaching based on their prior experiences with co-teaching or their own interpretation of the word "team". The second assertion argues the relationship between the co-teachers is a strong influence on the roles they assume in the classroom. When the relationship between the co-teachers is described as a "partnership", the teachers are more likely to not only consider their own role in the classroom, but also how their role affects their partner. These co-teachers are also more likely to work together to define roles aloud. Relationships that were described more as "co-workers" did not have this same level of consideration and resulted in increased division of responsibility and decreased communication between the teachers. Finally, this study supports and challenges prior literature surrounding content knowledge and co-teaching. Neither special education teacher felt they took on a subordinate role in the classroom, however their lack of content knowledge did directly affect which aspects of instruction they took the lead on. The results will be explored further in the following sections.

Common Stakeholder Definition and Need for Increased Cohesion

Through the interview data, it became apparent the teachers perceived that the school district wanted all co-teaching pairs to utilize the Team Teaching model of co-teaching. While the district may have been looking for a way to ensure both collaborative teachers are actively engaged in the co-teaching relationship, it seems as if this one-time professional development failed to explicitly convey this message to the collaborative pairs or create sustained change in the way co-teaching is implemented in the district. There was not a clear delineation of what the role of each teacher in the collaborative pair should take. With respect to the theoretical framework for this

capstone, teachers will define their role based on their own content knowledge and beliefs about teaching if the influence of the external domain is unclear. This is especially problematic when thinking about how a single special education teacher may be required to collaborate with up to four teachers in an academic year. Having to redefine their role for each content area teacher they are paired with can lead to more time figuring out what they should be doing and less time helping students with disabilities. The results of this study indicate a need for a common definition across stakeholders in order to create a shared philosophy surrounding the co-teaching model.

While the school district provided this guidance prior to the start of the school year, the two co-teaching pairs left the professional development with very different ideas of what the Team Teaching model should look like in the classroom. Mrs. Griffin and Ms. Caldwell saw co-teaching as an opportunity to bring two areas of expertise, mathematical content knowledge and working with students with disabilities, together to strengthen their instruction. Although the two teachers often planned on their own, they engaged in peer review of each other's work to offer suggestions and ultimately be on the same page. On the other hand, Ms. Graham and Mr. Hudson interpreted co-teaching to mean total division of labor in the collaborative classroom and likened Team Teaching with "equal". Even though these teachers described a sense of parity in the relationship, they did not engage in co-planning or Team Teaching instruction as defined by the model. Despite this, both pairs of collaborative teachers felt as if the professional development provided by the district did impact their roles in the classroom.

The district in this study prides itself on being a "decentralized central office." Ironically, the emphasis on one particular co-teaching model seemed very top-down. The

collaborative teachers were not able to provide specific reasons why Team Teaching was the particular co-teaching model of focus. In her interview, Ms. Caldwell although she and Mrs. Griffin knew they were supposed to be using Team Teaching, sometimes other models of co-teaching were more appropriate for a particular lesson. Because the teachers and school-level administrators did not take part in the philosophical planning for co-teaching in the district, the roles of teachers *and administrators* were ambiguous. Administrators did not engage in practices that supported the district's vision resulting in a lack of cohesion across the three stakeholders.

Recommendations for Policy and Practice

Before delving into the implications for practice it is important to remember the findings are only generalizable for this context at Central High School. Regardless, this study could prompt schools and school districts with similar contexts and co-teacher dynamics to also examine their own collaborative classrooms. At CHS, the lack of coherence could be resolved by having all stakeholders come together to participate in an active discussion about co-teaching. Here, with the input of all players, better cohesion could be established. A joint discussion could take place where every stakeholder is involved in creating common visions for students and developing lists of responsibilities for each teacher and administrator. By creating a space where everyone has the opportunity to take part in the planning and the implementation of co-teaching, each person will have a more vested interest in the success of collaborative classrooms. This could also serve to explicitly answer the sub-questions I pose in my first research question for a particular district. Ensuring there is transparency in how schools pair co-teachers, autonomy involved for teachers to choose whom they collaborate with, and

communal agreement for visions of each stakeholder's role could ensure that schools and districts define more clearly the role of the co-teacher in the collaborative classroom.

