ABSTRACT

CORSI-KIMBLE, REBECCA SUE. The Manifestation of Collective Attributions: Opportunities to Learn Mathematics in a Tracked Middle School. (Under the direction of Dr. Margareta Thomson).

Students are commonly placed into leveled mathematics classes based on perceived academic ability beginning in middle school. In theory, these ability groups help teachers craft their instruction to meet students’ needs. However, as teachers grapple with the pressures of accountability measures and the desire to help students achieve at high levels, they might provide students with inequitable learning opportunities depending on the perceived abilities of different groups. The leveling of mathematics courses primes teachers to pre-judge student capabilities; judgments directly related to the types of prominent societal beliefs regarding math ability. These beliefs are consequential for students because they influence the learning opportunities their teachers provide them.

This study follows an ethnographic case study design. Teacher observations, observations of grade-level mathematics team meetings, teacher interviews, and team-level focus groups combine to provide the context to best understand how eight middle school math teachers formulate and operate upon collective beliefs pertaining to students’ mathematics capabilities. Situated in a school that tracks students into leveled groups for mathematics instruction, patterns connecting these collective beliefs to the learning opportunities afforded to students are identified. An external model of social motivation assists with the interpretation of qualitative data.

Findings suggest teachers are overwhelmed by mandated top-down initiatives, which most likely contributes to the perceived elimination of teacher autonomy. While teachers collectively held lower expectations and low-ability attributions for “regular” students more
often than “advanced” students, differential attributions and expectations did not result in teachers offering more demanding learning opportunities to “advanced” students. Instead, the disjointed implementation of small group instruction, the expectation to use a new textbook resource, and the pressure to improve student achievement prompted teachers to primarily provide procedurally-oriented tasks to both “regular” and “advanced” students. Additionally, the math teachers attributed student performance to factors outside their control the majority of the time, indicating low levels of collective efficacy.
The Manifestation of Collective Attributions: Opportunities to Learn Mathematics in a Tracked Middle School

by
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A dissertation submitted to the Graduate Faculty of North Carolina State University in partial fulfillment of the requirements for the degree of Doctor of Philosophy

Curriculum & Instruction

Raleigh, North Carolina

2018

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For Judy.

For Duke, Chip, Tucker, and Luka, too.
BIOGRAPHY

Becca grew up in Owosso, Michigan with her mom, dad, and younger brother, Thomas. She graduated from Owosso High School and attended Saginaw Valley State University where she earned her bachelor’s degree in elementary education with a focus on mathematics. Upon graduating in 2008, she moved to North Carolina to pursue a teaching job.

Becca taught 7th grade math at Archer Lodge Middle School for six years. During that time, she coached softball and girls’ basketball, served on the school improvement team, and served as lead math teacher. Following her fourth year of teaching, Becca enrolled in a master’s program for elementary mathematics specialists at North Carolina State University. While she was in the program, she improved her pedagogical skills, strengthened her content knowledge, and began changing her practice to reflect what she had learned. In the midst of shifting her teaching from more procedurally-based to more conceptually-based, Becca became frustrated when students, parents, or friends would comment that they “were not good at math,” and noticed how these ideas impacted her teaching. These feelings of frustration led Becca to pursue graduate school full time.

Through research and teaching, Becca hopes to work closely with elementary and middle school math teachers by helping them provide high quality learning opportunities to all of their students. In addition, she hopes to help teachers dismantle their own implicit biases about students’ mathematics learning capabilities by beginning and continuing conversations about these perceptions, and how they are compounded by student grouping practices.
ACKNOWLEDGMENTS

To everyone who supported me emotionally and academically over the last four years, I am deeply appreciative. First, I want to thank Martha and Cole for being the PLC that inspired me to conduct this study. The years we worked together will continue to shape my work with teachers. Relatedly, I wish to thank my former Archer Lodge colleagues for giving me the space to try what I had learned in my master’s program, and for the encouragement to pursue this degree.

To my committee, who listened to my endless questions and supported me in the completion of this study. The extra time you dedicated to meeting with me, answering my emails, and calming my anxieties made me a stronger student and researcher. To Margareta, thank you for always thinking of me for presentation and conference opportunities. You have believed in me from the very start, and your kindness has been constant. Thank you for your confidence. To Karen, thank you for your insight with qualitative research. You made me believe that a qualitative study was feasible, and I referred to points you made in class throughout my coding and analysis. To Jonee, you stepped in on my committee without hesitation, and have helped me in so many ways. I’m excited about the work we have accomplished together, and for the potential to work together in the future. Thank you for your patience. To Valerie, just… thank you. You inspired me to pursue graduate school in the first place, and if I can come close to impacting math teachers the way you have impacted me, it will all have been worth it. Thank you for all of your time, patience, and support.

I must also thank the additional faculty who have made significant contributions to my experience over the last four years. To Temple Walkowiak, thank you for always finding the time to answer my questions and for helping me think through teaching elementary math
lessons. To James Minogue, thanks for the chance to be involved with the new doctoral course. The experience was super valuable, and I enjoyed teaching it with you. To Beth Sondel, for helping me find my purpose. To Sarah Carrier, thank you for always appreciating my work, and for considering my perspective with our work. To Candy Beal, thank you for all the snacks. You really saved me on some days. And lastly, to the late Jimmy Scherrer, thank you for first, believing I would get to this point and second, for indirectly teaching me the importance of finding a balance between life and work.

To Rachel, I am grateful for our continued friendship, and for the time you took to read and make edits.

To Jenna, during our friendship, you have always been an effective teacher. You taught me about the fovea, you taught me about Sudan, you taught me about the difference between Taco Bell and authentic Mexican restaurants, and you taught me how to have an active voice. Thank you for being the best.

To my parents, thank you for always believing in me.

Finally, to my wife Judy, thank you for your unconditional love and support. You lifted me up when I felt discouraged. You inspired me with creativity and helped shape my thinking when I hit dead ends. You made me tacos. I could not have done it without you.
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CHAPTER 1: Introduction

Background of Study

The implementation of No Child Left Behind (2002), has required teachers to monitor student learning and growth by demographic and socioeconomic subgroup. Teachers have begun to accomplish this type of monitoring through collaborative means. Professional learning communities (PLCs; Dufour, Dufour, & Eaker, 2008) are one way that teachers might be mandated by either their principal or other district officials to examine student performance with a primary goal of overall improvement on state mandated standardized tests. Although the PLC model was initially developed for teachers as a reflective and collaborative tool to evaluate all students’ learning, teams often divert from this intended purpose, focusing instead on data management and remediation strategies for struggling students.

Meanwhile, students are placed into a mathematics class based on perceived academic ability, typically beginning in middle school. In theory, these ability groups help teachers tailor instruction to meet the needs of students. However, the pressure of accountability measures often influences teachers to treat leveled groups differently (e.g. Boaler, 2016; Burris, 2014; Kalogrides & Loeb, 2013). Pre-judgment of student capabilities based on leveling is directly related to accepted societal beliefs regarding mathematics ability. Teachers and students alike are susceptible to the myth that mathematics ability is innate, that some people are simply “math people,” and others are not. Educational psychologists and math teacher educators have thoroughly studied how the quality of learning opportunities provided to students directly impacts these ideas.
As they exist within middle school mathematics PLCs, I examine these implicit beliefs of mathematics ability and their relationship to student placement, goals, and attributions. Additionally, I extend existing research in two areas: the effect of teachers’ collective beliefs concerning student ability, and the consequences of providing inequitable opportunities.

**Inquiry Worldview**

I situate this study within a transformative-action worldview (Christ, 2013; Mertens, 2007; Romm, 2015). Researchers who hold a transformative-action worldview are interested and engaged in issues of social justice. According to Mertens (2007), researchers subscribing to a transformative worldview recognize that “realities are constructed and shaped by social, political, cultural, economic, and racial/ethnic values indicat[ing] that power and privilege are important determinants of which reality will be privileged in a research context” (p. 212). This perspective is particularly applicable for researchers seeking a better understanding of schooling structures’ contributions to inequitable learning opportunities for students of different backgrounds. Although participatory action research methods are common within this perspective, my use of ethnographic methods to gather descriptive, foundational information from within a single school will lay the groundwork for future studies. For now, ethnographic methods allow me to gather, interpret, and understand the complex school environment where teachers make generalizations about students and teach them using a variety of methods.

For this study, my primary focus is the way middle school mathematics teachers collectively adhere to ideas and actions of social cognitive constructs (Dweck & Leggett, 1988). These beliefs, such as individual theories of intelligence, achievement goals for
students, and external attributions, shape and are shaped by social, political, cultural, economic, and racial/ethnic structures. After I understand the influence of these teachers’ beliefs, I will be able to progress from this observational and descriptive study toward action-oriented work where researchers and teachers collaborate to dismantle inaccurate pre-conceived notions of student ability based on perceived level or math placement.

**Statement of the Problem**

Middle school students are commonly placed into mathematics classes of various levels based on their perceived ability. Widely known as tracking, this practice is problematic because students placed in “higher” tracks are more likely to receive higher quality instruction and more experienced teachers than students who are placed in “lower” tracks (e.g. Boaler, 2016; Burris, 2014; Oakes, 1985). Further, the placement of students into advanced placement mathematics courses or remedial courses is typically divided along lines associated with race and class, where more affluent, White, and Asian American students are more commonly placed into higher level courses than their African American, Latinx (Merriam-Webster.com, 2017), and economically disadvantaged peers (Kalogrides & Loeb, 2013; Oakes, 1985; Tate & Rousseau, 2002). Limiting African American, Latinx, and poor students’ access to high-level courses also limits their access to high quality and experienced teachers who provide high quality opportunities to learn (Cobb & Russell, 2015; Oakes, 1985). These differences in access contribute to what is commonly referred to today as the achievement gap (e.g. Burris & Welner, 2005; Gutierrez, 2008; Ladson-Billings, 1997).

**Purpose of the Study**

I aim to identify the attributions teachers make in collaborative settings (PLC meetings, shared planning times, etc.) while they evaluate their students’ performance as they
collectively plan lessons for the varying ability levels of mathematics they teach. These collective, spoken attributions will reveal teachers’ beliefs of each perceived level’s learning capabilities, and perhaps also insight of why teachers believe these capabilities exist. I also work to identify and explain any emergent relationship between the factors used to determine student placement and the attributions teachers hold for student performance. By uncovering existing teacher attributions in a tracked middle school, it may then be possible to design and implement interventions to help teachers plan equitable learning opportunities for each group, or even better, move to eliminate tracking in their school altogether.

**Significance**

This study is significant to the fields of educational psychology and mathematics teacher education. Although studies have demonstrated how ideas about mathematics ability interact with achievement goals and attributions for both students individually and externally from teachers to students, few studies have used these constructs as a framework to investigate the dynamics within a team of teachers who are responsible for planning learning opportunities for their students. Further, qualitative examination will reveal how schooling structures restrict or empower teachers to provide equitable opportunities to students perceived to be at different levels. Lastly, the utilization of a social cognitive framework will allow for a unique interpretation of schooling structures in tracked middle schools.

**Definition of Terms**

1. **Ability Grouping**: The practice of grouping students into leveled mathematics classes based on criteria associated with their assumed mathematics abilities (i.e. standardized test performance, classroom grades, teacher recommendation, parental input, etc.). Also, commonly referred to as “tracking.”
2. Attributions: Cognitive constructs designating the cause of a particular outcome (Weiner, 1979). For example, a teacher may conclude that students performed poorly on a test due to an unexpected, heightened degree of difficulty, thus attributing the performance to task difficulty.

3. Entity Theory: The idea that intelligence or ability is innate and cannot be changed. Known more broadly as “fixed mindset” (Dweck, 1986; 2006).

4. Incremental Theory: The idea that intelligence or ability is malleable and can be changed over time. Known more broadly as “growth mindset” (Dweck, 1986; 2006).

5. Goal Orientation: The tendency of an individual to lean more toward performance or mastery goals. Individuals can be performance oriented, mastery oriented, or a combination of both depending on the context.
   a. Performance Goals: Goals set by individuals with an aim to show adequacy through assessment scores or in comparison to others.
   b. Mastery Goals: Goals set by individuals with an aim to grow and learn over time.

6. Mastery-Oriented: Describes an individual who tends to focus on making incremental gains while learning a new concept, even in the face of a challenge.

7. Learned Helplessness: Describes an individual who has learned over time, perhaps based on a series of failures, to exhibit helplessness in the face of a challenge.

