Instructional Coaching: A Support for Increasing Engagement in Middle School Mathematics

Christi Ritchie Edwards

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INSTRUCTIONAL COACHING: A SUPPORT FOR INCREASING ENGAGEMENT IN MIDDLE SCHOOL MATHEMATICS

by

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DEDICATION

This dissertation is dedicated to my family and friends. This journey has been a growth opportunity for us. To my family, thank you for your patience, understanding, and support, which were instrumental in the completion of this action research study. To my boys, thank you for constantly reminding me to relax and that it does not have to be perfect; just to do my best. I encourage you always to heed your own advice and to be lifelong learners looking for growth opportunities. To my friends, thank you for your encouragement and positive vibes.
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ABSTRACT

This observational case study employed a qualitative design to investigate the impact of student-centered instructional coaching and self-determined professional development on student engagement in middle school mathematics. Research demonstrates that engaging students in the learning process increases their attention and motivates them to engage in higher-level critical thinking. Teachers who adopt a student-centered approach to instruction increase opportunities for student engagement. Instructional coaches are used as a professional development tool to support teachers with student-centered instructional practices to engage students in their learning. This four-week study involved two sixth-grade mathematics teachers conducting Number Talks in one of their classes of 20-25 students. The instructional coach provided professional development on using Number Talks to improve student growth and engagement. Through the analysis of pre- and post-intervention surveys, focus group interviews, and classroom observations, I identified positive effects of instructional coaching support, perception of student-centered instruction, and coaching around engagement

*Keywords*: engagement, instructional coaching, professional development, student-centered learning, Number Talks, teacher perception, discourse, strategies
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LIST OF ABBREVIATIONS

AR ......................................................................................................................... Action Research
COP ..................................................................................................................... Community of Practice
DIP ...................................................................................................................... Dissertation in Practice
IRB ....................................................................................................................... Institutional Review Board
NCLB ................................................................................................................... No Child Left Behind
NCEE ................................................................. National Commission on Excellence in Education
NCTM ................................................................. National Council for Teachers of Mathematics
PD ......................................................................................................................... Professional Development
SDT ..................................................................................................................... Self-determination Theory
SLT ..................................................................................................................... Situated Learning Theory
CHAPTER 1
INTRODUCTION

As early as the 1920s, authorities were concerned about the psychological problems, early school leavers (Fuller, 1927). In the 1960s, commentators worried about ‘youth alienation’ from schooling and other social institutions (Murray et al., 2004). Today such young people are most likely described as ‘disengaged’ or ‘disconnected’ from school (Murray et al., 2004). There is a vast amount of literature on high school dropout policies and programs to improve student retention (Murray et al., 2004). Much of this focuses on the teen years and on programmatic interventions at the secondary school level. More recently, the middle years of schooling and student disengagement during early adolescence have received a great deal of attention (Murray et al., 2004).

The topic of student engagement has been a burgeoning area of inquiry over the last decades (Watt & Goos, 2017). Engagement is typically conceptualized as multidimensional, including behavioral, affective, and cognitive facets that map aspects of doing, feeling, and thinking (Fredricks et al., 2004). In mathematics, behavioral engagement refers to the extent to which students participate, including actual or intended enrollments, and the degree of effort applied (Watt & Goos, 2017). Affective engagement includes the emotional dimension of interest, study employment, and can expand to identification within the school culture (Fredricks, 2011). Cognitive engagement taps students’ personal investment, including self-regulatory strategies (Fredricks, 2011).
Eccles (2016) observed that the difference between these three features is unclear; however, it provides a useful classification heuristic for major elements of the essential theories of motivation, which aim to predict individuals’ choices and resulting actions. Students benefit from the affective, behavioral, and cognitive trifecta of engagement in mathematics based on according to the research of Eccles.

There has been a growing focus on mathematical engagement as a predecessor to students’ performance in national and international assessments and participation in science, technology, engineering, and mathematics (STEM)-related disciplines (Thomson et al., 2013). The progressive loss of talent from STEM fields is frequently referred to as the “STEM pipeline,” where the flow of having sufficient graduates slows towards a trickle (Watt & Goos, 2017, p.134). Retention problems in STEM fields are referred to as leaks in the pipeline (Waldrop, 2015). The White House reported in 2012 that 80% of minority groups and women leak out of the pipeline by switching to a non-STEM field or dropping out of high school (Waldrop, 2015). Lucy Sells (1980) identified mathematics as the “critical filter” delimiting (especially girls’ and women’s) access to a range of high-status, high-income careers.

Today, we have a better understanding of the essential role that mathematics plays in rooting technology innovation, manufacturing industries, financials, and social systems, as well as their subsequent advances in scientific knowledge (Watt & Goos, 2017). Mathematics has been regarded as the enabling discipline for STEM-related fields and many other areas of intellectual inquiry (Watt & Goos, 2017). Students in the United States consistently perform lower than students in other industrialized nations on international assessments, particularly in mathematics and science (National Commission
on Excellence in Education, 1983; Spring, 2011). Examining the root cause(s) of this
decline in mathematics is necessary to see why most students perform below average.

Number sense has been considered one of the most essential mathematical notions
to be addressed in school mathematics in the 21st century (Barrera-Mora & Reyes-
Rodriguez, 2019). One of the main objectives of mathematics education is to provide
theoretical and methodological principles to guide the design and implementation of tasks
that foster students’ mathematical reasoning and understanding (Barrera-Mora & Reyes-
Rodriguez, 2019). Task design is vital since the characteristics and pedagogies of tasks
are primary factors in determining the nature and qualities of students’ learning (Sarama
& Clements, 2009). On the other hand, tasks constitute the primary instrument used by
teachers to support students as they learn mathematical concepts (Anthony & Walshaw,
2009). Instructional coaches must model how to effectively facilitate complex authentic
tasks that require critical thinking, engaging in mathematical discourse with their
partner(s) opening justification for their solutions and reasoning.

Mathematics education research has obtained evidence that the largest gains in
mathematical understanding are related to tasks that require high levels of mathematical
thinking and reasoning and that engage students in doing mathematics using procedures
with connection to meaning (Stein & Lane, 1996). Although this research is not recent, it
appears consistent with expectations for current teachers who are encouraged to provide
student-centered instruction with opportunities for students to think critically, collaborate
with others to share ideas, and justify their solutions.
**Problem of Practice**

Engagement is typically conceptualized from a psychological standpoint, focusing on individual behaviors, interests, values, and cognitive investment in effortful learning (Watt & Goos, 2017). Theoretical models and understandings of students’ mathematical motivation and engagement studied within the educational psychology literature complement studies within mathematics education literature, which have predominantly examined processes that shape mathematical understandings (Watt & Goos, 2017).

Losses in interest, value, and own perceived abilities during secondary school predict choices away from STEM, more so for girls and women (Watt & Goos, 2017). Because interests and ability-related beliefs employ important influences on the extent of students’ mathematical participation, a decline in mathematical interests, value, and ability self-perceptions should be of particular concern for future studies and intervention efforts (Watt & Goos, 2017). School guidance counselors, administrators, and teachers are in a particularly critical context; they have the greatest access to be able to reach students before they self-select out of further studies in general or mathematics in particular. Engagement in learning clearly contributes to students’ mathematical identity transformation.

The relevance of number sense is apparent from the vast amount of research literature dedicated to this topic; several researchers have focused their attention on behaviors that characterize those who have number sense (Barrera-Mora & Reyes-Rodriguez, 2019). To develop mathematical understanding, students (and teachers) should play an active role as part of a learning community (NCTM, 2000). Communication allows students to defend their opinions, question their peers’ thinking,
and reveal common misconceptions in which they can collaborate with a partner using mathematical discourse to reorganize their thinking and understanding (Barrera-Mora & Reyes-Rodriguez, 2019). It is crucial that students develop number sense through experiencing problematic situations that allow them to relate quantities with real-life situations and develop the skills needed to decompose, group, use the basic arithmetic functions (add, subtract, multiply, and divide) and use the commutative, associative, and distributive properties (National Governors Association Center for Best Practices & Council of the Chief of State School Officers, 2010). Number sense is a basic skill for 21st-century citizens since, despite the existence of digital technologies that can perform basic mathematical functions and carry out some complex procedures quickly, computational devices cannot interpret mathematical results for making informed decisions (Fuson, 1992).

As an instructional coach, I am concerned that many students are not engaging in the learning opportunities provided. Based on teacher reports, administrative concerns, and district concerns about students’ math engagement, I identified middle school math students as a focus group for this study. I also wanted to explore how professional development targeting research-based, effective strategies affects the learning environment for students who have traditionally struggled in mathematics.

**Theoretical Framework**

This action research study is grounded in the Community of Practice (COP) framework comprising three dimensions: mutual engagement, joint enterprise, and a shared repertoire (Wenger, 1998). The COP is a branch of social learning theory that resides within the constructivism paradigm. Brooks and Brooks (1999) defined
constructivism as “a theory of learning that places the quest for understanding at the center of the educational enterprise” (p. 150). According to Wenger, mutual engagement involves a diverse group of people working together to negotiate meaning. Central to this negotiation of meaning is the members’ work towards a common goal which involves developing mutual accountability, shared goals, and rhythms. Eventually, this mutual engagement and work towards a common goal create a shared repertoire of meaning and resources that help to support and sustain the COP (Wenger, 1998).

**Communities of practice theory**

Communities of practice are dynamic learning communities in which individuals’ identities are shaped through their engagement with others both inside and outside the community, the alignment and negotiation of their views and competencies, and their imagination (Wenger, 1998). Teachers’ participation in effective communities of practice can influence their understanding of concepts or their use of new instructional strategies (Lotter et al., 2021). For example, Hepburn & Gaskell (1998) described how two high school teachers’ different communities of practice (technology versus physics) and relationships within these communities influenced how the teachers taught an applied physics curriculum. Friedrichsen et al. (2006) presented a case study of a preservice chemistry teacher’s inquiry-based teaching during his practicum. The teacher carried out many inquiry practices he had acquired as a former student in an inquiry-oriented science course, *Inquiry Empowering Technologies* (IET) (Friedrichsen et al., 2006). The teacher associated inquiry with the use of evidence and required students to create evidence-based explanations for how soap works. He served as a broker between his university community that stressed inquiry instruction and his traditional mentor teacher’s
classroom to use inquiry practices. As a result of his practicum, the teacher negotiated new meanings of inquiry teaching and expanded his view of technology (Friedrichsen et al., 2006). Community participation can limit or expand teachers’ learning opportunities and may require novices to be apprenticed through practice (Lave & Wenger, 1991).

**Situated learning theory**

Community of practice situated learning theory was first proposed as a model of learning in a community of practice (Lave & Wenger, 1991). Lave and Wenger (1991) argue that learning should not be viewed as simply the transmission of abstract and decontextualized knowledge from one individual to another but as a social process whereby knowledge is co-constructed; they suggest that such learning is situated in a specific context and embedded within a particular social and physical environment. Such situated learning within a community of practice has been applied to teachers learning to teach (Ackerson et al., 2009).

In developing a theory of mathematics teacher development, Jaworkski (2006) modified Wenger’s community of practice concept to emphasize critical inquiry. Jaworkski (2006) stated “Participants grow into and contribute to continual reconstitution of the community through critical reflection resulting in critical alignment; inquiry develops as one of the norms of practice and individual identity develops through reflective inquiry” (p. 204). Whereas Jaworkski (2006) encouraged teachers and researchers to examine classroom practice through action research, Lotter et al. (2021) suggested that placing this critical inquiry initially outside the teachers’ classroom during a PD program could help develop a community of practice in which participants receive a collection of shared reform practices through collaboratively participating in inquiry
instruction and exploring inquiry practice through practice-teaching and reflective feedback.

**Figure 1.1 Community of Practice**

Theoretical models and understandings of students’ mathematical motivation and engagement in mathematics, including behavioral engagement, refer to the extent to which students participate, including actual or intended enrolments, and the degree of effort applied (Watt & Goos, 2017). Social-contextual influences are contextual and social forces that clearly shape students’ motivations (Fullarton, 2002). School and class climate have been identified as especially important (Fullarton, 2002), although the bulk of variation resides at the individual student level (Spearman & Watt, 2013). A concentration on psychological variables has given less attention to social/ contextual support and barrier systems. A noteworthy exception is within the achievement goal theory (AGT) literature, where researchers have extensively studied the motivational climate of the classroom in terms of “mastery” versus “performance” goal structures (Watt & Goos, 2017).
In a mastery environment, the emphasis is on improvement, understanding, and self-development (Watt & Goos, 2017). In contrast, a performance environment is characterized by competition, an emphasis on grades, and outperforming others (Watt & Goos, 2017). Mastery environments promote students’ self-efficacy in mathematics (Friedel et al., 2010), their success expectancies, task values, and mathematical career intentions (Lazarides & Watt, 2015), and reduce maladaptive self-handicapping behaviors and avoidance of help-seeking (Turner et al., 2002). There is a large variation in students’ perceptions of the same classroom environment, highlighting that those students interpret their own learning experiences through perceptual systems that frame and filter those interpretations (Spearman & Watt, 2013).

Engagement can also productively be understood through a sociocultural lens. Sociocultural theories do not take the individual learner (or teacher) as the unit of analysis but, instead, uses the intersection of individuality and agency in the context of a person’s social and cultural experiences (Goos, 2013). To provide an analysis of these multiple dimensions of human experience, Lerman (2000) proposed a unit of analysis called “person-in-practice-in-person.” This unit acknowledges that the object of study (person-in-practice) involves more than individual behavior, cognition, or affect and that participation in practice (the classroom) establishes a new identity for the individual (practice-in-person). The students once again benefit from the trifecta: behavior, cognition, and affect.

Communication is a critical component in developing mathematical understanding. From a sociocultural perspective, students who share their reasoning about ideas with others and listen to others share their thinking create an understanding of
culturally established mathematical practices. Vygotsky (1994) said that a language is a cultural tool, a human instrument of communication. Individuals come to learn the meanings of culture by internalizing and being transformed by these meanings as they learn to speak the language of the culture. Thus, students create their own knowledge and develop mathematical meanings as they learn to explain and justify their thinking and reasoning to others (NCTM, 2000). As students speak the mathematical language, they transform their thinking of the mathematical concepts. Mathematical language comes from society and thought (concept) comes from the individual (Steele, 2001).

Children begin to speak about their thoughts in ordinary language. When they are actively involved both physically and mentally, they can make connections from their ordinary language to mathematical language (Pirie, 1998). Through their language, they express their current mathematical understanding, and teachers come to understand their thinking. When children express their thinking in ordinary language in a context in which they are making sense of the situation, teachers can make links between children’s language and the symbolic language of mathematics. Vygotsky (1994) claims that students will be able to identify the appropriate word or term when their understanding of the concept has matured.

Vygotsky (1994) suggested that students be given scientific language when some degree of understanding already exists. Applying Vygotsky’s idea to learning mathematics, the growth of mathematical understanding occurs through a process of connecting earlier thought with new mathematical language to create more meaning. Explaining one’s thoughts to others solidifies reasoning for oneself. During the process of students’ sharing and negotiating thinking, collective meanings are discovered. In the
presence of a knowledgeable teacher, these shared meanings become the shared mathematical meanings of society. Although not every student’s understanding is matched with another’s, through effective teacher facilitation and support, a teacher can build a model in their mind of the student’s conceptual understanding and, thus, understand a student’s taken-as-shared meanings (Steffe & Thompson, 2000). To have opportunities for students to build these meanings, teachers need to plan learning environments that encourage students’ active involvement and mental activity and provide social learning situations in which communication takes place.

The construction of meaning is the crucial focus of mathematics education. However, the meanings of words cannot be transmitted from one mind to another. In other words, teachers (or students) cannot give their understanding to another person (Sierpinska, 1998). Meaning cannot be taught directly, because children can memorize definitions, procedures, and algorithms and not link them to any previous experience (Bartolini-Bussi, 1998). Meaning surfaces in the discourse; children combine the words and phrases they have heard with their own thoughts to create meaning. Children generalize their actions (physical and mental) to word meanings (Pirie, 1998). This generalization of the language is concept formation or conceptual knowledge. Vygotsky (1962) believed that as children learn to use new words, they internalize the meanings of the words they say. According to Vygotsky (1994), a child’s cultural development of word meaning appears in a two-function process: first on the social level and then on the individual level where word meaning generalization has taken place.
Purpose of the Study

The intent of this qualitative, multiphase action research study is to investigate the impact of instructional coaching and self-determined professional development on student engagement in middle school mathematics.

Research Questions

RQ1 – How does instructional math coaching influence teacher practice in engaging students in middle school mathematics?

RQ2 – What are the obstacles to middle school student engagement in mathematics class?

RQ3 – What are teacher perceptions of student-centered professional development in mathematics?

Research Positionality

Researcher positionality is an essential element of the research process. Researchers must ask themselves, “Who am I in relation to my participants and my setting?” (Herr & Anderson, 2015). I am an educator with 31 years of experience. I have been a high school mathematics teacher for 25 years, the lead secondary math instructional specialist supporting middle school and high school math teachers within the district for three years and worked for the Southern Regional Education Board as a School Improvement Instructional Coach for the last year. Initially, I am an insider with all the teachers as we all were facing the challenge of students returning to the classroom after two years of virtual learning due to COVID, specifically relative to how to keep them engaged and interested in learning mathematics. Teachers providing mathematics instruction to students are analogous to my efforts to host PD to support teachers and administrators. I created “The Canvas Coaches Corner” to model how to organize a Canvas course and how to use specific features to maximize student access and
engagement. I have supported the participants at Beaufort Middle School as a School Improvement Instructional Coach for one year. During this time, I have provided PD targeted at SREB’s Powerful Instructional Mathematics Practices, deconstructing standards, creating standards-aligned learning targets, and formative assessments. I also provided individualized teacher support with lesson planning, co-teaching, and modeling of engaging math tasks with their students. Although I was a classroom teacher and therefore an insider as the research study began, my role shifted to that of an outsider due to the change in my position to a School Improvement Instructional Coach for the Southern Regional Education Board. This change shifted me into the role of an outsider working in collaboration with the insider(s) (administration) during teacher evaluations, teacher and student interviews, and technological professional development.

As a former teacher of primarily honors and AP students for most of my career, I have extremely lofty expectations for learners identified as Academically and Intellectually Gifted (AIG). I could have preconceived notions of the AIG students based on my expectations and the observed performance in traditional face-to-face instruction. I also was identified as an AIG student when in elementary school. My personal experience could create an unintentional bias toward my expectations for all AIG students. The focus of this research is on the lack of engagement of all levels of students in middle school mathematics. Unintentional bias for higher expectations for AIG students could affect the observational data that I collect. To address this possible bias, I will ask teacher participants to not identify which students are identified as AIG or have an Individualized Educational Plan (IEP).
Our obligation as researchers is to interrogate our multiple positionalities in relationship to the question under study (Herr & Anderson, 2015). Another aspect of my positionality is that I am a white female math instructional specialist at eleven secondary schools. This means that I look like most of the teachers in our district, but only 35% of the students. As a mathematics instructional coach for a nonprofit educational support organization, I work with schools in Alabama, Florida, North Carolina, South Carolina, and West Virginia. When visiting schools that are predominantly non-white, I have observed that students show me a greater level of respect than the schools where the students are also white. The research study will be taking a specific look at the engagement of middle school students in mathematics; more specifically, the focus group students at Beaufort Middle School may or may not be white like me. As a researcher, I must be honest and reflective about the limitations of my own multiple positionalities and take them into account methodologically (Herr & Anderson, 2015).

**Research Design**

Action research is undertaken to improve the quality of the practice of a particular discipline (Merriam & Tisdell, 2016). Action research is a systematic, reflective inquiry conducted by educators; they collect data concerning their teaching practices and student learning to cultivate realistic solutions to real problems (Mertler, 2017). The goal of action research is to address a specific problem in a practice-based setting, such as a classroom, a workplace, a program, or an organization (Herr & Anderson, 2015). Action research fits this study as I will participate and take an active role as a researcher and collaborator; this will allow for systematic inquiry and result in gaining a better understanding of this problem of practice.
A basic qualitative research design, based on the belief that knowledge is constructed by people in an ongoing fashion as they make meaning of an activity, experience, or phenomenon (Merriam & Tisdell, 2016). The purpose of this study is to investigate the impact of instructional coaching and self-determined professional development on student engagement in middle school mathematics; therefore, it fits the qualitative research design. Qualitative studies are epistemologically social constructivist, theoretically interpretive, and focus on (1) how people interpret their experiences, (2) how they construct their worlds, and (3) what meaning they attribute to their experiences (Merriam & Tisdell, 2016). This qualitative inquiry will be viewed with a pragmatic lens as the researcher’s desire is to affect change and relate knowledge to action (Kennedy, 2016).

**Participants**

The participants for this study will be two middle school mathematics teachers from Beaufort County Schools. The sample selection is based on purposeful, criterion-based sampling (Efron & Ravid, 2020); participants will be selected deliberately based on the criterion that they all teach at Beaufort Middle School. A focus group of two teachers will be selected based on criterion-based sampling: the criterion of teaching mathematics at Beaufort Middle School. Other participants include 50 students from classes of the teachers participating in the study. The study will focus on the impact of teacher implementation of Number Talks on student engagement in a specific class for each of the two teachers. Remaining participants will include the administrators, leadership team, instructional coach, and numeracy coach.
Data Collection

Data collection in a pragmatic approach allows the researcher to utilize multiple methods of inquiry, including interviewing, reviewing archival documents, and/or observing participants in their natural setting (Kennedy, 2016). Classroom observations and semi-structured interviews will occur pre-intervention and post-intervention in this study. Data collection and analysis are simultaneous activities in qualitative research (Merriam & Tisdell, 2016). This action research study will use three qualitative methods of data collection, pre- and post-intervention classroom observations, pre- and post-intervention surveys, and pre- and post-intervention focus group interviews, to determine if rich, self-directed professional development effect engagement and instructional strategies, such as Number Talks, to foster mathematical discourse and build numeracy skills (Bloomberg & Volpe, 2019). Information gathered from semi-structured observations, surveys, and interviews will be analyzed to address the identified research questions.

Semi-structured observations are designed to illuminate strategies used by the teacher to support students’ engagement (Efron & Ravid, 2020). I will conduct the 30-minute pre-and post-intervention observations at a distance using the observation protocol (Appendix C). Highly descriptive observation notes will include details of the participants, the setting, and the activities or behaviors of the students and the teachers. Surveys will be used initially to gather information about teachers’ opinions and perceptions of three obstacles to engaging in mathematics classrooms. Pre- and post-surveys will be utilized in evaluating the effectiveness of the intervention (Efron & Ravid, 2020). Using interviews as an inquiry method, I will collect data on teacher
perceptions, knowledge, opinions, experience, and beliefs about engagement in middle school math class (Efron & Ravid, 2020).

Table 1.1 Research Questions and Data Collection Methods

<table>
<thead>
<tr>
<th>RQ#1 – How does instructional math coaching influence teacher practice of engaging students in middle school mathematics classrooms?</th>
<th>RQ #2 – What are the obstacles to middle school student engagement in mathematics class?</th>
<th>RQ #3 – What are teacher perceptions of student-centered professional development in mathematics?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data collection methods for RQ #1:</td>
<td>Data collection methods for RQ #2:</td>
<td>Data collection methods for RQ #3:</td>
</tr>
<tr>
<td>1. Observations</td>
<td>1. Observations</td>
<td>1. Pre and post observations</td>
</tr>
<tr>
<td>2. Individual surveys</td>
<td>2. Individual surveys</td>
<td>2. Pre and post surveys</td>
</tr>
<tr>
<td>3. Focus group interviews</td>
<td>3. Focus group interviews</td>
<td>3. Pre and post individual interviews</td>
</tr>
</tbody>
</table>

Data Analysis

Qualitative research centers on “understanding how people interpret their experiences” (Merriam & Tisdell, 2016, p. 6). It is a paradigm within action research in education that builds “knowledge” and elicits “insight” that serves as agents of change (Efron & Ravid, 2020, p. 46). Ospina (2004) further highlights an important potential of a qualitative approach to action research: the emergence of “a novel perspective of a phenomenon […] not well understood because of the narrow perspectives used before” (p. 9). In pursuit of a “novel perspective” surrounding diversity training, I will maneuver through this action research accommodated by a qualitative design.
In this study, a basic qualitative research design will involve moving back and forth between concrete bits of data and abstract concepts, between inductive and deductive reasoning, and between description and interpretation (Merriam & Tisdell, 2016). Making meaning out of data involves consolidating, reducing, and interpreting what the participants have said and what the researcher has seen and heard (Merriam & Tisdell, 2016). The goal of qualitative action research is to organize the vast amount of collected data gathered through surveys, observations, individual interviews, and focus group interviews into a logical structure to enable the researcher to synthesize the information gathered (Efron & Ravid, 2020). The process of data collection and analysis is recursive and dynamic, with analysis becoming more intensive once all data is collected (Merriam & Tisdell, 2016). Field notes from observations, individual interviews, and focus groups provide the necessary data. The inductive analysis process begins by breaking down data into parts, organizing into codes, and identifying recurring constructs and categories (Creswell & Poth, 2018). Open and axial coding will reveal similar patterns (Merriam & Tisdell, 2016). Open and axial coding will allow for changes in categories that will be grouped to create major themes that convey the overall interpretations of the data (Bloomberg & Volpe, 2019).

*Microsoft 365*, a product family of productivity software, collaboration, and cloud-based services, will be used for sorting data, creating tables for assigning codes, and organizing data. Each set of field notes, focus group, and interview transcripts will be coded, line-by-line, providing the researcher with a better understanding of the data. The *Microsoft 365* transcribe feature will be used for transcribing the video recordings of focus group interviews and classroom observations. The codes will be organized into...
emerging categories; these represent a theme around which associated topics are grouped (Charmaz, 2014, as cited in Efron & Ravid, 2020). This process will be repeated with all sources of data until a level of saturation is reached, and a model demonstrating categories and themes is generated (Merriam & Tisdell, 2016). A summary table will provide a record of the categories and quotations that demonstrate their content; a codebook will provide a list of all codes and definitions along with these codes (Efron & Ravid, 2020).

**Rigor and Trustworthiness**

All research is concerned with producing valid and reliable knowledge in an ethical manner (Merriam & Tisdell, 2016). The rigor of qualitative research equates to the concepts of reliability and validity and all necessary components of quality (Cypress, 2017). Rigor is defined as the strength of the research design and the appropriateness of the method to answer the questions (Morse et al., 2002, as cited in Cypress, 2017). Trustworthiness refers to the quality, authenticity, and truthfulness of findings (Cypress, 2017). The trustworthiness of a qualitative study also depends on the credibility of the researcher (Merriam & Tisdell, 2016). Strategies to establish rigor in a basic qualitative inquiry may include addressing personal biases or assumptions, creating a system to test saturation, and ensuring a detailed reporting of the research procedures or participant validation of the researchers’ interpretation of the data (Kennedy, 2016). The strategies for rigor are influenced by the theoretical positioning and analytical lens of the researcher as well as how the researcher interacts with the data (Kennedy, 2016).
Significance of the Study

Mathematics education in the United States needs reform, despite the strides that have been made in the National Council for Teachers of Mathematics (NCTM) movement over the past three decades. As the public voice for mathematics education, NCTM strived to raise the consciousness of those involved in mathematics education by creating the standards document, initiatives, and other publications (Briars et al., 2015). NCTM is working to make the complexities of equity and access part of the discussions, the consciousness, and the actions of all mathematics educators (Briars et al., 2015).

Antiquated “I do, you do, we do” strategies, IRE patterns, and rote memorization methods do not support students in becoming mathematical problem solvers and gaining deep mathematical understanding (NCTM, 2014). Number Talks are an accessible, approachable pedagogical tool in which to enact the Standards for Mathematical Practice (Kamin, 2016) and can be utilized in any classroom from Pre-K through college to increase student engagement by developing equitable discourse practices, productive problem-solving dispositions, and increased number sense for all.

The researcher anticipates the findings from this study may lead to Number Talks being mandated and implemented in all middle school mathematics classrooms in Beaufort School District. The researcher also anticipates that professional development provided by the instructional coach for the focus group of mathematics teachers at Beaufort Middle School on implementing Number Talks would improve student engagement through mathematical discourse. When students are given a mental math problem and asked to explain their thinking, they benefit in several ways (Pourdavood et al., 2020). Humphreys and Parker (2015) found that with Number Talks, students feel
they can be competent math thinkers even if they are not fast, are more willing to persevere, and have more confidence in themselves to reason mathematically.

The results of this study will be of interest to mathematics educators and stakeholders interested in increasing student engagement, strengthening numeracy skills, and solving complex problems relevant to the students. This study addresses students who are unwilling to challenge themselves mathematically due to their lack of engagement. This study also addresses the impact of student-centered professional development on increasing student engagement.

The researcher intends to show how instructional math coaching impacts instructional practice to affect student engagement in middle school mathematics classrooms. The study addresses how the number talks instructional strategy can not only assist educators in building students’ mathematics skills but also help to engage students in mathematics and support their ability to see the relevance in solving complex mathematics problems. Through this action research study, educators from kindergarten through college may learn strategies to encourage students to become active participants in their current learning and life-long problem solvers. The results of this study could impact teachers from kindergarten through college.

**Limitations of the Study**

This study focuses on expanding our theoretical understanding of students’ engagement in mathematics during middle school years. This study is guided by the philosophical paradigm of constructivism, focusing on learning as an active and constructive process, and depends on the axiology assumption that research is valued, indicating the researcher is responsible for data collection (Narayan et al., 2013). Relying
on the constructivist paradigm, the goal of the professional development, provided by the instructional mathematics coach, is to have positive impacts on teacher participants’ instructional practices. Based on previous research, the assumption is that the implementation of improved instructional practices, such as using Number Talks, will improve student engagement.

The first limitation of this study is the small sample size with a limited number of participants. The small sample size could affect the identification of pertinent relationships within the data. A second limitation is access to the classroom for observations and individual coaching due to the limited number of days I will be on campus during the semester. As an instructional coach that serves numerous schools in the district, the researcher has limited availability to observe, debrief, and provide face to face feedback and recommendations for the teacher participants. Another limitation is the scheduling of the book study meetings, which depend on the dates that the administration schedules me to be on campus.