Administrative Support

The results of this study also indicate a need for a stronger administrative role in the implementation of co-teaching to ensure teachers are actively planning together in person. The structured time of common planning periods between collaborative teachers was already built into the schedules of each pair at CHS, however, the teachers in this study stated while they engaged in co-planning, they did not meet in person on a frequent or regular basis. Co-planning could serve as a mechanism for teachers to define their role in the collaborative class because it forces co-teachers to decide how much each teacher contributes to the content planning and instructional planning. Co-planning is also important because it provides a space for each teacher to become an educational consultant. The mathematics teacher can explain critical components of the content to the special education teacher ahead of time (i.e., potential misconceptions, areas for high-level questioning, connections to the real world) while the special education teacher can address any accommodations and modifications needed for students to be successful.

The work of several researchers, (Caron & McLaughlin, 2002; Dieker, 2001; Salend et al., 2002) prompted a call for reflection of best practices in the collaborative classroom. From this literature emerged the theme of co-teachers evaluation. Caron and McLaughlin have specifically noted a need for "measureable indicators" of quality co-teaching (2002). The Magiera-Simmons Quality Indicator Model of Co-Teaching (Magiera, Simmons, & Hance, 2008) outlines a systematic process to ensure that co-teachers collaborate successfully and achieve the best results for their students.

Administrators, who may have never had the opportunity to co-teach, can use the indicator model to understand steps should be implemented to obtain optimum co-teaching results (see Figure 15). The teachers in this study suggested because they are evaluated individually, there is little incentive to implement the co-teaching model. Current standards for individual teacher evaluation include knowledge of students, instructional planning and content, and instructional delivery. Only one standard partly addresses collaboration. This lack of emphasis on utilization of the co-teaching model encouraged the participants to let the teacher being observed take the lead during an observation class period. Additionally, special education teachers and mathematics teachers at CHS had different administrators conduct their observations and evaluations. There was no evidence to suggest the administrators communicated about the combined performance of their assigned co-teachers. This assignment of different administrators further undermines the implementation of co-teaching in the collaborative classroom.