8. Opportunities to Learn: Settings that permit students to engage with a mathematical task. Ranging from repetitive memorization tasks to high quality tasks considered to be “doing mathematics,” opportunities to learn will be categorized using Smith and Stein’s (1998) Task Analysis Guide for determining the task’s level of cognitive
demand and by the presence of opportunities for students to engage with the Eight Standards for Mathematical Practices.
CHAPTER 2: Literature Review

In high stakes achievement-focused accountability environments (Tichnor-Wagner, Harrison, & Cohen-Vogel, 2016), teachers work within structures of schooling built to group students into varying placements based on a perceived academic ability (e.g. Berry, 2008; de Boer, Bosker & van der Werf, 2010; Oakes, 1985; 1994). These ability groups, widely referred to as tracks, are especially common beginning with middle school mathematics (e.g. Burris & Garrity, 2008; Oakes, 1985). Although students are placed into different tracks, this alone does not determine the curriculum. Teachers must plan and implement lessons they deem appropriate for each track. Internal and external pressures on teachers to produce quality test scores often result in differential pacing, teaching styles, expectations, and tasks provided to students for practice. Such practices are problematic in tracked classrooms because the learning opportunities afforded to students in advanced tracks are not comparable to those for students placed in a lower track (e.g. Horn, 2007; Oakes, 1985).

More than thirty years ago, Tom and Cooper (1986) found that teachers were more likely to attribute student successes and/or failures to student ability if these performances aligned with their expectations of student characteristics such as family background, race, and social class. Further, the same teachers attributed student performance to factors outside of the student’s control if the outcome was unexpected. Essentially, if teachers expect success from students, they explain those successes as ability and failures as flukes. Tracking practices exacerbate these tendencies for teachers presently when so often the labels placed on different tracks, for example, “regular math” or “advanced math”, communicate expectations for student achievement. The implementation of No Child Left Behind in 2002 (No Child Left Behind [NCLB], 2002) and the more recent implementation of the Common
Core State Standards and Race to the Top (Ravitch, 2013) has encouraged teachers to closely monitor student scores on state mandated standardized tests, while also breaking down student performance throughout the school year by both race and social class (Dee, 2005).

The expectations teachers hold for students impact the opportunities they provide to students in different tracks. In many cases, these differential opportunities between tracks are inequitable. Although much research has outlined how tracking leads to inequitable learning opportunities for students, and expectations held for students in different tracks are linked to variable levels of instructional quality (Kalogrides & Loeb, 2013), few studies have examined how middle school mathematics teachers work collaboratively to plan for students in a tracked setting particularly within contexts predominantly focused on achievement and accountability. Additionally, existing research has yet to explain how collective beliefs of student capabilities manifest as teachers plan and implement differential learning opportunities with intentionally leveled groups of students.

I have organized the literature review into four sections. I begin by defining attribution theory and examining how it has been used as a lens to better understand teachers’ beliefs about their students’ successes and failures. I outline how attributions have been linked to stereotypes, and how more recent research on student ability as an attribution reveals a connection to goal theory and implicit theories of intelligence (e.g. Dweck, 1986; Dweck & Leggett, 1988). In the second section I present the results of studies specific to tracking practices and inequitable access to higher levels of mathematics for certain groups of students. In the third section, I sort through what is expected of teachers as they work within collaborative teaching teams to plan lessons for their students as well as the participation structures that exist within these teams. I examine how individual teachers are
positioned within their teams, how support for students is constructed through collaborative means, and the methods that have been used to capture these practices in action. I conclude by synthesizing the existing research, cultivating a space for my investigation of collective teacher attributions as they manifest in learning opportunities for middle school students’ mathematics classrooms.

**Theoretical Framework**

**Attribution Theory Overview**

Individuals consistently work to explain events that impact their lives (Weiner, 1979), and within achievement contexts, attributions function as causal explanations for successes and failures (Weiner, 1979). Attribution theory provides a lens of “social perception” (Weiner, Nierenberg, & Goldstein, 1976) to judge the performance on tasks that can be performed with measured or recognized amounts of success. In achievement contexts, students frequently judge their classroom performance, and teachers judge the performance of their students based on a compilation of four characteristics: their ability to do well on a task, the amount of effort put forth on a task, the difficulty of the task itself, and whether luck played a role in the performance on the task (Heider, 1958; Weiner et al., 1976). Further, there are three primary dimensions in which attributions exist: locus, stability, and controllability (Graham, 1991; Reyna & Weiner, 2001; Weiner, 1985).

First, locus designates whether performance on a task can be attributed to internal or external factors. Within the four general characteristics listed above used to judge success on such tasks, ability and effort are factors internal to an individual, whereas task difficulty and luck are external to a person’s performance. Second, the stability of an attribution pertains to whether it is able to change over time. Throughout the attribution theory literature, ability is
often cited as a stable characteristic (Weiner, 1985), whereas effort is not stable, and can increase or decrease within the context of each task. Moreover, task difficulty and luck are considered to be stable and unstable respectively (Weiner et al., 1976). Lastly, controllability describes how much control the individual has over the characteristics leading to the making of the attribution. Effort is a characteristic controlled by a student. In contrast, ability is traditionally considered beyond an individual’s control. Contemporary research on student ability (e.g. Dweck, 1986, 2006) suggests ability is more malleable and controllable than the early attribution theory literature indicates.

Although the most commonly referenced attributions for academic performance reflect ability, effort, task difficulty, or luck, additional attributions have been noted in more contemporary studies. For example, a year-long discourse analysis of elementary math teachers revealed they attributed different levels of student performance to such factors as the student’s age or grade level, out-of-school experiences, teaching methods, and descriptions for mathematics thinking (Wilson, Edgington, Sztajn, & DeCuir-Gunby, 2014).

**Studying Attributions in the Classroom**

In classrooms where measures of performance are presumed to be indicative of student learning, attribution theory provides a cognitive account of teachers’ interpretations for student performance levels (Martinek, 1989). Cooper and Burger (1980) examined such teacher attributions by providing them with prior achievement scores for a set of students and their subsequent level of performance on a task. The teachers were then asked to indicate potential causes for student performance outcomes on the task. When, based on prior levels of achievement, teachers believed a student was bright, they were more likely to attribute success on the task to factors considered internal and stable to the student, such as student
ability. For the same previously high-achieving students, failure was attributed to factors external to the student, such as task difficulty or inadequate directions. If failure for the high-achieving students was not attributed to external causes, teachers pointed to more controllable attributions, indicating that perhaps these students did not put forth the necessary effort to succeed.

Attributions from the same teachers shifted when it came to evaluating the performance among students who appeared to be low-achieving based on prior achievement. When these students were successful on the task, the teachers attributed their success to external factors, for example the ease of the task, or heightened levels of effort, which can be controlled by the student. However, failure on the task was attributed to low student ability, considered by the teachers to be internal and stable student traits. These findings are consistent across the attribution theory literature and link directly to research on teacher expectations for student performance (Brophy & Good, 1974; Burger, Cooper, & Good, 1982; Georgiou, Christou, Stavrinides, & Panaoura, 2002; Georgiou, 2008, Reyna & Weiner, 2001). Further, these findings provide credibility to what Weiner (1976) identifies as the low-expectancy cycle: that internal, stable and uncontrollable traits are prominent when outcomes are expected, whereas external and unstable causal attributions are cited when outcomes are unexpected. This means that students who have previously achieved at high levels are widely expected to perform well, and those who have not are expected to fail. In achievement contexts, holding attributions within a low-expectancy cycle has resulted in disparate student outcomes as teachers treat students differently depending on their expectations (e.g. Boaler, 2016; Brophy & Good, 1974; Friedrich, Flunger, Nagengast, Jonkmann, & Trautwein, 2015; Rosenthal & Jacobsen, 1968a, 1968b).
Relating Attributions and Self-Theories

When teachers make attributions for student performance and thus adjust their expectations for future performance, these attributions are simultaneously and inextricably linked to implicit self-theories (Dweck & Leggett, 1988; Hong, Chiu, Dweck, Lin, Wan, 1999). As mentioned previously, much of the early research specific to attribution theory considers a person’s ability to be a stable internal characteristic (Weiner, 1976). However, research on implicit self-theories reveals that some individuals view ability, also often referred to as intelligence, as a dynamic, malleable trait (Dweck & Leggett, 1988; Hong et al, 1999) and the lens thorough which a person theorizes intelligence or ability shapes how they cope with variable outcomes (Dweck, 1975, 1986; Diener & Dweck, 1978, 1980; Hong et al., 1999).

Dweck’s early research (1975) examines how students make attributions for failure, and whether altering those attributions might help them cope with failure on a task more productively. Students identified as “extremely helpless,” those who had learned to be helpless following repeated failures, were either exposed to consistent success for a wealth of problem solving trials, or to a series of successes with problems while failure was intermittently prescribed. Students who experienced intermittent failures were trained by the researchers to change their performance attribution by saying they “must not have tried hard enough,” indicating that in the instance of failure, performance should be attributed to insufficient effort. Following this intervention, students who underwent the attribution retraining either maintained or improved their performance on a later series of math problems, indicating that learning to attribute their performance to lower levels of effort helped them to be successful in the future. In turn, those in the success-only condition
showed considerable amounts of deterioration in their performance. Further, students from the attribution retraining group showed an increase in effort attributions following treatment when compared to those who only experienced success, and even transferred these attributions to their actual classroom settings where their teachers noticed an increase in affect and performance.

Building off of this work, Diener and Dweck (1978, 1980) investigated the relationships between attributions for performance and patterns of behavior in the face of failure. Following an instance of difficulty or failure on a task, children who exhibit helpless behaviors were more likely show a deterioration in performance than their mastery-oriented peers (those who sustain effort through difficulty or failure). Children who portrayed helplessness were more likely to make ability attributions for their failure and display a negative affect toward future tasks (Diener & Dweck, 1978). Mastery-oriented children, however were less likely to make any kind of attributions following failure and were instead more inclined to self-monitor or alter their strategies in order to eventually become successful. These children were also more likely to maintain a positive affect toward future tasks in spite of experiencing failure, and interpreted failure as an opportunity to improve, rather than a defining characteristic of their ability (Diener & Dweck, 1978).

The interpretation of successful performance is also differential between mastery-oriented students and those oriented toward helpless behaviors. In Diener and Dweck’s (1980) study, both mastery-oriented and helpless students were exposed to intermittent failures following sustained instances of success, and then asked about their perceptions of their previous successes. In spite of a documented strand of prior successes, students who exhibited helpless behaviors described low expectancies for future success following
instances of failure, in direct opposition with the expectancies of mastery-oriented students who believed their prior successes were predictive of future achievement. Further, upon a reinterpretation of the earlier successful performance, helpless students attributed those successes to external factors such as luck or task difficulty, whereas mastery-oriented students believed their prior successes could be attributed to their ability (Diener & Dweck, 1980). This finding is consistent with and corroborates the low-expectancy cycle (Weiner, 1976), indicating an interaction between student attributions and teacher attributions for student performance.

**Self-Theories and Goal Orientations**

The early research on self-theories of intelligence in achievement contexts made way for an abundance of studies seeking to better understand social motivation, beliefs about intelligence, and achievement goals (Dweck, 1986; Dweck & Elliott, 1983; Dweck & Leggett, 1988; Elliott & Dweck, 1988; Hong et al., 1999). One of the most prominent findings within this model of social motivation (Dweck & Leggett, 1988) is with the goals individuals set for achievement tasks, and how those goals foster their reactions to their performance outcomes. Depending on the goals an individual is interested in attaining, obstacles may lead to adaptive or maladaptive behaviors (Dweck, 1986). Adaptive behaviors might include a willingness to take on a challenging task and an overall positive affect, whereas maladaptive behaviors reflect an avoidance of challenging tasks, and an overall negative affect. The two types of goals held by individuals in achievement contexts are *learning goals*, held by individuals interested in learning something new, and who work toward increasing their ability; and *performance goals*, held by individuals who hope to
attain positive judgment of their performance, while also working to avoid negative perceptions of their performance from others (Dweck, 1986; Wigfield & Cambria, 2010).

Elliott and Dweck (1988) assessed the conditions under which children would exhibit mastery-oriented behaviors following achievement tasks with increased levels of difficulty. They found that children responded to failure on a task in a manner representative of learned helplessness when they valued performance goals and believed they had low ability. Their attributions for failure thus reflected a lack of ability, and their general affect toward learning was negative. Moreover, when children believed they were high in ability and encountered failure while also valuing performance goals, they responded with mastery-oriented behaviors and thus, did not make attributions for failure, and maintained a positive affect. While these results show how behaviors are mediated by beliefs about ability by children who hold performance goals, it should be noted that whether they believed they were high in ability or low in ability, these children avoided challenging tasks that may have caused them to make mistakes or be judged as having low ability. In stark comparison to the children who held performance goals, those who employed learning goals welcomed opportunities for a challenge and behaved in a mastery-oriented fashion following mistakes.