**Organization of the Dissertation**

The dissertation is composed of five chapters. Chapter 1 introduces the problem and purpose of the study, the theoretical underpinnings, and the design of the research with identified significance and limitations. Chapter 2 sets the background, importance, and the context of the study with relevant concepts illuminated and theoretically framed within the historical perspectives of instructional coaching and student engagement supported by previous research studies. Chapter 3 describes the research plan and rationale that validates the methodology. Chapter 4 presents the research findings based on the research questions, research design, data collection methods, and analyses process.
Chapter 5 details an overview of the study, focusing on the outcomes as they relate to the research questions and literature, with logical conclusions and recommendations for future research.
Definitions of Terms

Several key terms are used throughout this action research study. Understanding the definition of these terms in the context of the study is important.

- **Community of Practice:** Communities of practice are groups of people who share a common passion for something they do and learn how to do it better as they interact regularly (Wenger & Wenger-Trayner, 2015).

- **Constructivism:** Constructivism is the theory that says learners construct knowledge rather than just passively take in information. As people experience the world and reflect upon their experiences, they build representations and accumulate added information into their pre-existing knowledge (Wenger & Wenger-Trayner, 2015).

- **Epistemology:** A relational epistemology is all the “systems of knowledge built on relationships” (Wilson, 2008, p.74).

- **Instructional Coach:** An instructional coach is a teacher-leader whose key role is to collaborate with teachers to improve instructional practices (Knight, 2007). Instructional coaches are generalists who typically do not focus on a single content area for their support.

- **Instructional Practices:** Instructional practices are the specific teaching methods that guide learning in a mathematics classroom (Campbell & Malkus, 2011).

- **Number Talks:** Number Talks are “five- to fifteen-minute conversations around purposefully crafted computation problems that are solved mentally” (Parrish, 2011, p.15).

- **Philosophical Paradigm:** A paradigm is a “shared world view that represents the beliefs and values in a discipline and that guides how problems are solved” (Schwandt, 2001).

- **Professional Development:** Professional development is “sustained (not stand-alone or short-term workshops), intensive, collaborative, job-embedded, data-driven, classroom focused” opportunities for teachers to work alongside colleagues to enhance teacher beliefs and instructional practices (Every Student Succeeds Act [ESSA], 2015, p. 295).

- **Self-determination Theory:** Self-determination theory is a micro-level theory of human motivation that aims to explain the dynamics of human need, motivation, and well-being within a social context (Chiu, 2021).

- **Situated Learning Theory:** Situated learning is an instructional approach developed by Jean Lave and Etienne Wenger in the early 1990s, and follows the work of Dewey, Vygotsky, and others (Clancey, 1995) who claim that students are more inclined to learn by actively participating in the learning experience.
CHAPTER 2
LITERATURE REVIEW

Overview

The following chapter includes the concepts that outline the breadth and scope of the review of the literature for this action research study. It begins by revisiting the problem of practice as introduced in Chapter 1. It also identifies the purpose of the research, along with an overview of the theoretical framework and research literature to frame the problem of practice and associated intervention for this study. The literature review is presented in the following five subsections: the theoretical framework, historical perspectives, instructional coaching, student engagement, and math talks in middle school. Each section provides a description of the identified major topic and subcategories supplying an overview of the details. The summary provides a synthesis of the relevance of previous research as it relates to the identified purpose of this study.

Problem of Practice

The lack of student engagement in mathematics classrooms and how to address this problem is a central concern in educational research journals and speakers for educational reform conferences worldwide. It has been argued that students’ persistent struggles in mathematics suggest a need for a new reform of professional development for teachers (Taton, 2015). The importance of effective teacher professional development that positively impacts student learning is a topic of discussion in many educational
forums. It is not sufficient to solely focus on developing teachers’ content knowledge, however, because mathematical ideas are embedded within various representational forms; therefore, content-professional development must include pedagogical discussions (Darling-Hammond et al., 2020). Professional development in which authentic mathematical inquiry and pedagogical analysis occur in tandem is the goal of a research-based, high-quality professional development community.

**Purpose Statement and Research Questions**

The intent of this action research is to investigate the impact of student-centered instructional coaching and self-determined professional development on student engagement in middle school mathematics and to examine teacher attitude toward the implementation of strategies, student perception of teacher engagement, and academic performance of students. The intervention is the creation and facilitation of professional development to learn effective strategies to create a learning environment that encourages students to visualize problem-solving, calculate quickly, use higher-level thinking, and explore multiple strategies (Dunlosky et al., 2013). This study has been designed to answer the following questions:

**RQ1** – How does instructional math coaching influence teacher practice in engaging students in middle school mathematics?

**RQ2** – What are the obstacles to middle school student engagement in mathematics class?

**RQ3** – What are teacher perceptions of student-centered professional development in mathematics?

**Literature Review Purpose and Methodology**

The literature review serves as a method for researchers to survey prior research and studies and identify patterns, generalizations, and gaps within a particular topic
(Rozas & Klein, 2010). This information can provide a foundation, help define the research questions, and help frame the methods the researcher will use to conduct the research (Machi & McEvoy, 2016). The researcher uses the Community of Practice (COP) theoretical framework to ground this case study. The COP framework has been used in research to study the interactions of teachers and coaches during the academic year through observations and coaching conversations (McGatha, 2008). This research is different in that the instructional coach will provide professional development for teachers to support student-centered learning and the impact on student engagement in middle school math classrooms. Wenger (1998) described that, for learning in practice to take place, communities must be involved in the following three processes: “evolving forms of mutual engagement,” “understanding and tuning their enterprise,” and “developing their repertoire, styles, and discourses” (p. 95). This research study uses the COP framework to allow teachers to experience collaboration with their instructional coach through professional development supporting the implementation of math talks and how it affects student engagement.

For this study, I used the University of South Carolina online library to search databases ERIC and EBSCO for peer-reviewed journals, websites, and books. Key terms used to search were instructional coaching, student-centered instruction, teacher engagement, student engagement, professional development, communities of practice, educational theory, social justice, minority students, and culturally relevant pedagogy.

**Theoretical Framework**

This action research study is grounded in the neologism community of practice (COP) theoretical framework and supported by the situated learning theory (SLT), which
is based on the work of Jean Lave and Etienne Wenger (Pyrko et al., 2017). Lave and Wenger (1991) defined the COP simply as a group of individuals with a shared concern, issue, or passion who engage with each other regularly for the purpose of growing and learning. An authentic COP consists of three fundamental elements: a domain of knowledge, which defines a set of issues; a community of people who care about this domain; and a shared practice that they are developing to be effective in their domain (Wenger et al., 2002, p.27). The community encompasses the relationships and connections between members of the COP that empower them to engage in discourse, share knowledge and insights, and learn collaboratively. This immediate application of learning to the workplace makes participation in a COP rewarding and valuable (Trust & Horrocks, 2017).

COP’s are dynamic social structures fueled by the interactions of the participants engaged in the community (Brooks & Brooks, 1999). Trust and Horrocks (2017) emphasize that “learning in a COP is a socially constructed process of participation, interaction, negotiation of meaning and development of shared knowledge” (p. 646). The support and accountability of community members build relationships that are then carried from educators into the classroom. Situated learning and constructivism are at the heart of every COP.

Self-determination theory (SDT), proposed by Deci and Ryan (1985), aims to explain the dynamics of human need, motivation, and well-being within a social context. The SDT suggests that individuals possess three psychological needs: autonomy, competence, and relatedness (Chiu, 2021). School contexts influence engagement by supporting students’ of themselves as related in school, as capable of succeeding, and as
self-determined learners (Skinner & Pitzer, 2012). Students cumulatively construct views of themselves from these experiences (Connell & Welbourn, 1991). “Autonomy refers to the need for expressing one’s authentic self and experience that self as a source of action” (Skinner & Pitzer, 2012, p.27). Competence is the need to experience oneself as effective in interactions with social and physical environments (Elliot & Dweck, 2005) and is believed to underlie control processes (Bandura, 1997). Relatedness refers to the need to experience oneself as belonging and being connected to other people (Crittenden, 1990). These beliefs are durable convictions that create students’ apparent reality and guide their actions (Skinner & Pitzer, 2012).

**Historical Perspectives**

Educational reforms over the last few decades have targeted changes in the nature of teaching and learning. The No Child Left Behind Act of 2001 (NCLB) and the Every Student Succeeds Act (ESSA) in 2015 focused on improving inequity in our nation’s schools by implementing high-stakes standardized testing to hold teachers and schools accountable by measuring yearly student achievement (Puntin, 2022). Teachers’ perception of their own autonomy declined as the demands for accountability and standardization of the curriculum increased (Puntin, 2022). Sparks and Malkus (2015) share the results of a study conducted by the National Center for Educational Statistics during the 2003-2004, 2007-2008, and 2011-2012 school years identifying teachers that reported feeling moderately autonomous in planning and classroom instruction. Due to the accountability movement, teachers felt less autonomous because they did not think they had control over the content they taught, instructional resources chosen, instructional practices used, discipline, or homework (Knight, 2009). This decrease in teacher
autonomy established a need for quality professional learning opportunities to increase
teacher autonomy (Puntin, 2022). Knight (2009) explains the issue of decreased teacher
autonomy is a result of “irresponsible accountability” or professional learning by top-
down directives based on school needs to meet accountability measures (p. 16). In
contrast, Knight (2009) uprooted “responsible accountability” where teachers and
coaches work collaboratively to determine goals that can impact student engagement,
support student achievement, and establish the best strategies to achieve this goal; this
provides teachers with a high level of autonomy. Instructional coaching can establish
collective professional learning and support the autonomy of teachers.

The goal of equipping students with 21st-century skills has prompted teachers to
seek alternate methods of promoting real learning of mathematics, building communities
of best practices with students, teachers, and parents (Hoon et al., 2021). The successful
implementation of mathematics education reforms requires teachers to significantly alter
traditional teaching practices and develop a discourse community in their classroom
(Hufferd-Ackles et al., 2004; National Council of Teachers of Mathematics [NCTM],
2000). Over the last 20 years, numerous studies have investigated teachers’ attempts to
try new instructional practices in light of reform goals (Hufferd-Ackles et al., 2004).

**Culture and Mathematics in Schools**

In today’s mathematics classrooms, teachers face dynamic student populations.
The National Center for Education Statistics (NCES) predicts that by 2035 students of
color will make up most of the student population (NCES, 2016). These changes in the
population from year to year create new and continual challenges for educators. Although
educators group students by race, the cultural component that affects students’ way of
knowing, doing, and learning is more relevant than the color of their skin (Bonner, 2017). The great diversity that defines the public-school experience creates unique situations in which educators and students are challenged to learn and navigate cultural norms and situations (Bonner, 2017).

Although diversification of school populations brings opportunity, research shows that the needs of students from diverse backgrounds are not being met in mathematics classrooms across the nation (Lee et al., 2006). NCTM’s *Principles and Standards for School Mathematics* (2000) include the equity principle, which states that “excellence in mathematics education requires equity—high expectations and strong support for all students” and that “all students, regardless of their personal characteristics, backgrounds, or physical challenges, must have opportunities to study—and support to learn—mathematics” (NCTM, 2000, p. 12). These and other charges have led theorists in the field to offer similar solutions, as is illustrated through the emergence of educational theories such as culturally responsive teaching (Gay, 2000). These foundations support the idea that increased diversity offers teachers the “opportunity to empower students through explicitly culturally based instructional practices and rigorous, connected mathematics instruction, and to communicate the importance of teacher engagement in practices that support equity in mathematics classrooms” (Bonner, 2017, p.8).

**Culturally Responsive Teaching in Mathematics**

Culturally responsive mathematics teachers can teach content, even mainstream content, without asking students to live, act, or learn differently because of social norms; rather, these teachers try to offer cultural congruence for students in the mathematics classroom (Gay, 2000). These teachers are attentive to racial and cultural identity and
often develop these constructs while teaching (Walker, 2000). Culturally responsive teaching (CRT) is complex and theoretical in nature. CRT requires that teachers shift their ways of thinking and adopt fundamental changes in their pedagogical practices (Gay, 2000). This is especially challenging given the varying populations in each classroom and the prominence of state and district-mandated curricula (Bonner, 2017).

Bonner and Adams (2012) claim that culturally responsive mathematics teaching (CRMT) is vital to promoting equity in school spaces. Bonner and Adams’ research (2012) identifies four fundamentals of CRMT: knowledge, communication, relationship/trust, and constant reflection and revision. These areas present contexts within which individual teachers can enact CRMT based on unique student populations. Additionally, these cornerstones highlight areas of pedagogy on which teachers can focus and reflect when striving to become more culturally responsive (Bonner, 2017). Student-centered learning and therefore, student engagement, are derivatives of CRMT. This research study will examine the impact of student-centered professional development on student engagement.

**Instructional Coaching**

While millions of dollars are spent on traditional professional development each year in the United States, many school districts are exploring different means to increase students’ test scores (Obara, 2010). One strategy is hiring mathematics coaches as on-site professional developers (Obara, 2010). Although mathematics coaching is a newly investigated research area, and many issues still must be addressed as school districts implement coaching programs, coaching provides hope to schools that have struggled with traditional professional development programs (Obara, 2010). In response to recent
policy initiatives calling for implementing evidence-based classroom practice, instructional coaches are often utilized as providers of professional development (Desimone & Pak, 2017).

**Theoretical Considerations that Support a Community of Practice**

“Mathematical learning is not a process of internalizing carefully packaged knowledge but is instead a matter of reorganizing activity, where activity is interpreted broadly to include conceptual activity or thought” (Cobb et al., 1991, p. 5).

**Community of Practice**

This action research study is grounded in the Community of Practice (COP) framework comprising three dimensions: mutual engagement, joint enterprise, and a shared repertoire (Wenger, 1998). The COP is a branch of social learning theory that resides within the constructivism paradigm. A COP is rooted in the idea of situated learning theory.

**Constructivism.** According to the theory of social constructivism, social worlds develop out of individuals’ interactions with their culture and society (Lynch, 2016). The focus of constructivist instruction is not to memorize and recall facts but instead it is to help learners develop, explain, and interpret information and use this knowledge to approach new situations (Ertmer & Newby, 2013). Knowledge evolves through the process of social negotiation and evaluation of the viability of individual understanding. Every conversation or encounter between two or more people presents an opportunity for new knowledge to be obtained, or present knowledge expanded (Lynch, 2016).

Constructivism emphasizes the role of the student and the learning community in
constructing knowledge through inquiry, reflection, and academic discourse (Swan et al., 2009).

**Situated Learning Theory.** The situated learning theory argues that learning occurs best when it takes place in the context in which it is applied (Lave & Wenger, 1991). Lave and Wenger (1991) believe that learning should not be viewed simply as the transmission of abstract and decontextualized knowledge from one individual to another, but rather as a social process whereby knowledge is co-constructed; they suggest such learning is situated in a specific context and embedded within a particular social and physical environment.

**Math-Talk Learning Community**

A math-talk learning community is a classroom where students use discourse to support the mathematical learning of all participants (Hufferd-Ackles et al., 2004). The developmental trajectories in the Math-Talk Learning Community are (a) questioning, (b) explaining mathematical thinking, (c) sources of mathematical ideas, and (d) responsibility for learning. By math-talk learning community, Hufferd-Ackles et al. (2004) “refer to a classroom community in which the teacher and the students use discourse to support the mathematical learning of all participants” (p. 82).

Hoon et al. (2021) investigated the practices of a mathematics learning community in Taman Negara Pahang. This case study shows that all parties, namely teachers, parents, and students put a great amount of effort into developing mathematics education (Hoon et al., 2021). Teachers, as leaders, were illuminated as playing a lead role in fostering relationships in the learning community; therefore, they created a conducive culture for learning mathematics (Hoon et al., 2021). Although this case study
was not specifically on math-talk learning communities, the research provides evidence that a learning community that emphasizes quality mathematics teaching practices, dedication and commitment of teachers, and open lines of communication between teachers and parents provides students living in disadvantaged settings supports needed to perform well in mathematics (Hoon et al., 2021).

**Definition of Instructional Coaching**

Helping teachers change their practices is not an easy task. Teachers can be resistant to changing their instructional practices because it moves them away from their comfort zone (Duffy & Roebler, 1986; Fullan & Stiegelbauer, 1991). Instructional coaches (IC) are hired in schools to help teachers with professional development (PD) and model effective teaching practices. Coaches support administrators’ impact on the schools’ professional growth and innovative pedagogy. Administrators must foster a culture of support and learning in a school for teachers to feel compelled to grow professionally (Madsen & Mabokela, 2014). Administrators must be effective instructional leaders for coaching programs to be effective in schools (Fullan & Knight, 2011).

Administrators are responsible for creating a school culture of trust and collaboration which solidifies embedded follow-through of PD implementation to strengthen educators’ practices (Mieszanek, 2020). When administrators work to create these goals and vision of high expectations of professional growth with support from instructional leaders, teacher effectiveness increases, and that impacts student learning (Supovitz et al., 2009).
**Student-Centered Professional Development**

While these theoretical and empirically based recommendations for professional development have promise, professional development research includes mixed results, especially in mathematics (Polly, 2012). In a large-scale professional development study with middle grades mathematics teachers, researchers found that the professional development positively influenced teachers’ use of learner-centered practices in some cases, but with little evidence of influence on student learning outcomes (Garet et al., 2010). In the seminal Cognitively Guided Instruction project, teachers spent the first year demonstrating no change in their instruction or beliefs, but in the second year of professional development they started to drastically shift their teaching (Carpenter et al., 1996). Researchers in the Rational Number Project (Cramer et al., 2002) found that professional development only changed teachers’ practice when it was paired with classroom-based support during and immediately after lessons. Therefore, professional development that is content specific and develops teachers’ content knowledge in conjunction with teachers’ skills related to teaching with standards-based pedagogies can positively influence teachers’ instruction (Cohen, 2004).

Professional development works, according to the accepted theory of action, by (1) improving teachers’ knowledge, skills, attitudes, and beliefs; (2) improving instruction; and, hence, (3) improving student learning (Desimone, 2009, p.185). At the school and district levels, the goal of PD is to build the capacity of the teachers (Mandinach & Jackson, 2012; Killion et al., 2012), and, to be effective, most innovations require “getting to scale” – that is, attaining a systemic reach (Elmore, 1996, p. 25).
**Planning Professional Development**

Professional learning for educators must be designed with intentionality and strategic planning. Guskey (2014) shares what professional learning accomplishes, and the significance of its contribution is contingent upon how it starts. The effectiveness of any professional learning activity, no matter the content, format, or structure, depends primarily on the purposeful planning that takes place (Guskey, 2014). With backwards planning, schools can ensure they choose professional development activities specifically aligned with their identified goals (Guskey, 2014). Because the primary goal is to improve student learning outcomes, planning for PD must start with clarifying the outcomes. Beginning where we want to end and then working our way back to the process that will get us there is imperative when designing professional learning experiences (Guskey, 2001; Hirsch, 2012).

**Student Engagement**

Over the past two decades, there has been abundant research on student engagement because of its potential to address persistent educational problems, including low achievement, high dropout rates, and high rates of student boredom and alienation (Chapman et al., 2010; Fredricks, 2015). Engagement is typically conceptualized from a psychological standpoint, focusing on individual behaviors, interests and values, and cognitive investment in effortful learning (Watt & Goos, 2017). Theoretical models and understandings of students’ mathematical motivation and engagement studied within the educational psychology literature offer a powerful complement to studies within mathematics education literature, which have predominantly examined processes that shape mathematical understandings (Watt & Goos, 2017). The concept of engagement
with respect to the work designed by teachers and intended for students is grounded in
the belief that work is interesting and relevant to the student leads to greater academic
achievement (Schlechty, 2004). Recent research has
emphasized the importance of engagement as a critical factor in student success
(Manigault, 2014).

**Student Engagement in Mathematics**

In recent research, the term engagement has been used to focus on how students
assign importance to academic success and participate in curricular and extracurricular
activities that promote attachment to their environment (Willms, 2003, as cited in
Manigault, 2014). The thorough review of engagement by Fredricks et al. (2004) has
been crucial in establishing a framework that distinguishes between three types of
engagement (behavioral, cognitive, and emotional) and the multidimensional methods in
which they operate. Within the past decade, an additional dimension of student
engagement has emerged focused on social engagement (Roman et al., 2022).

Additionally, Reeve and Tseng (2011) proposed agentic engagement as an additional
dimension to address how students proactively contribute to the instruction teachers
deliver. Filsecker and Kerres (2014) suggested volitional engagement to theoretically
justify engagement as energy in action. Further research is needed to determine the
extent to which the proposed unique dimensions exist (Fredricks et al., 2016).

**Theoretical Considerations for Student Engagement in Mathematics**

Research on engagement has developed from a variety of different theoretical
foundations (Fredricks et al., 2016). Some researchers have used motivational theories
such as self-determination, self-regulation, flow, goal theory, and expectancy value to
explore connections between contextual factors, patterns of engagement, and adjustment
(Fredricks et al., 2016). While other scholars utilized school identification, school connection, and life course theories to depict the role of engagement in the process of school completion and dropout (Fredricks et al., 2016). This diversity in theoretical traditions leading this work has led to fragmented literature, where researchers selected measures from previous research without examining the theoretical framework and definition of the construct (Sinatra et al., 2014, as cited in Fredricks et al., 2016). This creates inconsistencies when comparing findings across studies to determine how engagement is similar and different from other bodies of literature (Christenson et al., 2012).

**Measures of Student Engagement**

Student engagement data can support teachers in identifying disengaged students who are at risk of falling behind. This enables teachers to develop interventions for at-risk students and continually reiterate their own instructional strategies to boost collective student engagement (Poll Everywhere, 2020). The two most utilized methods for measuring student engagement are the Fredricks et al. (2005) three-factor model and the Appleton, Christenson, Kim, and Reschly (2006) four-factor model, as measured on the School Engagement Instrument (SEI) (Manigault, 2014).

**The Fredricks, Blumenfield, Friedel, & Paris Three-Factor Model**

The Fredricks et al. (2005) three-factor model consists of three overlapping dimensions: emotional engagement, behavioral engagement, and cognitive engagement. School success was defined as achievement and positive behaviors (Manigault, 2014). Fredricks et al. (2004) suggested these factors represent the mind (cognitive), the heart (emotional), and the body (behavioral), which provides an
additional link to engagement (Manigault, 2014). Engagement is important to measure because an increase in engagement often leads to improvements in students’ academic performance, promotes school attendance, and discourages unfavorable youth behaviors (Fredricks et al., 2004). Fredricks et al. (2004) suggest that support from adults, opportunities to learn with peers, and opportunities for active learning all contribute to a student’s likelihood of becoming more engaged in school. This model suggests that engagement employs a multidimensional construct where emotional engagement includes interests, values, and emotions; cognitive engagement employs motivation, effort, and strategy; and behavioral engagement includes characteristics of work, following rules and principles (Manigault, 2014).

**The Appleton, Christenson, Kim, and Reschly Four-Factor Model.**

The Appleton, Christenson, Kim, and Reschly (2006) four-factor model consists of the components: affective engagement, cognitive engagement, behavioral engagement, and academic engagement. Appleton et al. (2006) included the academic component that the three-factor model does not take into consideration (Manigault, 2014). Activities and goals such as course credits, completion of homework, and the time the students remain on task without distraction are examples of academic engagement (Manigault, 2014). While both academic and behavioral engagement is observable, cognitive and affective engagement remain indiscernible and often difficult to measure (Manigault, 2014). Appleton et al. (2006) utilized self-report methods to measure the cognitive and affective engagement components. The Student Engagement Instrument (SEI) was used to gather data reported by students in the four areas presented in their model (Appleton et al., 2006). The SEI measures student engagement, and its structure suggests these domains
are observational as well as psychological (Manigault, 2014). Both models are considerations for measuring student engagement in the mathematics classroom to support the identification of targeted instructional strategies addressed by the instructional coach during professional development.

**Math Talks**

Math talks are instructional tools teachers can use to help their students understand mathematical thinking and discourse (Coulter, 2021). During math talks, teachers present a problem and allow students time to solve the problem independently (Coulter, 2021). After sharing their answers, correct or incorrect, the answers are revealed to the students (Coulter, 2021). The goal of math talks is for students with incorrect answers to “revise” their thinking and understanding by utilizing a different strategy to find the correct answer and to allow students to share their thinking with their peers (Parrish, 2011). Additional strategies include discussing with students why math talk is important, teaching them how to listen and respond, introducing sentence stems, highlighting the difference in explanation versus justification, and providing an example (Waggoner, 2015).

**Mathematical Skill Development**

Students participating in mathematical discussions can benefit from higher standardized test scores and more solid mathematical skills and general understanding (Susperreguy & Davis-Kean, 2016; von Spreckelsen et al., 2019). Susperreguy and Davis-Kean (2016) analyzed the relationship between the amount of mathematical input preschool children hear (i.e., math talk) from their mothers in their homes with their early math ability a year later. The researchers worked with forty mother-child pairs during the
research (Coulter, 2021). The mothers recorded their verbal exchanges with their children in their homes using an audio-recording device (Coulter, 2021). Through their research, Susperreguy and Davis-Kean (2016) found preschool children who were exposed to more conversations about math, such as math talks, tend to score higher on their standardized math tests a year later. These findings were also depicted in the research conducted by von Spreckelsen et al. (2019). The researchers found when students were able to participate in classroom-based math discussions, the student’s understanding of complex mathematical concepts grew (Coulter, 2021). In an examination of educational aspects of preschool math, the researchers investigated the different types of mathematical language used by teachers in various different daily activities. The researchers then assessed the relationship between educators’ math talk, math provisions, and several key preschool math skills, such as cardinality, verbal counting, and symbolic number knowledge. They found that “in settings with greater practitioners’ breadth of math language, children display greater cardinality skills” (Spreckelsen et al., 2019, p. 3). The research from both studies indicates the magnitude of how math talks and mathematical discussions can have an impact on students' standardized test scores and mathematical understanding (Coulter, 2021).

**Active Participation and Community**

Math talks encourage students to actively participate in their learning and provide students the opportunity to learn from each other (Hufferd-Ackles et al., 2004; Michaels et al., 2007; Waggar, 2015). Principles and Standards for School Mathematics (NCTM, 2000) emphasize the importance of learning in a mathematics community because it fosters student communication of mathematical ideas and helps students to build
mathematical understandings. Waggoner (2015) shared her observation of 24 fourth-grade students participating in creating math talk communities. She reported that students were collaboratively working together to problem solve, versus blurting out responses and arguing over answers (Waggoner, 2015). Waggoner (2015) noted a dramatic change since the first months of school when they sat quietly; now each student was eagerly participating in mathematical discussions involving multiple strategies to solve problems.

In a research study conducted by Hufferd-Ackles et al. (2004), the researchers found, “compared to the traditional teaching of algorithms, which can leave students with a lack of deep understanding of arithmetic, math talks depend on students’ problem solving and reasoning skills which deepen their understanding” (as cited in Coulter, 2021, p.8). The researchers observed teachers throughout the year and found growth in the following areas: questioning, explaining math thinking, source of mathematical ideas, and responsibility for learning (Hufferd-Ackles et al., 2004). These results support that math talks encourage students to be active participants in their own learning and provide opportunities to learn from each other.

**Attitudes and confidence toward mathematics**

Math talks support students to show a more positive attitude and confidence towards mathematics among pk-12 students and adults. In research described previously by Hufferd-Ackles et al. (2004), the researchers found both the teachers’ and students’ confidence in partaking in mathematical discussions grew. “A primary goal of such a community is to understand and extend one’s own thinking as well as the thinking of others in the classroom” (Hufferd-Ackles et al., 2004, p. 8-9). In research conducted by
Saylor and Walton (2014), they found that these benefits also reach adults. Saylor and Walton (2014) introduced the math talk learning community to seven preservice teachers and supported them to establish the math talk learning community at the beginning of the semester. They reported that after participating in a semester-long math talk learning community, all seven of the preservice teachers made strides in their understanding of the math talk learning community as a pedagogical approach, and much-experienced growth in their own understanding of mathematical concepts (Saylor and Walton, 2014).

**Impact on Number Sense**

In *Principles and Standards for School Mathematics* by the National Council of Teachers of Mathematics (2008), number sense is identified as one of the foundational ideas. Number sense is one’s “general understanding of numbers and operations along with the ability and inclination to use this understanding in flexible ways to make mathematical judgments and to develop useful and efficient strategies for managing numerical situations” (Tsao, 2011, p. 2). While conducting math talks, the teacher evokes answers to problems, prompts students to explain why solutions are reasonable or not, and encourages students to estimate prior to thinking about strategies; this is building number sense (Parrish, 2011).

**Number Talks**

Math talk is the structured discourse about a math topic employed during the main daily math lesson (Parrish, 2011). Number talks are a structured mini lesson that supports computational fluency which could be employed separately from the main daily lesson and might not be connected to that lesson content (Parrish, 2011). “Simply defined,
number talks are five- to fifteen-minute classroom conversations around purposefully crafted computation problems that are solved mentally” (Parrish, 2011, p. 34).

A brief daily practice where students mentally solve computational problems and talk about their strategies, to dramatically transform teaching and learning in their math class (Humphreys & Parker, 2015). Humphreys & Parker (2015) declare there is no step-by-step recipe for implementing number talks. Number talks, if they are to be meaningful, are to be organic in nature (Humphreys & Parker, 2015).

Decades of research have shown that the traditional instructional methods and curriculum in the United States have resulted in our students with fragile skills and shallow understanding (Hiebert, 1999). According to the results of the 2015 National Assessment of Educational Progress [NAEP], third-grade students scored lower in mathematics than in 2013 (National Center for Educational Statistics, 2016). The NAEP showed that 60 percent of third-grade students scored below proficiency during the 2015 assessment (Gaillard, 2018). Research shows that students who struggle with a basic understanding of numbers and who have difficulties flexibly using numbers and applying efficient computation strategies and algorithms typically lack number sense (Tsao & Lin, 2012). The number talks instructional strategy reflects the ideas of the constructivist theory as it follows that students use their own problem-solving methods and build ideas through interaction with peers (Gaillard, 2018). Social constructivism was founded on Vygotsky’s zone of proximal development theory, “the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem-solving under adult guidance, or in collaboration with more capable peers” (Vygotsky, 1978, p. 86). The zone of proximal
development emphasizes Vygotsky’s belief that learning is a social activity and reiterates the importance of using number talks and classroom discourse to support the development of students’ mathematical number sense and skill (Gaillard, 2018).