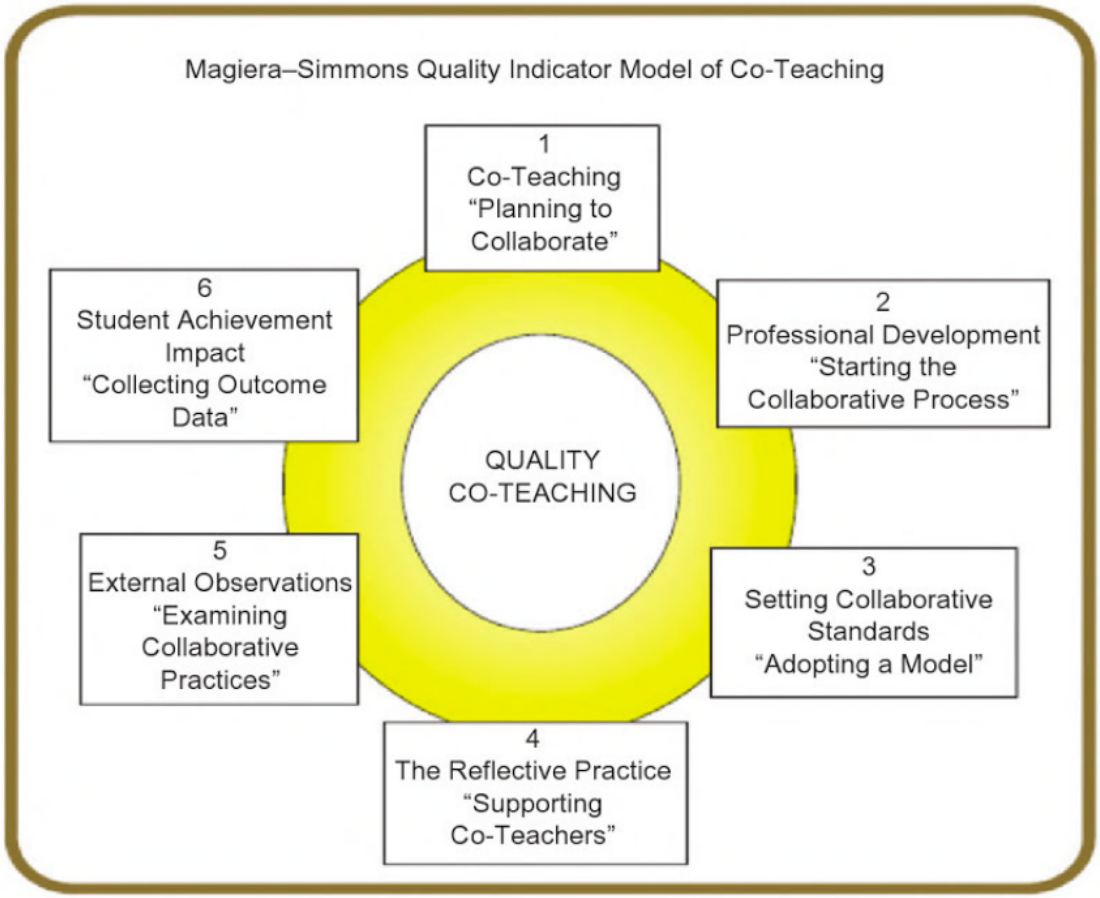

Figure 15. Magiera-Simmons Quality Indicator Model of Co-Teaching: Six Stages of Implementation. Source: Cook and Tankersley (2012).

Recommendations for Policy and Practice

While the co-teaching literature often cites a need for common planning time for successful co-teaching to occur (Arguelles, Hughes, & Schumm, 2000; Dieker & Murawshi, 2003), the school in this study already provided this support with common planning periods for every collaborative pair. This support seems trivial when teachers do not actually use it to meaningfully plan. The teachers in this study cited grading, planning for other classes, IEP meetings, parent conferences, meetings with other collaborative teachers, and meetings with Professional Learning Communities as reasons that take time away from meeting with their assigned co-teacher. A recommendation for

this is for administrators to ensure teachers are not spread too thin. The more co-teachers a teacher is paired with, the less likely it is they will co-plan with any of them. In order for teachers to truly co-teach, it is important they start with one or two partners. Limiting the number of content areas and grade levels in which the special educator co-teaches may also alleviate the load of co-teaching.

Fostering a more authentic collaboration between the content area teacher and collaborative teacher could also alleviate some of these concerns. By dividing the responsibilities of the mathematics classroom, the teachers are never truly collaborating. True collaboration between the teachers is essential because special education teachers have the expertise and strategies needed to ensure students with disabilities are not excluded from the rigorous, grade-level content. Fostering a closer collaboration could help effectively reach more students.

Ensuring that teachers are planning collaboratively not only provides time and space for both teachers to discuss what content should be taught to students, but also allows each teacher the opportunity to unpack the content and discuss what accommodations might be necessary to meet the needs of the students in the class. For special education teachers who are unfamiliar with the content and corresponding pedagogy, this is especially important.

Finally, administrators may want to move to a performance model that supports supervision and evaluation of co-teaching. Teachers in this study stated their enacted role(s) changed when administrators came to observe because they wanted to ensure the teacher being evaluated led the instruction. This is problematic for administrators who are trying to get a holistic view of the daily occurrences in a particular classroom and for

the teachers and students who feel a need to depart from daily routines. The first step in moving towards joint evaluation is ensuring the administrators know what to look for, listen for, and ask for when observing, supervising, and evaluating co-teachers (Murawski & Dieker, 2013; Murawski & Lochner, 2011; Wilson, 2005). According to Murawski and Lochner (2011), this includes the inability to tell the content area educator from the special educator, differentiated instruction and assessments, and evidence that all students are actively included and all have access to the academic content. Engaging in evaluation of both teachers simultaneously will also increase coherence of the co-teaching model across the district and reiterate best practices for collaboration.

Pairing Co-Teachers and Fostering Positive Relationships

> [T]here has been a mad scramble to place two teachers in the same room at the same time and call it co-teaching…The outcome of this dubious union is often a marriage that crumbles in front of the kids because the time and care needed to nurture and sustain it has not been provided (Kohler-Evans, 2006, p. 206).