Dweck and Leggett (1988) outline how implicit theories about ability are predictive of goal orientation, and consequently responses to and attributions for performance. Dweck and Leggett (1988) examine these connections through a review of research by Dweck and colleagues (e.g. Dweck, 1975, 1986; Diener & Dweck, 1978, 1980; Elliott & Dweck, 1988). Within entity and incremental self-theories, individuals may have considerably different perspectives of self-concept. Further, it should be noted that people are not often aware of their self-theories, and do not need to be aware of them for these ideas to impact self-concept.
Individuals who hold an incremental theory of intelligence believe that ability is a malleable trait, and through sustained effort, will learn something new and increase their ability (Aronson, Fried & Good, 2002; Blackwell, Trzesniewski, & Dweck, 2007; Dweck, 1986; Hong et al., 1999). For the incremental theorist, self-efficacy increases when failure is overcome with the elevation of effort (Hong, Chiu, & Dweck, 1995). However, the opposite holds true for entity theorists who believe they are smart when they finish a task first, outperform their peers, and complete easy work without errors, but decrease in self-efficacy when effort is needed to be successful on a task (Hong, Chiu, & Dweck, 1995). As self-efficacy is context dependent (Bandura, 1986; Schunk, Meece, & Pintrich, 2014), implicit self-theories in mathematics hold significant weight for students and can either limit or extend possibilities for learning more advanced concepts (Boaler, 2016; Dweck, 2006).

When Dweck (1986) investigated the link between achievement goals and behavioral responses to difficulty on tasks, mistakes, and even failure, she began to theorize that an individual’s self-theories may be a precursor to the goals they choose to work toward in achievement situations. Beliefs about ability and effort are central within a framework scrutinizing the differences between performance and learning goals, thus directly linking to attribution theory. Dweck (1986) proposed students who pursue performance goals likely hold an entity theory for intelligence, and those who pursue learning goals are more likely to ascribe to incremental theories of intelligence. Further research reinforces these findings (Dweck & Leggett, 1988, Hong et al., 1999).

**External Goals, Expectations, and Teacher Behaviors**

Connections between teachers’ own self-theories and teachers’ attributions for students’ performance became clear when Dweck and Leggett (1988) explained that the
implicit theories individuals hold for themselves may also be correlate with the external goals they hold for others. If an individual holds an entity theory for themselves, they are more likely to hold an entity theory for others, meaning they believe people are who they are and cannot be changed. The pattern holds for incremental theorists as well, who may believe that qualities in others can be cultivated, and change is possible. This set of implicit beliefs for others is consequential among teachers because their main responsibility is to ensure students are learning. The controllability dimension of attribution theory is also relevant in the framework where implicit theories for others are held. While Weiner (1976) expressed that ability was an uncontrollable trait, incremental theorists believe otherwise. Therefore, the perception of an attribute’s degree of controllability as it relates to a particular achievement outcome is relevant only to each individual holding that perception (Dweck & Leggett, 1988).

Dweck and Leggett (1988) suggest that implicit theories of others influence external goals that parallel the achievement goals outlined previously. External learning goals, cited by Dweck and Leggett (1988) as development goals, are typically held by those who hold an incremental theory for particular attributes of others. Development goals are held with the intention of improving valued attributes (such as ability) and focus on responding to difficulty or failure with mastery-oriented behaviors. A teacher who holds a development goal for their students focuses on growth and learning from mistakes, making it clear to their students that learning is the ultimate goal. Furthermore, external performance goals, otherwise known as judgment goals, embody beliefs that attributes in others are static, and generally apply to traits in a broad manner based on isolated evidence for large subsets of people, similar to stereotypes, to be discussed later in this section. Ascribing to judgment
goals for various groups under the influence of an entity theory is problematic for teachers who have the power in their classroom to sustain stereotypes, especially if they believe their students are incapable of improvement in an academic environment based on their individual characteristics (Reyna, 2000; Georgiou, 2008). A teacher who holds judgment goals for their students will emphasize getting the right answer and will focus on student failure as a trait associated with their ability to learn. Dweck and Leggett (1988) allude to this issue when they note, “the way something is categorized has important consequences for the way it is treated” (p. 266). An adaptation of Dweck and Leggett’s (1988) model of external social motivation is outlined in Figure 2.1.

![Figure 2.1. Model of external social motivation (adapted from Dweck & Leggett, 1988).](image)

Perceived levels of student effort and ability continuously function for teachers as a way to evaluate student achievement and their subsequent reactions to student performance (Georgiou et al., 2002; Graham, 1991; Reyna & Weiner, 2001; Weiner & Kukla, 1970). Reyna and Weiner (2001) used attribution theory as a lens to examine how teachers respond to students who commit undesirable transgressions in the classroom. They hypothesized that
teachers who perceive the cause of student failure to be controllable and therefore responisible for their performance would respond with anger, judgment goals (Dweck & Leggett, 1988), and punishment toward the student. They also hypothesized if teachers perceived the cause of student failure to be uncontrollable, the student would be relieved of responsibility and would receive sympathy from teachers who would then hold development (Dweck & Leggett, 1988) goals for these students and therefore respond with helping behaviors. Results from their two studies of teachers and undergraduates acting as teachers, indicate their hypotheses were accurate.

When teachers believed student failure could be attributed to a stable student characteristic, the teachers had a high expectancy for future failure. This expectancy for future failure was indicative of lower levels of influence efficacy (Reyna & Weiner, 2001), meaning teachers had minimal confidence that an adjustment in teaching strategy could alter and improve future outcomes. These teacher beliefs then led to teachers utilizing judgment goals more frequently than development goals. Not surprisingly, teachers who felt failure was due to unstable student attributes held lower future failure expectancies for those students and believed themselves capable of influencing improvement in future student performance. For teachers in this condition, higher levels of influence efficacy meant they were more likely to work within development goals. For students placed in differential tracks, this finding calls into question the quality of instruction students in low-achieving tracks may receive, assuming expectations for success are low.

**Attributions as Stereotypes**

Attributions for academic performance, including expectations for achievement, are directly linked to stereotypes (Dweck & Legget, 1988; Georgiou, 2008; Graham, 1991;
Reyna, 2000; Weiner, 1985). Stereotypes describe the types of characteristics and behaviors that can be expected from a particular group (Reyna, 2000). Furthermore, stereotypes offer explanations for why different groups of people can be categorized by those descriptions (Reyna, 2000). Weiner (1986) suggests stereotypes associated with inferior levels of intelligence are more likely to be attached to Hispanics, African Americans, and women, leading to low expectancies for success and low ability attributions for these groups.

Stereotypes are so closely related to attributions that they can be analyzed along the same three dimensions discussed previously: locus, stability, and controllability (Reyna, 2000). For example, from the perspective of a teacher, the stereotype “girls are bad at math” is associated with a belief that her failure is internal, stable, and uncontrollable. Consequently, the teacher will respond differently to a girl’s future success in mathematics when compared to a boy who fits the stereotype of a successful math student (Graham, 1991).

The attributions teachers communicate to students regarding their performance can have profound effects on students’ own attributions (Georgiou, 2008). Reyna (2000) suggests students begin to believe academic achievement is beyond their control when teachers communicate internal, stable attributions relative to achievement outcomes. This pattern is detrimental to students’ motivation in mathematics (Dweck & Elliott, 1983; Hong et al., 1995). Because mathematics is often regarded as a content area reserved for elite, White, affluent individuals (Boaler, 2016), this pattern of linking implicit beliefs about ability to racial and gendered stereotypes fuels a perpetual cycle discouraging minorities from pursuing careers in science and mathematics; a systemic, structural practice embedded in school systems placing students from marginalized backgrounds in lower achieving tracks at higher
rates than their more affluent, White classmates (e.g. Akos, Shoffner, & Ellis, 2007; Boaler, 2013, 2016; Burris, 2014; Oakes, 1985, 1990).

**Academic Tracking for Mathematics Instruction**

For the purpose of this review, I conceptualize academic tracking as “the sorting of students within a school or district that results in different access to academic curriculum and the opportunity to learn” (Burris, 2014, p. 3), and interchangeably use the term *ability grouping*. As students transition from elementary to middle school, they are typically placed into leveled mathematics courses designed for the perceived ability levels of students who theoretically have previously performed at various levels (Akos et al., 2007; Boaler, 2016; Oakes, 1985). Although some individuals believe grouping students in this way is beneficial and maximizes learning opportunities (Benbow & Stanley, 1996), extensive research in this area has revealed the composition of students across stratified mathematics groups differ from each other demographically, as they are noticeably divided by race and social class (Dauber, Alexander, & Entwisle, 1996). This is especially problematic because racial minorities and students from lower class backgrounds are more likely to be placed within lower achieving mathematics tracks (Catsambis, 1994; Burris, 2014; Dauber et al., 1996; Hoffer, 1992; Kalogrides & Loeb, 2013; Mickelson, 2015; Oakes, 1985). Further, students placed into a particular track are unlikely to change course throughout the remainder of their secondary careers (Boaler, 2016), especially vertically from lower to higher tracks (de Boer, Bosker, & van der Werf, 2010; Fuligni, Eccles, & Barber, 1995; Hallinan, 1996).

In the years prior to the implementation of No Child Left Behind legislation (2002), and much before the push for school choice initiatives (Ravitch, 2013), tracking was investigated in order to determine its effectiveness with student achievement. Slavin (1990)
synthesized the effects of secondary school tracking when students were grouped based on prior achievement but still taught the same curriculum. Under these conditions, Slavin found the effect of tracking to be non-existent, meaning that tracking provided no achievement benefits to students regardless of placement. Slavin further argued that tracking practices should discontinue, particularly because they create within-school racial segregation.

Another early study compared students in a high-track placement to those in a low-track placement (Gamoran & Mare, 1989) and used national longitudinal data to determine tracking’s effects. It found the inequalities between groups in existence prior to track placement were merely reinforced, indicating students placed in high tracks had a considerable advantage over those placed in low tracks, and access to the higher tracks strongly predicted graduation.

Factors Determining Placement

Factors contributing to academic tracking are abundant, inconsistent (Useem, 1992a; 1992b), and influenced by a wealth of actors (Akos et al., 2007; Burris, 2014; Useem, 1992a; 1992b). Whether academic tracking functions as a symptom or consequence in the era of accountability (Burris, 2014), student sorting is based in tradition (Oakes, 1985). In most cases, quantitative achievement measures are analyzed to determine student placement (Burris, 2014; Kalogrides & Loeb, 2013; Slavin, 1990), including standardized test scores or other statistical measures (Dougherty, Goodman, Hill, Litke, & Page, 2015). However, these measures of student achievement are frequently considered in combination with teacher or counselor recommendations, student grades, (Oakes, 1985), and varied levels of parental influence (Cobb & Russell, 2015; Dauber et al., 1996; Oakes, 1985; Burris, 2014; Useem, 1992a; 1992b).
A longitudinal investigation of student tracking practices across three large urban districts, including over 900 schools in the United States (Kalogrides & Loeb, 2013) examined patterns of placement for students who were sorted, according to district officials, by measures of prior achievement. An analysis of school-level administrative files revealed classes intended for lower achieving students were more likely to be taught by teachers with less experience and had an over-representation of both minority students and students with lower socioeconomic status than higher-level courses. Australian studies of student placement for mathematics instruction have parallel findings (Beswick, 2017). Kalogrides and Loeb (2013) also found that in the transition from elementary to middle school, racial segregation between schools decreased while segregation within schools increased, meaning the overall diversity of schools increased, yet within those schools’ classrooms, diversity decreased. Patterns of segregation by race and social class have been further documented in a wealth of additional tracking studies in the United States (Boaler & Staples, 2008; Burris, Heubert, & Levin, 2006; Dauber et al., 1996; Mickelson, 2015; Oakes, 1985, 1990).