**Application of procedures and algorithms.**

Students are dependent on rote procedures that they apply mindlessly (Humphreys & Parker, 2015). “The depressing thing about arithmetic badly taught is that it destroys a child’s intellect, and, to some extent, his integrity. Before they are taught arithmetic, children will not give their assent to utter nonsense; afterward, they will” (Sawyer, 1961). Hyman Bass points out that arithmetic algorithms are remarkable tools; they are reliable and efficient, and they work with all numbers. The trouble is that their compactness “hides the meaning and complexity of the steps involved” (2003, p. 323).

O’Nan (2003) study sought to determine if daily number talks would lead to an increase in the number of strategies students could use to solve an identified problem and if an increase in known strategies would produce greater mental math achievement. After six weeks of daily number talks, students were able to name and use more than twice as many math strategies than they previously did, and the speed with which they mentally calculated two-digit addition problems increased significantly (Johnson & Partlo, 2014).

**Addressing misconceptions.**

Classroom discussions are the core of number talks and all answers, both right and wrong, are recorded and reviewed; wrong answers are opportunities to correct misconceptions and investigate further (Parrish, 2011). The subtraction algorithm conceals the concept of place value in the service of efficiency. Students arrive at the correct answers by treating numbers as columns of *place value-neutral* digits. Placing the
value of the digits in the background, the relationship between the quantities is lost (Humphreys & Parker, 2015). Another misconception is when teaching students to borrow, teachers often say, “You can’t take 7 from 3.” However, you can take 7 from 3, and it is -4 (Humphreys & Parker, 2015).

Johnson and Partlo (2014) concluded that participating in regular number talks had a positive impact on the fourth-grade learners’ mental math and computational skills. Students were able to list more strategies or explain their thinking more specifically on the post-test and the post-questionnaire, demonstrating they were aware of multiple methods used to solve problems (Johnson & Partlo, 2014). However, even though students could name more strategies, they still relied heavily on the standard algorithm to solve double-digit addition and subtraction problems. This indicates the need for more experience using the strategies while performing mental math for students to apply the strategies accurately, efficiently, and flexibly (Johnson & Partlo, 2014).

**Impact on future mathematics.**

Students learning something in second grade and finding out it is not mathematically true in seventh grade make mathematical rules seem arbitrary (Humphreys & Parker, 2015). The previously mentioned example of being told that you cannot subtract 7 from 3 and then learning in sixth grade that 3 subtract 7 is -4 is an example of “facts” that students are exposed to in their early years that are later “not true” creates doubt within students’ minds and creates resistance to mathematical rules.
Students’ fragile understanding of arithmetic follows them into middle school and algebra, where the damage is difficult to repair (Humphreys & Parker, 2015).

**Summary**

The purpose of this action research is to investigate the impact of instructional coaching and self-determined professional development on student engagement in middle school mathematics and to examine teacher attitude toward the implementation of strategies, student perception of teacher engagement, and academic performance of students.

Instructional coaching is being utilized as an approach to teacher learning. For over thirty years standards-based reform has emphasized the need to alter teacher practice to elevate student achievement (Desimone & Pak, 2017). To support this endeavor, federal, state, and district-level governments have mandated instructional coaching as a strategy for developing teacher practice through student-centered professional development (Coburn & Woulfin, 2012). Instructional coaching occurs during the process of classroom instruction or regularly scheduled planning time (Quintero, 2019). Instead of presenting a general workshop, instructional coaches observe teachers in their classroom, provide feedback, and engage in meaningful discussions with teachers about their lessons (Quintero, 2019). For district and school leaders, the theory of action behind instructional coaching provides a clear way forward as a promising new method of professional development that is “content-based and intended to support teachers in meeting the aims of school or district-based instructional reform” through “embedded and situated work that includes observations of classroom teaching, demonstration of
model practices, and cycles that includes pre- and post-conferences with practitioners” (Gallucci et al., 2010, p. 922).

Research on school organizations shows that instructional coach positions can support teacher learning and changes in classroom instruction (Camburn, 2010; Coburn et al., 2010; Coburn & Russell, 2008). There is growing empirical evidence linking coaches to improved teaching practice (Lockwood et al., 2010) and some indications that it leads to higher student achievement (Bright & Hensley, 2010), but overall, the research on the outcomes of instructional coaching policy has not kept pace with its implementation (Mangin, 2009). Although there is a considerable body of research that provides a starting point for further investigation, the understanding of the effects of instructional coaching on teacher practice, district policy implementation, school reform, or student learning is still developing (Galey, 2016). Large-scale evaluations of coaching are rather limited to studies that focus on either literacy or mathematics coaching, exclusively, and this research usually takes place when coaching is the key component of a specific professional development (Galey, 2016).

Student-centered professional development is an area where additional research is needed. Effective professional development relates to cognitive science research on what we know about the best possible learning environments (Ferlazzo, 2022). Three interrelated factors essential for ensuring high-quality learning are learner-, knowledge-, and assessment-centered (Ferlazzo, 2022). The learner-centered principle is rooted in a constructivist idea that acknowledges people learn best when they actively construct knowledge that builds prior understanding based on firsthand experience with data and evidence (Ferlazzo, 2022). Learners can represent students or adults as they construct
knowledge, connect details with a broader framework for understanding, and relate information with their previously acquired knowledge (Ferlazzo, 2022). The ideas that educators construct serve as the framework from which they attempt to advance their understanding. Ferlazzo (2022) claims that how educators think about their ideas, monitor, and reflect on their developing understanding is crucial for regulating and being more self-reliant. Therefore, professional development is most impactful if it provides educators the opportunity to play an active role in learning (Ferlazzo, 2022).

Student engagement in mathematics is undeniably one of the most discussed topics in educational research. Student engagement has been linked to improved achievement, persistence, and retention (Finn, 2006), with disengagement having a profound effect on student learning outcomes and cognitive development (Ma et al., 2015), and being a predictor of student dropout in secondary school and higher education (Finn & Zimmer, 2012). There is ongoing disagreement about whether there are three components e.g., (Eccles, 2016) – affective/emotional, cognitive, and behavioral – or where there are four, with the recently suggested addition of agentic engagement (Reeve, 2012; Reeve & Tseng, 2011) and social engagement (Fredricks et al., 2016). There has also been confusion as to whether the terms ‘engagement’ and ‘motivation’ can be used interchangeably (Christenson et al., 2012), especially when used by policymakers (Eccles & Wang, 2012, as cited in Bond et al., 2020). Liljedahl (2014) identifies engagement with Csikszentmihalyi’s concept of flow; conceptualizing flow (engagement) as the tension between skill and challenge (Irvine, 2019). The relationship between engagement and flow is also identified by Fredricks et al. (2004) as being related to emotional engagement. However, some scholars have related work on engagement to other theories,
usually involving constructs from motivation; self-determination theory (Fredricks et al., 2004; Reeve, 2013), social cognitive theory (Smart & Marshall, 2013), self-regulation (Reeve, 2013), and emotional response theory (Mazer, 2013). Measuring engagement is challenging for several reasons: it is a latent variable that is unobservable directly and must be interpreted from overt behaviors, the three traditionally recognized components of engagement (behavioral, emotional, cognitive) are not always independent, there is not a universal agreement on identifying the components, and there is considerable overlap with other concepts from motivation (Archambault et al., 2009).

Math talks, also known as number talks and math talk communities, are short whole-group conversations revolving around using multiple mathematical strategies and concepts (Keenan, 2019). The purpose of math talks is for students with incorrect answers to reflect and revise their strategy for finding the correct answer and allow other students to share their mathematical thinking with their peers (Parrish, 2011). These math talks help teachers promote foundational number sense skills in their students (Keenan, 2019). When students participate in mathematical discussions, they can benefit from higher standardized test scores and a stronger mathematical understanding (Susperreguy & Davis-Kean, 2016). Wagganer (2015) reports that math talks encourage students to actively participate in their learning and provide opportunities for students to learn from one another. Hufferd-Ackles et al. (2004) found growth in students’ questioning, explaining math thinking, multiple strategies, and responsibility for learning. Saylor and Walton (2014) found that implementing the math talk learning community supports positive student attitudes and confidence toward mathematics as well as among adults.
CHAPTER 3

METHODS

The intent of this research is to investigate the impact of instructional coaching on student engagement in middle school mathematics. Through an interactive, reflective process, this study will investigate the main research question: How does instructional math coaching influence teacher practice in engaging students in middle school mathematics classrooms? This research study will also investigate two sub-questions: (a) What are the obstacles to middle school students’ engagement in mathematics class? And (b) What are teacher perceptions of student-centered professional development in mathematics?

Research Design

The goal of applied research is to improve the quality of the practice of a particular discipline (Merriam & Tisdell, 2016). Action research is a systematic, reflective inquiry conducted by educators; they obtain data about their teaching and student learning to design and develop realistic solutions to situational problems (Mertler, 2017). The goal of action research is to address a specific problem in a practice-based setting, such as a classroom, a workplace, a program, or an organization (Herr & Anderson, 2015). Action research fits this study as I will participate and take an active role as a researcher and collaborator; this will allow for systematic inquiry and result in a better understanding of this problem of practice.
Action research is a form of practitioner research. It not only seeks to understand how participants make meaning or interpret a particular phenomenon or problem in their workplace, community, or practice but it also seeks to engage participants at some level in the process of solving a practical problem (Merriam & Tisdell, 2016). Action research is emergent and, as Herr and Anderson (2015) state, “oriented toward some action or cycle of actions” (p. 4) in which researchers and participants engage to improve practice. With a methodical inquiry-based approach to investigating teachers’ own practices in a specific setting, action research utilizes a cyclical approach of identifying a problem, collecting relevant data, analyzing and interpreting this data, and developing an action plan in response to these findings (Carr & Kemmis, 1986, as cited in Mills, 2011).

Whereas other types of research are detached from daily practice, focusing on identifying relationships between variables or establishing theoretical underpinnings, “action research can be used effectively to bridge the gap between theory and practice” (Mertler, 2017, p. 31). This bridge is beneficial for my study because there is a gap in research on self-directed professional development to support middle school students’ engagement in mathematics.

A second benefit of using action research is the practicality of practitioner-researchers studying the outcomes of a program or action in their own setting (Herr & Anderson, 2015). This approach involves the intervention of professional development to support effective practices for students’ engagement and success in middle school mathematics classrooms. The third advantage of action research is the participatory nature of the practitioner-researcher collaborating with teachers; they engage in the process of determining the focus of professional development, basing it on their lived
experiences and perceived levels of student engagement (Mertler, 2017). The study will determine the answer to the research question “How does instructional math coaching influence teacher practice in engaging students in middle school mathematics classrooms?”

A basic qualitative research design will be used to explore the problem of practice. It is based on the belief that knowledge is constructed by people in an ongoing fashion as they engage in and make meaning of an activity, experience, or phenomenon (Merriam & Tisdell, 2016, p. 21). Basic qualitative studies can be described as epistemologically social constructivist in nature and theoretically interpretive; they focus on (1) how people interpret their experiences, (2) how they construct their worlds, and (3) what meaning they attribute to their experiences (Merriam & Tisdell, 2016). This basic qualitative inquiry will be viewed with a pragmatic lens as the researcher’s desire is to prompt change and relate knowledge to action (Goldkuhl, 2012, as cited in Kennedy, 2016).

A pragmatic approach to data collection allows the researcher to utilize multiple methods of inquiry, including interviewing, reviewing archival documents, and/or observing the participants in their naturalistic setting (Kennedy, 2016). Classroom observations, surveys, and semi-structured interviews will occur pre-intervention and post-intervention in this study. Data collection and analysis are simultaneous activities in qualitative research (Merriam & Tisdell, 2016). Information gathered from individual teacher interviews, focus-group interviews, surveys, and classroom observations will provide qualitative data that will be analyzed using an inductive approach to reveal emerging ideas (Merriam & Tisdell, 2016). Unlike quantitative research, which focuses
on the use of deductive logic to test hypotheses, qualitative research allows researchers to analyze data using an inductive approach through which they determine the themes that emerge from the data (Merriam & Tisdell, 2016). The interactive process of analyzing data will include categorizing and coding procedures that identify units of meaning within the data (Efron & Ravid, 2020). This will help group ideas and find connections among data gathered from various sources, giving an overall consistency to findings.

**Setting and Participants**

This study will take place in a rural public middle school in the Southeast. Enrollment at the middle school is approximately 461 students with 46% Female, 54% Male, 162 sixth graders, 154 seventh graders, and 145 eighth graders. Enrollment has stayed relatively flat over the last five years. Among this population, 68% are considered economically disadvantaged. The student body is 35.4% White, 8.2% Hispanic, 49.5% Black, 5.6% two or more races, 0.9% Asian, 0.4% American Indian or Alaska Native. The Black population constitutes most of the minority enrollment of 64.6%; this minority enrollment is above the state average. There are 35 full-time certified teachers. The student-to-teacher ratio is 13 to 1. The percentage of teachers with 3 or more years of experience is 68.4%. The per pupil expenditure is $14,475.

The participants include a focus group of two sixth-grade middle school math teachers and students selected from two respective sixth-grade classes of approximately 25 students, ages 11 to 12 with similar maturity levels. The sample selection is based on purposeful, criterion-based sampling; teacher participants were selected deliberately based on the criterion that they teach at the same middle school (Efron & Ravid, 2020). Due to the homogeneity of the student participants, a manageable focus group of
students from each class will comprise a maximum variation purposeful sample (Shaheen et al., 2019; Kitzinger, 1995). The researcher supports the teachers with bi-monthly instructional coaching, so direct access to students’ information was available. The selected sample will be adjusted if categorical and thematic saturation occurs (Creswell & Creswell, 2018).

As the Southern Regional Education Board (SREB) Instructional Mathematics Coach and researcher, I first obtained and documented consent from the superintendent, as well as the principal at each school, to conduct the study and collect data. Ethical consideration of the participants is a key element of this research study; it protects the interests and well-being of all the participants (Mertler, 2017; Springer, 2014, as cited in Efron & Ravid, 2020). A letter of introduction was sent to all participants identifying me as the researcher and my role as the SREB Instructional Mathematics Coach, describing the purpose of the study, and outlining what the participants’ involvement in the study; it communicated the potential for a positive educational impact on both teachers and students (Efron & Ravid, 2020). I asked each teacher to complete a consent form to participate in the study and grant permission for me to record or video them. As required by state law, participating schools already have audio/visual permissions on file for each student in the school. Even though my observation recordings will not be shared outside of the classroom, I checked the permissions with the help of school staff. Observations are part of the natural process of education practices and are expected to aid in the process of identifying areas for professional growth that can aid student learning (Mertler, 2017).
Intervention and Data Collection

My qualitative action research utilized an intervention of self-directed professional development, supported by the researcher in the role of the SREB Instructional Mathematics Coach. This involved a change in the traditional “rules” for professional development (PD) as it allowed teachers more freedom to self-direct their PD experience (Rose, 2020). Prior to the study, most PD experiences for teachers in the study school district were administratively directed. Seldom were teachers given a voice to express their identified professional needs and guide the direction of PD. The intervention allowed middle school teachers opportunities to collaborate with peers and the researcher to determine the focus of the PD with the identified purpose of the study in mind, creating a learning environment with a focus on enhancing engagement of all math students. Participants completed a pre-intervention survey addressing the research question “What are the obstacles to middle school student engagement in mathematics class?” This will prompt discussions surrounding their determination of the PD.

As the SREB Instructional Mathematics Coach and researcher, I provided participants with a twelve-week timeline for determining the self-directed PD topic, participating in Number Talks PD, implementing effective Number Talks in the classroom, and individual observations by the researcher. I facilitated bi-monthly virtual PLCs to discuss the implementation progress of effective Number Talks in the learning environment.

Phase One: Planning and Participation Selection

I began discussing my problem of practice with the principal, instructional coach, and numeracy coach in May 2022. I decided to use focus groups because focus groups
facilitate group discussions that possess elements of both participant observation and individual interviews while also preserving their own uniqueness as a method of research (Bloomberg & Volpe, 2019). Sample selection of participants in qualitative research is based on the relevancy of their experiences regarding the topic of the study and their ability to support the researcher to obtain valuable data that will contribute to the existing research on instructional coaching and student engagement (Onwuegbuzie & Leech, 2007). Selecting a purposive sample, the two participants were selected based on the student population they teach (Maxwell, 2013). The lack of student engagement in mathematics was particularly noticed in schools that had a high poverty population. Therefore, the selection of this rural school in South Carolina was purposeful.

After collaboration with the instructional coach and numeracy coach we agreed that sixth grade would be the best team of teachers to use as the focus group based on a shared cultural experience and shared concerns related to the lack of student engagement (Bloomberg & Volpe, 2019). Due to my schedule of being at the school two days a month, I would need to be proactive in planning the timeline and scheduling each phase of the research study. During an in-person meeting in September 2022, the principal provided her permission to conduct my study at the school and discussed with me the protocols for receiving district permission to conduct research and discussed with me the protocols for receiving district permission to conduct research. I requested the district Board Policy for conducting research from the principal via email in December 2022 (Appendix N).

I submitted my Application for Approval for Conducting Research Affiliated with BCS in early December 2022. This permission was approved the following week, which
enabled me to finalize the application for the Institutional Review Board (IRB) Submission approval. Once the IRB application was submitted, I discussed the proposed research idea with the two selected sixth grade teachers and asked them to take their time thinking about whether they wished to participate. Table 1 (see below) details the demographic data for each participant. Both gave a verbal confirmation within 48 hours. Once the IRB agency approved the application, teachers were provided with the Consent to Participate in Doctoral Research Study Number Talks Professional Development (Appendix G).

Two requested revisions on the initial IRB Submission were completed and final approval to begin research in mid-January 2023 was granted. The first requested revision was an Exemption Category Justification indicating the parent letter was unclear as to what they agreed to and inquired what happens to the students that do not return the form at all. I replaced the invitation to opt-out with an Invitation for Student Participation in Exempt Research. The second requested revision addressed the clarity of the parent permission letter, how tracking of those that agreed would occur, and if parent permission was even required. I clarified that no sensitive data or identification would be included, and that students and teachers will potentially benefit from the research. This was exempt research because it was in their own educational setting, observation is part of the normal education practice, and no parties require consent. The reviewer granted me approval to conduct research (Appendix M).

The Detailed Timeline Proposal (Appendix I) was shared with teacher participants, administrators, the instructional coach, and the numeracy coach. Scheduling took significant planning due to my limited number of assigned days of service at BMS. I
contacted two additional schools within the district to ask them to revise my schedule to half-days which would allow me to complete the post-intervention observations of the Number Talks. Both schools verbally confirmed the schedule change and provided support for conducting the data collection process. January 23, 2023, both teachers completed the consent to participate letter and the pre-intervention survey.

**Phase Two: Pre-intervention Survey**

Qualitative surveys use open-ended questions to produce both short answers and long-form responses. Surveys for qualitative research open-ended questions yield responses that are more detailed and more conversational in nature. Therefore, open-ended responses are more difficult to analyze because they are neither standard nor systematic (Patton, 2002). Open-ended questions were presented to teachers in a Google form that contained the pre-intervention survey. The survey consisted of three sections: demographic questions, student engagement questions, and instructional coaching support questions (Appendix A). Each question required a short open-ended response allowing participants to express their own ideas and responses without being influenced by predetermined response choices. I shared the pre-intervention survey with participants via google forms on January 23, 2023. Teacher #2 completed the survey January 23, and teacher #1 completed it on January 24. Their responses were subsequently transferred to an Excel spreadsheet for review. After examination, the responses were used to adjust the Semi-Structured Focus Group Pre-Intervention Interview Questions (Appendix B).

**Phase Three: Pre-interventions Observations**

The pre-intervention observation for each teacher was conducted by me, as the instructional mathematics coach, on January 24, 2023. Teacher #1 was observed during
their first block self-determined class for observations. Teacher #2 was observed during their second block class. I used the Qualitative Data Observation Collection Tool (e Appendix C) which included descriptive and reflective field notes to collect data during these pre-intervention observations. The tool did not allow adequate space to record the details of the observation, so I wrote more notes on the back of the page. Once the observations were over, I took time to note additional reflections on the right side of the tool. This initial observation helped me realize I needed to write detailed notes on an additional sheet of paper and then complete the form with identified categories following the observations. I shared the completed field notes with teachers to allow them to address anything that occurred that I may not have noted.

**Phase Four: Pre-intervention Focus Group Interview**

Interviewing is often selected as a primary method of data collection due to the potential for gathering rich, detailed descriptions (Bloomberg & Volpe, 2019). I utilized the participant survey responses to create the focus group interview questions. Although predetermined questions were written prior to analyzing the surveys, the participant feedback illuminated additional questions which drove the direction of the focus group interview to gain as much information and data as possible prior to the intervention. The semi-structured Focus Group Pre-Intervention Interview Questions (Appendix B) provide factual evidence of teacher demographics, teacher perceptions of student engagement, perceived obstacles to engagement, teacher experiences with instructional coaching, and their perception of what constitutes effective professional development.

A successful interview is contingent on all participants and their willingness to engage in rich discussions about student engagement and instructional coaching.
(Bloomberg & Volpe, 2019). The focus group interview protocol included asking questions and recording answers by making handwritten notes and recording via Zoom the virtual interview on January 20, 2023 (Creswell & Creswell, 2018). I transcribed the interview from the recorded Zoom discussion by utilizing the Microsoft 365 transcribe function. Next, I reviewed the transcript and compared it to the recording. This process revealed discrepancies that I corrected in the transcript before coding began. Several participant’s responses were not complete or transcribed incorrectly. Reviewing the video and the transcript simultaneously improved the validity of the study. The next step in the process was to analyze the corrected transcription data and code data based on identified categories and themes. I shared the recording and transcript of the interview with participants to ensure accuracy and prevent research bias. I encouraged them to note clarifications or corrections and share with me before data analysis began.

**Phase Five: Intervention – Professional Development: Using Number Talks to Support Student Engagement & Growth**

After reflecting on the survey and focus group interview responses, I made minor adjustments to the Professional Development: Using Number Talks to Support Student Engagement & Growth. It was beneficial to discuss teacher perception of effective professional development (PD). Often teachers say the PD they receive is not easily applied to their daily teaching and learning (Balta & Eryilmaz, 2019). I constructed the PD with the North Carolina Regional Educational Laboratory research-based framework that promotes ongoing professional development and individual reflection and group inquiry into teachers’ practice. In practice, the five phases overlap, repeat, and can occur simultaneously (The North Central Regional Educational Laboratory, n.d.). These
support teachers in building a knowledge base, observing models and examples, reflecting on their practice, changing their practice, and gaining and sharing expertise (Figure 3.1). I utilized this framework to create a comprehensive, ongoing and meaningful PD to support teachers to become familiar with number talks and implement them with fidelity.

To determine teacher perceptions of student-centered PD in mathematics, I researched and determined that the components of Thomas Guskey’s 5 Elements of Effective Professional Development would be helpful for acquiring teacher feedback and self-reflection. Effective PD evaluations require the collection and analysis of Guskey’s five critical levels: participants’ reactions, participants’ learning, organization support and change, participants’ use of new knowledge and skills, and student learning outcomes (Guskey, 2000). I created a form to use when observing and debriefing with teachers after the implementation of the instructional practice or strategy that was the focus of the PD (Appendix L).

![Figure 3.1 The professional development phases](image)
I conducted the PD in Teacher #2’s classroom on February 1, 2023, during their planning block. The goals of the PD were: (a) What are Number Talks?, (b) The Importance of Mathematical Discourse, (c) Establishing the Routine of Number Talks, (d) The Math Standards in Number Talks, I Number Talks in Your Classroom, and (f) Online Resources. This was an interactive PD allowing teachers an opportunity to practice leading a Number Talk after participating as a student while I modeled facilitating a Number Talk.

Number Talks support computational fluency and students’ ability to think about numbers flexibly. This five-step strategy was modeled during the PD: (1) display your daily Number Talk and give individual think time to solve, (2) students communicate their thinking using silent hand signals, (3) observe student thinking by focusing on their hand signals, (4) have a student share answer with strategy and record, and (5) students respond through silent hand signals and share thinking. Number talks are most effective when students learn to use subtle and specific hand gestures to indicate if they have solved the problem or if they are still thinking (Figure 3.2).

![Number Talks Hand Signals](image)

*Figure 3.2 Number talks hand signals*
Phase Six: Classroom Observations of Number Talks

Semi-structured classroom observations were conducted five times per classroom. I conducted the initial 30-minute pre- and post-intervention observations on January 24, 2023, using the observational protocol (Efron & Ravid, 2020). Detailed observation field notes include details of the setting, participants, activities, and behaviors of the teacher and the students (Merriam & Tisdell, 2016). I used descriptive and reflective notes from the observational protocol data collection tool, as well as video and audio recordings to improve the accuracy of the observational data allowing for holistic interpretation of the case study being investigated (Efron & Ravid, 2020; Merriam & Tisdell, 2016). During the post-intervention observations, my focus was strictly on the Number Talk portion of the lesson, whereas the initial pre-intervention observation was a 30-minute segment. Four post-intervention observations occurred: February 7, 2023, February 9, 2023, February 13, 2023, and February 14, 2023. I shared the recording and transcript of the observation, as well as my initial feedback notes, with participants to ensure accuracy and prevent research bias.

Phase Seven: Post-intervention Survey

Qualitative techniques provide researchers with a unique depth of understanding which is difficult to gain from a closed question survey (Creswell & Creswell, 2018). I utilized the post-intervention survey as a precursor to the post-intervention focus group interview. The survey included open-ended questions that seek to explore individual experiences and reveal participants’ perceptions (Bloomberg & Volpe, 2019) in three areas: class setting, student engagement, and instructional coaching support. I shared the post-intervention survey with participants on March 3, 2023. Teacher #1 completed it on
March 8, 2023, and Teacher #2 submitted their responses on March 6, 2023. I examined the survey responses and used them to modify the pre-determine final focus group interview questions to address comments and concerns that I noted.

**Phase Eight: Post-intervention Focus Group Interview**

One strength of a focus group interview discussion is that this socially oriented method often allows participants to feel more relaxed than in a one-to-one interview (Bloomberg & Volpe, 2019). Focus groups are beneficial as they elicit a range of feelings and beliefs, understand differences in perspectives, provide insight on factors that influence opinions, and seek ideas that emerge from the conversation (Kreuger & Casey, 2015). I used Zoom as the platform for the virtual focus group interview conducted March 15, 2023. The hour-long discussion was recorded via Zoom, and the transcription was created using the Microsoft 365 transcribe function. To ensure accuracy, I simultaneously viewed the recording and compared the transcript, which allowed corrections before the coding process began. I shared the recording and transcript of the interview with participants to ensure accuracy and prevent research bias. This provided them with the opportunity to inform me of any discrepancies or clarifications needed before analysis occurred. Examination of the corrected transcription data and coding based on emerging categories and themes was the next step in the process.

**Data Analysis and Results**

Data analysis in this qualitative case study occurred with other procedures of developing this qualitative research. I was collecting data, writing up finding, and segmenting and taking apart the data simultaneously (Creswell & Creswell, 2018). Because text data is so dense and rich, researchers need to winnow the data by focusing
on specific parts of the data while ignoring other components due to non-relevancy (Creswell & Creswell, 2018). I began by organizing and preparing my data for analysis by transcribing focus group interviews, typing up field notes, and arranging the data into categories based on the source of the information. Next, I examined all the data to get a general sense of the information and reflect on its overall meaning. I wrote notes in the margins of the transcripts and observational field notes and began recording notices and wonders about the data as part of the reflective cycle. The next step in my process was to start coding all the data.

**Participants**

The participants in this qualitative case study represented a sample from the six middle schools in a county in southeast South Carolina. Table 4.1 details the demographic data for the participants. I collected data on participant roles, years of teaching experience, years of teaching strictly mathematics, and grade level. This information was used to select the specific participants for the focus group that represent different years of teaching experience and years of teaching strictly mathematics.

**Table 3.1 Participant Profiles**

<table>
<thead>
<tr>
<th>Name</th>
<th>Certification and/or Degree</th>
<th>Years of Teaching Experience</th>
<th>Years of Teaching Strictly Mathematics</th>
<th>Grade Level Taught</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher #1</td>
<td>Master’s in education</td>
<td>20</td>
<td>16</td>
<td>6+ grade</td>
</tr>
<tr>
<td>Teacher #2</td>
<td>Master’s &amp; MIT in Elementary Education</td>
<td>12</td>
<td>3</td>
<td>6+ grade</td>
</tr>
</tbody>
</table>

**Coding**

Coding is the process of organizing the data by bracketing chunks and writing a word representing a category in the margins (Rossman & Rallis, 2012). This involved
taking the data gathered and organizing it in a meaningful way. To analyze the data in this study, I used a combination of Merriam and Tisdell’s (2016) process for analyzing data, Miles et al.’s (2019) method of coding and recoding data, and Auerbach and Silverstein’s (2003) six steps for constructing a theoretical narrative from text. I began by thinking about the purpose of the study (Merriam & Tisdell, 2016). I asked myself, “What was I trying to find out?” This led me to my research questions: How does instructional coaching influence teacher practice in engaging students in middle school mathematics classrooms? I also wanted to investigate two sub-questions: (a) What are the obstacles to middle school student engagement in mathematics class? And (b) What are teacher perceptions of student-centered professional development in mathematics? The next step in the process for analyzing the data was to think about the lens of a constructivist framework (Auerbach & Silverstein, 2003). This study is grounded in the Community of Practice (COP) framework which is a branch of social learning theory that resides within the constructivist paradigm. After re-identifying the focus of the study, I began the coding process.