Although the teachers in this study indicated who they would like to work with the following school year, it became evident the pairings were based more on convenience than the alignment of teaching philosophies or compatible personalities. The teachers seemed to be aware of this and reiterated the theme of a "forced marriage" from the co-teaching literature (Cook & Friend, 1996). Mrs. Griffin and Ms. Caldwell were a special case for co-teacher pairing at CHS. As the department chair, Mrs. Griffin used her position of power to handpick Ms. Caldwell to co-teach with her since the two already had an existing relationship. Even though Mrs. Griffin was able to pick her for the 2016-2017 school year, both teachers did reference there was no guarantee they

would collaborate together the following year. Despite the success of a partnership, the convenience of scheduling by administrators takes precedence over determining which teachers will be assigned to each other.

Dieker and Murawski's (2003) suggest asking teachers to find their own collaborative teaching partners or asking for volunteers after all teachers have received a professional development on what co-teaching is and what it looks like in the classroom. Allowing teachings to have more say in who they collaborate with could maximize their chances of success. The teachers in this study who were able to choose each other, Mrs. Griffin and Ms. Caldwell experienced greater feelings of success with the implementation of co-teaching and equal ownership of the students and classroom. These teachers often referred to their relationship as a "partnership". This contrasts with the relationship between Ms. Graham and Mr. Hudson who assumed more of a "co-worker" role than a "partner" role. Ms. Graham spoke about her indifference to being assigned to Mr. Hudson in her interview and commented it was her job to work with whoever she was assigned. Their relationship seemed to lack the same level of respect as Mrs. Graham and Ms. Caldwell's relationship and failed to give *both* teachers a sense of ownership over the students. This lack of ownership was a significant factor in Mr. Hudson assuming the "assistant" role in the classroom. In order for both teachers to be equally vested in the co-teaching model, equal ownership of students and classroom is critical.

Recommendations for Policy and Practice

Research continues to find contradictory results related to the pairing of co-teachers (Damore & Murray, 2009). The main reason cited for these contradictions is that co-teaching involves two people with distinct, complex, and dynamic personalities.

Dieker and Murawski's (2003) work suggests administrators use surveys for thoughtful pairing to learn more about each teacher's learning preferences, multiple intelligences, personal dispositions, and relationship dynamics. Dieker and Murawski's (2003) SHARE worksheet (see Appendix D) is a resource for helping potential partners communicate about their hopes, expectations, responsibilities, and pet peeves. Gathering this information for each co-teacher can assist with more thoughtful co-pairing to ensure administrators are setting co-teachers up for success.

Administrators can also enforce building-level changes to help foster more positive co-teaching relationships. This could include ensuring both teachers are represented inside (i.e., a desk for each teacher) and outside of the classroom (i.e., name on door, syllabus, and gradebook). Ensuring that both teachers are equally represented to students and parents could increase ownership over students and buy-in for both teachers. As Bauwens and Hourcade (1995) warned, the more teachers can use the word "ours", the less likely it is for turf wars to occur. The administrators can also make sure to provide opportunities for the co-teachers to bond and get to know each other in ways that might take their relationship from co-worker to partner. These opportunities could include team building exercises or challenges, working lunches for co-teachers to brainstorm strategies over a meal, or hosting social events for teachers to get to know each other better outside of the school setting.

Professional Development for Collaborative Teachers

Both pairs of co-teachers in this study engaged in division of responsibilities to some extent. Mrs. Griffin and Ms. Caldwell took turns planning the lessons, although they did edit each other's work. Mrs. Griffin assumed the role of content expert, while

Ms. Caldwell became the behavior management authority. Ms. Graham and Mr. Hudson completely divided the responsibilities with little communication across them. If the mathematics and collaborative teacher are dividing responsibilities so definitively this negates the point of having two experts in the classroom.

When analyzing the instances when the special education teachers took the lead, the teacher with less content knowledge became the teacher primarily responding to student error. Without the requisite content knowledge and specialized mathematical knowledge, Schilling and Ball's (2008) work indicates these teachers might have trouble appropriately generalizing representations, interpreting student work, and analyzing mistakes. This is especially problematic regarding the literature presented in chapter two which points to error analysis as an entry point to mathematical discourse in the classroom. For special education teachers who have not had opportunities to learn the content or pedagogy, this could diminish the chances for students to unpack the error and reach higher order thinking. Moving past procedural knowledge is critical for students to not only perform well on benchmarks, but also to lay a strong foundation for future mathematical knowledge. The data of this study supports the notion that teachers with limited content knowledge might not know how to engage in high-press questioning, resulting in less student-talk in the classroom.