Indicators of middle school students’ mathematics placement were investigated by Dauber et al. (1996) who found the single greatest indicator for 8th grade course placement was a student’s 7th grade placement. Further, they identified elementary school records as the most influential variables for low-achieving students, leading to low-track placements upon their arrival in middle school. Transitions from elementary to middle school have been addressed in tracking research (de Boer et al., 2010; Faulkner et al., 2014) through an analysis of teacher recommendations and the trajectories students are placed on as a result of those recommendations.
**Teacher recommendations.** A widely held belief is that mathematics ability is inherent and indicative of the intellectual capacity for learning it (Boaler, 2016; Cobb & Russell, 2015; Dweck, 1986, 2006). Unfortunately, holding an entity theory for mathematics ability is not limited to individuals outside of the teaching profession, and is evident in placement recommendations as students progress from one grade level to the next. These recommendations may be even more consequential for students in systems outside of the United States where tracking is mandated (Boaler, 2013). De Boer and colleagues (2010) looked directly at placement recommendations made by elementary teachers as their students transitioned to secondary school in the Netherlands, where students have the option of being placed in an advanced academic track that leads to university studies, a middle track that prepares students for service-oriented careers, or vocational tracks modeled as preparation for participation in a blue-collar workforce. The authors found teacher recommendations for track placement matched closely with their expectations for particular students based on elementary achievement. However, these recommendations also included expectations relative to student background and familial characteristics. Students whose parents held high aspirations for their child’s educational attainment and who came from higher socioeconomic backgrounds were more likely to be recommended by their teachers for the advanced track toward university studies than their less-affluent peers. In systems where tracking practices are common, implicit theories about intelligence may have an influence over the placement recommendations teachers make for students (Dweck, 1986). Further, stereotypes of race or social class might shape these implicit beliefs leading to student placement recommendations (Graham, 1991; Reyna, 2000).
Faulkner and colleagues (2014), examined fifth grade teacher evaluations for student academic potential and students’ eventual 8th grade mathematics course placement for a representative sample of students from a national longitudinal K-8 dataset. With an additional focus on student race, the authors investigated whether the teacher’s implicit beliefs would lead to more favorable opportunities for particular groups of students, including access to algebra in middle school. After controlling for mathematics performance, teacher evaluation, gender, and socioeconomic status, the data revealed the odds of African American students taking algebra by the 8th grade were lower than their White peers. Although mathematics performance served as a better indicator of eventual algebra placement for White students, mathematics performance and teacher recommendations predicted placement for African American students. Of particular interest is the difference in opportunities afforded to African American students when teacher recommendations and prior performance are considered, as the data revealed African American students with high teacher evaluation scores and high performance in mathematics had nearly the same probability of taking algebra by the 8th grade as their African American peers whose prior performance and teacher evaluations were average. These findings indicate teachers’ stereotypical low-ability attributions for African American students may be at play, discouraging from recommending high achieving students for accelerated courses.

Moreover, in a qualitative account of mathematically successful African American boys enrolled in algebra in middle school at the time of the study, Berry (2008) alluded to the power of teacher recommendations as they relate to middle school mathematics placement. Five of eight student participants had been placed into programs for gifted students early in elementary school, placing them on track to access accelerated mathematics courses in
middle school. However only one of the five was recommended by a teacher to determine eligibility. Teachers instead, focused on classroom behavioral problems for these boys, using classroom behavior as a proxy for academic potential, expressing that they were not appropriate behaviors for accelerated courses. Unbeknownst to the teachers holding the power of recommendation, behavioral outbursts in class were induced by boredom as these boys were being forced to revisit material they had already mastered. Fortunately for the students in this study, parents insisted their children were capable of success in an accelerated mathematics environment and advocated for high track placement on their behalf.

A closer look at the power of parental influence in a system of tracking reveals how their own levels of educational attainment, experiences in school, or membership within particular social classes impact their involvement with their own child’s placement.

**Parent involvement.** As suggested by Kalogrides and Loeb (2013), the pressures parents place on schools may have a substantial impact on student placement, therefore exacerbating the issue of within-school segregation. Parents privileged with social capital (Burris & Garrity, 2008; Cobb & Russell, 2015) who use their power to ensure their children are placed with more experienced teachers force administrators to adhere to their wishes, leaving less affluent students to be placed with teachers who are less experienced. As parents tend to believe in the static nature of the capacity to learn mathematics (Boaler, 2016), those with the power to do so will fight to ensure the best possible opportunities for their children to learn, which may include advocating for the maintenance of a tracking system or threatening to remove their high achieving students and above average test scores from the school (Burris & Garrity, 2008; Cobb & Russell, 2015).
Besides pressuring schools to maintain tracking practices in general, the extent to which parents are able to intervene in the placement decisions specific to children varies across communities (Useem, 1992a; 1992b; Dauber et al., 1996). Useem (1992a) interviewed mothers to examine levels of parental influence and intervention pertaining to mathematics class placement of their 6th and 7th grade children and the mothers’ involvement with school-based activities. These factors were positively associated with their children’s current track placements. Mothers with higher levels of educational attainment were more likely to intervene on behalf of their children, lending support for the theories suggesting that educational advantages transfer between generations.

Another study by Useem (1992b) across 26 districts addressed the likelihood of advanced track placement for students in middle or high school based on parental influence within the school. Students in districts with parents who had attained higher levels of education were significantly more likely to be enrolled in algebra or accelerated mathematics by 8th grade. Further, due to inconsistent and vague placement procedures, students placed in an accelerated track in one district might have been denied access in another, calling into question the strength of parental intervention necessary to have a positive impact. Longitudinal data gathered by Dauber et al. (1996) contribute knowledge of parental influence on student placement in middle school, adding that parents who hold high expectations for their children have greater influence on their children’s placement into advanced courses, but that parental influence does not play a reciprocal role with lower-level placements.

In the era of high-stakes accountability and school choice, the perceived quality of a school is determined by its standardized test scores (Burris, 2014; Ravitch, 2013). In some
cases, the goal of attaining and maintaining impressive test scores serves as the driving force behind active parents deciding what is best for their children (Burris, 2014). In one suburban school, affluent, White parents threatened to remove their students and their students’ proficient math scores when the school moved to end student tracking in favor of heterogeneous grouping practices for math instruction (Cobb & Russell, 2015). Through their fight to maintain tracking practices, these parents made it clear they understand tracking benefits those placed in advanced tracks to the detriment of those placed in lower tracks. Additionally, the parents made clear they would rather have their children change schools than have them placed in a mixed ability groups with “those” kids (Burris, 2014). Parents inherently understand the difference in student opportunity between advanced and remedial tracks. The expectation that their children deserve the types of learning opportunities offered in advanced classes is further linked to their beliefs about the nature of mathematics ability (Burris, 2014; Oakes, 1985).

Opportunities to Learn

Tracking is a means of identifying and sorting students based on their perceived capacity to learn, thus pre-determining the depths of the mathematics curriculum made available to each group (Horn, 2007; Oakes, 1990; Slavin, 1990). The labels used to name courses are often indicative of the expected levels of performance for the assigned students (Oakes, 1985), frequently prescribing a curricular path ripe with expectancies for each track’s performance. As Horn (2007) worked ethnographically among two teams of teachers tasked with eliminating remedial courses, she noted how they articulated their beliefs regarding the level of rigorous instruction students were capable of handling. Among one of the teams observed, Horn noticed repeated instances of what she termed the “mismatch problem,”
which emerges when both teachers and students believe that only *some* students have the ability to be successful with more rigorous instruction. Teachers in one school classified students according to perceived mathematics ability through discussions surrounding topics of student achievement, innate ability, expected or observed behaviors, and attitudes. Ultimately, these teachers concluded students who were “not quick” would struggle with more complex mathematics concepts, thus requiring additional support, which would require more work for the teachers.

Teacher content knowledge, time spent on instruction, and resource access often vary dramatically for students placed in different ability groups (Oakes, 1985; Slavin, 1990). In low track classrooms, teachers are more likely to rely on rote memorization tasks and the repetition of procedures to teach mathematics content as their beliefs concerning mathematics learning are more traditional (Stipek, Givvers, Salmon & MacGyvers, 2001). Relatedly, in a large-scale study of urban middle school mathematics teachers (Wilhelm, Munter, & Jackson, 2017), researchers concluded teachers who describe student mathematics difficulty in an unproductive manner (i.e. as a function of the student’s traits or home communities) were less likely to implement mathematics lessons where students had opportunities to participate in high quality mathematical discourse. In correlation with these findings, when students’ mathematics learning difficulty was framed unproductively by teachers, their students were more likely to be in math classes with increased proportions of students of color, and students classified as English Language Learners (ELL).

In many cases, repetitive review of the content leads to boredom, frustration, and outbursts of disruptive behavior. What teachers expect behaviorally from high achieving and low achieving groups of students has an impact on the type of instruction provided to each
group (Berry, 2008; Burris, 2014; Oakes, 1985; Slavin, 1990). Observing a tracked high school, Oakes (1985) found that a considerable time in low-track classrooms was lost to behavior management compared to high-track counterparts. On average, 80% of class time was devoted to instruction in high-track classrooms compared to only 67% for low-track classrooms. Further research has reflected comparable findings in ability grouped secondary settings (Hand, 2010).

Tate (1995) critiqued curriculum materials and specific mathematics standards for their lack of consideration for African American learners in an examination of frameworks for measuring opportunities to learn mathematics. Following a review of literature, Tate noted that four variables contribute to varying levels of teacher provided learning opportunities: content coverage, content exposure, content emphasis, and quality of instructional delivery. Tate’s findings are consistent with Oakes’ (1985) account of differential opportunities for students in low-achieving tracks. Students in these tracks, which are often disproportionately African American, are limited in their coverage of meaningful content, restricted from accessing or investigating meaningful and conceptual mathematics scenarios, and often subjected to a limited view of mathematics. Oakes further noted instructional time in low-track classrooms was dedicated to learning a series of procedures to find a single correct answer instead of a complex system of tools to help strengthen arguments, solve problems, or enhance multiple perspectives (Oakes, 1990).

**Student Trajectories and Access to Accelerated Mathematics**

Middle school mathematics placement is a strong indicator of the mathematics courses students will take throughout high school, significantly directing their path toward either college or the workforce following graduation (Akos et al., 2007; Burris et al., 2006;
Dauber et al., 1996; Faulkner et al., 2014). Moses and Cobb (2001) proclaim algebra to be the “gatekeeper” for citizenship and explain access to algebra is vital for achieving mathematics literacy and, perhaps more importantly, full democratic participation. Specifically, they associate rates of mathematics illiteracy for racial minorities with increased probabilities of imprisonment and living in poverty. They suggest that access to algebra and opportunities to effectively learn mathematics might serve as a means of liberation from these negative outcomes. Unfortunately, studies of student placement and race reveal limited access to advanced courses for African American students, Latinx students, and students from other racial minority groups (Hallinan, 1994; Ladson-Billings, 1997, 1998, 2004), meaning this liberation, although possible, is harder to achieve for students from historically marginalized backgrounds.

Useem (1992b) addressed issues of access to accelerated mathematics in middle school and discovered inconsistent requirements for placement across districts. Qualitative accounts gathered from department heads, coordinators, and principals disclosed information regarding track structures, enrollment patterns in 8th grade algebra, criteria for placement in accelerated mathematics, and how much control parents, students, teachers, and administrators had over student placement. In some districts, administrators expressed belief that standardized test results should determine track placement for students, while administrators in other districts preferred teacher recommendations take precedence. These criteria, inconsistently applied across 26 districts, resulted in varied proportions of accelerated mathematics placement. In nine of the districts, fewer than 19% of students were enrolled in algebra by 8th grade, while ten districts enrolled between 20-28% of students in
8th grade algebra. The remaining seven districts reported 8th grade enrollment in algebra to be at or over 30% of students.

Access to accelerated mathematics courses is often limited to schools where affluent and White students enroll at higher rates (Oakes, 1990). Further, in schools where the population of poor, minority students increases, opportunities to enroll in advanced placement courses decrease (Oakes, 1990), as fewer of these courses offered. Ladson-Billings describes this phenomenon in a vignette comparing the opportunities of two young adults enrolling in high school courses, where a White student in an affluent neighborhood has access to multiple advanced placement courses. In contrast, an African American student enrolled at a more diverse neighborhood high school is limited in course offerings with zero advanced placement courses (Ladson-Billings, 1995). In some instances, educators deny the existence of a relationship between race and access to accelerated opportunities. However, as Delpit (1988) illustrates, “pretending gatekeeping points don’t exist is to ensure that many students will not pass through them” (p. 292).

The opportunity gap and tracking. Among the most consistent findings in education research is that the gap in achievement between White students in the United States and their marginalized peers persists. Why White students continue to outperform their peers is the topic of continued debate. However, researchers who focus on tracking practices have attempted to pinpoint tracking as a substantial cause. Oakes (1985) suggests the tests used to differentiate the perceived capabilities of students are normed around unrealistic meritocratic principles (Cobb & Russell, 2015). Ladson-Billings (2013, as cited in Cobb & Russell, 2015) furthers this argument when she explains that standardized tests are structured to compare the intellectual abilities of racial minorities to White students, thus embodying
racism. In fact, reframing the achievement gap as a gap in opportunity “highlights the fact that current disparities in achievement are the product of long-standing structural inequities, such as access to highly-qualified teachers, resources, and so forth” (Wilhelm, Munter, & Jackson, 2017, p. 348 citing Darling Hammond, 2007; Flores, 2007).