The coding of the pre- and post- intervention surveys entailed downloading the questions and participants responses into an Excel spreadsheet. The formal process of data analysis began by assigning alphanumeric codes according to the categories and the descriptors of the study’s conceptual framework (Bloomberg & Volpe, 2019). Each question cell was labeled with Spre or Spost and the respective question number (for example, SpreSQ#1 or SpostQ#2). Each response was transferred to a small Post-it note with the label written at the bottom. I began sorting these by similar ideas based on keywords or phrases. Assigning codes to categorize these data extracts immediately after
acquiring the survey responses allowed me to start grouping similar types of data. These codes were essential later in the study to derive themes for the qualitative analysis.

I wrote the categories at the top of the large flip chart sheets on the wall in my office and began putting the participants’ responses under the appropriate category. Coding is a way of making sure the data is valid (Creswell & Creswell, 2018). This ensured my analysis was undertaken systematically, and other researchers could review it, guaranteeing transparency. The construction of categories is an inductive process (Merriam & Tisdell, 2016). I used the inductive coding method by analyzing the data, looking at small pieces and developing the codes based on what I found within the data. The following categories emerged from the review of the pre-intervention survey: number talks, engagement, challenges/obstacles to engagement, instructional coaching, relevance, student-centered learning, and teacher experience. The initial coding of the survey took place January 29, 2023, once all participants had completed it.

Focus group participants joined me virtually for the pre-intervention interview on January 30, 2023. The Microsoft 365 platform was used to transcribe the Zoom recording of the focus group discussion. Comparing the transcription to the recorded interview allowed me to confirm the accuracy of the data. Next, I reviewed the transcript and compared it to the recording. This process revealed discrepancies that I corrected in the transcript before coding began. The next step in the process was to analyze the corrected transcription data and code the data based on identified categories and themes. I shared the recording and transcript of the interview with participants to ensure accuracy and prevent research bias. I encouraged them to note clarifications or corrections and share with me before data analysis began.
Merriam and Tisdell (2016) use the visual comparison of the complex data analysis process as a dialect where you move between seeing the overarching picture (the forest), and the particulars (the trees). The coding process for the focus group pre-intervention interview took place four days after the initial sorting of the data. Reliability of the study is increased by allowing time to elapse between coding sessions (Miles et al., 2019). When coding the transcribed data, I focused on patterns or insights related to my purpose and was guided by the constructivist framework. As I read the data set, I made notes in the margins of the category related to relevant quotes. This iterative process of open coding will lead to the ongoing refinement of what will become the final coding schema (Bloomberg & Volpe, 2019). Repeating the process of using post-it notes for relevant quotes and labeling each one for later referencing (for example FpreQ#), I began placing them on the respective category paper. New categories emerged during the coding of the focus group interview: behaviors (suggest engagement), goals (teacher), classroom practices (affect engagement).

Classroom observations were conducted both prior to and after the intervention and to allow for a comparison of student engagement when Number Talks were implemented. During the pre-intervention observations, I recorded detailed field notes on notebook paper. That afternoon I transcribed my field notes on the Qualitative Data Collection Tool (Appendix G). I completed the reflective field notes portion of the table. The data analysis for the observations was like that of the surveys and interviews. Analysis “is the search for patterns in the data and for ideas that help explain why those patterns are there in the first place” (Bernard, 2006). I read each observation highlighting keywords or phrases and making notes in the margins to help determine codes and
categories. Transferring these codes to Post-it notes, I made certain to include who said what for quotes, as well as labeling pre- or post-intervention observation, teacher identification, and observation number. The code PreOT2#1 represents pre-intervention observation number one of teacher two’s classroom. New categories that emerged from the pre-intervention surveys include thinking, discourse, strategies, and active participation.

As with all aspects of the research process, precision is critical (Bloomberg & Volpe, 2019). I recorded all codes and their respective definitions for each survey, focus group interview, and observation in a codebook. I created tables for categories, emerging themes, and associated quotes. These tables become my coding frame. At this point, I made the shift to a more deductive mode of thinking (Merriam & Tisdell, 2016). Each coding session involved me revisiting the table and recoding categories, continually looking for patterns to create new categories and eventually, themes will emerge that align with the constructivist framework. As coding continued, after my facilitation of the PD Using Number Talks to Support Student Engagement & Growth, I repeated the data analysis process for post-intervention survey data, post-intervention focus group data, and field notes from the remaining four post-intervention observations.

During the coding of the post-intervention data, the same general ideas appeared, and codes began to repeat, indicating saturation has occurred, and this is an appropriate amount of data for this study (Merriam & Tisdell, 2016). As the data analysis process developed, I moved from basic descriptive codes toward answering the research questions of the study, looking for an overarching structure or process that can be examined at a theoretical level (Gehman et al., 2018). I clustered the codes together based
on similarity and regularity and collapsed into themes inspired by the constructivist framework and aligned them to the research questions of the study. In the developing theory stage of Auerbach & Silverstein’s (2003) six steps for constructing a theoretical narrative from text, once step five is completed, step six is to create a theoretical narrative by retelling the participants’ story in terms of the theoretical constructs. I created the thematic analysis (Table 4.2) that includes codes and supporting teacher quotes from the survey or interview transcribed data to align with each theme: historic perceptions of student engagement, instructional coaching support, and effects of coaching around engagement. This data analysis process was completed over a span of four weeks.

**Qualitative Data Analysis**

In this study, a basic qualitative research design involved moving back and forth between concrete bits of data and abstract concepts, between inductive and deductive reasoning, between description and interpretation (Merriam & Tisdell, 2016). Making meaning out of the data involves consolidating, reducing, and interpreting what the participants have said, and what the researcher has seen and heard, to make meaning out of the data (Merriam & Tisdell, 2016). Table 3.2 shows alignment of research questions, data sources and analysis methods.
Table 3.2 Research Questions, Data Sources, and Analysis Methods

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Data Collection Sources</th>
<th>Data Analysis Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ1: How does instructional math coaching influence teacher practice if engaging students in middle school mathematics classrooms?</td>
<td>● Observations</td>
<td>Inductive analysis</td>
</tr>
<tr>
<td></td>
<td>● Individual surveys</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● Focus group interviews</td>
<td></td>
</tr>
<tr>
<td>RQ2: What are the obstacles to middle school student engagement in mathematics class?</td>
<td>● Observations</td>
<td>Inductive analysis</td>
</tr>
<tr>
<td></td>
<td>● Individual surveys</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● Focus group interviews</td>
<td></td>
</tr>
<tr>
<td>RQ3: What are teacher perceptions of student-centered professional development in mathematics?</td>
<td>● Pre and post observations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● Pre and post surveys</td>
<td></td>
</tr>
</tbody>
</table>

The goal of data analysis in qualitative action research is to organize the vast amount of collected data gathered by surveys, observations, individual interviews, and focus groups into a logical structure to enable the researcher to synthesize the information gathered (Efron & Ravid, 2020). The process of data collection and analysis is recursive and dynamic, with analysis becoming more intensive once all data is collected (Merriam & Tisdell, 2016). Field notes from observations, individual interviews, and focus groups provide the necessary data.

The inductive analysis process begins by breaking down the data into parts, organizing it into codes, and identifying recurring constructs and categories (Creswell & Poth, 2018, as cited in Efron & Ravid, 2020). Open and axial coding revealed similar patterns (Merriam & Tisdell, 2016). Open and axial coding allowed for changes in categories. These categories were grouped to create major themes that convey the overall interpretations of the data. The Microsoft 365 platform was used to transcribe the Zoom recording of the focus group and the classroom observation recordings. Each set
of field notes, focus group and interview transcripts were coded, line-by-line, providing the researcher a better understanding of the data. The codes were organized into emerging categories, these represent a theme around which similar topics are grouped (Charmaz, 2014, as cited in Efron & Ravid, 2020). This process is repeated with all sources of data until a level of saturation was reached, and a model demonstrating categories and themes was generated (Merriam & Tisdell, 2016). A summary table provided a record of the categories and quotations that demonstrate their content; a codebook provided a list of all codes and definitions along with these codes (Efron & Ravid, 2020).

**Research Procedures**

The study began with the teacher focus group completing the pre-intervention digital survey to elicit teacher participant responses to perceptions of nine identified teacher behaviors to student engagement during Week #1. Results of these contingency-question formatted surveys will serve as informational data utilized by the researcher to create open-ended questions for the pre-intervention focus group interview. The teacher focus group will meet Wednesday (Week #1) via Zoom for a 45-minute interview to discuss questions derived from the initial individual surveys as a first step in coaching teachers through the student-centered PD process. The researcher will use the recorded interview to add details to their notes capturing discourse moments relevant to the research questions. As the researcher, using the observation protocol, I will conduct 45-minute pre-intervention semi-structured observations of both teacher’s mathematics class to illuminate strategies used to support student engagement on Friday (Week #1) (Efron & Ravid, 2020). Using video/audio recordings in conjunction with field notes will
enhance the opportunity to capture accurate behaviors, attitudes, and social interactions (Efron & Ravid, 2020).

Rigor and Trustworthiness

All research is concerned with producing valid and reliable knowledge in an ethical manner (Merriam & Tisdell, 2016). Rigor of qualitative research equates to the concepts of reliability and validity and all necessary components of quality (Cypress, 2017). Morse et al. (2002, as cited in Cypress, 2017) define rigor as the strength of the research design and the appropriateness of the method to answer the questions. Trustworthiness refers to quality, authenticity, and truthfulness of findings (Cypress, 2017). The trustworthiness of a qualitative study also depends on the credibility of the researcher (Merriam & Tisdell, 2016).

Strategies to establish rigor in a basic qualitative inquiry may include addressing personal biases or assumptions, creating a system to test saturation, ensuring a detailed reporting of the research procedures, or participant validation of the researchers’ interpretation of the data (Caelli et al., 2003; Cooper & Endacott, 2007, as cited in Kennedy, 2016). The strategies for rigor are influenced by the theoretical positioning and analytical lens of the researcher; how the researcher interacts with the data (Kennedy, 2016).

Triangulation

Triangulation is the process of using more than one data collection method, multiple sources of data, multiple investigators, or multiple theories to increase the credibility or internal validity of the study (Merriam & Tisdell, 2016). Triangulation increases credibility by countering the concern (or accusation) that a study’s findings are
simply an artifact of a single method, a single source, or a single investigator’s blinders (Patton, 2015, as cited by Merriam & Tisdell, 2016). Triangulation, the inclusion of multiple perspectives, guards against viewing events in a simplistic or self-serving way (Herr & Anderson, 2015). This qualitative research study involves multiple sources of data analysis: pre- and post-intervention surveys, pre- and post-intervention observations, pre- and post-intervention interviews, and focus group interviews. An analysis of data from each method will be triangulated to establish validity of the study.

**Member Checking**

Member checking, also known as participant or respondent validation, is a technique for exploring the credibility of results, contributing to the trustworthiness of my data (Lincoln & Guba, 1985). Member checks is the process of soliciting feedback on the preliminary findings from the participants of the study (Merriam & Tisdell, 2016). Maxwell (2013, as cited in Merriam & Tisdell, 2016) claims member checking is the single most important way of ruling out the possibility of misinterpreting the meaning of what participants say and do and the perspective of what they have on what is going on, as well as an important way of identifying your own biases and misunderstandings. I provided participants with a copy of their interview transcript to confirm accuracy in the transcript process and prevent research bias. Focus group participants will receive a thematic analysis draft of our interview to determine accuracy. Their confirmation solidifies credibility of my findings to support future research.
**Audit Trail**

The audit trail is a transparent description of the research steps taken from the start of a research project to the development and reporting of the findings (Cohen & Crabtree, 2006). Intentional steps were taken to provide a detailed track record of the data collection process; this establishes confirmability (Lincoln & Guba, 1985). Audit trails document the course of development of the completed analysis (Carcary, 2009). To develop a detailed audit trail, I will maintain a log of all research activities, develop memos, maintain research journals, and document all data collection and analysis procedures throughout the study (Creswell & Miller, 2000, as cited in Carcary, 2009).

Lincoln and Guba (1985) specify six categories of information that need to be collected to inform the audit process: raw data, data reduction and analysis notes, data reconstruction and synthesis products, process notes, materials related to intentions and dispositions, and preliminary development information. More specifically, I will include field notes, condensed notes, and unitized information. Structure of categories (themes, definitions, and relationships) and a final report including an integration of concepts, relationships, and interpretations will be included. Methodological notes including procedures, designs, strategies, and rationales provide a clear description of the research path. Reflexive notes, motivations, predictions, and intentions will be a part of the audit trail (Cohen & Crabtree, 2006).

**Summary**

Chapter 3 included a description of the research process and methods of analysis used in this study. Action research was used to advance the practice of teachers and improve student learning in their own setting (Efron & Ravid, 2020). Through an
iterative, reflective process, this study will investigate the following research questions:
(a) How does instructional math coaching influence teacher practice in engaging students in middle school mathematics classrooms? (b) What are the obstacles to middle school student engagement in mathematics class? and (c) What are teacher perceptions of student-centered professional development in mathematics? A basic qualitative study will be conducted to address these research questions by collecting data through surveys, observations, focus groups and individual observations (Merriam & Tisdell, 2016). Thematic analysis will enable the researcher to use open and axial coding, group codes into themes, and formulate the themes into a narrative communicating the validity of the analysis. Triangulation of multiple data methods, member checks of the interview transcripts and field notes, and the detailed audit trail ensure the validity and credibility of the data, ultimately producing a study that is both rigorous and trustworthy.
CHAPTER 4
RESEARCH RESULTS FINDINGS

As the instructional coach and researcher my identified problem of practice is that many middle school students are not engaging in the mathematics learning opportunities provided. The purpose of this research study was to determine if middle school students’ engagement in mathematics was impacted by targeted professional development on the use of Number Talks. The study also sought to identify teacher perceptions of the obstacles to student engagement. The study examined specifically how instructional mathematics coaching impacted instructional practice to affect student engagement.

Student engagement, defined as “goal-oriented attention and action” (Jensen, 2005, p.34), has a significant influence on a student’s ability to learn (Hoffman & Nadelson, 2010). Engagement can also be fostered by teachers through their choice of instructional strategies and methods (Khemmani, 2006; Uekawa et al., 2007). Tolley et al. (2012) found in their research that after providing training to teachers on instructional strategies intended to engage learners, observation and survey data suggested that the training had an impact on teaching practices and student engagement in the classrooms. Essential research questions focused on teacher perception of instructional coaching support and the impact of professional development to support their instructional practices.

Overview of the Study

The four-week study consisted of eight phases of interaction with the participants and data that included (a) planning and participation selection, (b) pre intervention
observations, (c) pre-intervention survey by focus groups participants, (d) pre-intervention focus group interview, (e) intervention – Professional Development: Using Number Talks to Support Student Engagement & Growth, (f) classroom observations, (g) post-intervention survey, and (h) post-intervention focus group interview. The data collection and analysis processes occurred simultaneously and continuously throughout the research study (Merriam & Tisdell, 2016). I used an inductive approach to transcribe and code observational field notes, focus group surveys and interview responses and organize into emerging categories, which represented themes around which I grouped associated topics (Merriam & Tisdell, 2016). Coding allowed me to access identifying notations during the analysis and the write-up of my findings. I developed a Research Study Timeline in October 2022 that had the process running from December 2022 to May 2023 (Appendix H).

Presentation of the Data

Table 4.1 Themes and Codes

<table>
<thead>
<tr>
<th>Theme 1</th>
<th>Code</th>
<th>Relevant Quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perception of Student-Centered</td>
<td>Culture &amp;</td>
<td>SPreSQ#2: “Students are engaged because they feel confident, respected, and there</td>
</tr>
<tr>
<td>Instruction</td>
<td>Attitude</td>
<td>are a variety of strategies presented to reach different types of learners and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>there is good classroom management that has clear expectations.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SPreSQ#9: “Student-centered learning in my classroom means that students at</td>
</tr>
<tr>
<td></td>
<td></td>
<td>various times work on their own, in groups or with partners. I also offer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>learning through different strategies so that students that are different</td>
</tr>
<tr>
<td></td>
<td></td>
<td>types of learners have the opportunity to see it differently. For example, using</td>
</tr>
<tr>
<td></td>
<td></td>
<td>relevant information so they see the use of a concept in real life, or giving</td>
</tr>
<tr>
<td></td>
<td></td>
<td>opportunities to work on computers or on whiteboards standing up. Being student-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>centered does not mean the students learn by themselves.”</td>
</tr>
</tbody>
</table>
**Relationships**

SPreSQ#6: “What works for me is a positive attitude, encouraging students and speaking to them straight without them feeling intimidated.”

**Dispositions**

FPostQ#1: “Um, except for a couple times I was doing them every day, or at least every other day. Then I also implemented them in other classes.”

FPostQ#13: “A lot more involvement from the students than usual. The other thing is it is not necessarily on a topic that they were learning that day. So, you know, you get to mix up some of the talks.”

**Theme 2**

**Instructional Coaching Support**

**Implementation & Planning**

FPostQ#11: “A lot of time is spent on planning to determine the activity I am doing. Your coaching support of using number talks to increase engagement helped get a routine established that is working.”

FPostQ#9: “Also, what helped me at the beginning was the professional development where you modeled several of them for us and we were ‘the students’. That helped a lot. Watching the videos, you shared was beneficial too.”

**Professional Development**

FPostQ#11: “A lot of time is spent on planning to determine the activity I am doing. Your coaching support of using number talks to increase engagement helped get a routine established that is working.”

**Implementation of Number Talks**

FPostQ#9: “Well, for me, I feel more confident implementing and using number talks. Watching you personally from the first time to now as I do them, I see that we were guiding our students too much.”

**Frequency**

FPostQ#7: “I did number talks every day or if not, every other day.” (speaker 3) “I did number talks 3-4 times a week.” (speaker 2)

**Theme 3**

**Effects of Coaching Around Engagement**

**Thinking & Discourse**

SPreSQ#4: “Behaviors that suggest student engagement include eyes on the speaker, students questioning and participating in the learning, and engaging in on-topic conversations when doing group work.”

FPreQ#1: “My students at first, they were asking ‘Why are you making us do this?’ But then, once they realized how their thinking started changing because when they would hear other people’s strategies of like ‘I doubled that and this”

FPostQ#10: “Well in my class they are more engaged when they are doing an activity. For
example, like today we were graphing equations with two variables, and they were doing with a partner on a big piece of paper. Having that piece of paper makes a big difference in their level of engagement.”

Knowledge Gained  
FPreQ#5: “Coaching is only as good as what you feel the knowledge that you are gaining from it.”

Intentional Strategies  
FPostQ#6: “If somebody has not given a strategy, I will begin calling on them. I always pull out my handy dandy popsicle sticks with their names on them to randomly call on them to share their strategy.”

Collaboration  
FPostQ#3: “I think when they were when I was doing number talks the first few times, they really liked them, so they were kind of getting along better.”

Active Participation  
FPostQ#12: “I think that people figure it out on paper, whiteboards, or whatever. I see that they are involved in it and the actual groups are talking about the question in front of them as opposed to off-topic subjects.”

Instructional Methods  
FPreQ#6: “I appreciate the knowledge that our Instructional Coach and Numeracy Coach bring. And you bring new ways of teaching math and model for us. That is very beneficial to our students.”

Visible Thinking  
FPostQ#13: “Right. They are shown that sometimes they do not know the basics as much as they should, because on paper they could not do it. But if I showed them a pretty picture, they could do it. So, that was interesting.”

Research Questions and Associated Themes

The research questions answered by this study are:

RQ1 – How does instructional math coaching influence teacher practice in engaging students in middle school mathematics?

RQ2 – What are the obstacles to middle school student engagement in mathematics class?

RQ3 – What are teacher perceptions of student-centered professional development in mathematics?
Data analysis revealed three major themes: determination of teacher perspective on student engagement, teacher views on student-centered professional development, and how instructional coaching influences teacher practice to engage students in mathematics. Theorizing is “the cognitive process of discovering or manipulating abstract categories and the relationships among those categories” (LeCompte & Preissle, 1993, p. 239, as cited in Merriam & Tisdell, 2016). The purpose of qualitative data analysis is to identify patterns, categories, themes, and answers to research questions (Merriam & Tisdell). Each theme was determined with the research questions and the constructivist framework in mind. Questions from the surveys and focus group interviews connected themes to the specific research question (see Table 4.3). I will now convey the storyline of my research following Bloomberg & Volpe’s (2019) thematic presentation of findings by providing (a) an overview description of each emergent theme; (b) an outline of findings that contribute to the theme; (c) a comparative summary of the range of key points made by individual participants supported by direct quotations; (d) an action step (pp. 256-257).

**Table 4.2 Research Questions and Associated Material**

<table>
<thead>
<tr>
<th>Associated Survey Question or Focus Interview Question</th>
<th>Associated Themes</th>
<th>Research Question</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SPostA#2:</strong> Did a particular student or group of students respond to Number Talks better than others? If so, please describe the student.</td>
<td>Instructional Coaching Support</td>
<td>How does instructional mathematics coaching influence teacher practice in engaging students in middle school mathematics classrooms?</td>
</tr>
<tr>
<td><strong>SPostS#4:</strong> What were your students’ level of engagement during Number Talks?</td>
<td>Historic Perspectives of Student Engagement</td>
<td>What are the obstacles to middle school student-engagement in mathematics class?</td>
</tr>
</tbody>
</table>

**SPreS#1:** How do you define student engagement?  
**SPre#2:** What are the key characteristics of a highly effective classroom?
<table>
<thead>
<tr>
<th>Question</th>
<th>Instructional Coaching Support</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SPreS#5:</strong> How would you describe authentic engagement in your classroom?</td>
<td></td>
</tr>
<tr>
<td><strong>SPreS#7:</strong> What are the challenges or obstacles to student engagement?</td>
<td></td>
</tr>
<tr>
<td><strong>SPostS#5:</strong> Number Talks are time well spent in class. Please explain your response.</td>
<td></td>
</tr>
<tr>
<td><strong>SPostI#1:</strong> Did the professional development “Using Number Talks in Middle School” provided by your instructional mathematics coach prepare you to implement Number Talks? <em>(Select all that apply.)</em></td>
<td></td>
</tr>
<tr>
<td><strong>SPostI #2:</strong> Do you feel more confident in implementing Number Talks in your classroom regularly?</td>
<td></td>
</tr>
<tr>
<td><strong>SPostI #3:</strong> If “no,” how could you feel more confident?</td>
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<tr>
<td><strong>SPreI#2:</strong> What does effective professional development look like?</td>
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<tr>
<td><strong>SPreS#3:</strong> How important is the role of student engagement in learning?</td>
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<tr>
<td><strong>SPreS#4:</strong> What behaviors suggest student engagement?</td>
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<tr>
<td><strong>SPreS#6:</strong> What practices in your classroom most affect student engagement?</td>
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<tr>
<td><strong>SPreS#9:</strong> Based on your experiences, what does student-centered learning look like and/or sound like in your classroom?</td>
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<tr>
<td><strong>SPostI#1:</strong> Did the professional development “Using Number Talks in Middle School” provided by the instructional mathematics coach prepare you to implement Number Talks?</td>
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<tr>
<td><strong>SPostI#2:</strong> Do you feel more confident in implementing and using Number Talks in your classroom regularly?</td>
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<tr>
<td><strong>SPostI#4:</strong> How could the professional development “Using</td>
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</tbody>
</table>
Findings

This intervention had two main objectives. First, this intervention intended to introduce Number Talks to participants, model several for them, and provide support for implementing them to increase student engagement, while also supporting number sense. Second, the intervention intended to shift teacher practice to a more student-centered approach. Qualitative data collected from pre- and post-intervention surveys, pre- and post-intervention focus group interviews, and pre- and post-intervention classroom observations suggest these goals were met.

Historic Perceptions of Student Engagement

Most researchers claim that engagement is made up of three components: emotional engagement, behavioral engagement, and cognitive engagement (Anderson et al., 2004). Emotional engagement reflects students’ feelings on belonging, whereas behavioral engagement consists of students’ active participation (Anderson et al., 2004). The third component, cognitive engagement, is associated with motivational constructs such as self-regulation, goal orientation and intrinsic motivation (Appleton et al., 2008). The catalyst for conducting this research study was to explore teacher perception of student engagement in middle school mathematics and of student-centered professional development, with the overarching goal of determining if instructional coaching could impact student engagement. The second research question that guided this research study was: What are the obstacles to middle school students’ engagement in math class? During the coding portion of the data analysis process, the theme of historic perceptions of student engagement was used to provide clarity into research question two.
Initial pre-intervention survey data and pre-intervention focus group data will provide evidence of the historic perspective of student engagement and reveal the obstacles to student engagement. Teacher 1 responded in the pre-intervention survey, “Students are engaged because they feel confident, respected, and there are a variety of strategies to reach different learners…” \textit{(Emotional)} and “Students are involved in the learning process. Engaged students are participants in the learning by questioning, working with others, taking notes and listening” \textit{(Behavioral)}. This teacher also said, “Engaged students show a desire to learn and want to succeed” \textit{(Cognitive)}. Teacher 1 addressed all three components of engagement: emotional, behavioral, and cognitive. Teacher 2 responded in the pre-intervention survey, “Engaged students are reaching out to the teacher, asking questions, and working with other students” \textit{(Behavioral)}. This teacher stated in the focus group interview, “Eighty percent or more of the students with really good eye contact, able to answer questions that are presented to them…” \textit{(Behavioral)}. Teacher 2 provided responses that described the actions that demonstrate participation. Both teachers painted a clear picture of what the three components of student engagement should look like in their sixth-grade mathematics classroom.

Although the participants understand what student engagement is, they identified numerous barriers to engagement in their class at the beginning of the research study. They discussed current barriers to student engagement in their classrooms during the pre-intervention focus group interview. Teacher 1 stated, “I think the biggest barrier I see are that students become disengaged, they become bored when they cannot follow the instruction because they don’t have the prior knowledge that they need.” Teacher 2 responded, “I agree with ----. The other parts though are lack of attention span,
distractions in the classroom, and lack of motivation…” and “…it is student behavior. I mean I try to minimize the personal attacks that are directed at each other.” Teacher 1 provides an example of another barrier, “We were talking about starting to talk about the properties of math. I asked, ‘What values are put in based on the value you want for \( x \)?’ So, to me that right there stops their engagement because they don’t understand the meaning of academic vocabulary.”

Teachers also addressed the challenges to student engagement in the pre-intervention survey. Teacher 2 identified challenges: “Students who are so low that they lack confidence to even try,” and “Students that are more interested in being noticed, even though their motivation may be for negative reasons.” Teacher 2 admits, “I also have had experience where my attitude has created the obstacle of student engagement, especially when emotions take control.” Both participants agreed that sometimes their own emotions affect their actions, and in turn, can have a negative impact on student engagement.

A final point of interest in the survey was whether the challenges are the same or different depending on which group teachers are teaching. Although both teachers agree the challenges are different with different groups, they respond differently. Teacher 2 wrote,

Rarely do you have the same personalities spread throughout different classes… Advanced classes need to be pushed; low classes need to be encouraged with minor successes being celebrated. The classes in between may need to be kept on track or encouraged.

Teacher 1 shared,
In the accelerated class, this group knows their basic math facts…I need to keep them focused by challenging them. In the regular sixth grade math, many students are missing many basic concepts and it is difficult…when they do not have the prior knowledge,…[and] this year there has been more drama with several students not getting along, so group work becomes difficult.

These historic perspectives of student engagement and the obstacles to creating an engaging student-centered classroom drove the study. Data analysis of the pre-intervention survey, pre-intervention focus group, and the field notes from the pre-intervention classroom observation provided insight to the additional research questions through the themes that emerged. The problem of practice that began this study was the lack of student engagement in middle school mathematics classrooms. These findings validated the need for an intervention to address the identified obstacles.

**Instructional Coaching Support**

Instructional coaching support is one way to provide sustainable continuous improvement within a school. Determining if instructional coaching works and how mathematics coaches impact teacher instructional practice are real questions in an ongoing debate around the value of content coaching. Rigorous college-and-career readiness standards require shifts in traditional mathematics instruction (Russell, 2020). As a result, many schools and districts have created instructional coaching to complement more traditional professional development efforts (Desimone & Pak, 2016). Although roles vary in implementation, typically instructional coaches are responsible for creating intensive, job-embedded learning opportunities for teachers through strategies such as offering ongoing workshops, leading professional learning communities, and working
individually with teachers to “coach” their planning efforts and execution strategies (Russell, 2020). The third research question that guided this study was: What are teacher perceptions of student-centered professional development? During the process of coding data, the theme instructional coaching was used to provide insight to research question three.

To determine teacher perceptions of student-centered professional development, it was important to determine teacher insights on student-centered instruction and professional development, as well as their current feelings toward or experiences with instructional coaching. Data from this pre-intervention survey helped drive the creation of the intervention – PD Using Number Talks to Support Engagement & Growth. When asked what effective professional development looks like, Teacher 1 answered this pre-intervention survey question with a reflective lens, “Effective professional development means that it is something that will help me grow in my abilities and help me be a better teacher.” Teacher 2 connected to previous experience when he wrote, “Learning something I didn’t know and having a strong desire to implement it immediately.” Hence, the participants view professional development as a learning opportunity to grow instructional practices.

Based on personal experiences participants were asked what student-centered learning looks like and/or sounds like. Teacher 2’s description had a focus on questioning: “I feel when the students take a role in questioning themselves, questioning me, that leads to the student taking more of the role of the learner.” Teacher 1 describes student-centered learning in her classroom:
The students at various times work on their own, in groups or with partners. I teach the concepts and allow them time to explore it themselves...while allowing them to help each other. I also offer learning through different strategies so that students that are different types of learners can see it differently.

Collectively the participants identified student-centered learning as using multiple strategies, exploring math, working collaboratively or individually, and questioning their thinking and the thinking of their peers.

Teachers often have varied opinions of what their instructional coach’s role is, and for good reason. Instructional coaches are asked to wear a variety of hats at different times based on the needs of the school. The participants view the role of their instructional coaches similarly. Teacher 1: “Coaches help you with new ideas, and suggestions for how to teach something. They are the teachers’ teacher.” Teacher 2: “The instructional coach makes sure the best practices are known and followed. The numeracy coach does something similar, with more focus on math practices and sharing math tools with us.” Teacher 1 summed it up by identifying the instructional coach as the teachers’ teacher.