Recommendations for Policy and Practice

Effective PD is relevant, implemented gradually over time, recurring, coherent, and designed in a manner that fosters collective participation. Guskey (1991) states the magnitude of change requested is inversely proportional to the likelihood of a person actually making that change. It is important to note that while starting small is essential

for long-lasting change, this is not the same as "thinking small". For administrators and teachers who are unfamiliar with co-teaching, it is important not to expect them to know how to implement the co-teaching model over night. Instead, these co-teachers and administrators should be supported by receiving ongoing, sustained PD, especially since the duration of the professional development is directly related to the depth of teacher change (Shields, Marsh & Adelman, 1998; Weiss, Montgomery, Ridgway, & Bond; 1998). Coherence is another critical component for a PD to be considered high quality. Without PD being integrated into existing programs and initiatives, it is difficult for teachers to build on earlier activities, meet goals, and see changes in student achievement (Birman, Desimone, Porter, & Garet, 2000).

There is no doubt that these special education teachers have heavy caseloads so it is unrealistic to expect them to have the same amount of content knowledge as the mathematics teachers. A more feasible way to have them increase their conceptual knowledge of the mathematics could be to offer them support specific to the class that they co-teach in. One method for doing so could be to participate in lesson study where the collaborative teachers have the opportunity to see how teachers with the mathematic content knowledge respond to student error and elicit higher level thinking. Explicitly modeling this could help them prompt questions for their students such as "What did I do wrong here?" or "How could I have come to this answer?" or "Does this answer make sense?" Content teachers could receive more support in the form of a professional development on appropriately implementing accommodations for students with disabilities. This could include strategies for ensure tests and classroom activities are appropriate for students, ensuring students have access to the material, and making

modifications to instructional materials to set students up for success. Some of these strategies could also benefit students without disabilities.

Limitations of the Study

This capstone study has several limitations that should be considered when interpreting its results. The study is limited by the small sample size of collaborative pairs (made up specifically of a mathematics teacher and special education teacher). Because each collaborative pair in this study made up a single unit of analysis, it was difficult to find patterns *between* the pairs. The small sample size limited the generalization of the results to other collaborative classrooms. It is my hope that the results of this study provided a robust description of the findings so the possibility exists that other teachers or schools districts may use this capstone to inform their own work with co-teachers in the mathematics classroom. My presence may have also altered "business-as-usual" with regards to mathematical instruction and implementation of discourse. This may have affected the teacher interviews, as teachers could have deviated from their true feelings and simply stated what they thought I wanted to hear. Due to the voluntary nature of this study, there may have been a difference in the type of teacher who would allow researchers to come into the classroom and spend time being interviewed versus those who would not respond to the invitation to participate. The timing of this study could have also affected the data obtained during the observations. The students and teachers were coming off of a two-week winter break and they may have needed time to fall back into their classroom norms. Finally, because I was the sole researcher for this study, it was not possible to examine researcher bias in the same way a

study comparing the data collection from multiple researchers would be able to. As such, I recognize that the findings of this capstone study are rooted in my own biases.

Summary

The recommendations presented in this chapter are based on the findings of the study and the existing literature. Chapter six concludes with an action communication written for the school district in which Central High School is located. In this action communication I present my findings and recommendations to the district and building-level administrators.

CHAPTER VI: ACTION COMMUNICATION

From: Amanda M. Allen
Doctoral Candidate
University of Virginia
405 Emmet St. S
Charlottesville, VA 22903

Dear District and School Administrators,

I am writing to report findings and recommendations for your school and division based on a 4-week case study of two pairs of co-teachers who teach in the collaborative mathematics classroom at Central High School. Each pair was observed every day during this time period for an entire 90-minute block and teacher interviews were conducted at the conclusion of the 4-week observations.

The purpose of this study was to better understand how teachers make meaning of their roles in the collaborative mathematics classroom. The findings are not meant to be generalized to your entire school district, but rather to serve as jumping off points for future growth and development related to the implementation of co-teaching.

The findings of the study are:

1. Different stakeholders (administrators and teachers) have different definitions of "Team Teaching" and different priorities/visions for the implementation of co-teaching.

2. The relationship between co-teachers strongly influences his or her role in the classroom.

3. Content knowledge, which plays a role in which instructional activities each teacher takes on, is necessary to correctly interpret and respond to student error in the mathematics classroom.