The assumption that all students are provided with equal opportunities exemplifies meritocratic ideologies (Cobb & Russell, 2015; Ladson-Billings, 1995; Oakes, 1985). However, this belief is in jeopardy when school districts use scores from standardized tests to place students on different academic tracks. As soon as students are separated into ability groups, those placed in low-achieving tracks, some as early as Kindergarten (Shepard & Smith, 1988) are no longer afforded a level playing field with those placed in a high-achieving track. As the research has indicated, students in lower track placements are held to lower expectations, provided fewer opportunities to demonstrate their learning, and judged on their behavior more than their high-track peers. Those who believe in the myth of the meritocracy (Cobb & Russell, 2015; Oakes, 1985, p. 11) maintain these structural inequalities in schools by dismissing systemic racism.

Sociopolitical spheres of education research consider the laser focus on bridging the achievement gap to be considered problematic (Basile & Lopez, 2015; Gutierrez, 2008; 2013a; Ravitch, 2013). As Gutierrez (2013a) explains, a focus on the achievement gap begins as a concern for the learning opportunities of marginalized students, but provides a space for discourses that describe academic inequities as static, allows for the perpetuation of colorblindness by giving educators a space to discuss students of color without actually naming them, and promotes deficit thinking tied to negative narratives and stereotypes of underperforming students, all while referencing White students as the comparison group. A
recent investigation into international test scores reveals that while the gap persists between White student groups and minority and working-class student groups, students in every group have made gains in recent years (Ravitch, 2013). Thus, focusing interventions on altering existing tracking practices and expanding teachers’ professional development opportunities to eradicate low-ability attributions and entity theories of intelligence will be more productive and offer more equitable opportunities to marginalized students than an intense focus on the achievement gap.

**Investigating the Elimination of Tracking Practices**

The process of eliminating tracking within schools, known also as “detracking,” has been successfully accomplished as demonstrated by increased student achievement, improved overall learning culture, and more equitable opportunities for student learning (Burris et al., 2004, 2006; Burris & Garrity, 2008; Boaler, 2016; Boaler & Staples, 2008). Although the practice of detracking is not lacking opponents in an era of accountability (Burris, 2014; Burris & Garrity, 2008; Cobb & Russell, 2015), the placement of students into heterogeneous groups for mathematics instruction has shown students are capable of growth at all levels when given chances to grapple with applicable, complex, situational, and conceptual mathematics (Burris et al., 2004, 2006; Burris & Garrity, 2008; Boaler, 2016; Boaler & Staples, 2008).

In a diverse, suburban middle school outside of New York City, Burris and colleagues (2006, 2008) longitudinally analyzed the impact of academic tracking on mathematics achievement both before and after tracking was eliminated through universal acceleration, a process that placed all students in algebra by 8th grade. Achievement and demographic data for three cohorts of students prior to universal acceleration revealed only
11% of African American students and 15% of Latinx students chose 8th grade algebra within a structure allowing students to choose their 8th grade mathematics course. In contrast, half of White and Asian American students opted for the acceleration. Achievement levels for all students dramatically increased following mandatory universal acceleration and heterogeneous grouping. In addition to African American and Latinx students’ 23% to 75% proficiency increase on the state algebra exam, White and Asian American students’ proficiency levels soared from 54% prior to universal acceleration to 98%. This result demonstrates heterogeneous grouping’s impressive benefits for all students, dispelling the notion that high-achieving students are hindered when forced to take a class with previously low-achieving students (Boaler, 2016). Boaler and Staples (2008) contributed similar findings when heterogeneously grouped high-achievers outperformed students placed in high-track courses at nearby traditionally grouped high schools.

Studies focusing on the elimination of academic tracking noted how a key element of the detracking process was intensive and sustained professional development for teachers. In the Burris et al. (2006, 2008) studies, universal acceleration meant all teachers were responsible for teaching the same content, and that accessible, high quality, rigorous instruction was the expectation for every student. In the urban California high school where Boaler and Staples (2008) studied the effects of heterogeneous mathematics grouping over five years, the teachers made a commitment to develop and implement a curriculum that would provide students at any previous level of achievement the opportunity to participate, collaborate, and make academic growth. Within this commitment to provide equitable learning opportunities for students from all academic, racial, and cultural backgrounds, these
teachers worked to actively promote common teaching philosophies, including incremental theories of intelligence (Boaler, 2016; Boaler & Staples, 2008; Dweck & Leggett, 1988). The second team of teachers in Horn’s (2007) study of mathematics departments tasked with eliminating remedial mathematics tracks held more reform-oriented beliefs than the team described previously. Mathematics teachers’ conversations were optimistic at the reform-oriented high school. Instead of attributing student difficulties to student abilities, teachers reflected on the opportunities they provided for their students to be successful and discussed how they might alter levels of task difficulty or pedagogical practices to better accommodate students performing at all levels. Teachers’ discourse about student achievement is loaded with assumptions, beliefs, theories, strategies, and emotions (Gill & Hoffman, 2009; Horn, 2007; Horn & Kane, 2015). Further, working within an education system holding them publicly accountable for student learning, teachers take advantage of opportunities to collaborate and professionally develop each other (Gutierrez, 2013a).

**Professional Learning Communities**

Tasked with providing learning opportunities for students at every achievement level, teachers regularly collaborate to improve teaching practices such that all learners will benefit (DuFour, 2004; Tichnor-Wagner et al., 2016). Moreover, as teachers are considered internal experts at their schools, they are tasked to plan, teach, assess, and analyze the performance of every student to identify areas for improvement. Participation in a professional learning community (PLC; Dufour, Dufour, & Eaker, 2008) is more likely to be mandated by school districts to encourage increase student achievement when achievement-based accountability functions as a driving force to get all students to achieve at proficient levels. Collaborative within-grade-level teams or subject-area departments within secondary schools are not
automatically PLCs, as it often assumed (Dufour et al., 2008). Above all else, the purpose and focus of PLCs is a constant concentration on student learning (DuFour, 2004, DuFour et al., 2008; Moller, Mickelson, Stearns, Banerjee, & Bottia, 2013; Watson, 2014). An international review by Stoll, Bolam, McMahon, Wallace, and Thomas (2006) defines a PLC as “a group of people sharing and critically interrogating their practice in an ongoing, reflective, collaborative, inclusive, learning-oriented, growth-promoting way; operating as a collective enterprise” (p. 223). For teachers, this means adhering to the six characteristics outlined by Dufour and colleagues (2008) where members of PLCs demonstrate: a shared mission, vision, and goals, all focused on student learning; a culture of collaboration that focuses on learning; a joint curiosity and inquiry into current best practices; an action-oriented mentality; a commitment to improvement; and an assessment of initiatives reflected in results.

Research on teacher collaboration has demonstrated that teachers identify their membership within subject-specific departments to be the most significant aspect of their lives at work, and relationships with other teachers promote an appreciated sense of community and collegiality (Gutierrez, 2000). Further, increased levels of collegiality have been linked to a willingness to incorporate new teaching strategies as well as increased levels of professionalism (Talbert & McLaughlin, 1994), a key component to functioning within a teaching team designating itself as a PLC (Dufour, 2004; Dufour et al., 2008). Although the development of relationships with colleagues and an increase in the feeling of professionalism are workplace benefits for teachers, achievement gains for all students must be a central goal and reflecting on those gains is necessary when considering whether PLCs are actually effective within a secondary school.
Effective PLCs

Compared to the average team of teachers, effective professional learning communities offer students a wider range of learning opportunities (Louis & Marks, 1998; Moller et al., 2013). This finding may be attributed to one of the foundational characteristics of effective PLCs, which is their commitment to a shared vision intentionally focused on student learning (DuFour et al., 2008; Stoll et al., 2006; Watson, 2014). When PLC members subscribe to a shared vision, they move beyond simply collecting best practices for teaching and extend to ensure those practices lead to student learning (Dufour, 2004). Additional characteristics of effective PLCs include shared feelings of inclusivity, mutual trust, respect, support for one another, and a sense of openness (Watson, 2014). In particular, these attributes emphasize the community aspect of a PLC, and influence a phenomenon known as collective teacher efficacy (Evans, 2009).

Evans’ (2009) examination of collective teacher efficacy contributes to the discussion of PLC’s shared visions and overall effectiveness. She explains teachers have a need to feel in control of student learning, and although they attribute student success to teacher knowledge, skills, and dispositions, they only do so if a heightened collective sense of teacher efficacy coincides with high levels of student success. The collective sense of teacher efficacy is linked to student race and social class, which subsequently links causal attributions to different subgroups of students. Evans explains, “if persons or the group decide that the causes of events they face are beyond their control, such an appraisal affects their sense of efficacy, which in turn affects their response to these events” (2009, p. 68). This finding amplifies the importance for PLCs to share a vision of concern for all students’ learning. A shared vision is no longer intact if teachers attribute student failure to
characteristics of a particular group, lowering their future expectations and in turn altering opportunities for those students.

Recently, the term PLC has become ubiquitous in that it is commonly used to describe systems of teacher collaboration within schools where many other notable characteristics of legitimate PLCs are not present (DuFour, 2004; Watson, 2014). However, it is important to note that a teacher’s sense of community and collaboration may have a positive impact on student learning regardless of the label attached to the team of teachers doing the collaborating. A longitudinal study examining student achievement trajectories in elementary school mathematics (Moller et al., 2013) found students benefit from having teachers who had a strong sense of community and collaboration among other teachers. This was especially true when students’ race and social class were considered. When their teachers felt a strong sense of community and collaboration, African American students from low socioeconomic backgrounds maintained significantly greater achievement in mathematics than their peers from the same background whose teachers felt weak community and collaboration amongst colleagues.

**Teachers as Agents of Change**

In the midst of her conversation on the sociopolitical turn in mathematics education, Gutierrez (2013a) explains how the pressures on teachers within achievement-based accountability contexts leave little space for one-stop professional development interventions to make a difference in student learning. Instead, teachers have taken it upon themselves as experts of their school’s context to collectively professionally develop themselves (Gutierrez, 2013a). Because PLCs focus on teacher learning in order to further student learning, teachers engage in consistent examinations of their professional practices, reflecting on pedagogies
that promote learning for all students (Horn, 2007; Horn & Kane, 2015; Stein & Brown, 1997). Within PLCs, teachers are encouraged to move away from the solitary work that used to be planning, teaching, and grading, toward making teaching a more public activity (Watson, 2014). As effective pedagogical practices are shared with other teachers, the implementation of effective methods gains momentum, eventually leading to communal improvement across a school. However, opportunities for teacher learning across schools are not equally distributed. As Horn and Kane (2015) uncovered, teacher teams engaging in ambitious discussions related to problems of practice and solutions are more likely to have productive relationships with complex instructional practices. As meaningful pedagogical conversations within PLCs increase, the teachers within those PLCs are more likely to make complex connections between student mathematics learning and their social contexts.

Moving teachers out of isolation and into PLCs is not necessarily a seamless operation. In some instances, teachers are resistant to adopt collective personas in the name of making change in their schools (Stoll et al., 2006; Watson, 2014). Watson (2014), for example, critiques the expectation that teachers in effective PLCs must agree upon and work within a shared vision, questioning whose values are honored and therefore shared within the community. For some values to be honored, others’ may be silenced. The imposition of shared values on a team of experienced teachers may amplify the loudest voices, which may communicate inclusivity depending on the collective beliefs related to student learning and their abilities to do so. Additionally, the micropolitics associated with the work PLCs are expected to accomplish amplifies pressures on teachers to increase student performance on standardized achievement measures (LeChasseur, Mayer, Welton, & Donaldson, 2016;
Pomson, 2005). Herein lies the space to examine collective social cognitive beliefs within a functioning team of math teachers

Where PLC membership is required for teachers, their priorities for improving student learning, student achievement, and data management may conflict with priorities of their administration. When teachers gather mixed messages from principals and district officials about the focus of their efforts, teacher learning within PLCs may be stifled. A study on teacher inquiry within six underperforming urban elementary and middle schools with mandated PLCs (LeChasseur et al., 2016) sought to better understand how teachers within PLCs negotiate their practices as a cohesive unit when exterior pressures compete with one another. At half of the schools, teachers consistently reported feeling superficial relationships among the members of their mandated teams, and that this restricted meaningful collaboration. This finding indicates although the teams were officially operating as PLCs operating as PLCs, their shared mission was not carried out to fidelity and likely never present at all.

Within the same study (LeChasseur et al., 2016), district officials of participating schools disagreed with teachers on expectations for PLCs and how they should function. Because the schools in this study were already the focus of external scrutiny based on substandard student performance, principals expected PLCs to follow district mandates for making data driven decisions for their instruction, a common use for PLCs in the era of high-stakes accountability (Slavit, Holmlund, Nelson, & Deuel, 2013). Teachers reported struggling with the development of a true collaborative culture under a highly regulated structure of data collection and data-driven decision making. Instead of spending time reflecting on teaching practices and holding each other accountable for student learning,
teachers feel restricted by district officials who use PLCs as an additional means of accountability.