The data supports the assertion that participants view student-centered professional development as a professional learning opportunity to grow by learning new best instructional practices to support student-centered learning. Instructional mathematics coaching supports providing professional learning opportunities for mathematics teachers to improve teaching to support students. This led me to provide the intervention - PD: Using Number Talks to Support Engagement & Growth.
Effects of Coaching Around Engagement

Student engagement is critical to academic success; research shows that student engagement is one of the strongest predictors of student outcomes (Ringewald, 2017). Even though student engagement is a prerequisite for learning, it is a behavior that must be supported by teachers and the school community (Ringewald, 2017). The identified problem of practice that drives this study is the lack of student engagement in middle school mathematics classrooms. The first research question that guided this study was: How does instructional coaching influence teacher practice in engaging students in middle school mathematics classrooms? During the data coding process, the theme effects of coaching around student engagement was used to provide insight to research question one.

The order of the discussion of the findings in relation to the research questions was intentional. Starting with the theme, historic perceptions of student engagement established where the participants' views resonated prior to the intervention and continued instructional coaching. Next, defining what instructional coaching support is and determining teacher perceptions of student-centered professional development paved the way for the PD: Using Number Talks to Support Engagement & Growth. The data indicated that teachers were interested in receiving instructional coaching support to improve teaching practices and learn additional instructional strategies. The PD prepared teachers to implement Number Talks in their sixth-grade math classrooms. Data collected over a four-week period indicate mathematics coaching influences teacher instructional practice in engaging middle school students. The data included post-intervention
classroom observation field notes, post-intervention survey data and post-intervention focus group interviews.

After four weeks of implementing Number Talks and receiving instructional coaching support, teachers were asked to respond to survey questions and participate in a focus group interview. Participants indicated they had implemented Number Talks three times per week and shared specific observations. Teacher 1 wrote, “My students’ number sense skills are stronger.” Teacher 2 shared, “My students are more willing to participate in mathematics tasks and activities.” When asked to report the students’ interest level of engagement during Number Talks, Teacher 2 said, “50% of students demonstrated an attempt by holding their thumb to their chest, indicating they had an answer.” This teacher acknowledged and celebrated the small successes, as he had previously addressed. Teacher 1 wrote, “All students demonstrated an attempt by holding a thumb to their chest indicating they had an answer.”

There are a range of approaches instructional coaches can take when working to affect teacher instructional practices. Examples of coaching support include creating and facilitating professional learning opportunities, modeling, providing resources, planning lessons, and providing feedback (Ringewald, 2017). Jim Knight (2006) argues that coaching is one of the most effective ways to improve instruction in school because it offers a multifaceted approach of “support, feedback, and intensive, individualized professional learning” (p.36). Knight (2009) elaborates that “traditional one-shot approaches to professional development – where teachers hear about practices but do not receive follow-up support are ineffective at improving teaching practices. Much more support is needed to help teachers translate research into practice” (p.18). A specific
coaching support that I provided was sharing the classroom observation recordings and focus group interviews, along with the transcripts to allow teachers to review and indicate any discrepancies. Reitano & Sim (2010) argue that sharing and reflecting upon recorded observations shifts teacher practice as it increases reflection, and reflective practice leads to teacher growth while also supporting the validity of the study.

Participants agreed that implementing Number Talks is time well spent in class and provided evidence of their claim. Teacher 1: “It made students talk about math without getting bogged down on correct answers,” and Teacher 2 said, “In my opinion, any math talk is good talk. The discussions of strategies when doing number talks helps with solving skills.” Both participants indicated they felt more confident in implementing Number Talks regularly due to the professional development intervention. Teacher 1 reported, “I had used Number Talks previously, but I learned new helpful strategies for implementing them,” whereas Teacher 2 wrote, “I had no previous knowledge of Number Talks; therefore, it was highly beneficial.”

During the post-intervention focus group interview, several findings arose during the discussion. When asked what they noticed in their classroom since implementing Number Talks, Teacher 2 said, “In my advanced class you could hear them when they’re trying to solve things, talking about strategies and actually using the word strategies.” Teacher 1 shared, “I think when I was doing Number Talks the first few times, they really liked them.” Participant feedback indicates students were actively participating, collaborating with one another, and sharing strategies for solving problems because of the implementation of Number Talks.
I also asked participants to share the challenges they experienced after training and implementing Number Talks. Teacher 1 said, “Their attitude towards it influenced the other students,” and Teacher 2 said, “Full participation” was a challenge. They were then asked what they liked best about the intervention. Teacher 1: “The engagement. They seemed to be really engaged and everyone wanted to answer and share their strategies.” Teacher 2: “I like talking about numbers. Yeah, I mean it is like a fun type of thing to open up your mind. You know every now and then another thought was provoking to me.”

Data indicated instructional coaching around engagement supported teachers by providing professional learning opportunities, modeling Number Talks and various other instructional strategies to support teacher instruction that impacts student engagement. Although there are identified challenges, including a lack of full student participation and some disengaged attitudes, the overall data indicated that by implementing Number Talks regularly and effectively, students become more engaged in their own mathematical learning. The data supported the impact of instructional coaches as a professional development tool to improve teacher’s instructional practice in order to enhance student learning and engagement.
CHAPTER 5
SUMMARY AND DISCUSSION

Overview of the Study

Previously mentioned in previous chapters, this dissertation in practice sought to analyze the number of students not engaging in the learning opportunities provided. This observational case study investigated the impact of instructional coaching on student engagement in middle school mathematics. The study answered the following qualitative research questions:

RQ1 – How does instructional math coaching influence teacher practice in engaging students in middle school mathematics?

RQ2 – What are the obstacles to middle school student engagement in mathematics class?

RQ3 – What are teacher perceptions of student-centered professional development in mathematics?

The specific area of focus examined how instructional coaches used self-determined professional development to support teachers’ instructional practices. As the instructional coach and researcher, I provided professional development for middle school mathematics teachers focused on implementing Number Talks. The focus group consisted of two sixth-grade mathematics teachers at a small middle school in rural South Carolina. As an instructional mathematics coach that serves multiple states, I was available to complete the four weeks of classroom observations during the first block. The overall findings indicate that the teachers were positively impacted by instructional
mathematics coaching in the form of professional development. Their instructional practices improved, and student engagement increased.

The following chapter will begin with analyzing the results as they relate to the Literature Review, while supporting their connection to the theoretical framework. Then provide recommendations that emerged from the analysis of the qualitative data. Third, reveal the plan for implementation for recommendations for practice. Fourth, share reflection on the action research model presented in the dissertation in practice. A discussion of identified limitations and suggestions for this action research study. The chapters conclude with a concise summary of the dissertation, overall conclusions, and suggestions of how the study could illuminate the problem of practice.

**Results as They Relate to Literature Review**

Results from this qualitative study confirmed several claims in the existing literature as they relate to the literature review. “Mathematical learning is not a process of internalizing packaged knowledge but is instead a matter of reorganizing activity or thought” (Cobb et al., p. 5). This section will provide connections between existing literature from Chapter 2, the Literature Review and this study.

First, the theoretical considerations that support a community of practice (COP) comprise three dimensions: mutual engagement, joint enterprise, and a shared perspective (Wenger, 1998). The COP is a branch of the social learning theory that resides within the constructivism paradigm. Social constructivism is grounded in the belief that social worlds develop from individuals’ interactions with their culture and society (Lynch, 2016). The math-talk learning community is a classroom where students use discourse to support the mathematical learning of all other participants (Hufferd-
Like the findings in this research study, Hoon et al. (2021) researched the practices of a mathematics learning community. The case study shows that all parties, including parents, students, and teachers, put an emphasis on developing mathematics education, playing a lead role in fostering the relationship.

Similarly, teachers in this study created a learning environment that supported students in collaborating, sharing their individual strategies, questioning, and providing feedback on problems they were to solve (Hoon et al., 2021). The research of Hoon et al. (2021) provides evidence that a learning community that puts emphasis on quality mathematics practices, dedication and commitment of teachers, and open lines of communication between parents and teachers provide students living in disadvantaged settings the necessary supports to perform well in mathematics (Hoon et al., 2021). The research lacks a parent involvement component. The data from this study was gathered from a middle school in which more than 75% of students are on free and reduced lunch due to the low socioeconomic status of the community.

**RQ #2 What are the obstacles to middle school students’ engagement in math class?**

During the coding portion of the data analysis process, the theme of historic perceptions of student engagement was used to provide clarity to research question two. Historic perspectives of student engagement was the theme that emerged from the categories of culture and attitude, relationships, and dispositions at the time of saturation. The category of culture and attitude emerged from the codes of questioning, active participation, involvement in the learning, oral participation, listening, showing a desire to learn, desire to succeed, discourse, confidence, and using multiple strategies (see Table 5.1).
Math talk communities support students to have more confidence and demonstrate a more positive attitude towards mathematics. The findings in this study indicate that Number Talks support students to demonstrate more confidence and a better attitude towards mathematics, which were both obstacles mentioned before participants implemented Number Talks. When participants were asked to describe the key characteristics of a highly effective classroom, Teacher 1 stated, “Students are engaged because they feel confident, respected, and there are a variety of strategies presented to reach different types of learners.” When asked what they would tell other math teachers regarding the impact of Number Talks in their classrooms, Teacher 1 reported, “A lot more involvement from the students than usual.” Hence, the findings of this study are consistent with the research of Hufferd-Ackles et al. (2004). The researchers found that both students’ and teachers’ confidence in participating in math discussions grew (Hufferd-Ackles et al., 2004).

Data analysis of the pre-intervention survey, pre-intervention focus group, and the field notes from the pre-intervention classroom observation provide insight into the additional research questions through the themes that emerged. The problem of practice that began this study was the lack of student engagement in middle school mathematics classrooms. These findings validate the need for an intervention to address the identified obstacles.

**RQ #3 What are teacher perceptions of student-centered professional development?**

During the process of coding data, the theme of instructional coaching was used to provide insight to research question three. Implementation and planning, professional development, thinking and discourse, frequency and implementation of Number Talks
were the categories that merged to develop Instructional Coaching (Table 5.1).

Professional development is at the core of this question. Although theoretical and empirically based recommendations for professional development have promise, research on professional development contains mixed results, especially in mathematics (Polly, 2012). In the literature review, I viewed this statement as a catalyst for delving deeper into the research on the impact of professional development. This search led me to several studies that support the positive impact student-centered professional development has on teachers to improve their instructional practice.

Professional development is impactful, according to the accepted theory of action, by (1) improving teachers’ knowledge, skills, attitudes, and beliefs; (2) improving instruction; and, hence, (3) improving student learning (Desimone, 2009, p.185). This study found that participants view student-centered professional development as a professional learning opportunity to grow by learning new best instructional practices to support student-centered learning. Teacher 2 shared, “Professional development is good when I learn something I didn’t know and have a strong desire to implement it immediately.” Teacher 1 agreed and added, “Effective professional development means that it is something that will help me grow in my abilities to become a better teacher.” The same teacher also claimed, “Instructional coaches are the teachers’ teacher.” These statements collectively support Desimone’s (2009) research on the impact of professional development.
RQ#1 How does instructional coaching influence teacher practice in engaging students in middle school mathematics classrooms?

The theme effects of coaching around student engagement was used during the data coding process to provide insight to research question one. The categories that merged to develop this theme were ideas of engagement, knowledge gained, instructional strategies, active participation, collaboration, instructional methods, and visible thinking (see Appendix L). Ideas of engagement and instructional coaching are the categories of focus for connecting the research in the literature review and this study. Decades of research address student engagement and academic achievement in middle school students.

Instructional coaching around engagement supported teachers by providing professional learning opportunities, modeling Number Talks and various other instructional strategies to support teacher instruction that impacts student engagement. The North Carolina Teachers of Mathematics (2009) admits the research on instructional coaching in mathematics is scarce and does not provide sufficient data to determine the impact of professional development by the mathematics coach on student engagement. There is considerable evidence from research that for professional development to improve teaching practice and student learning effectively, five features need to be in place: content focus, active learning, coherence, sustained duration, and collective participation (Desimone, 2009).

The intervention PD: Using Number Talks to Support Student Growth & Engagement was designed using Guskey’s five critical levels of professional development evaluation instrument as a measurement tool when creating the content of
the PD (see Appendix L). The levels are (1) participants’ reactions, (2) participants’ learning, (3) organization support and change, (4) participants use of new knowledge and skills, and (5) student learning outcomes (Guskey, 2002). When planning professional development to improve student learning, the model of these must be reversed. Instructional coaches must plan backwards (Guskey, 2001), starting where they want to end and then working backwards (Guskey, 2002). As the research observer, I witnessed and have classroom observation transcripts and videos that see participants use new knowledge and skills as they implement Number Talks. The post-intervention surveys and post-intervention focus group interviews validate the student learning outcomes were met through the participants’ learning and reactions to implementing Number Talks. The impact of the professional development provided by the instructional coach was positive. Participants’ interactions with students during classroom observations allowed me to see their learning through the modeling provided in the PD impacted the engagement level of the students.

Table 5.1 Themes and their Respective Categories and Codes

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<tr>
<th>CATEGORIES</th>
<th>CODES</th>
<th>THEME #1</th>
<th>THEME #2</th>
<th>THEME #3</th>
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<td>Instructional Coaching Support</td>
<td>Effects of Coaching Around Engagement</td>
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<td>Professional Development</td>
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<td>Thinking &amp; Discourse</td>
<td>Knowledge Gained Intentional Strategies</td>
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<td>Active Participation</td>
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<td>Implementation &amp; Planning</td>
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<th>CATEGORIES</th>
<th>Frequency</th>
<th>Instructional Methods</th>
<th>Visible Thinking</th>
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<td>Learning New Strategies</td>
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<td>Questioning</td>
<td>Strong Desire to Implement</td>
<td>Questioning</td>
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<td>Active Participation</td>
<td>Immediately Grow in Abilities</td>
<td>Involved in their Learning</td>
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<td>Be a Better Teacher</td>
<td>Working with others</td>
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<td>Oral Participation</td>
<td>Discourse</td>
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<td>Using multiple strategies</td>
<td>Variety of Strategies</td>
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<td>Get Kids Moving</td>
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<td>Increases Knowledge</td>
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<td>Students Improve through the Process</td>
<td>Confidence</td>
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Practice Recommendations

The primary findings of this study support the previous literature that professional development to improve teaching practice and student learning effectively, five features need to be in place: content focus, active learning, coherence, sustained duration, and collective participation (Desimone, 2009). The driving question for this research study was to determine how instructional coaching influences teacher practice in students in middle school mathematics? The two supporting questions focused on teacher perceptions of obstacles to student engagement and student-centered PD. As previously mentioned, the research on instructional coaching in mathematics is scarce and does not provide sufficient data to determine the impact of PD by the mathematics coach on student engagement (NCTM, 2009). This study found that instructional coaching influenced teacher practice when the PD provided was relevant, timely, interactive, and applicable and when continued instructional coaching support was provided. This study is significant because it adds to the current literature on instructional coaching and engagement. The results of this study will impact K-12 teachers’ instructional practices and improve student engagement with the intent of affecting student achievement.

In response to policy initiatives from the state and local levels, instructional coaches are often utilized as providers of PD. Instructional coaching is a powerful mechanism for teacher learning because it reflects the previously mentioned five features of effective PD:

(a) content focus: activities are assigned that are focused on subject matter content and how students learn that content; (b) active learning: opportunities for teachers to observe, receive feedback, analyze student work, (c) coherence: content, goals, and curriculum and goals, teacher knowledge and beliefs, the needs of the students, and school, district, and states reforms and policies; (d) sustained duration: PD activities that are ongoing throughout the
school year and include 20 hours or more of contact time; and (e) collective participation: groups of teachers from the same grade, subject, or school participate in PD activities together to build an interactive learning community (Desimone, 2009).

Evidence supporting the success of this PD with these five features was acquired from cross-sectional studies, longitudinal studies, and literature reviews of qualitative and quasi-experimental studies (Desimone, 2009, as cited by Desimone, 2017). Desimone & Pak (2017) claim that the conceptual foundation of the instructional coaching model should embody content focus, active learning, coherence, sustained duration, and collective participation. I concur with Desimone & Pak (2017) that instructional coaching is consistent with research-based ideas of effective PD. This study supports Desimone & Pak’s (2017) claim, and I recommend that I use this model when training future instructional coaches. Prior to doing this research, I was not familiar with this model or the research supporting coaching as a valuable PD opportunity for teachers.

A second recommendation I have involving practice is to provide the PD Using Number Talks to Support Student Growth & Engagement to all K-12 mathematics teachers in the school district. The study is grounded in the Community of Practice (COP) framework comprising three dimensions: mutual engagement, joint enterprise, and a shared repertoire (Wenger, 1998). The COP is a branch of the social learning theory residing within the constructivism paradigm. Wenger (1998) contends mutual engagement involves a diverse group of people collaborating to make meaning of a situation or concept. Training all teachers in how to implement Number Talks to support student growth and engagement is only part of the plan. Establishing a COP will allow the group of mathematics teachers to collaboratively engage in purposeful reflection and discourse to develop personal meaning and a mutual understanding. The COP will also
include teachers collaboration with the instructional coach and numeracy coach to
determine strategies for implementing Number Talks. I will continually support teachers
with this process.

**Implementation Plan**

The primary purpose of public education is to promote student learning.
Professional development should focus on enhancing professional practice and leadership
capacity at both the school and jurisdiction levels. PD must be well planned in
consultation with all education partners to ensure resources are used efficiently. Research
indicates that changes occur over time. Hence, “for PD to be effective it must be
systematically planned, systemic, supported and sustained” (CASS, 2023). A PD plan
centered on these factors should result in school improvement and enhanced student
learning (CASS, 2023).

In education, we utilize a wide range of data to study trends, identify issues,
measure the results of initiative, target interventions, and verify assumptions. Many
factors affect the development of a thorough PD plan. I will use data to inform each step
of the comprehensive PD plan. By collecting and analyzing data in the planning and
implementation phases of the PD plan, I will use resources appropriately, support
professional practice development and measure the results of the plan. Guskey (2000)
identifies three purposes of data during the PD creation process: planning, formative
evaluation, and summative evaluation. Data collected for planning will determine the
goal of the PD. Formative evaluation involves identifying sources of data to assess the
plan and determine what changes should be made to reach the goals. Summative
evaluation and reporting of the PD program to determine if the goals were met.
This model represents a systematic planning process that combines the art and science of PD development. This model is similar to the professional inquiry and action research process. Effective PD requires thoughtful planning over time in a cyclical and recursive process (CASS, 2023).

![Figure 5.1 Professional Development Planning Cycle](image)

**Table 5.2 Implementation Plan for District Professional Development**

<table>
<thead>
<tr>
<th>Implementation Plan of District PD: Using Number Talks to Support Student Growth &amp; Engagement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Establish a Community of Practice (COP)</strong></td>
</tr>
<tr>
<td>Meet with district numeracy coaches, instructional coaches, administrators, and secondary director to create a PD Planning Committee. Discuss the problem of practice and collaborate to develop a shared vision that includes core belief of the purpose of PD, a vision for effective PD at the district and school level, and guidelines to support the development and implementation of the plan.</td>
</tr>
<tr>
<td><strong>Train PD Planning Committee Members</strong></td>
</tr>
</tbody>
</table>
Facilitate the PD: Using Number Talks to Support Student Growth & Engagement with the committee members. This supports a train the trainer model of implementing effective PD at the district level.

**Conduct Participant Needs Survey**
Collaborate with the PD Planning Committee to create a google form for the Participant Needs Survey. Each site based instructional coach or numeracy coach will conduct the Participant Needs Assessment by emailing it to all math teachers.

**Develop PD Program Goals**
Use the data gathered from the Participant Needs Assessment to determine the PD Goals.

**Identify Possible PD Strategies**
The committee develops a focused, comprehensive, ongoing PD program for implementing and supporting K-12 math teachers to use Number Talks.
- Which delivery model addresses the goals and meets participants’ needs?
- What resources are needed?
- How will the PD be ongoing and sustained?
- How will the impact of the PD be measured?

Effective implementation of PD requires gathering data on these five questions as determined by Guskey (2000).
1. What is the collective response of the participants?
2. What did the participants learn from the PD?
3. What resources were provided for the goals to be met?
4. Are participants applying new knowledge and skills?
5. Did the PD program influence teacher practice and as a result student learning?

**Complete Action Plan and Measures**
The committee finishes the detailed PD and action plan for implementation and evaluation. Obtain required approval from the superintendent and communicate PD plan with all stakeholders.

**Implement Action Plan**
Consider the following questions to plan for a successful implementation.
- What strategies will be used to support the committee?
- How will you communicate with participants?
- How will the committee maintain communication with PD providers?
- How will the committee determine and share successes during the year?

**Revise Action Plan**
Based on evidence collected the action plan may need revision. Monitor and collect data of program success. Are participants applying new knowledge and skills? Is the program influencing practice and student learning? If so, what evidence supports the claim.

**Summative Evaluation**
Summative data indicates completion of the PD planning cycle. Were the program goals met? Did the program meet the needs of the participants?

**Complete Final Report**
Create a final report including an overview of the program, findings and evidence of the program’s success and recommendations for future PD.

Reflections on Action Research and Methodology

Implementing action research for this DIP has been a transformational learning experience. Action research (AR) is a systematic, collaborative, and democratic orientation toward inquiry that seeks effective solutions to complex problems that people confront in their communities and organizations (Mertler, 2017). The research process is iterative, cyclical, and participative in nature and fosters deep understanding of a given situation, informing future action, starting with conceptualizing and particularizing the problem and then moving through multiple interventions and evaluations (Bloomberg & Volpe, 2019). This quantitative action research study created a substantial amount of data that needed to be analyzed to provide effective interpretations for the interpretation of positive change. Data collection and analysis are interwoven in the process. The data analysis presented the findings of the study by organizing data from pre- and post-intervention surveys, pre- and post-intervention focus group interviews, and pre- and post- classroom observations into categories to produce interpretive insights. The findings of this study were presented in a readable narrative. As I was writing the narrative, I kept the intended audience in mind and allowed a story to emerge using direct quotations from the participants. The quotations provide the proof that supports the assertions that were made to support answers to the research questions.

Multiple sources of data support the impact of instructional coaching as a professional development tool guiding teachers to improve instruction. The greatest discrepancy between the action plan I envisioned and the action plan that was actually implemented was the continual collaboration between the participants and the
instructional coach post-intervention. Once the teachers began implementing Number Talks, I anticipated that we would have more time to debrief, discuss what went well and what needed improvements for moving forward, and collaboratively plan for the next Number Talk. However, teachers had many obligations during their planning and after school that impeded the time available for in depth debriefing as I originally planned. With any intervention, its ultimate success depends on the teachers delivering it. Instructional principles espoused in contemporary approaches to professional learning highlight the importance of an ongoing approach that: is embedded in teacher practice; organized around collaborative problem-solving; involves reflection and feedback; and is followed up with support from a range of experts (Guskey, 2003).

Coaching is one strategy that has the ability to accomplish this as it includes modeling, observation, and constructive feedback (Helmer et al., 2011). As the instructional coach who provided the PD, I understand the critical need for ongoing continuous support. This belief is supported by the Community of Practice theoretical framework that grounded this study. Lave and Wenger (1991) emphasize community participation can limit or expand teachers’ learning opportunities and may require novices to be apprenticed through practice. Although I communicated through email when we were not able to debrief face to face, that was minimal support in comparison to the intent of this study design.

Components that turned out as expected included the willingness of the participants to try a new instructional practice to support student learning and engagement. Both teachers came to the study with an open mindset, actively participated in the PD, and immediately implemented Number Talks. The desire to improve
instructional practice was a positive factor in the success of this study. Another aspect that turned out as expected was their historical perception of student-centered learning and engagement. I anticipated their responses almost verbatim.

If I could make changes to the methods of this study, I would meet with the participants that were considered for this study and explain in detail clear expectations of each aspect of the study, allowing them to ask clarifying questions. Additionally, I would conduct more post-intervention classroom observations over a longer period of time. Currently, that factor was impeded by my predetermined work schedule and did not allow me to be at the school as often as needed. Lastly, I would have provided preselected Number Talks that both teachers were to use on specific days for the first two weeks and then they could select their own. Having participants conduct the exact same Number Talks would provide more accurate classroom observation data, and analysis of those specifically could provide rich findings.

I was able to gain new learning and insights by doing this study. I have a stronger foundation of the research on the impact of instructional coaching and PD. Site-based PD with continuous support from the instructional coach visibly had a positive impact on teacher confidence and implementation of a new instructional strategy. The teachers confirmed this in the post-intervention survey and focus group interview. The study helped me to understand the value of intentional, structured planning before beginning an intervention to address a problem of practice. I see the necessity to ensure trustworthiness by triangulation. These were both unfamiliar aspects of action research at the onset of this study.
The research was valuable to me on a personal and professional level. Personally, this research provided me with the opportunity to try an intervention in hopes of solving the identified problem of practice. This was extremely gratifying to see the positive impact instructional coaching had on the instructional practices teachers implemented that led to greater student engagement. Student engagement is one of my initial focuses when supporting teachers to reflect on their classroom learning environment. The lack of student engagement is rampant, and I now have hope that I can make a positive impact by personally providing PD and continuous coaching support for teachers.

Professionally, participation in this research has provided me access to an enormous amount of related literature and research on three areas that I will put to use as an instructional coach supporting over twenty schools and hundreds of teachers: professional development, engagement, and instructional coaching. This research will be a catalyst for conducting additional action research studies based on the assertions made and the questions that surfaced as a result of the findings. I will use this research study to impact instructional coaches and teachers on a greater scale by presenting at our summer national conference, coaching the new instructional coaches in my organization as part of our onboarding process, and as I coach instructional coaches in the 13 states that we support.

**Limitations and Suggestions**

Research limitations are the characteristics of design or methodology that impact or influence the interpretation of the findings of the research (Bloomberg & Volpe, 2019). The data from this study were collected from a convenience sample in a small middle school in South Carolina. Limitations of the study expose the conditions that may
weaken the study (Lock et al., 2013; Rossman & Rallis, 2012, as cited in Bloomberg & Volpe, 2019). In analyzing this study’s data, several possible limitations emerged. Specific areas of reflection include increasing the number of participants, revisiting specifications for implementation of Number Talks and refining a measure of engagement.

**Small Sample Size**

If research is valid, it clearly reflects the world being described (Bloomberg & Volpe, 2019). Having only two participants and only five observations from each teacher produced a small sample size which potentially impacts the validity of the study. Increasing the study to all sixth-grade teachers in the district would provide more observations and a larger sample size.

**Specifications of Number Talk Implementation**

There was not a specified number of Number Talks teachers were asked to implement within the research study window. The participants did not conduct an equivalent number of talks; therefore, one class having more experience with Number Talks could impact comfort levels of the teacher and students, hence impact the trustworthiness of the study. Classroom observations could reveal better data than the teacher that did fewer talks. The validity of the study is not guaranteed. Hence, specifying a set number of Numbers Talks to be implemented each week, versus just following the recommendations from the PD, would impact the trustworthiness of the study.

**Measuring Engagement**

One potential limitation of this study was the way engagement was measured in classroom observations. I used the Qualitative Data Collection Tool (Appendix G) to
record both descriptive and reflective field notes during pre- and post-intervention classroom observations, as well as video and audio recordings to improve the accuracy of the observational data allowing for holistic interpretation of the data. I adapted the observational tool to be specific to Number Talks. However, it was difficult to determine which category was being observed. I was overwhelmed with the need to put each action in a specific category. As a result, I missed some interactions in real time that may have provided data for this study. I was fortunate to have the lessons recorded and could compare the field notes and add the missed opportunities for witnessing engagement behaviors, emotions, and cognitive desire to succeed.

The original Qualitative Data Collection Tool (Appendix G) had two columns devoted to descriptive notes and reflective notes. Collecting observational data consists of capturing as much of the engagement behaviors, attitudes, conversations, and levels of motivation. Instead of editing the tool to be specific to Number Talks, the original would have provided a more authentic raw recording of field notes in the descriptive section while observing. I would still watch the video recording while simultaneously comparing the field notes and making necessary additions or adaptations. The reflective column allows for my thoughts and connections to previous data.

**Recommendations for Future Research**

The key findings of this study confirm that instructional mathematics coaching influences teacher practice in engaging students in middle school mathematics classrooms. Previous literature exists that confirm coaching as a professional development model that improves student achievement (Harbour & Saclarides, 2020), but gaps exist in determining the effectiveness of instructional coaching as a viable
professional development tool to improve mathematics instruction (Brown et al., 2017; Harbour & Saclarides, 2020). Conclusions drawn from this research represented how instructional mathematics coaching can influence teacher practice in engaging students in middle school mathematics classrooms.

Implications for future research should include focusing on determining if instructional coaching as a professional development tool is effective in improving student engagement in elementary mathematics classrooms. This research study specifically addressed middle school. However, future research could explore whether the impact would be different for elementary teachers. Among the possible focuses to consider for elementary teachers could be whether they would respond differently to the intervention provided by the instructional coach to improve student engagement. Future research could also investigate whether a teacher's instructional grade level significantly affects how they respond to the PD provided by the instructional coach. Does it make a significant difference in the grade level the teacher is supporting and how they respond to the PD provided by the instructional coach?

Future research might be conducted to examine specific types of strategies and the impact they have on student engagement. Case studies could provide data on the impact of implementing various strategies to solve mathematics computations on student engagement. Additional research to determine if teachers choose to implement a specific strategy when provided multiple strategies in PD. Comparing the findings to those of this study would add to the research base for supporting student engagement in mathematics.

Teacher PD is the process of teacher development using different instructional activities, the development of beliefs, and conceptions that underlie the activities (Balta
PD of teachers aims to improve knowledge, skills, and values and be a tool for continuous school improvement (Balta & Eryilmaz, 2019). Another consideration for future research would be to conduct the study in elementary, middle, and high school and compare data to determine if the grade level has an effect on the implementation of the strategy learned in the PD. Further considerations could include how strategies at each grade level impact student engagement. The potential for instructional coaches to develop site-based PD and continuous support for K-12 mathematics teachers exists. This research could impact K-12 teachers worldwide.