Based on these findings, I provide the following recommendations for improving how co-teaching is considered and implemented in your school district:

- Establish a common definition for co-teaching across your district by inviting all stakeholders to be a part of the discussion.

- Encourage co-teachers to define their roles out loud as much as possible. Having co-teachers explicitly state their preferences and teaching philosophies and find common ground allows them to move from co-workers to partners in the collaborative classroom.

- Ensure both teachers feel a sense of ownership over students and classroom by guaranteeing each teacher is represented in the classroom and on communications with parents and students.

- Explore ways to increase administrative support in co-planning, co-instruction, and co-evaluation to increase coherence.

- Provide professional development to administrators and teachers. For many teachers who are used to teaching in silos, co-teaching can require a paradigm shift. In order to create systematic change, these professional developments should be ongoing, sustained, and aligned with existing school and district initiatives.

- Identify individual teacher needs for learning and growth and support these teachers by differentiating workshops or professional development to meet their needs. For example, a content area teacher may need more training in implementing accommodations while a special education teacher may need more content knowledge for the particular courses they collaborate in.

I invite any questions or further dialogue regarding these findings and recommendations. Please feel free to contact me via e-mail at adm5k@virginia.edu.

Sincerely,

Amanda M. Allen

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Appendix A

Invitation to Participate

Dear Teacher,

I am a doctoral student at the University of Virginia and former mathematics teacher. I am currently working on a capstone study that seeks to examine how teachers define their role in the collaborative mathematics classroom. Additionally, I hope to better understand how co-teachers work together to incorporate mathematical discourse as a strategy for increasing the understanding of all learners in the classroom. As part of my research, I would like to visit your class to observe what how you and your co-teacher work together to meet the needs of your students.

The data I plan to collect during the study will include the following:

- Your name, mathematics background, and number of years of mathematics teaching experience.
- Notes I make during classroom observations.
- Related communication between you and myself such as emails.
-

Additionally, I would like to interview you to gain more insight on the decisions you make in your classroom. This interview will give me an opportunity to ask questions about instances I observed in your classroom. It will not be an evaluation of any sort. With your permission, I would like to take written notes and audio-record the conversation. The purpose of the audio recording is for me to refer to later as an accurate record of what was said during our conversation. The recording will deleted no later than May 1, 2017 and will not be shared with anyone.

I will not allow access to the data by anyone unrelated to the project. Each participant will be given a pseudonym from the start of the project so your name will never appear on any of the data.

Your participation in this research study is completely voluntary. You may choose to participate in an observation, an interview, both, or neither. You do not have to participate in the research study. Additionally, you have the right to withdraw yourself from the study at any time. If you wish to withdraw from the study, please contact me. There is no penalty for withdrawing. If you would like to withdraw after I have observed your class or after the interview, please contact me at adm5k@virginia or 757-303-6667.

If you have questions about your rights as a research participant, please contact:
Tonya R. Moon, Ph.D.,
Chair, Institutional Review Board for the Social and Behavioral Sciences
One Morton Dr., Suite 500
University of Virginia, P.O. Box 800392
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Email: irbsbshelp@virginia.edu

Website: www.virginia.edu/vpr/irb/sbs

Thank you for your consideration,

Amanda Allen

Appendix B

Informed Consent Agreement

Please read this consent agreement carefully before you decide to participate in the study.

Purpose of the research study: Research indicates the co-teaching model has become the leading instructional model in an attempt to provide students with disabilities with a high quality education (Friend & Bursuck, 2002; Friend & Cook, 1995; Murawski & Dieker, 2004; Vaughn, Schumm, & Arguelles, 1997). There is a lack of consensus, however, about the effectiveness of this model. This specific study seeks to better understand the process through which co-teachers define their roles in the classroom and how these roles support or promote mathematical discourse in the classroom. The enactment and sustainment of discourse was chosen to be the focus of the study because of its role in promoting student reasoning, eliciting student thinking, advancing student explanation and justification, and creating opportunity for posing purposeful questions

What you will do in the study: The researcher will conduct 15-20 classroom observations with your class during this school year. For these observations, you will not be asked to alter your normal teaching practices. The researcher will not play an active role in your classroom and hopes to observe a typical lesson in your classroom. You will be asked to participate in 1-2 interviews during the 2016-2017 school year. You may decline to answer any of the questions asked or this interview altogether.