**Studying PLCs in Action**

While the larger study by LeChasseur and colleagues (2016) gathered observational data from within PLC meetings, the study’s primary data source was from interviews with teachers and principals. To capture the essence of a teacher team in action means to pull out the commonalities across teachers that drive collective productivity and emerge through their everyday interactions with each other, notably through a shared vision and commitment to student learning (Dufour et al., 2008). A series of qualitative observations reveal individual and collective beliefs contributing to teachers’ planning and continued development of pedagogical strategies (Gill & Hoffman, 2009; Horn & Little, 2010). For example, Gill and Hoffman (2009) used a qualitative case study model to identify teacher rationales for lesson planning decisions while discussing those details with colleagues. All observations took place during a shared planning time, once per week. The authors explained that their embedded presence allowed them to capture teacher beliefs that might be not be revealed through interviews due to their undesirability. Shared beliefs about students’ innate levels of ability, such as the repeated expression that low-ability students must be taught calculation rules before concepts, was a dominant theme Gill and Hoffman uncovered during their shared planning time observations of 4th and 8th grade teachers.

Horn and Little (2010) used similar methods, embedding themselves in an urban high school’s mathematics and English departments. In addition to gathering qualitative accounts of collective teacher beliefs that drive lesson planning, the research team also paid close attention to the professional learning opportunities available to the teachers through PLCs.
Through discourse analysis methods, the authors noticed a pattern of normalizing, or sympathizing among teachers struggling with lesson implementation. Of additional interest is the impact of the researcher’s presence and participation in the department. Teachers in one team reported feeling they could be more open with their ideas and struggles in department meetings, noting that the presence of a researcher who could relate to their struggles contributed to increased feelings of collaboration.

To gather qualitative data from a PLC in action requires gaining access to their formal and informal meetings, establishing a common presence, and becoming part of the school’s everyday mathematics teaching community. As Gill and Hoffman (2009) noted, studying teachers during their shared planning times and utilizing ethnographic methods (Creswell, 2013) may be more meaningful than conducting interviews, as implicit beliefs, achievement goals, expectations, attributions, and stereotypes may be considered undesirable in a formal one-on-one setting, and are therefore not disclosed. An investigation of collective teacher attributions for students in a tracked middle school provides a window of opportunity to intervene and promote incremental theories of intelligence and effort attributions for all students, regardless of race, social status, or mathematics placement.

**Literature Review Summary**

The consequences associated with accountability measures are a looming presence for teachers, as student performance on high-stakes tests operates as a reflection of teacher quality (Gutierrez, 2013b). For middle school mathematics teachers, the stress associated with student performance outcomes is accompanied by motivations and beliefs pertaining to themselves, their students, and the traditions of schooling. Teachers’ social cognitive constructs interact with structural tracking practices within schools and the expectations of
PLC participation in a way that places teachers in a unique position of power. At the nexus of this intersection is the space within which teachers must negotiate decisions about how they treat their students and present learning opportunities.

Teachers operationalize attributions through their discourse with one another (Wilson et al., 2014). When teachers’ beliefs about ability are consistent with a particular theory of intelligence (entity or incremental), these beliefs directly impact both high and low-achieving students. These beliefs are both subtly and overtly communicated to students through verbalized expectations, assignment types, or treatment following poor or exceptional performances, impacting how these students see themselves as mathematics learners (Boaler, 2016). Because planning rigorous mathematical tasks is no longer an isolated activity in most schools, it is wise to study mathematics teaching departments utilizing the PLC model for collaboration (Gutierrez, 2000; Tichnor-Wagner et al., 2016). Within PLCs, collective attributions, implicit self-theories, and achievement goals contribute to a pattern of teacher behaviors manifesting in different types of learning opportunities teachers provide to tracked students.

While these three constructs of interest uniquely fit together to better understand the opportunity gap, the most relevant studies contributing to this review took place prior to 2010. Teachers have since been held singularly and increasingly responsible for improving student scores on standardized tests and accountable for student performance more than ever before. Teachers’ intentions to provide equitable learning opportunities may be restricted by the accountability measures linked to their students’ standardized test performance. Further, within this environment, teachers feel as though they are under constant surveillance (Gutierrez, 2013a). Under immense pressure within such high-stakes environments, teachers
might subscribe to other department members’ attributions as a means of maintaining collegiality and reducing workplace anxiety. Thus, it is necessary to study PLCs in an achievement-focused accountability context to observe how their members’ attributions for student performance influence one another, and how collective beliefs about student abilities influence the planning process.

**Research Questions**

Considering the foundation of existing literature and the need to better understand how mathematics teacher teams’ collective social cognitive structures play a role in providing equitable instructional opportunities to students, the current study addresses the following research questions:

1) How does the context of a tracked middle school impact math teachers as they collectively evaluate student learning and plan learning opportunities?

2) In a middle school that groups students for mathematics based on perceived ability, to what do mathematics teachers collectively attribute differential student success?

3) In what ways do collective attributions and beliefs about students’ mathematics capabilities influence the planning and implementation of learning opportunities for students placed in varying ability groups?
CHAPTER 3: Methods

Site Selection and Sample

I situated this study in a single middle school, Gator Ridge, in the Green City School District located in the southeastern United States. (I have replaced all potential identifiers associated with the school and district with pseudonyms throughout.) Gator Ridge qualified for this study by meeting three conditions:

1. The school traditionally groups students by perceived mathematics ability for mathematics instruction.
2. The teachers in the school are expected to follow a PLC model for grade-level subject specific collaboration.
3. The school’s student population is demographically diverse, allowing for the interpretation of student placement and learning opportunities relative to demographic breakdowns as demonstrated by existing literature.

I contacted a district-level mathematics facilitator in March of 2017 to gain access to a school meeting these criteria. Following Institutional Review Board approval for research in July of 2017, I worked with the district to secure participation from the mathematics teachers at Gator Ridge. In August of 2017, the district granted approval for research and I scheduled introductory meetings with each of the Gator Ridge mathematics teachers. As compensation for participation, I provided each teacher with a $50 gift card at the completion of data collection in late November of 2017.

Participants

Seven regular education teachers and one student teacher served as the primary participants for this study. Each classroom teacher is responsible for four 60-minute class
periods of daily mathematics instruction and one 40-minute class period each morning (Academy Time) designated for flexible grouping and remediation as the teachers find necessary. At a minimum, each grade-level team of teachers attended two weekly scheduled PLC meetings during their shared planning time; one meeting specifically designated for collaborative planning, and another to attend to student data.

The contributions and participation in occasional grade-level PLC meetings prompted me to obtain informed consent from two additional participants – a district-level facilitator and an AIG (Academically and Intellectually Gifted) specialist. Since both participants were occasionally part of the PLC meeting process, their contributions were considered meaningful to understanding meeting contexts. However, as they did not fulfill the requirements for full participation in the study, they did not receive compensation. See Appendix A for informed consent form.

The eight teachers comprising the primary participants ranged in classroom teaching experience from less than one year to 22 years. Six of the seven teachers of record taught three grade-level classes and one advanced-level class. Angela, the student teacher, was not a teacher of record, and Dawn had a non-traditional math teaching role at Gator Ridge. Dawn was previously the mathematics interventionist for all grades. However, Dawn was tasked with teaching one 6th grade math class in addition to her three “exploratory” math electives due to the increased 6th grade student population this school year. All participating teachers of record are White, while the student teacher self-identifies as Indian American. See Table 3.1 for a summarized description of the participants.
Table 3.1  
Participant summary.

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<th>Name</th>
<th>Grade level/ Position</th>
<th>Years of experience</th>
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<th>Classes taught</th>
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</tr>
<tr>
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<td>3</td>
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<td>Intervention elective: 1 per grade level</td>
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</tr>
<tr>
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<td>4</td>
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<td></td>
<td></td>
<td></td>
<td>Math 7+: 1 section</td>
</tr>
<tr>
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<td>&lt;1</td>
<td>Math 7: 3 sections</td>
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<tr>
<td>Julie</td>
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Subjectivity Statement

As a former 7th grade mathematics teacher, I worked within a grade-level team driven by student success. Compared to other grade-level teams at the school, my team’s youth and fewer years of experience seemed to correlate with our willingness to adjust our teaching styles to best accommodate our students. However, as accountability pressures resting on student test scores increased, our instruction grew noticeably structured around the types of practices we deemed appropriate for our students such that they would be proficient on the state-mandated standardized test at the end of the school year.
In my former school, students were placed into one of three or four ability groups for mathematics. In accordance with the literature, instructional styles, learning opportunities, and ideas about mathematics learning varied from one ability group to the next, and often from one teacher to the next. As a researcher who has studied the implicit beliefs individuals hold related to mathematics learning and how these beliefs are intertwined with the practices of grouping students by perceived ability, I have been increasingly reflective on the learning opportunities I provided to my former students. Further, I have been curious about the dynamics that were present within my PLC that made us seemingly successful through the eyes of accountability measures, but perhaps not as successful at providing equitable learning opportunities to our students. I have often witnessed the ways teachers talk about mathematics ability as a static human characteristic and am increasingly interested in how to ameliorate these beliefs in order to move toward more equitable teaching practices for middle school students. My experience as a middle school mathematics teacher combined with my more cognizant research lens provides me with a unique perspective with which to observe and interpret this phenomenon. I have incorporated strategies to minimize researcher subjectivity within the qualitative data analysis and maintain the credibility of the results.

**Role of the Researcher**

In an attempt to become an embedded member of the mathematics teaching community, I shared my experiences pertaining to methods of practice, knowledge of mathematical concepts, and memories pertaining to school-related activities such as coaching or field trip planning when appropriate. Primarily as an observer, my role required me to watch closely and listen intently to gather each teacher’s conceptions of student learning. During observations, the teachers did not ask me for my opinions or ideas but did express
their curiosity regarding my research. Although they knew I was unable to share my opinions about the ways they structured their classroom instruction, they frequently reminded me that they were anxious to hear this study’s results so they could gather meaningful external feedback. Additionally, down time during planning periods, time after school, and conversations during lunch were casual in nature and typically focused on social activities unrelated to school. My presence during these non-instructional moments established trusting relationships over the course of data collection.

Although students were not the unit of analysis for this study, they became comfortable with my presence in the classroom over the course of data collection. Albeit infrequently, during my observations I did assist students at times. Typically, these instances were characterized by a student noticeably in need of assistance waiting patiently to get the attention of their teacher. I would approach them to see if they had a question I could answer. When they accepted, I would assist them in a way consistent with the teacher’s types of questioning and expectations for that particular class.

For the remainder of observational data collection, I sat in a back corner of the classroom out of the way. Ultimately, I focused on being accepted within the mathematics community at Gator Ridge. The relationships I formed over this time were collegial and, in every instance, welcomed by the teachers. As the semester progressed and responsibilities for the teachers increased, we would engage in conversations about the challenges they encountered and how they planned to overcome them. These conversations strengthened the trust between me as a researcher and the teachers which in turn reinforced the validity and reliability of the qualitative data.
Ethnographic Case Study Approach

Hammersley (2006) defines the approach of ethnography in the following way:

I will take the term to refer to a form of social and educational research
that emphasizes the importance of studying at first-hand what people do
and say in particular contexts. This usually involves fairly lengthy contact,
through participant observation in relevant settings, and/or through
relatively open-ended interviews designed to understand people’s
perspectives, perhaps complemented by the study of various sorts of
document - official, publicly available, or personal. (p. 4)

With this in mind, and for the purpose of this study, ethnography as a qualitative approach is
an appropriate fit. Traditionally, researchers who engage in ethnography are “embedded”
within a culture for extensive periods of time in order to better understand the everyday lives
of their participants. Although I position myself as a researcher within a school for nearly a
complete semester, this length of time is much shorter than that of a traditional, cultural
ethnography. Therefore, it is more appropriate to refer to this approach as an ethnographic
case study (Parker-Jenkins, 2016), as a case study alone “does not reflect or do justice to the
level of involvement that a researcher must undertake in an ethnography over a long and
sustained period of time” (Parker-Jenkins, 2016, p. 4), and an ethnography alone would
require at least a complete year, if not multiple years to completely interpret the cultural
norms of the population of interest. Within an ethnographic case study, trust can be gained
among participants by becoming a regular member of the community.

Ethnographic Field Notes. A significant portion of data from this study takes the
form of ethnographic field notes (Emerson, Fretz, & Shaw, 1995). As an embedded member
of the school community, it was imperative that I engage with the teachers as seamlessly as possible. Field notes can be used as a running record of observations, with intermittent jottings keeping track of specific instances of interest (Walford, 2009). Field notes can also be expanded upon following an interview or observation through reflective journaling, building upon thoughts that were too complex to capture in the immediate moment. The field notes for this study add to the thick description (Geertz, 1994) necessary to provide a complete picture of the happenings in a tracked middle school.