The findings of this study indicate that mathematics teachers incorporate Number Talks in their daily instruction regularly. Evidence suggests incorporating Number Talks into daily instruction does not increase engagement in lower-level students as much as it does with the academically gifted population. However, the ability to indicate their thinking by using the hand gestures for having a method to solve the provided mathematics problem was prevalent with all ability levels. Future research over a longer period of time, such as an entire school year, could reveal findings that provide a more accurate indication of the impact of implementing Number Talks with fidelity and at least three times a week.

This research opens the door to additional studies that have a focus on how teacher proficiency with Number Talks and implementation grows and affects student engagement. Increasing the length of the study to a semester or entire year would provide stronger evidence, allowing teachers ample time to become more experienced and skillful when executing Number Talks with students. Observations would include taking notes on what the students were doing as well as teacher actions and questions. Video footage
would aid in the observations and allow for triangulation of what the teachers observed in terms of engagement.

**Summary**

“Tell me and I will forget. Teach me and I remember. Involve me and I learn.”

-Benjamin Franklin

As I conclude this study, I wanted to pause and reflect on the road that I traveled during this journey. Upon reflection, the words of Benjamin Franklin resonated with me for several reasons. From the perspective of the researcher instructional coach, I see the intervention PD and the continuous instructional support as the “involve me” so they can “learn.” If I had just “told” the teachers about Number Talks, it is likely they would not implement the practice based merely on a conversation. I believed I could increase their interest and awareness of Number Talks by modeling one for teachers. However, “teaching” them by showing them does not indicate they will try them with their own students. When I facilitated the PD Using Number Talks to Support Student Growth and Engagement for teachers, I actively engaged them in the PD. By modeling the Number Talks for them and providing the support and the opportunity for them to try them while the PD “involved” them in the learning process and implementation occurred.

The intent of this qualitative, multiphase action research study was to investigate the impact of instructional coaching and self-determined professional development on student engagement in middle school mathematics. The study found that instructional coaching influenced teacher practice when the PD provided was relevant, timely, interactive, applicable, and continued instructional coaching support was provided. As the researcher instructional coach my hope is that this study impacts K-12 educators everywhere to see the value of instructional coaching as a professional development tool.
and to realize the effect of implementing Number Talks has on student engagement.

Whether the teachers are mathematics teachers is irrelevant; understanding the process of identifying a problem of practice, determining an intervention, effectively administering the intervention, and continuous instructional coaching support is valuable to all educators. Lastly, remember that we all need to be “involved” in the process if we want educational transformation to occur.
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APPENDIX A

PRE-INTERVENTION SURVEY QUESTIONS
Administered to participants in a Google Form

Table A.1 Pre-Intervention Survey Questions

<table>
<thead>
<tr>
<th>Demographic Questions (Short Answer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What is your age?</td>
</tr>
<tr>
<td>2. Including the current year, how many years have you been a teacher?</td>
</tr>
<tr>
<td>3. Including the current year, how many years have you been a teacher at Baywatch Middle School?</td>
</tr>
<tr>
<td>4. What subject/grade do you teach?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Student Engagement Questions (Short Answer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How do you define student engagement?</td>
</tr>
<tr>
<td>2. What are the key characteristics of a highly effective classroom environment?</td>
</tr>
<tr>
<td>3. How important is the role of student engagement in learning?</td>
</tr>
<tr>
<td>4. What behaviors suggest student engagement?</td>
</tr>
<tr>
<td>5. How would you describe authentic engagement in your classroom?</td>
</tr>
<tr>
<td>6. What practices in your classroom most affect student engagement?</td>
</tr>
<tr>
<td>7. What are the challenges or obstacles to student engagement?</td>
</tr>
<tr>
<td>8. Are the challenges the same or different depending on which group you teach? Explain how</td>
</tr>
<tr>
<td>9. Based on your experiences what does student-centered learning look like and/or sound like in your classroom?</td>
</tr>
<tr>
<td>Instructional Coaching Support (Short Answer)</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>1. What is the role of your instructional mathematics (numeracy) coach?</td>
</tr>
<tr>
<td>2. What does effective professional development look like?</td>
</tr>
</tbody>
</table>
**APPENDIX B**

**SEMI-STRUCTURED FOCUS GROUP PRE-INTERVENTION INTERVIEW QUESTIONS**

Table B.1 Semi-structured Focus Group Pre-Intervention Interview Questions

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>How long have you been teaching? How long have you been teaching math?</td>
</tr>
<tr>
<td>2.</td>
<td>What is your certification? Degree?</td>
</tr>
<tr>
<td>3.</td>
<td>Suppose I am a new instructional coach walking into your classroom, what behaviors would I see that demonstrate student engagement?</td>
</tr>
<tr>
<td>4.</td>
<td>What barriers have you experienced with student engagement?</td>
</tr>
<tr>
<td>5.</td>
<td>Describe your experiences with instructional coaching. Give examples.</td>
</tr>
<tr>
<td>6.</td>
<td>In what ways has instructional coaching influenced you as a collective group? Give examples.</td>
</tr>
<tr>
<td>7.</td>
<td>What is a goal you would like to work on this year? Why did you choose this goal? Describe how you will reach this goal.</td>
</tr>
<tr>
<td>8.</td>
<td>Tell me about your experience with the Professional Development: Number Talks - Let’s Talk About Making Sense of Math.</td>
</tr>
<tr>
<td>9.</td>
<td>What are some strategies that have helped to remove the obstacles that were affecting student engagement?</td>
</tr>
<tr>
<td>10.</td>
<td>What would you tell the other mathematics teachers in your school/district regarding the Number Talks PD?</td>
</tr>
<tr>
<td>11.</td>
<td>Are there specific self-determine PD supports you would like to have? Explain your selection.</td>
</tr>
</tbody>
</table>
APPENDIX C

QUALITATIVE DATA OBSERVATION COLLECTION TOOL

Table C.1 Qualitative Data Observation Collection Tool

<table>
<thead>
<tr>
<th>Observer:</th>
<th>Teacher Observed:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Observation Date:</th>
<th>Class Period/ Time Frame:</th>
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<tbody>
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<table>
<thead>
<tr>
<th>Number of students:</th>
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<table>
<thead>
<tr>
<th>Learning Target/ Objectives:</th>
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### QUALITATIVE DATA OBSERVATION COLLECTION TOOL

<table>
<thead>
<tr>
<th>Descriptive Field Notes</th>
<th>Reflective Field Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers providing feedback to improve student learning</td>
<td></td>
</tr>
<tr>
<td>Teachers teaching in ways that enable students to learn</td>
<td></td>
</tr>
<tr>
<td>Teachers being enthusiastic about their subject</td>
<td></td>
</tr>
<tr>
<td>Teachers making the subject interesting</td>
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<tr>
<td>Teachers caring about students learning</td>
<td></td>
</tr>
<tr>
<td>Teachers being available to discuss student learning</td>
<td></td>
</tr>
<tr>
<td>Teachers challenging students to think</td>
<td></td>
</tr>
<tr>
<td>Teachers providing opportunities for students to apply their learning</td>
<td></td>
</tr>
<tr>
<td>Teachers encouraging students to question and challenge teachers</td>
<td></td>
</tr>
<tr>
<td>Specific strategies shared by students</td>
<td></td>
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<tr>
<td>Multiple students shared strategies</td>
<td></td>
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<tr>
<td>Number Talk was led more by the teacher or the student</td>
<td></td>
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<table>
<thead>
<tr>
<th>Descriptive Field Notes</th>
<th>Reflective Field Notes</th>
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APPENDIX D

INTERVENTION-PROFESSIONAL DEVELOPMENT

Figure D.1 Intervention – PD: Using Number Talks to Support Student Engagement & Growth

Using Number Talks to Support Student Engagement & Growth

February 1, 2023

Common Concerns from Middle School Teachers

“Students don’t know their basic facts.”

“Students can’t divide.”

“Students can’t solve a problem because they can not work with the numbers that are there.”

“Students can’t add and subtract whole numbers, much less fractions.”

Shifting Teacher Perspectives

Previous Practice

• Paper/pencil practice
• Unrelated computation problems
• Explicit teacher modeling
• NO Calculation!

Where we want to be

• Computational fluency with a focus on “sense-making”
• Flexible computation based on mental strategies
• Recognize and articulate the strategy/thinking used
• Understand connections between strategies

Goals of Professional Development

• What are Number Talks?
• The Importance of Mathematical Discourse
• Establishing the Routine of Number Talks
• The Math Standards in Number Talks
• Number Talks in Your Classroom
• Online Resources

Number Talks: A vehicle to change perspectives

• Improve computational fluency
• Improve classroom mathematical discourse
• Improve use of representations to develop conceptual understanding
• Deepen understanding of mathematical properties and how the properties work with different operations and numbers

Why do Number Talks?

Number Talks provide students a platform to explain their mathematical understanding in a safe, risk-friendly environment. Teachers are able to gain insight into student thinking which could include non-traditional approaches, connections to previous understanding, and misconceptions.

Number Talks, when implemented consistently, develop flexibility with numbers using number relationships and the structure of numbers, and provides opportunities to use mathematics in a manner that is meaningful to students.

Number Talks remove the focus on speed and direct students to deeply think about mathematics while emphasizing the mathematical process and communication.
What are Number Talks?
A brief daily practice where students mentally solve computation problems and talk about their strategies, as a to dramatically transform teaching and learning in the mathematics classrooms.

The Importance of Mathematical Discourse

I am calling every secondary math teacher to spend some time learning how students form the concept of number and their operations and then use Number Talks as the vehicle for acting on our students lack of numeracy skills.

- doubling/halving
- counting on partial products
- decomposing numbers
- making 10s
- friendly numbers
- open number lines
- area model
- relational thinking
- compensation

As secondary teachers we need to know the Sequence of Learning looks like and how to diagnosis where our students are in this sequence, stop complaining about their lack of skills and refine our own skills as teachers.

NUMBER TALK norms:
1. There are many ways to see, or do, any problem.
2. Everyone is responsible for communicating his/her thinking clearly so that others can understand.
3. Everyone is responsible for trying to understand other people’s thinking.
4. Everyone is responsible for trying to understand other people’s thinking.
5. Everyone is responsible for trying to understand other people’s thinking.

EQUITY & ACCESS

1. There are many ways to see, or do, any problem.
2. Everyone is responsible for communicating their thinking clearly so that others can understand.
3. Everyone is responsible for trying to understand other people’s thinking.
4. Everyone is responsible for trying to understand other people’s thinking.
5. Everyone is responsible for trying to understand other people’s thinking.
The Key to Number Talks: Purposeful Problems

Select problems that guide students to focus on mathematical relationships.
- Start where students are comfortable... whole numbers.
- Develop a series of related problems that scaffold — Number Strings.
- Develop Number Strings based on strategies.

Designing the problems requires careful planning in order to push student thinking.

Establishing a Routine for Number Talks

- This is a best practice and a way to encourage mathematical discourse.
- It also builds student understanding and strengths in numeracy.
APPENDIX E

SEMI-STRUCTURED FOCUS GROUP POST-INTERVENTION INTERVIEW QUESTIONS

Table E.1 Semi-structured Focus Group Post-Intervention Interview Questions

<table>
<thead>
<tr>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How long have you been implementing strategies from the Professional Development?</td>
</tr>
<tr>
<td>2. How do your students react to Number Talks?</td>
</tr>
<tr>
<td>3. Describe any notices in your classroom since the beginning of Number Talks?</td>
</tr>
<tr>
<td>4. Suppose I am a new instructional coach walking into your classroom, what behaviors would I see that demonstrate student engagement?</td>
</tr>
<tr>
<td>5. What barriers/obstacles have you experienced with student engagement?</td>
</tr>
<tr>
<td>6. Are there certain times when students seemed to be extremely engaged in mathematics?</td>
</tr>
<tr>
<td>7. Describe your experiences with instructional coaching. Give examples.</td>
</tr>
<tr>
<td>8. In what ways has instructional coaching influenced you as a collective group? Give examples.</td>
</tr>
<tr>
<td>9. Tell me about your experience with a specific Professional Development that you felt was useful.</td>
</tr>
<tr>
<td>10. What are some strategies that have helped to remove the obstacles that were affecting student engagement?</td>
</tr>
<tr>
<td>11. What would you tell the other mathematics teachers in your school/district regarding the Number Talks PD?</td>
</tr>
<tr>
<td>12. Are there specific self-determine PD supports you would like to have? Explain your selection.</td>
</tr>
</tbody>
</table>
APPENDIX F
POST-INTERVENTION SURVEY QUESTIONS
Administered to participants in a Google Form

Table F.1 Post-Intervention Survey Questions

<table>
<thead>
<tr>
<th>Demographic Questions (Short Answer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What is your age?</td>
</tr>
<tr>
<td>2. Including the current year, how many years have you been a teacher?</td>
</tr>
<tr>
<td>3. Including the current year, how many years have you been a teacher at Baywatch Middle School?</td>
</tr>
<tr>
<td>4. What subject/grade do you teach?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Student Engagement Questions (Short Answer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. How do you define student engagement?</td>
</tr>
<tr>
<td>6. What are the key characteristics of a highly effective classroom environment?</td>
</tr>
<tr>
<td>7. How important is the role of student engagement in learning?</td>
</tr>
<tr>
<td>8. What behaviors suggest student engagement?</td>
</tr>
<tr>
<td>9. How would you describe authentic engagement in your classroom?</td>
</tr>
<tr>
<td>1. What practices in your classroom most affect student engagement?</td>
</tr>
<tr>
<td>2. What are the challenges or obstacles to student engagement?</td>
</tr>
<tr>
<td>3. Are the challenges the same or different depending on which group you teach? Explain how</td>
</tr>
<tr>
<td>4. Based on your experiences what does student-centered learning look like and/or sound like in your classroom?</td>
</tr>
<tr>
<td>Instructional Coaching Support (Short Answer)</td>
</tr>
<tr>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>1.  What is the role of your instructional mathematics (numeracy) coach?</td>
</tr>
<tr>
<td>2.  What does effective professional development look like?</td>
</tr>
</tbody>
</table>
APPENDIX G
INVITATION TO PARTICIPATE IN DOCTORAL RESEARCH STUDY

Dear ______________,

My name is Christi Edwards. I am a doctoral candidate in the College of Education Department at the University of South Carolina. I am conducting a research study as part of the requirements of my degree of Doctor of Education in Educational Practice and Innovation – Curriculum Studies, and I would like to invite you to participate.

I am studying the impact of instructional coaching, specifically for increasing engagement in middle school mathematics. If you decide to participate, you will be asked to complete pre- and post- intervention surveys followed by a focus group interview. Observations will be conducted once pre-intervention, followed by four post-intervention observations.

You will be asked questions about your view on student engagement and instructional coaching. You may feel uncomfortable answering some of the questions. You do not have to answer any questions that you do not wish to answer in the surveys or during the interviews. The meeting will take place virtually via Zoom January 31, 2023, and should last about 30 minutes. The interview will be recorded so that I can accurately transcribe what is discussed. The recording will only be reviewed by the researcher destroyed upon completion of the study.

Participation is confidential. Study information will be kept in a secure location at the University of South Carolina. The results of the study may be published or presented at professional meetings, but your identity will not be revealed. Participation is anonymous, which means that no one (not even the research team) will know what your answers are. So, please do not write your name or the names of your students on any of the study materials.

Others in the group will hear what you say, and it is possible that they could tell someone else. Because we will be talking in a group, we cannot promise that what you say will remain completely private, but we will ask that you and all other group members respect the privacy of everyone in the group. We will be happy to answer any questions you have about the study. You may contact me at 704-985-3474, CRE4@email.sc.edu, or my faculty advisor, Dr. Jefferies, rjeffries@sc.edu.
Thank you for your consideration. If you would like to participate, please complete the PRE-INTERVENTION SURVEY google form. When you are done, please email me or contact me at the number listed below to discuss participating.

With kind regards,

Christi R Edwards

Christi R. Edwards

20812 Running Creek
Church Road
Locust, NC 28097
704-985-3474

CRE4@email.sc.edu
# APPENDIX H

## STUDY TIMELINE

Table H.1 Study Timeline

<table>
<thead>
<tr>
<th>Study Focus</th>
<th>Second Quarter December</th>
<th>Third Quarter January</th>
<th>Third Quarter February</th>
<th>Third Quarter March</th>
<th>Third Quarter January - May</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Study Tasks</strong></td>
<td><strong>RQs 1A, 1B</strong></td>
<td><strong>RQs 1, 1A, 1B</strong></td>
<td><strong>RQs 1, 1B</strong></td>
<td><strong>RQs 1, 1B</strong></td>
<td><strong>RQs 1, 1A, 1B</strong></td>
</tr>
<tr>
<td><strong>Recruit teachers and provide consent to participate letters.</strong></td>
<td>• Teachers complete the pre-intervention survey.</td>
<td>• Teachers complete the pre-intervention questions.</td>
<td>• The researcher conducts observations #3, #4, and #5 per teacher.</td>
<td>• The researcher conducts observation #6 per teacher.</td>
<td>• Analyze data – compare survey responses, interview responses, and observational data to identify themes.</td>
</tr>
<tr>
<td><strong>Teachers complete the consent to participate letter.</strong></td>
<td>• The teacher focus group meets to discuss the pre-intervention questions.</td>
<td>• The researcher practices an observation to test the observation tool and make necessary changes before the actual data collection begins.</td>
<td>• The teacher focus group completes the post-intervention digital survey.</td>
<td>• Data analysis will occur within stages while being categorized, coded and analyzed by a computerized program to determine themes.</td>
<td></td>
</tr>
<tr>
<td><strong>Teacher focus group meets to discuss the pre-intervention questions.</strong></td>
<td>• The researcher practices an observation to test the observation tool and make necessary changes before the actual data collection begins.</td>
<td>• Teachers attend Number Talks</td>
<td>• The researcher practices an observation to test the observation tool and make necessary changes before the actual data collection begins.</td>
<td>• Teachers attend Number Talks</td>
<td></td>
</tr>
<tr>
<td><strong>Teacher focus group meets to discuss the pre-intervention questions.</strong></td>
<td>• Teachers attend Number Talks</td>
<td>• Teachers attend Number Talks</td>
<td>• Teachers attend Number Talks</td>
<td>• Teachers attend Number Talks</td>
<td></td>
</tr>
<tr>
<td><strong>The researcher practices an observation to test the observation tool and make necessary changes before the actual data collection begins.</strong></td>
<td>• Teachers attend Number Talks</td>
<td>• Teachers attend Number Talks</td>
<td>• Teachers attend Number Talks</td>
<td>• Teachers attend Number Talks</td>
<td></td>
</tr>
<tr>
<td><strong>Data analysis will occur within stages while being categorized, coded and analyzed by a computerized program to determine themes.</strong></td>
<td>• Teachers attend Number Talks</td>
<td>• Teachers attend Number Talks</td>
<td>• Teachers attend Number Talks</td>
<td>• Teachers attend Number Talks</td>
<td></td>
</tr>
</tbody>
</table>
professional development facilitated by the instructional coach.
• The researcher conducts observation #1 and #2 per teacher.

categorized and coded.

RQ#1: How does instructional math coaching influence teacher practice of engaging students in middle school mathematics classrooms?
RQ#1A: What are the obstacles to middle school students’ engagement in mathematics class?
RQ#1B: What are teacher perceptions of student-centered professional development in mathematics?
APPENDIX I
MANUAL CODING OF FOCUS GROUP PRE-INTERVENTION INTERVIEW

Table I.1 Manual Coding of Focus Group Pre-Intervention Interview

<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker</th>
<th>Coding</th>
</tr>
</thead>
<tbody>
<tr>
<td>00:00:03</td>
<td>Speaker 1</td>
<td>OK, So what I did was I took your responses from the survey, and I created these questions. It is really eleven little, short questions that you just feel free to answer.</td>
</tr>
<tr>
<td>00:00:16</td>
<td>Speaker 1</td>
<td>I will make sure I also go back and share what my research questions are about again.</td>
</tr>
<tr>
<td>00:00:23</td>
<td>Speaker 1</td>
<td>My dissertation focuses on the lack of student engagement in middle school math classrooms. This was a topic that I chose before I ever came to work here in BMS.</td>
</tr>
<tr>
<td>00:00:38</td>
<td>Speaker 1</td>
<td>I have noticed this problem of practice in the district I previously worked in as well as many schools I serve currently.</td>
</tr>
<tr>
<td>00:00:43</td>
<td>Speaker 1</td>
<td>And sixth grade was the least typical. I mean, they were more engaged than 7th and 8th, but.</td>
</tr>
<tr>
<td>00:00:57</td>
<td>Speaker 1</td>
<td>I feel like your kids are already somewhat engaged to a certain point. I mean certain kids are, whereas others must keep ruling them in. But y'all both do a good job of doing that already.</td>
</tr>
<tr>
<td>00:01:11</td>
<td>Speaker 1</td>
<td>My focus wanted to be on 6th grade because number talks is going to be the intervention, I will provide professional development on.</td>
</tr>
<tr>
<td>00:01:17</td>
<td>Speaker 1</td>
<td>Some of your students might be familiar with them from elementary school. They might know what a number talk is, and they might not. Since I do not work with any of the elementary schools in BCS I have no idea.</td>
</tr>
<tr>
<td>00:01:29</td>
<td>Speaker 1</td>
<td>But the purpose of number talks, and I'll talk more about this in the PD, is to engage students while the number talks serve as a vehicle for making sense of math; develop efficient computation strategies; communicate mathematically; and reason and proving solutions.</td>
</tr>
<tr>
<td>00:01:40</td>
<td>Speaker 1</td>
<td>For example, we put up a problem like it could be 43 – 28. And they cannot write anything down. Using</td>
</tr>
</tbody>
</table>
mental math, how would your students solve that? And how would you?

00:01:49 Speaker 1 And then we want to talk about the strategies for it. The students do not talk. You give them a minute, minute and 1/2 however long you think they need to think of a strategy, and then you stop them, and you start saying, “OK, So what are some of your answers? And they tell you.

00:02:03 Speaker 1 And then I jot down what they say.

00:02:04 Speaker 1 And I am like, oh, well, we had like, three people that said whatever I could remember, the numbers I said. There and then, someone share with me how you did this because some of them, when it's mental math will like round up like if it was 48 they said well, I really took fifty and if it was whatever the number I said 32 then they took 30 and they did 50 - 30 But then they had to take into account for what they rounded up and down. That is what we want to get them to the point that they can pick strategies in their own head.

00:02:35 Speaker 1 To build number sense, persevere to solve problems, and share their thinking verbally to support student discourse. That is the bottom line.

00:02:40 Speaker 1 However, a lot of times kids might not be knocking the top out of the current standard you are working on.

00:02:51 Speaker 1 You can use a number talk that addresses a previous skill, and it is something that they connect to.

00:02:56 Speaker 1 Oh, I already know how to do this, and they pull it in and then it builds that engagement piece.

00:03:03 Speaker 1 You might see some of your students who particularly do not normally just volunteer share their thinking. And so, as we do these, we remind them we will discuss our strategies and both correct and incorrect answers.

00:03:13 Speaker 1 I am looking forward to answering a few questions through this process.

00:03:20 Speaker 1 Does instructional coaching, through my professional development on how to implement number talks, support you in engaging students in mathematics? What are the obstacles to engagement in your math class? And I will be curious to see how you feel the student’s engagement and mathematical reasoning improves over a four-week period of doing them daily.

00:03:36 Speaker 1 Is there an impact on student engagement? Like do you see, do you foresee that anything's changing engagement?

00:03:43 Speaker 1 And it is not always a quick process the very first time you do it because you will establish norms, procedures, etc. But once they start sharing their think you will think, Oh my gosh, this is great.
So, it is something when I was in the classroom, I began doing these even in my high school classes. My students at first, they were like, Why are you making us do this? But then, once they realized how their thinking started changing, because when they would hear other people’s strategies of like, well, I doubled that. And then I have this and then I they are like, oh, I never thought about it like that.

So those conversations that come out of it are often what increases the engagement.

Now, I am going to ask you some questions. I did not send you a set of these questions because it was not anything I really want you to study. I just want you to tell me, like, right off the bat what you are thinking.

I will alternate the order of which of you take the question first each time. Like I will start Mr. Tighe and I will let him answer the first one and then Anna, anything after he answers.

Anything that you want to add to or disagree with or whatnot, feel free. Both of you will get to answer each question, but it might be that you do not have the same answer for each question, or it might be that you want to ask a few questions. From this point this should only last about 30 minutes.

So, then I will go back and take our answers and put it into a format that I'll share with y'all, anything and everything that I'm going to be turning in, I'll make sure you'll have a chance to read it first in case there is anything that I missed that you said.

You are like, well, wait, this is how we said it. I will go back and change it.

All right, so. Are you all ready?

I got a question.

Danny or ******** like the dog in.

What would you prefer to be called?

Danny or ******** like the dog in.

Danny. OK, what would you like to be called by me?
So, Danny, your first question is how long have you been teaching? And how long have you been teaching math?

And so, some of these questions may be repeated from the survey, but there is a purpose behind.

So how long have you been teaching and how long have you been teaching math?

Twelve years. Exclusively math, three years.

OK, twelve and three. All right. Thank you very much.

Anna, how about you?

I have been teaching. And this goes back to my history.

I think I have been teaching ever since high school because in high school I went, and I taught reading to elementary kids during my lunch hour.

Oh, that definitely counts.

We had a program like that at my high school and on Saturdays, like once a month or something, I would go and teach math or reading to inner city kids in Washington, DC so they would take a bus downtown and we would go in and tutor them.

I guess not teach them but tutoring them.

But formal teaching as in teaching in a school I have been doing that for. Probably around 20 years and out of those 20 years, maybe I started teaching math maybe for sixteen of those years. Because the first few years I kind of had to get my foot in the door and I was teaching Spanish.

OK, got you. All right. Well, thank you.

The next question is what is your certification or your degree? For example, I am certified in 9-12 secondary mathematics with a master’s degree in mathematics education, so that is your certification and or degree?

OK. So, the next question is what is your certification or your degree? For example, I am certified in 9-12 secondary mathematics with a master’s degree in mathematics education, so that is your certification and or degree?

OK, so I have a master’s in education. And I had a certification through Arizona that was K28, but when I transferred to South Carolina, South Carolina only honors Arizona’s one to six. So, what I was teaching in a private school, I was teaching UM 8th grade math and eighth taking high school math in an accelerated program.

Right.

So, I was teaching that there.

OK, well, that makes sense.

How about you, Danny?

Also master’s and MIT in elementary Ed. Which South Carolina is two to six.
Speaker 1 OK. Two to six. OK, good to know.
Speaker 1 (FPreQ#3) All right, Danny, this is your question. Suppose I am a new instructional coach walking into your classroom. What behaviors would I see that demonstrates student engaged?
Speaker 1 And you can think of a specific class, or you can think of the year.
Speaker 1 I mean it does not even have to be this year.
Speaker 2 I think I would go with in general on that.
Speaker 2 I mean you know we have all had classes that are engaged, and we have all had classes that are our challenge with engagement.
Speaker 2 You see a good amount. Eighty percent or more of the students with relatively good eye contact, able to answer questions that are presented to them without an answer.
Speaker 2 You know that is during the actual teaching portion, but the engagement to me is really how they are involved in the learning themselves. Where they are working on whatever we give as an assignment.
Speaker 2 They're involved in trying to do their best to learn it.
Speaker 1 All right. Anna, how about you?
Speaker 3 I would agree with that, seeing that they are engaged, that they are participating would be the word that I would use. Participating, whether it is participation orally or you see them actually doing work.
Speaker 3 In my classroom, it could depend on the class and what part of it. Today, obviously you would see a lot of students at the white board mostly, and that really happens in my accelerated classroom a lot.
Speaker 3 And I am trying to get it to happen in my other classes, but it is kind of difficult with them. It is a little more difficult, but that would be engagement whenever they are at the white boards, they seem to be really engaged and they like to do.
Speaker 1 OK. All right, so now, Anna, this is your question now.
Speaker 1 (FPreQ#4) We've talked about student engagement. So what barriers have you experienced with student engage?
Speaker 1 So, you said like for example, this piggybacks off what you just said that with your accelerated group, you know they do like to come to the whiteboard, but it's a little harder with your others.
00:11:53 Speaker 1 What are some of those barriers that you have experienced with student engagement?

00:11:59 Speaker 3 I think the biggest barriers that I see are that students become disengaged, they become bored when they cannot follow the instruction because they don't have the prior knowledge that they need.

00:12:18 Speaker 3 So, for example, if I am doing you know some examples.

For example, I am doing some today. We were talking about starting to talk about the properties of math. But some of them do not understand what it means. What values are put in based on the value that you want for X?

00:12:40 Speaker 3 So, to me that right there stops their engagement because they don't understand the meaning of the academic vocabulary. Yes, even though it is something that I take for granted that they know, but I also explain it.

00:12:58 Speaker 3 But then they are, you know, right there. They put up a wall. No, I cannot do that.

00:13:04 Speaker 3 So not having prior knowledge to me is definite hindrance to engagement.

00:13:13 Speaker 1 All right. And how about you, Danny?

00:13:18 Speaker 2 Repeat the question.

00:13:20 Speaker 1 Sure. What barriers have you experienced with student engagement?

00:13:31 Speaker 2 Well, I mean. What Anna says I completely agree with, but that part I did hear the.

00:13:41 Speaker 2 The other parts though are lack of attention span, distractions in the classroom, and lack of motivation by students.

00:14:02 Speaker 1 Lack of motivation and distractions. OK, good.

00:14:07 Speaker 1 Alright, are there specific distractions, either one of you experienced? That is kind of a follow up question.

00:14:13 Speaker 1 I just thought off what are some of those specific distractions?

00:14:26 Speaker 2 I would say that it is student behavior. I mean I try to minimize the personal attacks that are directed at each other.