Time required: The observations will take place during normal class times and will not require any additional time by you. If you agree to be interviewed, the intended time of the interview is less than two hours.

Risks: There are no anticipated risks in this study.

Benefits: There are no direct benefits to you for participating in this research study. The study may help us understand the different ways teachers respond to student error and what aspects of the classroom are valued.

Confidentiality: The information that you give in the study will be handled confidentially. Your information will be assigned a code number. The list connecting your name to this code will be kept in a locked file. When the study is completed and the data have been analyzed, this list will be destroyed. Your name will not be used in any report. Any audio recording will remain in a locked space at all times and will be erased after it has been transcribed (will be erased no later than May 1, 2017). Your name will not be used in the reporting of the data.

Voluntary participation: Your participation in the study is completely voluntary.

Right to withdraw from the study: You have the right to withdraw from the study at any time without penalty. If you would like any of the information collected from you during your time in the study destroyed, you have the right to say so.

How to withdraw from the study: If you want to withdraw from the study, you may tell the researcher at any time. There is no penalty for withdrawing.

Payment: You will receive no payment for participating in the study.

If you have questions about the study, contact:
Amanda Allen, Doctoral Candidate
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If you have questions about your rights in the study, contact:
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Website: www.virginia.edu/vpr/irb/sbs

Agreement:
I agree to participate in the research study described above.

Signature: _____ **Date:** _____

You will receive a copy of this form for your records.

Appendix C

Interview Protocol for Teachers

Interviews will all be semi-structured with the focus of questioning to better understand how teachers define their role in the classroom and how this role works to support mathematical discourse for students. Teachers may also be asked questions about moments observed during class that need further clarification. For example, "During class today, I noticed that you reviewed the questions from the homework students had problems with…do you typically go over homework answers?"

1. **Please describe your current teaching position and any other required responsibilities you have at your school.** (Probe for grade level, subjects, other work responsibilities such as committees.)

2. **Please describe your teaching experience or background?** (Probe for number of years, subjects taught, teacher education, how long they have been co-teaching, information that may shed light on mathematical content knowledge).

3. **What does successful co-teaching look like?** (Probe for how does co-teaching look like in their classroom).

4. **How do you and your co-teacher decide who will take on what in terms of planning? How often do you plan together?** (Probe for instructional, meeting the needs of students).

5. **What supports does your school or district offer for co-teachers?** (Probe for common planning time, thoughtful pairing, professional development).

6. **How does the co-teaching model enable you and your co-teacher to meet the needs of all students in the classroom?** (Probe further for students with disabilities, how does this model offer support in a way that a non-collaborative classroom would not?).

7. **Describe your work as a co-teacher?** (Probe for what works well, what are challenges, logistical challenges, potential challenges in teaching philosophies).

8. **How do you and/or your co-teacher foster mathematical discourse in your classroom?** (Probe for specific examples, allude to classroom observations).

Appendix D

Figure 1. Sharing Hopes, Attitudes, Responsibilities, and Expectations (S.H.A.R.E.)

Directions: Take a few minutes to individually complete this worksheet. Be honest in your responses. After completing it individually, share the responses with your co-teaching partner by taking turns reading the responses. Do not use this time to comment on your partner's responses—merely read. After reading through the responses, take a moment or two to jot down any thoughts you have regarding what your partner has said. Then, come back together and begin to share reactions to the responses. Your goal is to (a) Agree, (b) Compromise, or (c) Agree to Disagree.

1. Right now, the main **hope** I have regarding this co-teaching situation is:

2. My **attitude**/philosophy regarding teaching students with disabilities in a general education classroom is:

3. I would like to have the following **responsibilities** in a co-taught classroom:

4. I would like my co-teacher to have the following **responsibilities:**

5. The biggest obstacle I **expect** to have in co-teaching is:

6. I think we can overcome this obstacle by:

7. I have the following **expectations** in a classroom:

    (a) regarding discipline

    (b) regarding classwork

    (c) regarding materials

    (d) regarding homework

    (e) regarding planning

    (f) regarding modifications for individual students

    (g) regarding grading

    (h) regarding noise level

    (i) regarding cooperative learning

    (j) regarding giving/receiving feedback

    (k) regarding parental contact

    (l) other important expectations I have