Additionally, field notes serve as an “inscription on social life and social discourse” (Emerson, Fretz, & Shaw, 1995, p. 8), and transform the occurrence of a passing event into a record that can be analyzed and categorized at a later date. As Emerson and colleagues emphasize, the interpretation of an event is dependent upon the sensitivities and concerns of the researcher. Thus, in this study, as I documented observed teacher interactions in addition to observations of individual teachers implementing lessons, the dual-focus of the field notes included 1) communicated social cognitive constructs and 2) the opportunities to learn provided to each group of students.

Uncovering the local meaning of the observed culture is a primary goal of ethnographic research (Emerson, Fretz, & Shaw, 1995). For this study, the hours I spent immersed in a middle school setting among math teachers required an openness to interpreting what it means to be a math teacher at this particular school, as free as possible from pre-conceived notions for what might be expected in the day-to-day collaborating, planning, and implementation of mathematics lessons. Further, carrying out ethnographic methods means that data collection is intertwined with, and therefore inseparable from the methods of analysis (Emerson, Fretz, & Shaw, 1995). Thus, field notes maintain a running
record of observed actions, comments, and relative physical features associated with grade-
level team meetings and individual classroom observations. Primarily, I documented field
notes on a laptop computer and supplemented with notebook jottings or notes taken on my
iPhone when a laptop was either inappropriate or inaccessible. Occasionally, I practiced
reflective journaling to contextualize a PLC meeting or full-day teacher observation.

**Semi-Structured Interview Protocol.** Later in the fall semester, I utilized a semi-
structured interview (DeMarrais, 2004) to capture each teacher’s individual beliefs about
mathematics ability, as well as their intentions with external achievement goals and
attributions for students in each academic track. Interviews featured open-ended questions
that could be expanded upon if necessary. Questions for the one-on-one interviews and focus
groups were inspired by questions asked of teachers in Oakes (1985) *Keeping Track*, and
Jackson, Gibbons, and Dunlap’s (2017) study on teachers’ views of student’s math
capabilities. See Appendix B for semi-structured interview protocol.

**Focus Group Protocol.** Teachers then participated in a focus group (Kreuger &
Casey, 2002) with their grade-level mathematics PLC. During this focus group, I posed
questions from a focus group protocol to guide discussion among the teachers as they
considered their collective thoughts on ability grouping, opportunities to learn, and implicit
theories for mathematics learning. The focus group provided teachers with an opportunity to
collectively ruminate on the pressures they feel to demonstrate student learning. Teachers
also used this time, prompted by specific questioning, to share beliefs about existing tracking
structures. See Appendix C for the prompts utilized during grade-level focus groups.
Procedures

Timeline. Figure 3.1 demonstrates the timeline for this study. I met with each mathematics teacher at Gator Ridge during the two teacher workdays prior to the first day of school. During this time, I outlined my role as the researcher and each provided their informed consent. Beginning the first day of school, August 28, 2017, I was present at the school five days per week. Each day, I observed a single math teacher for the complete school day. My presence at the school remained constant through mid-October, when I began to taper my time to four days per week, down to one day per week in late November. I completed individual teacher observations and PLC meeting observations during the first seven weeks of school, one-on-one teacher interviews in late October through mid-November, and lastly focus groups with grade-level PLCs at the end of November.

Study Timeline

*Figure 3.1. Ethnographic case-study timeline.*

Classroom Observations. Beginning on the first day of school, I spent complete school days observing a single classroom teacher. Each teacher of record was observed for three complete school days over the course of the fall semester. My original plan was to schedule full-day observations Monday through Friday each week, observing grade-level PLC meetings during that teacher’s grade-level planning. However, after the first two weeks
of observations, I amended this observation schedule to maximize the number of grade-level PLC observations. I scheduled PLC full-day observations of individual teachers Tuesdays through Thursdays because PLC meetings occurred on Mondays (for two of the grade levels) and Fridays (for every grade level). See Table 3.2 for a sample weekly observation schedule.

Table 3.2

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 PLC planning</td>
<td>Full day single teacher</td>
<td>Full day single teacher</td>
<td>Full day single teacher</td>
<td>8 PLC data meeting</td>
</tr>
<tr>
<td>meeting</td>
<td>observation</td>
<td>observation</td>
<td>observation (6th grade)</td>
<td></td>
</tr>
<tr>
<td>7 PLC planning</td>
<td></td>
<td></td>
<td></td>
<td>7 PLC data meeting</td>
</tr>
<tr>
<td>meeting</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6 PLC data meeting</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6 PLC planning meeting</td>
</tr>
</tbody>
</table>

Full day observations, including planning time, grade-level meetings (including teachers of all subjects), lunch time, and the time spent at school before and after the school day allowed me to see how each teacher prepares for and implements lessons for each group of students. Each individual observation began just before the start of the school day and finished in the time after students were dismissed. In many cases, conversations with the teachers at the conclusion of the school day were reflective on the part of the teacher, adding to my interpretation of their individual dispositions. I paid special attention to any teacher expression of perceived student capability, especially if the expressed perceptions varied between classes, and I noted those instances as soon as possible within field notes.

I took ethnographic field notes for each full-day classroom observation using a laptop computer. At Gator Ridge, teachers teach four 60-minute classes per day, one 40-minute flexible instruction class (Academy time), and have a single, 90-minute planning period. I noted specific details and descriptions for classroom observations including each classroom’s
setting (e.g. desk arrangement, the teacher’s orientation relative to the students), the classroom atmosphere (e.g. students’ behavior when entering the classroom, students’ mood as they attend math class) the teacher’s mood, the lesson type and style for the day (including directions from the teacher, the teacher’s role in the lesson, what was expected of the students, overall responses from the students toward the teacher’s expectations), and the level of cognitive demand for the lesson or task. I later utilized The Task Analysis Guide (TAG; Smith & Stein, 1998) to address the cognitive demand of each lesson. For tasks coded using the TAG, I considered the expectations from the teachers, the directions they provided to the students, and what the scanned learning opportunity prompted the students to actually do.

During lunch, the teachers were responsible for monitoring students in the cafeteria. In keeping with ethnographic methods, I accompanied each teacher to lunch and socialized with them and their colleagues while also witnessing their responsibilities in action. When these conversations among teachers expanded to include interpretations of student capability, I used my iPhone to record contemporaneous jottings. Jottings (Emerson, Fretz, & Shaw, 1995) can be used by a researcher to recollect an event, or in this study, a conversation that occurs, when full field notes are written up at a more appropriate time.

Over the course of each school day, there were moments where students worked silently, or instruction was repetitive (e.g. small group station rotations over the course of a 60-minute class period). It was during these times that I captured the essence of the class in field notes, summarizing the overall classroom atmosphere and connecting that to the lesson content, the lesson structure, and teacher-student interaction. By the end of a complete school day, I adequately captured the teacher’s experience.
Lastly, as a means of identifying the types of learning opportunities afforded to different groups of students and provided by different teachers, I recorded blank student assignments (e.g. worksheets, problem sets) using an iPhone scanner application. I scanned these assignments during the classroom observation associated with a specific teacher and included them in field notes from that day. I also gathered student assignments from teachers during their grade-level PLC planning meetings such as scanned worksheets or task-sheets that would be presented to the students to complete in small groups.

**PLC Meeting Observations.** With the aim of intimately understanding the dynamics of each grade-level mathematics PLC, it was my intention to attend every scheduled grade-level PLC meeting for each grade, as well as any informal, unplanned meetings (during a shared planning time, for example) that occurred during classroom observation days while I happened to be present. Once I began classroom observations and the PLC meeting schedule became apparent, I adjusted my observation schedule to maximize the number of PLC meetings I could attend. In an effort to more intentionally attend to student learning, the mathematics teachers at this school have split their scheduled PLC meetings into two specific types of meetings. Weekly, each mathematics PLC commits to meeting for 90 minutes to collaboratively plan, and for 30 minutes to specifically attend to student performance data. Refer to Table 3.2 for a typical weekly schedule for PLC meeting observations.

During each grade-level PLC meeting, I took ethnographic field notes on a laptop computer (Emerson, Fretz, & Shaw, 1995), and scheduled meetings were audio recorded to be referenced during analysis. Field notes functioned to capture conversations that took place among teachers, including salient comments (Wolfinger, 2002). Within my field notes, I also documented the physical setting of each meeting, the general dispositions of each
teacher, and the primary points of discussion (e.g. best teaching practices, classroom management issues, grading practices, task planning, etc.).

On two occasions in mid-September and mid-October respectively, I observed the mathematics department “vertical” PLC meeting. Dawn (the previous math interventionist) structured these hour-long meetings to address concerns among the mathematics department. During these meetings, I took field notes as the teachers discussed resource availability, expectations for lesson structure, supply needs, and one chapter from Jo Boaler’s (2016) book *Mathematical Mindsets* as part of an ongoing book study.

**Teacher Interviews.** Following the completion of every classroom and PLC meeting observation, I interviewed the eight participating teachers individually in a quiet location of the teacher’s choosing (e.g. a classroom or break room) for approximately an hour. I provided each teacher with a copy of the interview questions to follow during the interview.

I audio recorded interviews with the permission of each teacher and transcribed each interview within two weeks using the transcription program *transcribe*. During each interview, a paper copy of the interview questions was used to jot notes and symbols serving as reminders of noteworthy comments made pertaining to ability grouping, external attributions, theories of intelligence, achievement goals, stereotypes, or differential learning opportunities for students. Following interview transcription and an additional listen through, I reviewed each teacher’s interview transcript in person with them. This process allowed me to ask any final clarification questions, and also served as a member check.

**Grade-Level PLC Focus groups.** The final source of qualitative data was derived from three small-scale focus groups, one with each grade-level mathematics PLC. I scheduled focus in the weeks between Thanksgiving and winter break after I had completed
and transcribed every individual interview. The hour-long group interviews took place in one of the mathematics teacher’s classrooms. The 7th and 8th grade focus groups were conducted during their planning time and the 6th grade focus group after school following an early release day. I moderated the focus group discussion using a series of prepared questions, and when appropriate, I added relevant questions based on the discussion’s direction. With permission from all team members, I audio recorded each focus group and transcribed within one week using the transcription service *transcribe*.

**Credibility**

For this study, I intentionally and carefully collected data from a variety of sources. Because I collected field notes through a series of individual teacher and PLC meeting observations and conducted interviews and focus groups, I was able to triangulate my findings across data sources. In the weeks following interview transcription, I returned to Gator Ridge to engage in the member checking (Creswell, 2013) process with each participating teacher. During this meeting, each teacher approved of their interview transcript and answered additional follow up questions that emerged during the transcription process. Lastly, the consistency of data collection over fourteen weeks contributes to the reliability of the findings. The teachers quickly became comfortable with my presence in their classrooms and eventually treated me as a regular member of their Gator Ridge mathematics community.
CHAPTER 4: Results

Data Analysis

In January of 2018, I analyzed each source of qualitative data using qualitative data analysis software, *NVivo 11*. Interview transcripts, focus group transcripts, ethnographic field notes from both PLC meeting observations and teacher observations, and scanned learning opportunities from those observations were analyzed using first-cycle and second-cycle coding techniques (Miles, Huberman, & Saldaña, 2014).

For transcripts and meeting observations, coding began by considering complete statements uttered by teachers. Specifically, I coded complete segments of interaction that were similar to what Horn (2005) categorized as *episodes of pedagogical reasoning*, “moments in teachers’ interaction where they describe issues in or raise questions about teaching practice that are accompanied by some elaboration of reasons, explanations, or justifications” (p. 215). The first cycle of coding utilized both deductive and emergent codes.

Codes that emerged in the field are outlined in the section that follows.

**Emergent codes from the field**

Codes emerged as time in the field progressed and throughout the data analysis process (Miles, Huberman, & Saldaña, 2014). As teachers made attributions for student performance unrelated to the model of external social motivation, they were recorded and utilized in remaining analysis. When an attribution emerged later in analysis, previously coded data were recoded with said attribution(s) specifically in mind. Examples of emergent attributions for student performance include *support from parents*, *gaps in knowledge*, known or observable *traits* of the student (such as an EC identification or language barrier issue), and *curriculum* concerns.
Additionally, codes emerged or were created as a way to ensure the research questions were accurately and specifically answered. For example, because the second research question seeks to identify what teachers collectively attribute to differential student success, I developed a series of codes that pinpoint moments where the teachers were in agreement with one another. Thus, while analyzing focus groups and PLC meeting field notes, I utilized codes like consensus, and consensus minus one to indicate that either the entire team was in agreement, or that two of the three members were in agreement regarding their ideas. Further, as inspired by the PLC literature (Dufour, Dufour, & Eaker, 2008), moments from meetings or focus groups where teachers agreed upon both the evaluation of student work and the subsequent planning of learning opportunities were coded using the shared vision code.