00:14:45 Speaker 2 Some students just get so involved and caught up in what other people are saying that the learning becomes secondary.
<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker</th>
<th>Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>00:15:00 Speaker 1</td>
<td>Well, that makes sense because they let the drama take over is a good way to describe it.</td>
<td></td>
</tr>
<tr>
<td>00:15:08 Speaker 2</td>
<td>We are dealing with middle schoolers, so.</td>
<td></td>
</tr>
<tr>
<td>00:15:11 Speaker 3</td>
<td>Yeah, I think that the drama is like the one word that kind of defines those behaviors.</td>
<td></td>
</tr>
<tr>
<td>00:15:18 Speaker 3</td>
<td>Kind of puts them all together.</td>
<td></td>
</tr>
<tr>
<td>00:15:20 Speaker 1</td>
<td>I like that. I do. That kind of sums it up because it can be personal drama. It can be, like you said, like an attack on someone. It can even just be like the way they’re staring at somebody, you know. That can fuel a fire sometimes that can take us in a different direction.</td>
<td></td>
</tr>
<tr>
<td>00:15:39 Speaker 1 (FPreQ#5)</td>
<td>All right, #5 and Danny we will start with you on this one. Describe your experiences with instructional coaching and give examples.</td>
<td></td>
</tr>
<tr>
<td>00:15:48 Speaker 1</td>
<td>And this does not have to be with me, who is not in the school daily. It can be, but it can also be like with your instructional coach or numeracy coach in the school.</td>
<td></td>
</tr>
<tr>
<td>00:16:00 Speaker 1</td>
<td>When you think about instructional coaching, what kind of experiences have you had? What are some ways that they support you?</td>
<td></td>
</tr>
<tr>
<td>00:16:09 Speaker 2</td>
<td>OK. Was that question about issues I had or just support?</td>
<td></td>
</tr>
<tr>
<td>00:16:12 Speaker 1</td>
<td>No, just what experiences?</td>
<td></td>
</tr>
<tr>
<td>00:16:13 Speaker 2</td>
<td>Say some work. OK.</td>
<td></td>
</tr>
<tr>
<td>00:16:17 Speaker 2</td>
<td>I guess when I heard the word experience, when I was thinking of these issues.</td>
<td></td>
</tr>
<tr>
<td>00:16:28 Speaker 2</td>
<td>My experience with coaching and professional development is minimal.</td>
<td></td>
</tr>
<tr>
<td>00:16:34 Speaker 2</td>
<td>Even if I find it kind of good, it is often not the right time to put it into my plan.</td>
<td></td>
</tr>
<tr>
<td>00:16:47 Speaker 3</td>
<td>OK.</td>
<td></td>
</tr>
<tr>
<td>00:16:48 Speaker 2</td>
<td>And sometimes I… Like, again, historically I have found it to be a waste of my time. And I’m not talking about Beaufort middle.</td>
<td></td>
</tr>
<tr>
<td>00:17:01 Speaker 2</td>
<td>I am talking about historically. But as far as the coaching is only as good as what you feel the knowledge that you’re gaining from it.</td>
<td></td>
</tr>
<tr>
<td>00:17:20 Speaker 2</td>
<td>I feel fortunate to have had Roger and especially Tracy at the school, and I do appreciate that we have gotten you and your connection into the school. Thank you.</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>Speaker 1</td>
<td>Speaker 2</td>
</tr>
<tr>
<td>---------</td>
<td>---------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>00:17:42</td>
<td>No, thank you.</td>
<td>But then you know... so my experience is that most of the time I go back, I say, “Oh yeah, that'd be great.” But I do not try it. And I am just going to talk about personal flaws here.</td>
</tr>
<tr>
<td>00:17:44</td>
<td></td>
<td>It is like. If I do not rush to put it into a plan the next day. Somebody can talk about it next week and I'll go, “What are you talking about?” So that's a personal flaw of mine.</td>
</tr>
<tr>
<td>00:18:15</td>
<td></td>
<td>Like that intentionality of taking what was in the PLC or PD and then implementing it immediately.</td>
</tr>
<tr>
<td>00:18:23</td>
<td></td>
<td>Exactly, and now, there have been cases where I have implemented things and you know it works well.</td>
</tr>
<tr>
<td>00:18:33</td>
<td></td>
<td>But I do try to keep an open mind, but at the same token it is my experience mostly is out of all the hours I've spent in PLC I've implemented minimal amounts of the suggestions that I've been given.</td>
</tr>
<tr>
<td>00:19:04</td>
<td></td>
<td>All right. OK.</td>
</tr>
<tr>
<td>00:19:05</td>
<td></td>
<td>Mostly a fault of my own.</td>
</tr>
<tr>
<td>00:19:08</td>
<td></td>
<td>Well, and that is, I mean I think we could be honest about any kind of training like from my you know the training that I received from SREB if it if I do not feel that it is valuable to what I'm doing right then.</td>
</tr>
<tr>
<td>00:19:21</td>
<td></td>
<td>It is hard for me to put it in a pocket over here and say, OK, well, when that is applicable, I'll run get it, you know, because of the time factor of when am I going to go get it?</td>
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<tr>
<td>00:19:33</td>
<td></td>
<td>I think that's fair because if it's not connected, then it would be forgotten, or I ask myself if I can even implement it?</td>
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<tr>
<td>00:19:46</td>
<td></td>
<td>Yes, timing I think is very critical when you are giving professional development like the time of is this relevant now to me. If it is not, then I have to weigh what am I going to focus on, you know?</td>
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<tr>
<td>00:19:58</td>
<td></td>
<td>Going to put that waiting period, like when it probably would be appropriate to implement, I have forgotten.</td>
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<tr>
<td>00:20:05</td>
<td></td>
<td>Right. And you all have a lot of support too, so that is even more information to process.</td>
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<tr>
<td>00:20:11</td>
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<td>I would agree with what Danny has stated. Before I came to this school. One of my other hats that I wore at my previous school was that I was a technology person, so I was kind of like the coach that told them how to do the technology that I wanted them to be able to use in the classroom.</td>
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</table>
So that was the only kind of coaching that I ever knew. Coming into Beaufort Middle we had some other people that were called coaches, but they really did not do much coaching.

To my understanding, they just would tell us, ohh like the district thinks we should do this or that. And so, this year and last year, I do not know how long Dr. Sands has been around really. I do not remember when she started. She has, really, I think, stepped in and done a lot of coaching and now with you and with Mr. Jacqueline it has been a whole lot more helpful.

UM, so you know. So, I do see. Oh, OK, I can do this. Or I can do that. For example, on what you are concentrating. Because I have looked at those videos, I've tried to implement them into my classroom by Joe Bauler.

I do not know what her name is. And yes, so I have watched a lot of her videos. But I am not sure I have done them through the years with her number stories or whatever you call them.

So, I have done some of them this year. I did not feel that I put enough effort into it at the beginning of the year because I. Usually like at the beginning of the year, because that is what at one time it invested.

So, I do appreciate having coaches that help us to teach better. I, you know, I definitely need, you know, strategies I know if I am having a difficult time with something. So, I really appreciate that. But, like Danny in the back of my head, or maybe it is too much in the front of my head that I also have been told that I have to teach this curriculum.

So you want me to teach this curriculum, but you want you are piling all this other stuff on top of it so. Which do you want me to prioritize to do this PD or that PD? Or do you want me to, you know? Right.

So sometimes I have felt, and I'll be honest, I have thought that I can't teach because I cannot teach the way I want or the way I've known because it's, you know, this other factors in there saying, oh, you've got to do this.

You've got to keep data for this, I do not think Beaufort middle was ever as data driven as it is now, and that is totally new to me. So yes, I'm learning on that. You know, so that's something new that I have to that I've had to learn in the last few years because before nobody ever emphasized the data as much as it is.
Now and I would just say too from like being in different States and like I was in North Carolina for so long, I think within the last I would say 7 to 8 years, there's been a huge shift in focusing on the data and I think a lot of that is, you know, I don't get too sidetracked, but I think a lot of that is. Because we have tools now that give us that. Whereas before technology we didn't have it and to collect that data was insane. I mean, you know, to have to do it by hand and it's subjective.

**00:24:54 Speaker 3** Right, yeah.

**00:24:56 Speaker 1** And so like, I just think for example, and this is a little bit of a tangent, but like with I excel how quickly it is that we can go and look to see which kids have the same common misconceptions?

**00:25:07 Speaker 1** You know, using data in that way, I think is an instructional tool to help me as a teacher be able to address common misconceptions that would have been entirely too much. It can take hours to grade all your student work and look at it and sort it. And so, for that I am very thankful. But I do hear and value100% of what you are saying it feels like one more thing being put on your plate.

**00:25:35 Speaker 1** And that that is one of the reasons that I chose number talks. The implementation is quick, and it is not intended to be an additional burden where you feel like, “OK, we've got to collect all these papers; we've got to sort them; grade them and then plan interventions.”

**00:25:51 Speaker 1** It is more about the conversation and what is coming out of it and learning about what your kids do know already.

**00:26:00 Speaker 1** Sometimes they know a whole lot more than I thought they did, and then other times I was misconstrued that that they, they are not sure. And so that is why I picked this actual strategy was because I thought it was something that can be used from kindergarten to 12th grade if used effectively. We will talk more about specifics tomorrow afternoon.

**00:26:22 Speaker 1** I keep getting into it because I am passionate about it.

**00:26:25 Speaker 1 (FPreQ#6)** But all right, next question. Question #6 what ways has instructional coaching influenced you as a collective group?

**00:26:39 Speaker 1** Now you might have already just answered that question. And so, like if I had a big group of you, but like for example let me say what I heard both of you say and you'll tell me if I need.

**00:26:50 Speaker 1** I heard both of you say that you do appreciate what like the knowledge that Doctor Sans and Mr.
Jacqueline and I bring. And you like to be able to hear new ways of teaching math and things that can be beneficial to your students. It's just it's a lot about the timing, having time to implement whatever it is and is it really going to make a bigger bang?

In the book than what you are already doing. And making those and having it at an appropriate time where it's like, oh, I could do that tomorrow.

00:27:34 Speaker 1
You know, whereas if you are thinking well, I would have been good six months ago, but I'm already into this and I don't want to replace it with that because I really don't see that it's going to be that big of a bang for my buck.

00:27:47 Speaker 1
So let me read the question again if you want to add anything.

00:27:49 Speaker 1
So in what ways has instructional coaching influenced you as a group like at Beaufort?

00:27:56 Speaker 3 Well, I would say that I think before we were at this stage whatever stage we want to be in right now, I would just ask Danny what he was teaching because I just kind of wanted to know. And now we talk more often, or I go in and I ask him a whole lot of questions and he is like what? And he is probably thinking that I am bothering him, but I'm really, I'm trying to keep up with what he's doing.

00:28:35 Speaker 3 He is usually ahead of me, and I do not know whether that has to do because his class is way smarter than mine, or his teaching is different than mine, which is it is our teaching is very different. So, I think in that respect it's great because it has, you know, like Danny knows I excel like nobody else I know so I have gone to him and me, you know, I've said, hey, you know, how are you doing with this with I excel. So, in that respect, yes it has made me, Uh, you know, talk to my team which.

00:29:16 Speaker 1 So, you are mastering that, right? But the A-Team. How about that? Yes, there is a reason I asked 6th grade. OK, just saying. Just saying there is a reason.

00:29:28 Speaker 2 We are the B team because we are in the B hall.

00:29:32 Speaker 1 Well, you are my A team. How about I am going to go put an A up over there.

00:29:36 Speaker 2 Yeah, we are big B team in the hall. But A in your heart.

00:29:41 Speaker 1 There you go. That is exactly right. If y'all, tell the others I will say that y'all step your game up and y'all might be in a jam.
00:29:52 Speaker 2
Did I mention I was recording this?
00:29:55 Speaker 1
No, you did not, but that I okay. I say what I mean.
00:30:02 Speaker 1 (FPreQ#7)
All right, next question. What is a goal you would like to work for this year and why did you choose that goal?
00:30:09 Speaker 1
So, this question, when I originally stated it would have had this begin at the beginning of the year. So, from here till the end of the year, let us just change the question just a little bit. In thinking in terms of this professional development, we are going to do and with learning more about number talks and implementing it, what what's a reasonable goal for you?
00:30:42 Speaker 1
What do you think would be a reasonable goal for how number talks go in your classroom?
00:30:52 Speaker 3
Is Danny going first? Or not.
00:30:54 Speaker 1
Yes, Danny, you are going.
00:30:58 Speaker 2
I used to do well in elementary school. We are using Big Ideas. We are using everyday math.
Everyday math was mental math.
00:31:17 Speaker 1 Right.
00:31:19 Speaker 2 And you know. Full disclosure, I really have not looked at the book of Number talk but …What I am saying it is the same type of thing.
00:31:39 Speaker 2
It is maybe not the skill we are working on today, but it is something where kids were talking about numbers and I guess talking about numbers, number talk.
00:31:57 Speaker 2
But you know, mental math was the same type of thing and, as a matter of fact, Christi, you said you know and, in your thing, it is like mental math. I am of the belief that any math talk is good talk. It gets the brain to find some connections.
00:32:25 Speaker 2
As we work into the properties of algebraic expressions more and more things are coming back. The greatest common factor and other things. To keep talking about what you have already learned and reinforcing that skill is just a positive too, but to what goal I want to achieve on this?
00:33:01 Speaker 2 I do not tie it to academics. I mean, I do not know how to say it. Well, I want to do number talks and as a result I want my map scores to go up consistently by 2 points.

00:33:16 Speaker 1 Very good, yes.

00:33:20 Speaker 2 Across the board. You know or four points across the board when I do not know what a correlation would be between number blocks and the and the like.

00:33:27 Speaker 1 Right, right. Just an area you want to see an improvement in.

00:33:33 Speaker 2 Yes, so I mean. What we do, whether it is to find best practices, or we want to find things that help. The most important thing is that the kids move.

00:34:02 Speaker 1 Right, right.

00:34:04 Speaker 2 One thing I have tried to implement since the beginning of the year is Big Ideas as one set of questions per every lesson. That are not necessarily targeted to the current learning, it goes back now.

00:34:31 Speaker 1 Good point to make, Danny. You have a good start already.

00:34:33 Speaker 2 Prior learning, you know, so I want to now implement that so that I can touch on one in class. I started with: All right, we are going to be factoring expressions. So, can you tell me right now, what factors are?

00:34:55 Speaker 2 I have twenty kids plus in that class and everyone tried to pick a spot on a wall to look at in the hopes I would not call them. They do not know what the word factor means.

00:35:12 Speaker 3 And it is not because we have not explained it.

00:35:14 Speaker 1 Right.

00:35:15 Speaker 2 And then I get to my advanced class, and I am like OK guys quick, what is that's the number that you multiply by another number is what you're asking for? Some kids catch on to it. You can call them advanced. Some kids do not. All you can do is try to reinforce what you learn so they do not forget what you talked about.

00:35:48 Speaker 2 Two months ago today, two weeks ago, two days ago or two minutes ago.

00:35:50 Speaker 1 Right.

00:35:55 Speaker 2 And if number talk can accomplish them understand what a factor is.
If they can understand. Why you borrow from the tens column, no matter how many times I do the OK. Think of this as pennies. You do not have any pennies. But you must pay Anna 8 pennies. But you have 9 Dimes. What do you do?

Go to the bank and you find that nice teller and you give her dimes. How many pennies are you going to get?

The scariest moment in my life when you hear crickets on that. You know?

And the number sense with money. Excuse me, the numbers associated around money with our current.

The population of students lacking number sense is exponentially getting worse. And oh, I we, I just had a conversation with middle and high school teachers today. It was 8th – 12th grade teachers.

Matter of fact, you are still having conversations with middle school.

Teachers said it was 8th, 9th and 10th. I corrected myself. It was algebra one teachers, and we were talking about just that very fact. We used to go to example that all our students could relate to is how many quarters are in a dollar you.

Oh, you think they could relate, but students lack money sense.

They are like “what?” Or how many Dimes does it take to make up a dollar? And the number since there with money. I know that it is still being taught in elementary school. I am not, I am not quoting anyone other than the fact that they don’t see cash very much anymore.

And you know, they really struggled with that and that was a conversation I was going to tell you.

I am going to defend elementary school teachers on this because I can guarantee one of them did. You know, it has two thumbs, and they are pointing right at me. I cannot tell you how many times I tried to complete those things to them.

Right. I am saying it is hard.

So, if number sense increases that knowledge, I am all for it. But that is like the longest non answer outside of Pete Buttigieg. You
know and Joe Biden that is. You know, you asked the question, what gold do I want from it? I want them to be better.

00:39:12 Speaker 2
I am. I do not have it definable.

00:39:16 Speaker 1 No, that is good. I mean a goal does not have to be a smart goal whether it was measurable, and you know I have it in as a question.

00:39:22 Speaker 2
You can count on it being a smart goal coming from me.

00:39:26 Speaker 1
Of course, of course. Do you know what I mean? It did not have to be measurable, specific, measurable, attainable.

00:39:36 Speaker 2
You did say goal.

00:39:37 Speaker 2
That is kind of defined that way.

00:39:41 Speaker 1
It is. I can hear what you are saying. You want your students to be improve through the process, whatever that looks like.

00:39:51 Speaker 1
And how about you, Anna?

00:39:53 Speaker 3
Yes, I am. I hear what he is saying, and I hear what you are saying.

00:39:58 Speaker 3
You do not know how many times a day I go, “Okay, how many quarters are in a dollar? That is my famous.

00:40:05 Speaker 1
Yes, I heard what you said the other day when I was in there for your pre observation.

00:40:11 Speaker 1
Then, like and you are like “How many quarters are in a dollar like, you know, like you? Yes, definitely do.

00:40:19 Speaker 3
And do you know what? I have quarters in my desk now because I learned my lesson, and now I have quarters in my desk because they are.

00:40:29 Speaker 2
I know who to go to when I want to show them?

00:40:34 Speaker 3
And they do not have that. There is no number sense when it comes to money. There is no connection between the numbers there.

00:40:45 Speaker 2
And Venmo's only going to kill that.

00:40:46 Speaker 1
There is a real possibility that will not help the cause.

00:40:49 Speaker 3
And so... what do we do?
00:40:53 Speaker 2 Yes, that is who knows what that is worth at a given moment.
00:40:57 Speaker 1 I am not sure, and I hope I do not live long enough to have to be explaining in class. You know that is that, but that it is the truth.
00:41:05 Speaker 1 It is a real issue, you know, obviously number sense is part of number talks.
00:41:14 Speaker 1 You know my I could have chosen a lot of different strategies to use to increase engagement. And so, it is twofold here for me. Selfishly, I have an opportunity to work with teachers to increase in engagement, but then I also wanted a strategy that has impact on their learning, and I mean all strategies should, but let us be real.
00:41:38 Speaker 1 I mean, there are some that are better than others.
00:41:40 Speaker 1 And as I was researching and I have spent three years on this as I have been researching, I really have been impressed. Research has proven that it supports improvement pf number sense.
00:41:59 Speaker 1 We are never going to be able to say it is the direct cause, you know, but it is a strategy that supports it and that and what we will be.
00:42:15 Speaker 1 I wish that it could last three months, and I could do that many observations and we could see it over a long scale because of like my due dates for my we have my data and things. The time scale, you know, we are shooting for being finished with observations. I will observe each of you four times.
00:42:37 Speaker 1 I will be doing is trying to compare a difference in student responses and their engagement.
00:42:45 Speaker 1 That is it. It is not going to be something that I do not want y'all in any way shape or form to think I am rating you in any way.
00:42:52 Speaker 1 I am looking at the student engagement and I am trying to determine this using qualitative data collection.
00:43:01 Speaker 1 I am not doing quantitative where it is numerical where I make tallies or anything like that.
00:43:06 Speaker 1 It is observable, qualitative. I will be recording the Number Talks using my iPad and then I will complete my field notes
immediately afterwards while it is fresh on my mind. I will rewatch the video to compare and update anything I missed.

**00:43:11 Speaker 1**
What are the students doing and saying? This is what I am observing.

**00:43:12 Speaker 1**
And the other day when I was doing the pre observation and I was writing frantically as hard as I could. What were some things that were said this, that and the other?

**00:43:21 Speaker 1**
I did realize that it would be better if I just have my iPad and recording verbally what I'm hearing and then just like this so then I can go back and sit down and transcribe it.

**00:43:35 Speaker 1**
It will be nothing that anyone will see ever. It is gone because I think that being able to hear what they are saying will be.

**00:43:46 Speaker 1**
Easier for me to write if I can watch them while I am in there and make notes on their body language like you both mentioned, body language, eye contact. Those are huge components of engagement, as you mentioned in the survey and earlier in this focus group interview. But then also their responses are extremely valuable to note.

**00:44:03 Speaker 1**
It is a twofold process. If you are OK with that, I certainly will. I mean, I do not have to get permission from the parents. The district said that because it is nothing that will be posted anywhere.

**00:44:16 Speaker 1**
It is nothing that anyone will watch. I would like you to watch each one and reflect before doing your next one. I will make sure to get these videos and my feedback sent to you promptly.

**00:44:29 Speaker 1**
It is just going to be for sound purposes because I want to be able to accurately give you guys feedback that this is what was observed this day.

**00:44:39 Speaker 1**
And I have written it in my dissertation where after I do an observation and I get my results; you know scribe down then I will give it to you. I am not giving it to you as homework. You have to look at it. I am giving you an opportunity to scan, skim over it, and if you see anything that you think you missed how.

**00:45:02 Speaker 1**
Engaged Suzie Q.

**00:45:04 Speaker 1**
Students, and it might be that Susie Q is typically a student that never says a word.

**00:45:15 Speaker 1**

So as an observer that is coming in that is not in there every single day, you know you will be able to also support.

**00:45:25 Speaker 1** My write up of it by saying yes, this is pretty accurate. But I would include Susie Q's performance. For example, how much she is improving.

**00:45:36 Speaker 1**

So that is the direction I am going. So, there are a total of four observations post-intervention (our professional development)

**00:45:56 Speaker 1**

I have gotten Whale Branch Middle School and Beaufort High School to let me do half days. On those days I will come observe you guys. I will do 1/2 day at Beaufort so I can be your first.

**00:46:07 Speaker 1** And your second and then I will go to their school for the afternoon and then on another day, when I am supposed to be at Beaufort all day I'll switch out.

**00:46:15 Speaker 1**

They were all very supportive. They said, “Certainly, do what you need to do if we get your support, it's fine.”

**00:46:25 Speaker 1**

I did kind pack this in all the months of January-February. I technically have until March 5th to get data collected. So, I wanted to tell you that like never feel like if it is a day I am supposed to be coming and you are sick, that you come on in because, Oh my gosh, she is coming today. It must be done today. This is the schedule that I made and like any other schedule things could happen.

**00:49:15 Speaker 1** Well, that concludes my questions. When all this is said and done, we will do a post interview like this. It will be different from those questions but some more questions based on you knowing what I want you to be thinking about during this time.

**00:49:35 Speaker 1**

It has questions about how professional development empowered you as a teacher to implement a strategy that increases student engagement at whatever level.

**00:49:50 Speaker 1** It might be that you know just personally that it really got the male students more engaged, or it really got the really, quiet students more engaged. So just kind of keep those kinds of things in your mind as you reflect each day.

**00:50:03 Speaker 1**

You can make notes anytime you want to, for feedback purposes.

**00:50:08 Speaker 1**
But that is our last survey and focus group interview.

00:50:11 Speaker 1
We will go back and reflect together, and so I am telling you that just to say that if you want to keep any notes, I am not requiring it, then you know, you can jot those down.
So, when we have this conversation, it will be.

00:50:23 Speaker 1
That will be the focus of that one. Others could be: What is your experience?
So how did you think it went? Did you see a difference and? And then I take what I observed, and I put y'all's opinions versus what I have written down and then we make a determination, whether it had a minimal impact, a moderate impact, a high impact, you know, and that is how it is kind of labeled versus because we can't say it's absolutely caused it, but it could have Had an impact on.

00:50:58 Speaker 1 So that is that is all I appreciate y'all very much do y'all have any questions?
**APPENDIX J**

**MANUAL CODING OF FOCUS GROUP POST-INTERVENTION INTERVIEW**

Table J.1 Manual Coding of Focus Group Post-Intervention Interview

<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker</th>
<th>Coding</th>
<th>Transcript</th>
</tr>
</thead>
<tbody>
<tr>
<td>00:00:06</td>
<td>Speaker 1</td>
<td></td>
<td>Just like you told me not to record today, I am not going to do anything with that.</td>
</tr>
<tr>
<td>00:00:09</td>
<td>Speaker 1</td>
<td></td>
<td>I just wanted to see what strategies they were going to do if they did partial products.</td>
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<tr>
<td>00:00:14</td>
<td>Speaker 1</td>
<td></td>
<td>OK, so I am not going to do anything with it. I just wanted to see, and I was afraid out. I am not going to write it all down anyway. It is not part of this.</td>
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<tr>
<td>00:00:23</td>
<td>Speaker 1</td>
<td></td>
<td>Question number one and these are these are simple, straightforward questions.</td>
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<tr>
<td>00:00:29</td>
<td>Speaker 1</td>
<td></td>
<td>How long have you been implementing strategies from the PD using number talks in middle school?</td>
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<tr>
<td>00:00:36</td>
<td>Speaker 1</td>
<td></td>
<td>And it was on February 1st. Did you hear the question?</td>
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<tr>
<td>00:01:08</td>
<td>Speaker 2</td>
<td></td>
<td>You said no question number one and then froze.</td>
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<tr>
<td>00:01:11</td>
<td>Speaker 1 (FPostQ#1)</td>
<td></td>
<td>So, question number one is how long have you implemented strategies from the professional development using number talks in middle school?</td>
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<tr>
<td>00:01:19</td>
<td>Speaker 1</td>
<td></td>
<td>And that was on February 1st.</td>
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<tr>
<td>00:01:23</td>
<td>Speaker 2</td>
<td></td>
<td>OK. I am going to say about the six weeks.</td>
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<tr>
<td>00:01:29</td>
<td>Speaker 1</td>
<td></td>
<td>I am telling you; these are some simple, straightforward questions.</td>
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<tr>
<td>00:01:32</td>
<td>Speaker 1 (FPostQ#2)</td>
<td></td>
<td>What strategies did you learn from implementing number talks, and it does not necessarily have to be strategies, but what are some things that maybe you realized from your students participating in them about them, or about what their favorite strategies were, or anything like that.</td>
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<tr>
<td>00:01:51</td>
<td>Speaker 1</td>
<td></td>
<td>Basically, would you learn about them?</td>
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<tr>
<td>00:01:58</td>
<td>Speaker 2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The lower kids had less strategies and the kids who were advanced had more.

00:02:08 Speaker 2
At least the ones who like to participate seem to enjoy it.

00:02:16 Speaker 2 Other ones kept trying to hide.

00:02:20 Speaker 1 I noticed that as well, I agree.

00:02:23 Speaker 1 And I am going to rewatch this. I do not know why I am trying to write it down now.

00:02:27 Speaker 1 And you are right that they do. I noticed as I have watched in both classes and in some other schools, some of them are, even when they put their fist up here, they are just scared to even put their thumbs up for fear of being called on.

00:02:41 Speaker 1 But then once they see that they can be more than one strategy, it is not just right or it is wrong, they seem more receptive to participating.

00:02:52 Speaker 1
We must also consider when I observed you guys y'all only had done them for three weeks. I know you got all four observations in three weeks.

00:03:02 Speaker 1
If it were something where y'all had had time to implement it for two weeks prior to me coming or two weeks and then maybe going for a while and come back, I know that would be a big difference, but that is nothing y'all can control. That is just the nature of doing research when you can.

00:03:17 Speaker 1 (FPostQ#3)
All right, #3, describe any notices in your classroom since the beginning of number talks, like, not just during the number talks, but have you do you feel like there is anything that has changed in how students are?

00:03:33 Speaker 1 Acting or working? Or has it improved?

00:03:38 Speaker 2
Again, I would probably go to the advanced class, and you could hear them when they are trying to solve things about talking about, you know, strategies using the word strategies.

00:03:49 Speaker 1
Well, that is big too that they use that word, you know. Also, they used different kinds of strategies.

00:03:54 Speaker 2
Or paraphrasing, you know. So how would we go about, you know, solving something like that?

00:04:00 Speaker 1
Whereas before they might just think there is just one way.

00:04:04 Speaker 1
The way that the first person did it.

00:04:05 Speaker 2
Well, I do not think they opened up to other ideas.

00:04:09 Speaker 1

Lower students had fewer strategies

Advanced students had more strategies

Hear students talking about strategies

Conflicting opinion – engagement
There you go. All right, four.

00:04:12 Speaker 1 (FPost#4)
What challenges did you experience after the training and implementing the number talks like, what was the most difficult or what were any difficulties that you had?

00:04:22 Speaker 2 Full participation.

00:04:30 Speaker 1
All right. I never thought about that.

00:04:32 Speaker 1 (FPost#5)
What did you like best about number talks?

00:04:38 Speaker 2
I like talking about numbers. Yeah, I mean it is actually like a fun type of thing to open up your mind.

00:04:47 Speaker 1
And I mean, even for me it was.

00:04:50 Speaker 2 You know every now and then another thought was provoking to me.

00:04:55 Speaker 1
And I bet when you do it multiple times during the day and you see it in the first block you might notice they answer it with partial products. Whereas the second block does not even think along those lines. Whereas third block took it to a whole different level. I feel like when I work with different groups of students from grade levels, but also different, even the same grade level.

00:05:18 Speaker 1
I feel like I noticed that that they have just different ways and as we progress, sometimes they have even more ways, once they start noticing, like oh, yesterday somebody did something like this similar. Then they start thinking like that.

00:05:32 Speaker 1
I noticed that. Hey, Anna. And is that one of Anna's classes from?

00:05:40 Speaker 1
There were two similar number talks.

00:05:45 Speaker 1
Hey, how are you?

00:05:46 Speaker 3
I do not know why my video's not working.

00:05:48 Speaker 3
Have no idea.

00:05:49 Speaker 1 It is OK. I mean we want to see you, but do not think about it being a problem. Mine was frozen a minute ago.

00:05:56 Speaker 1 (FPostQ#1)
I am going to catch you up. I have just asked Mr. Ty a couple questions just because I respect y'all's time, these are quick questions. The first one is how long have you been implementing strategies from the professional development that we did using number talks in middle?
And that was on February 1st if you are kind of trying to figure out A-frame of reference.

*Speaker 3*

For when February 1st was when you started.

*Speaker 1*

Yes, that one was when we did the PD and I know you didn't get to come to the PD, but that's when the PD was shared virtually with you.

*Speaker 3*

Uhm, except for a couple of times I was doing them every day, or at least every other day. Then I also implemented them in my other classes.

*Speaker 1 (FPostQ#2)*

All right, good. #2, what strategies did you learn from implementing number talks?

*Speaker 1*

And it does not have to be that you did not already know it. Maybe just a strategy that you saw your kids use for the first time. And you may not have saw any.

*Speaker 3*

This is just for me.

*Speaker 1*

Yes, Danny already answered these questions.

*Speaker 3*

OK. I do not know if you would call them strategies, but I noticed how very different some of them thought sometimes in their groupings and noticed how when I tried to do a number sense that was actually like a multiplication problem.

*Speaker 3*

And it was very interesting because I thought a lot of them would do grouping.

*Speaker 3*

You know things together kind of using the distributive property in their head.

*Speaker 3*

And I was really surprised that in my first period class that, I would say all of them use the algorithm instead and try to do that in their heads.

*Speaker 3*

And I was like, OK, so none of you are grouping and then, you know, I kind of did a little grouping exercise and showed them how they could have done it differently.

*Speaker 3*

But I was really surprised at that because I thought that that was being taught in elementary school. More of a multiplying by groups kind of thing.

*Speaker 1* And it is how they start multiplication is they do they go from like repeated addition to multiplication by groups they do so.
Speaker 1: That is, I mean, they should have that background, but it could be that because they already know the algorithm at this point, and they use it more often that they would not let themselves go back to that. I saw one the other day and the teacher was like, well, I know you know how to do it like that now. She was trying to get him to do it, she said.

Speaker 1: But before last week. How do we do this? And they were all quiet. They would not say anything, and she said, “it is because you are in here, Christi. They are afraid if they show you a strategy that they used before, that you are going to think they do not know what they are supposed to be doing.

Speaker 1: And I said, oh, no, guys, you will never third graders, but still anyway, so I found that to be true too.

Speaker 1: When I have done them like I know y'all know how to do this a different way, but they all wanted to do it the same way.

Speaker 1 (FPostQ#3): #3 Describe any notices in your classroom since the beginning of implementing the number talks. That does not have to just be during the number talk, but have you noticed anything different in your classroom? For example, how they interact or anything?

Speaker 3: Uhm, I think when they were when I was doing number talks the first few times, they really liked them, so they were kind of getting along better with each other.

Speaker 3: And then I think some of them got tired of it because then I put one up and then somebody goes, “Oh, no, not this again.”

Speaker 3: So that person saying that kind of made everybody start thinking that which I did not like.

Speaker 3: But you know, that is just how kids are sometimes.

Speaker 3: But it influenced them, right?

Speaker 3: And that was I think that number talk was the one with the multiplication on it.

Speaker 3: So it was not, you know, pies or sandwiches or anything like that, which seemed to go over really well. And those are more thought provoking for them.
00:10:52 Speaker 3
Or even when I did one with dots and they had to divide the dots up into like 5 different things or something like that.

00:11:01 Speaker 3
Even then, they seem to like that more than just being presented with numbers.

So that was kind of interesting.

00:11:07 Speaker 1 They're trying to, and I think that also, I mean this is just my thoughts, I think sometimes those strategies of like that? Like the one that Mister Tighe did was like, I would say 42 times. I cannot remember what it was. Was it 42 * 15? I think one of the first students said, you know, multiply 40 by 5 and then 40.

00:11:31 Speaker 1 You know, like they did start that way And gets it, not the non-traditional way then they do not go straight to the algorithm.

00:11:43 Speaker 1 But sometimes if that first person says the algorithm, although we know that is not wrong, then it is like it sort of closes everybody is thinking if that makes sense.

00:11:57 Speaker 1 (FPostQ#4) All right, #4, what challenges did you experience after training and implementing them? What are some challenges that you faced?

00:12:04 Speaker 1 And one of them you just kind of said like with students saying. Like their attitude towards it kind of influenced others in the class.

00:12:12 Speaker 3 Right.

00:12:13 Speaker 1 Anything else?

00:12:18 Speaker 3 I like doing them and that is why I think next year I'm going to implement them more and more or at least start at the beginning of the year.

00:12:31 Speaker 3 I think the only hard thing was when it came to that multiplication one. Because I am not going to have sandwiches and pies and dots forever.

00:12:42 Speaker 1 Every day, right? The point is we want them to be able to do the mental math of a math problem. That is the goal.

00:12:49 Speaker 3 Right.

00:12:49 Speaker 1 That is where we are going, you know, and it is nice to have other kinds too mixed in there, but if they can start seeing just real math problems, but nothing else with it, then it forces them to think of it in different ways, and that's uncomfortable for some of them.

00:13:05 Speaker 1 Sometimes it is uncomfortable for a lot of them, but the more times we keep doing it, they will start seeing it on their own. I think that is my thoughts, but I don't know.

00:13:14 Speaker 1 (FPostQ#5)
OK, now what did you like best about the number talks, Anna?

**00:13:20 Speaker 3** The engagement. Uh, you know, they seemed to be really engaged and everybody wanted to answer and give their strategy.

**00:13:30 Speaker 3** So, I thought that was the best part.

**00:13:34 Speaker 1** And I noticed in that first block class in the beginning the very first one that I did not hit record on, but I remember in the beginning, they were kind of skeptical to give their thought, but then once two people did it, then it was almost like you had to stop.

**00:13:53 Speaker 1** You had to say, OK, that is enough. It was like then everybody wanted, and they started repeating what the other person was saying.

**00:13:59 Speaker 3** Yes, right.

**00:13:59 Speaker 1** Just in a different way. It was like they thought they had to give an answer.

**00:14:03 Speaker 3** Right.

**00:14:04 Speaker 1** You have one extreme or the other. Mr. Tighe and IY were talking about that in the lower classes. Sometimes it is hard to get him to say anything. And so, you have that extreme.

**00:14:12 Speaker 1** And then you have extreme to high kids. Everybody wants to have a voice. So, it's finding that happy medium, I think.

**00:14:21 Speaker 1** OK question 6, Mr. Tighe, I asked you this one.

**00:14:23 Speaker 1 (FPostQ#6)** So, we both said what we liked best. So, what did you like least about the number talks?

**00:14:30 Speaker 2** Is that one to me?

**00:14:31 Speaker 1** Yes, that is to you first and then Anna.

**00:14:34 Speaker 2** Again, I did like participation, but I did like I the least was the lack of participation, lack of eye contact.

**00:14:44 Speaker 1** Oh, they would look away so that hopefully you wouldn't look at them, right?

**00:14:53 Speaker 1** Even as adults, we do that sometimes, don't we?

**00:14:57 Speaker 1** What about you, Anna? Anything different?

**00:14:59 Speaker 3** That is a good one.

**00:15:02 Speaker 3** That, you know, there's times when they still do not want to look.
Or if somebody has not been giving a strategy and I will call on them. I do not like it when they go, “I didn’t have my hand up” and they always do that with their number sense or something else.

So, then I always pull up my handy Dandy magical popsicle sticks.

There you go to randomly pull. There you go and you know that is the point.

I mean, I know we have not put their fist to their chest. And you know, but sometimes you are going to sit there, and all those fists are there, and nobody is going to stretch. It is that passive aggressive almost. Like I am not going to put my hand up.

Yes, they go, “No, I’m still thinking.”

OK, you thought long enough. Tell me anything. Get me started.

All right, good points. All right, #7, how often have you implemented number talks? So, Anna, you said almost every day or if not every day, every other day.

OK, so I thought. I got that one ended up.

How about you, Mr. Tighe?

Yes, around 3-3 days a week.

OK I think that is a good number because it's not you, you know you're not burning them out on it, but and you're mixing them up.

It is not like the same exact kind of problem every time, and so I think that is good.

#8, what was the overall level of engagement of your students during number talks and by that?

Right, yes.

I am not saying you got to rank it on a 1 to 10. You can but did you feel like it was about the same as anything else they did? Was it better?

You know, just during the number talk time. What was your overall level of engagement?
And it does not have to be the class I observed. You could just talk about
in general, or you could develop a different class.

00:17:03 Speaker 3
I think in general, and I guess I am sticking more to the class that I said I
was going to do because I was really more faithful to that class.

00:17:16 Speaker 3
If you want to use that.

00:17:19 Speaker 3
And the other because the other classes have a lot of behavior issues.

00:17:25 Speaker 3
So, I think the engagement was they were definitely more engaged.

00:17:32 Speaker 1
Mr. Tighe, I'm trying to do something to that question again.

00:17:42 Speaker 2 Level engagement I put it about.
Yes. What? What would you?

00:17:44 Speaker 1
Say the overall.

00:17:48 Speaker 2
Yeah, I mean, there was about 80% involvement overall, some classes
more, some classes less.

00:17:58 Speaker 2
That was about it. And you know, all in all that is, I mean, that is good if
we if we have our kids.

00:18:04 Speaker 1
I mean we want everyone engaged ultimately, but realistically, is that
going to happen? But overall, you know, I feel like you both have classes
that are diverse.

00:18:14 Speaker 1 It is not like every single block you have is a high
group or every single block you have is a low group. So, if we are looking
at that collectively, that's a pretty good number.

00:18:23 Speaker 1 (FPostQ#9)
Do you feel more confident in implementing using number talks in your
classroom daily than you did prior to February 1st?

00:18:34 Speaker 3 I think I am.

00:18:37 Speaker 1 All right.

00:18:38 Speaker 3 I am even willing to, do try again the, uh, the ones
that have real numbers, or maybe something that's a little bit more
difficult.

00:18:51 Speaker 1 Because, you know, nothing bad is going to come out
of it. I mean, we are not going to corrupt them by doing it. It does not
have a negative impact. If it helps a couple more think in a different way
then we hope that becomes contagious, right.

00:19:06 Speaker 1 How about you, Mr. Tighe Do you feel more
confident or comfortable?

00:19:09 Speaker 2 The word was. Hold on. Let me read it.
<table>
<thead>
<tr>
<th>00:19:11 Speaker 2</th>
<th>Right., I feel more confident in implementing and using number talks.</th>
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<tr>
<td>00:19:22 Speaker 1</td>
<td>Yeah, I mean, the more you do anything the, the, the more confident you are going to be in, in, in implementing it. I am sure you know there's a couple of things I've probably, you know, have asked a little deeper along the way.</td>
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<td>00:19:36 Speaker 1</td>
<td>Well, and I think for me watching you guys personally from the very first time to like now still doing them. It is almost like we and not that you were guiding your students too much in the beginning at all.</td>
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<td>00:19:51 Speaker 1</td>
<td>But I see you put more on them and weigh less on yourself, which is what you know, ultimately, our classroom should be like, more student centered and less of us centered. So, that is a natural effect of doing them, which is a positive.</td>
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<td>00:20:08 Speaker 3</td>
<td>Also, what helped me at the beginning was the professional development where you modeled several of them for us and we were “the students”. That helped a lot. Watching the videos, you shared was beneficial too.</td>
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<tr>
<td>00:20:12 Speaker 3</td>
<td>This is because I was not sure where this was going, but I had to have the one book that had suggestions, what questions to ask.</td>
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<td>00:20:20 Speaker 3</td>
<td>And then after I did that a couple of times, it was like, oh, OK, this is not difficult.</td>
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<td>00:20:25 Speaker 3</td>
<td>I understood better what they wanted to do so. And you know what?</td>
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<tr>
<td>00:20:31 Speaker 1</td>
<td>And you just mentioned a good point because depending on what books you look at or if you Google it and you look at other people doing them, you watch teaching channel, you know, different things.</td>
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<td>00:20:40 Speaker 1</td>
<td>Every time I see it, I observe a lot of teachers doing them in elementary schools and it was working. And I am like, God I thought about doing it that way before, you know, like even what do you notice? What do you wonder?</td>
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<tr>
<td>00:20:53 Speaker 1</td>
<td>So, that is how we grow at it. I believe is like going outside of our box and like watching someone else do one and trying it a different way. It is a good point.</td>
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<td>00:21:03 Speaker 1 (FPostQ#10)</td>
<td>Are there certain times when students seem to be highly engaged in mathematics?</td>
</tr>
<tr>
<td>00:21:11 Speaker 1</td>
<td>Not sure what I meant by that question to be quite honest.</td>
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</table>
Well, in my class, yeah, there are more engaged when we are doing an activity like for example today, we were graphing equations with two variables and they were doing it with a partner on a big piece of paper and having that big piece of paper.

Yes, really makes a difference on the engagement rather than saying, OK, you work on this with your partner and put it in your notebook.

It is just something out of the ordinary, not just. You know I, yes.

His name of.

Right. So, I think, yes, they are those are the times and unfortunately, I do not. I cannot always do that kind of activity.

You know, Mr. Tighe introduced me to Jamboard and that works well too, but there are times when I've again had those naysayers. That is like, oh, no, we are doing this again so.

The clue is, you know, I guess variety and I'm I need help on that.

Well, you know and that is something that I think is my role is like to introduce different strategies along the way without overwhelming anybody. Not like every single time I come, there is a new strategy.

Here is a new strategy. Now, that is too much. But like, different things.

What are some strategies that have helped to remove the obstacles that were affecting student engagement?

In the past I have done, you know, I have done other things. I have done quizzes. I have tried a variety of different strategies. What got me this year is that there was the point when they were so far behind that I really could not afford to do that because I had to teach them the standard.

And even though I know, because I did do games this year, I did, you know, besides, I excel, I did quizzes. I did Kahoots.

But to me, those are just kind of a reinforcer after you teach the rules or algorithms or the reasons why you must do it a certain way.

Right. Like a forming distance.

I have not done as much. This year, as I have in previous years, but again that goes back to the students I am teaching.

Right. And what their needs are currently.
00:24:02 Speaker 3 Right.
00:24:04 Speaker 1 Right, Mr. Tighe, what about you? Are there certain times that you feel like students are more highly engaged in your class?
00:24:13 Speaker 2
A lot of the time is spent on prep, and you know the activity that you have going. So, what I am that's words that pretty much describe what Miss Ward just said. They seem to get into my and when I do, the group jams and I excel you know them.
00:24:39 Speaker 2
The number talks brought some activity in it and let them work in groups and Overall, they do a pretty good job of getting the work done in class. Especially compared to even last year's class.
00:24:54 Speaker 2 I mean, you know, the seventh graders, it was like pulling teeth to get them to do work.
00:25:00 Speaker 2 You know; the percentage is much lower this year. Of a lot less people failing, so this is a group that, you know, sits down and gets it done.
00:25:11 Speaker 1 And that's good news. So, when you said that about groups, it made me think the last time that I video one and Mr. Tighe we were talking about prior to that when we were talking about how it was on it was the same couple kids that is your inclusion group and it was the same couple kids that were offering you know, and you had other tables where they are writing anybody. And one thing I had suggested, and he tried it and it worked.
00:25:39 Speaker 1 I mean, not every single table, but he said to them that he was going to expect at least one response from each table.
00:25:47 Speaker 1 And he, like it, was fine if they talked a little bit together, you know, like he allowed them to talk amongst themselves to produce a strategy. So, I think sometimes when you do have low groups, especially if there is someone at the table that has some, does not mind speaking out and giving that if you give them. But that's not what number talks about per se.
00:26:09 Speaker 1 You know the rules are, but you differentiate it in your classroom like you need. And if your students thrive on that group. It might get them. You know, they could have whiteboards out and I think you did do whiteboards.
00:26:22 Speaker 1 You had your whiteboards out and they had to write up their strategy on their whiteboard and hold it up. And so that was it kind of made everybody a little more accountable for being a part of it than just sitting and waiting on the ones they know to have the right.
00:26:36 Speaker 1 Or a right answer question. So, this is the thought that comes to mind.
00:26:48 Speaker 1 (FPostQ#12)
This is a question about student engagement and like
From the perspective of if I am an instructional coach, pretend like I do not know your classrooms and I walk into your classroom. What behaviors would I see demonstrating student engagement?

00:27:03 Speaker 1
In other words, what do you think of when I walk in your room, and I am looking to see if students are engaged. What does that really look like in your room?

00:27:14 Speaker 1
Either one of you can go first.

00:27:17 Speaker 2
I think just the people figuring questions out, you know, on paper, whiteboards, whatever.

00:27:27 Speaker 2
You kind of see that they are involved in it and the actual groups that are actually talking about the, you know, the question in front of them as opposed to talking about.

00:27:39 Speaker 2
You know the weather or off topic subjects.

00:27:43 Speaker 1
Like lip gloss or things like that, like the group this morning that was working on their acts or there. I do not know if it was their big ideas or IXL like together like most of them truly were working the problems and having a conversation about that, and that is good.

00:27:58 Speaker 2
Well, it was Big Ideas at the beginning and IXL once they had finished.

00:28:06 Speaker 1
All right. What do you think, Anna? What does engagement look like? If you are looking at students?

00:28:09 Speaker 3
I agree with him. You come in and you see the kids are working on what they are supposed to be working on, whether it is with a partner or on their own, whether it is task cards that they're going from one table to another.

00:28:27 Speaker 3
If they are doing the work and trying to do the math that goes along with it, then that would be being engaged.

00:28:37 Speaker 3
And if it is during a lesson during those 15 minutes or whatever, when I do a lesson, if they are paying attention Making eye contact or even having questions, then that would be being engaged.

00:28:54 Speaker 1
And that is a good point is when they get to the point that they will ask a question like it doesn't have to necessarily be a probing question. I mean, I love for kids to say, wait a minute. Where did that come from?

00:29:07 Speaker 1
They are engaged if they are saying, “How'd you get that?” They are thinking.

00:29:14 Speaker 1
I tell them, “I love your questions. It shows me you are thinking about the math!”
00:29:15 Speaker 1
That is the way I can tell if you are understanding or not.
00:29:21 Speaker 1
So those questions, I am glad you put that in about asking questions because they could be probing questions like somebody could be saying well, would that always work?
00:29:29 Speaker 1
I mean, I would be thrilled to death if a kid questions that, you know, would that always work. So, different types of questions is a very good point.
00:29:38 Speaker 1
All right, two more questions.
00:29:40 Speaker 1 (FPostQ#13)
What would you tell other math teachers in your school or district regarding the PD using number talks in middle school?
00:29:48 Speaker 2
And you do not have to just think about the PD, but like implementing number talks. What would you say to other teachers? They can be in this school or other teachers you know.
00:30:01 Speaker 2
It allows more involvement from the students than usual. The other thing is it is not necessarily on a topic they were learning that day. So, you get to mix up some of the talks.
00:30:15 Speaker 2
OK, I am sorry you said not necessarily on a topic they are doing involvement every day today, but what was the 2nd part?
00:30:23 Speaker 2
It allows them a little variety in their course of the week. I like that.
00:30:31 Speaker 3
Yeah, I would say that it helps them to be to get your class engaged and I agree with Mr. Tighe that you can use it as part of your spiraling review.
00:30:50 Speaker 3
I was using fractions because a lot of them I could. I was trying to pull out everything that I could see that had fractions because that's what my students are weak on is fractions.
00:31:04 Speaker 3
So, I wanted to see their thinking.
00:31:06 Speaker 3
So, it made me realize that they know what fractions are, but they are just not getting the math thinking.
00:31:17 Speaker 1
And maybe they are just not persevering in problem solving. It makes you know they understood the fraction, they just were not applying it when needed.
00:31:21 Speaker 3
Right, and they are also it show that sometimes they do not know the basics as much as they should, because on paper they couldn't do it. But if I showed them a pretty picture they could do it. So, that was interesting.

Speaker 3

I would tell another teacher to at least try it because it does show engagement and it can help you if you want to review something, you can pick something out that has a review topic on it, or if you know if you are going to do.

Speaker 3

There are some that involve triangles and that might be before your lesson, just to get them thinking about it. So, there's variety.

Speaker 1

I like it. Thank you very much.

Speaker 1

Last question and this is it based on what we have done so far with this, are there any other PD support that you need?

Speaker 1

It can be about number talks. It can be any additional support that you need.

Speaker 1

Even though I am not going to be here, that does not mean I cannot provide support. I will be here one more time too, with number talks or any other type of engagement in your classroom.

Speaker 1

Can you think of anything right now? It is okay if you cannot think of anything right now.

Speaker 2

I am not the best to formulate thinking of other PD. It is not a, not a negative PD comment.

Speaker 2

It is just when I get shown something I rarely think OK, what else do I have to be shown so?

Speaker 1

Right, right.

Speaker 2

So, I am going to have to go on that for now.

Speaker 1

And that is good. I mean, that is fine.

Speaker 1

But you each get a book.

Speaker 1

OK, so the book that I delivered here to the school, it's the green one.

Speaker 1

Do y'all want does do y'all want the same as do you both want a copy of that book or is there another one of the number talk books you want? I know Mr. Tighe had one that you had in your room?
00:33:42 Speaker 1
Maybe it was Anna's room
00:33:46 Speaker 3
I had one that he had, but it was fifth grade and.
00:33:52 Speaker 3
And lower and it was.
00:33:56 Speaker 3
To my way of thinking, it was too many words.
00:34:02 Speaker 1
Not enough evidence.
00:34:04 Speaker 3
Yeah, I mean then Mr. Tighe had the other book and I bought that book.
00:34:09 Speaker 3
I do not remember what the name of it was.
00:34:10 Speaker 3
It is the one with the little guy on the front that says number sense.
00:34:15 Speaker 3
And I bought that one because I liked it so much that I wanted to look at it.
00:34:17 Speaker 1
OK.
00:34:19 Speaker 3
So, I got that. I already have that one.
00:34:26 Speaker 1
OK. Well, and so do you have the green one? Which one do you have the green one or do either one of you have it? Is it in here? In Tracy's room?
00:34:36 Speaker 3
I do not think I have any.
00:34:37 Speaker 1
OK, I had it delivered here to the school, but I do not know where it is at.
00:34:43 Speaker 1
I will find it. It might be Mr. Jacklines room.
00:34:46 Speaker 1
It is in one of the other. I will bring it down. You can look at it if that is one that you want your own copy of.
00:34:53 Speaker 1
I mean that copy, it can go to either one of you and if both of you want to order the same one and just have it delivered here, or if you are like, no, I do not want that one.
00:35:02 Speaker 1
Person on the front instead of that one.
00:35:04 Speaker 1
I can order that one and if neither one of you want the green one, but there is some other resource. You won't just let me know because I appreciate y'all.
00:35:12 Speaker 1
This was a lot of time y'all gave me to help me out with my research, so I really do appreciate it.

00:35:17 Speaker 1 I think I can tell it a difference when I come in and I see the students from the beginning of February to now, their conversations, which would be what I would say.

00:35:30 Speaker 1 Their conversations, even when they are working on IXL or something or it might have been the big ideas today, Mr.

00:35:38 Speaker 2 And that's not the class that I observed previously.

00:35:41 Speaker 2 But I heard two little girls. They were working on a problem. One of them got 21.00 and the other one got 2100.

00:35:50 Speaker 2 And I knew what the one that got 2100 had done wrong. But she was arguing with the one that got 21.

00:35:55 Speaker 2 She was like, no, you're wrong.

00:35:57 Speaker 2 And she was like well.

00:35:58 Speaker 2 No, you're wrong.

00:35:59 Speaker 2 And I said, well, maybe I should talk about.

00:36:02 Speaker 2 I'll said was maybe I should talk about how you got your answer, and let's see if you can think through it.

00:36:08 Speaker 2 And so when we did.

00:36:10 Speaker 2 The one little girl that had 2100 she.

00:36:12 Speaker 2 It's like.

00:36:13 Speaker 2 Well, I mean, it couldn't be that because it's 14% of 150. I mean that's more than that.

00:36:19 Speaker 2 And she the little girl, the one that came up there and did that where she you measured her.

00:36:23 Speaker 2 Mr. Todd, she looked.

00:36:25 Speaker 2 She looked at the girl to her left and.

00:36:27 Speaker 2 She went what?
Do you think like I made? I mean 2100 and that's not even reasonable.
00:36:33 Speaker 2
And I said so guys, if you'll do that to your answers, you know, and they went, oh, and it was it was just a matter of she never even wrote down the decimal. She wrote 14 times. Whatever the number was, 150, I think.
00:36:45 Speaker 2
And and she just completely forgot that it was a percent.
00:36:48 Speaker 2
She wrote the number 14.
00:36:49 Speaker 2
And so they both knew how to multiply correctly.
00:36:53 Speaker 2
They just.
00:36:54 Speaker 2
It was a very big detail, but so having that conversation, I think getting to hear kids talk about my is the ultimate goal and like being able to explain their thinking.
00:37:05 Speaker 1
And know why it was wrong.
00:37:09 Speaker 1
It was a percent like she physically said that.
00:37:11 Speaker 1
I did not have to say go back and look at what you did wrong, like when she started thinking about it, it dawned on her so.
00:37:18 Speaker 1
I think that and I think it does come with time and I like, I like that.
00:37:21 Speaker 1
I hear you say you would like to start the year out.
00:37:24 Speaker 1
It is ultimately best when you do start a year out like that with it, because it becomes part of your classroom routine, and you don't have to do it every single day.
00:37:33 Speaker 1
In the beginning it is encouraged that you do it every day because then they start.
00:37:40 Speaker 1
Jumping on board and where people are and it's like you set the tone of the class is the expectation that I need to know how you're going to. Solve this versus coming in mid-February like we did.
00:37:51 Speaker 1
But that is not your fault.
00:37:52 Speaker 1
That is mine.
So, I appreciate you.
00:37:55 Speaker 1
Thank you very much.

00:37:56 Speaker 1
I know you have plenty to do. So, I am going to let you off of here.

00:38:00 Speaker 1
But I will be back in April for my it's the day of day.

00:38:04 Speaker 1
But anytime if y'all need any support between now and then, do not hesitate to call me or e-mail me or anything else.

00:38:18 Speaker 3
Well, thanks.

00:38:19 Speaker 3
Thanks for letting me participate because I always liked number sense because I knew about it before, but nobody had really made me implement them.

00:38:30 Speaker 3
So this was kind of like the push I needed to to start doing that strategy so.

00:38:38 Speaker 1
And I was the same way in the classroom. Sometimes I know things. But unless I was being held a little bit accountable, I would say I would do it later.

00:38:47 Speaker 1
You know, I will do that later and sometimes I miss some opportunities.

00:38:50 Speaker 1
I am sure that if I had tried, I would have seen value in it. So, I hear what you are saying. I am guilty of the same thing.

00:38:58 Speaker 3
All right. Well, thanks.

00:38:59 Speaker 1
Thank you both. I appreciate it.

00:39:02 Speaker 1
Have a good afternoon.
### APPENDIX K

**TEACHER DEBRIEF DOCUMENT**

Table K.1 Teacher Debrief Document

<table>
<thead>
<tr>
<th>Professional Development Implementation &amp; Feedback</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructional Coach:</td>
<td></td>
</tr>
<tr>
<td>Teacher:</td>
<td>Class Period/Time:</td>
</tr>
<tr>
<td>Number of Students:</td>
<td></td>
</tr>
<tr>
<td>Learning Target/Objective(s):</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Descriptive Field Notes &amp; Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants’ reactions</td>
</tr>
<tr>
<td>Participants’ learning</td>
</tr>
<tr>
<td>Organization support &amp; change</td>
</tr>
<tr>
<td>Participants’ use of new knowledge</td>
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<tr>
<td>Student learning outcomes</td>
</tr>
<tr>
<td>ADDITIONAL FIELD NOTES:</td>
</tr>
</tbody>
</table>
APPENDIX L

INSTITUTIONAL REVIEW BOARD FOR HUMAN RESEARCH APPROVAL LETTER

INSTITUTIONAL REVIEW BOARD FOR HUMAN RESEARCH APPROVAL LETTER for EXEMPT REVIEW

Re: 

Dear [Name],

This is to certify that the research study *Instructional Coaching: A Support for Increasing Engagement in Middle School Mathematics* was reviewed in accordance with 45 CFR 46.104(d)(1), the study received an exemption from Human Research Subject Regulations on 1/20/2023. No further action or Institutional Review Board (IRB) oversight is required, as long as the study remains the same. However, the Principal Investigator must inform the Office of Research Compliance of any changes in procedures involving human subjects. Changes to the current research study could result in a reclassification of the study and further review by the IRB.

Because this study was determined to be exempt from further IRB oversight, consent document(s), if applicable, are not stamped with an expiration date.

All research related records are to be retained for at least three (3) years after termination of the study.

The Office of Research Compliance is an administrative office that supports the University of South Carolina Institutional Review Board (USC IRB). If you have questions, contact Lisa Johnson at lisaj@mailbox.sc.edu or (803) 777-6070.

Sincerely,

ORC Assistant Director and IRB Manager
APPENDIX M

COMMUNICATION WITH ADMINISTRATION AND PARTICIPANT

Research Proposal Question

Mon 12/12/2022 1:54 PM
To:

Good afternoon, I hope you are having a good Monday. I am looking forward to working at tomorrow and Wednesday.

I am currently working on requesting permission from to conduct research at Will you share the Board Policy that I should reference? I am creating my own document, but if there is a specific request form, they prefer will you also share that?

Thank you so much for your support!
LET THE RESEARCH BEGIN!

19/2/2023 10:48 PM

3 attachments (49 KB)

Consent to Participate Appendix F Updated 1/21/23 A/Y.docx Consent to Participate Appendix F Updated 1/21/23 D.T.90003 Study Timeline Appendix 1 Detailed Timeline Proposal.pdf

Good afternoon, [Name], I hope you are doing well. I appreciate you both for agreeing to participate in my research study. I received final approval yesterday that I can begin immediately. This is very exciting news! I am looking very forward to working with you. I am copying Tracy, Roger, and Ms. Thompson on this email to ensure everyone is informed of the proposed dates and procedures for this exempt research.

Teacher Pre-Intervention Survey for Exempt Research - This Google Form is a brief survey (10-15 minutes). There are 3 sections with 3-5 questions per section. Please complete this by 11:59pm January 23. Your responses to these questions will help the researcher create questions for our Pre-Intervention Focus Group Interview.

I have attached the Consent to Participate in Doctoral Research Study. Please read over this closely and let me know if you have any questions. Below is the Detailed Timeline Proposal.

I am truly looking forward to our collaboration and supporting you during each step of the journey.

Sincerely,