For nearly a complete semester, I was embedded at Gator Ridge collecting qualitative data. Thus, numerous codes emerged in the field directly related to each teacher’s general disposition, to their ideas about what it meant to work in a productive math PLC, or to prior years of experience teaching middle school mathematics, for example. These codes allowed me to capture the culture of teaching and teacher teamwork at Gator Ridge far beyond the boundaries of the model of external social motivation. For instance, the teachers frequently discussed the expectation for them to implement a series of top-down initiatives originating from either the district-level or administrative-level. Therefore, one of the most prominent and frequently used emergent codes was that of initiatives. For a comprehensive list of codes and their definitions, refer to the codebook in Appendix D.
Deductive Codes – The Model of External Social Motivation

Using the model of external social motivation as a guide, I settled on three different components for coding. These three components functioned as deductive codes (Miles, Huberman, & Saldaña, 2014). As the model of external social motivation notes the relationships often realized between a teacher’s external ability attribution, goal orientation, and personally held theory of intelligence, I coded each of these items separately when communicated by teachers. For the purpose of later analysis, I paid special attention to how each teacher’s ability attributions aligned with student placement within perceived ability groups. Goal orientations were coded as either mastery or performance when articulated by teachers in observed settings, interviews, or focus groups. Finally, any time a teacher indicated that they recognize the existence of inherent mathematics ability, I coded this as a reflection of their personally held theory of intelligence.

To better understand the comments I highlighted while coding these components, consider the following examples. During a full-day observation in Kayla’s 6th grade classroom, her first period began with students checking their homework against an answer key displayed via projector on the front board. While students worked, Kayla noticed one of the answers was actually incorrect. She used the incorrect answer on the key to communicate to her students the importance of making and learning from mistakes. I decided to code this classroom interaction as a communication of the mastery orientation.

As an additional example of how I utilized the model of external social motivation in the analysis of qualitative data, any comment from a teacher suggesting they implicitly adhere to the idea that mathematics ability is inherent, or a trait that some people have while others do not, was coded as math person. Sample evidence of the math person idea was
captured during an observation of Mark’s 7th grade first period when he casually told his students, “if you’re a math person, you can really see that they’re really the same thing,” during a lesson on multi-digit decimal division.

Goal orientations, theories of intelligence, and ability attributions were communicated by teachers often and were therefore present throughout the data sources with the exception of the scanned learning opportunities. During the second-cycle of coding, codes for goal orientation, theory of intelligence, and ability attribution were queried to detect patterns of belief and behavior within and across teachers. These patterns will be further discussed within the key findings regarding equity dispositions for teachers as participants in grade-level mathematics PLCs.

**The Controllability Dimension – Attribution Theory**

Attributions primarily exist along three dimensions: locus, stability, and controllability (Graham, 1991; Reyna & Weiner, 2001; Weiner, 1985). Evans (2009) noted how teachers’ need to be in control of student learning is directly related to their collective feelings of efficacy for student learning. Recall her emphasis on teachers collectively attributing student struggles or failure to factors deemed outside of teacher control and how those attributions decreased their sense of efficacy and thus their behavior. Alternatively, Evans explained that collective teacher efficacy was heightened when students were successful, and the teachers could attribute the success to teacher knowledge, skills, and dispositions. With this study specifically in mind, I dissected each attribution made by the teachers along the controllability dimension. Importantly, because the teachers are the focus of this study, I determined the dimension of controllability based on *their* perceived ability to control the factors they saw as contributing to student performance.
Three of the four primary attributions from attribution theory were included as deductive codes for spoken teacher attributions. Ability, effort, and task difficulty were utilized, whereas luck was not included in the coding scheme because it did not occur as one of the attributions used by teachers to explain the performance of their students. For each of the three primary attributions, the controllability dimension was considered. When teachers attributed student success to student ability, contextual features allowed me to determine whether the teacher believed the student’s ability was something they, the teacher, had control over. Therefore, I broke down the ability attribution as two separate codes: ability_c, indicating the teacher believes the student’s mathematics ability is something the teacher can control, and ability_u, indicating the teacher believes the student’s mathematics ability is out of the teacher’s control. I was also able to break down task difficulty into two separate codes. If the teachers wrote a test and then later explained that students struggled because the problems were too challenging, this was coded as task difficulty_c, as the teachers were in control of the challenge level presented to students. However, when results returned from a district-level assessment and the teachers stated that students struggled due to the rigor of the questions, this was coded as task difficulty_u, since the test questions were out of the teacher’s control.

In every case where teachers attributed student performance to the student’s level of effort, the effort expended by the student was always considered out of the teacher’s control despite their desire to increase the effort their students put into learning and completing tasks. While student effort was always out of the teacher’s control, it still functioned as an upper-level code with sub codes communicating various types of effort or lack thereof in their students. Sub codes for effort included apathy, belief in self, organized, and advocate for self.
Finally, as previously mentioned, I evaluated each emergent attribution along the controllability dimension. Some attributions were inherently out of the teacher’s control, such as the curriculum they are required to follow, or factors associated with the school, like a student’s schedule. However other emergent attributions could be categorized divided along the controllability dimension depending on the context within which they were employed by the teacher or teachers. For example, consider the external support attribution. When teachers attributed student success to having provided additional support, such as intentional one-on-one instruction, or pulling them for additional practice in Academy Time, that attribution for success was coded as controllable support, or support_c. Conversely, when student success was attributed to external student support that was out of the teacher’s control, such as parental support, this attribution was coded as support_u.

**Coding Opportunities to Learn**

With regard to the third research question, which seeks to identify the ways collective attributions contribute to the planning and implementation of learning opportunities for differently perceived ability groups, the observed learning opportunities needed to be evaluated to allow for comparison across teachers and grade-level PLCs. I captured opportunities to learn in three distinct ways. First, when teachers discussed enacted lessons either with each other or during their interviews, their description of the task as it was implemented was coded. Second, as teachers planned future learning opportunities during their PLC meetings, the descriptions and expectations for student engagement were recorded and then coded appropriately. Third, assignments, worksheets, and class activities were scanned during full-day individual teacher observations or PLC planning meetings.
Two distinct tools were utilized to deductively code each learning opportunity: Smith and Stein’s (1998) Task Analysis Guide (TAG) and the Eight Standards for Mathematical Practice from the Common Core State Standards (National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010). When possible, each learning opportunity was categorized using the TAG and simultaneously coded for each mathematical practice for which the task allowed opportunity. To be clear, learning opportunities captured for the purpose of this study did not allow for dual coding in every occurrence. For instance, assignments coded memorization with the TAG could not be coded further because opportunities for students to engage with the mathematical practices were not present.

Finally, codes emerged in the field that allowed me to assign a specific purpose to each scanned or observed learning opportunity. Beyond the TAG and the Standards for Mathematical Practice, these codes describe what the teachers hoped students might gain from each opportunity. For example, on the day before each summative assessment, 7th grade students were heterogeneously grouped for a “carousel review.” This assignment was double-coded as practice and reteach/review. Further, as teachers planned learning opportunities during observed PLC meetings, their descriptions were taken into account for the coding of said opportunities. Thus, when analyzing learning opportunities planned during a 7th grade planning PLC meeting, for example, the small group station referred to as “practice with the key” was coded as practice in addition to any potentially relevant deductive codes from the TAG and Standards for Mathematical Practice.

For every learning opportunity observed, described, or scanned for the purpose of analysis for this study, I also recorded the perceived student level. Specifically, when
teachers planned to provide a particular worksheet to their “regular” classes, I noted the link between the assignment and the students who worked through it during the coding process.

Queries for Analysis

Once the first-cycle of coding was complete, I completed the second-cycle of coding with queries run in NVivo 11. I ran queries within each grade-level for the purpose of identifying collective attributions made for students who are successful, collective attributions made for students who are underperforming, and the frequency of specific types of attributions made for different levels of student performance more generally. Each query included tags to detect whether the teachers were referring to “regular” or “advanced” classes, and whether they held higher or lower expectations for the group they were discussing. I also collapsed codes into meaningful units where the overlap of specific codes highlighted patterns of behavior among and within teachers. For example, consider the employment of matrix coding (Bazeley & Jackson, 2013) which allowed me to look within one case, like the 8th grade mathematics PLC. With this analysis technique, I was able to look within all of the data sources coded as 8 PLC and could look at how the teachers’ attributions for student performance and expectations for different groups of students overlapped with one another. Matrix coding queries revealed patterns of beliefs that differed for each ability group, and I was able to infer how collective attributions contributed to the planning and implementation of differential learning opportunities across teacher teams.

Additional tools in NVivo 11 allowed for more general analyses of the Gator Ridge math department. For example, the Explore tool allowed me to visualize the frequencies of attributions utilized by all mathematics teachers and from every source of data collected. The hierarchical chart provided pictorial representations of the attributions used in relation to
each other (See Figure 4.1 for a breakdown of the attributions used by math teachers over the course of the study). This broad analysis provides a context within which to firmly understand how the math teachers at this school evaluate different levels of student performance, while paying particular attention to the dimension of controllability.

**Key Findings**

**Research Question 1**

How does the context of a tracked middle school impact math teachers as they collectively evaluate student learning and plan learning opportunities?

**Descriptive and Contextual Features of Gator Ridge**

Gator Ridge is located in a suburban community. The school serves a diverse population of approximately 630 students. Table 4.1 outlines the demographic breakdown of the students. Public data from the 2016-2017 school year indicate that 56% of the students who took the state standardized test for “regular” mathematics last year were proficient, while 95% of the students who took the state standardized test for Math I were proficient. Additionally, the school follows a one-to-one model, which means every student is issued a laptop computer for use during the school year. The computers are checked out at the beginning of the school year and are checked back in following testing.

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>Percent of student population</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>52%</td>
</tr>
<tr>
<td>Latinx or Hispanic</td>
<td>34%</td>
</tr>
<tr>
<td>Black or African American</td>
<td>10%</td>
</tr>
<tr>
<td>Mixed Race</td>
<td>3%</td>
</tr>
<tr>
<td>Asian and Native American</td>
<td>&lt; 1%</td>
</tr>
</tbody>
</table>
At Gator Ridge, the school day begins when students arrive in the classroom at 8:20 A.M. From 8:20 until 9:00, Monday through Thursday, the math teachers utilize Academy Time to work with small groups of students. Two of these days are spent with a permanent group of between 8-12 students who were hand-picked based on their prior standardized test scores. These are students who have “always passed the reading test but have never passed the math test.” Every math teacher except Dawn has one of these permanent groups. Dawn’s permanent academy group consists of eleven 8th grade students who she personally selected as a group of students who struggle with their “mindset.” She shares how she hopes to focus their time together on developing a growth mindset and other keys to success. The other two days of Academy Time allow the math teachers to flexibly group students and pull them for tutoring, remediation, test corrections, or retests as needed. On Fridays, every teacher in the school sponsors and supervises a club during Academy Time.

I arrived at Gator Ridge each morning and set up in the back corner of a math classroom. Within two weeks, I settled into the school day routine with the math teachers and the students. Teachers moved quickly to make last minute copies or to perfect the message displayed on their SMART boards before students arrived. Once the small group of students trickled in at 8:20 for Academy Time, they followed any posted or spoken directions. This process was unique to each teacher but followed the same general set of expectations. In Julie’s 8th grade classroom, students chose to sit in two demographically segregated groups of five during Academy Time as Julie made last-minute instructional decisions from her desk. In Mark’s 7th grade classroom, students huddled around a semi-circle table at the front of the classroom where Mark perched on a stool off to the side. In Karen’s 6th grade classroom, students sat at a collection of individual desks in the middle of the classroom
where Karen would then sit among them. Ultimately, the math teachers were engaged with their students from the moment they entered each morning regardless of the teacher’s unique style.

As one of three middle schools in the Green City school district, Gator Ridge math teachers are keenly aware of their students’ performance compared to the other two middle schools. In fact, the modest size of the district allows for cross-school collaboration, planning, and assessment-item writing during professional development days. Consequently, the teachers at Gator Ridge are reasonably familiar with their colleagues from other schools’ math departments. When comparing their students, the Gator Ridge math teachers often mentioned where they believe they stand, performance-wise.

A typical example of this type of comparison arose during the 7th grade focus group when Emma and Mark reflected upon district-wide benchmark scores from the previous school year. The episode began with Emma reminding Mark, “I don’t know if you remember when we were sitting in the data room, and we pulled up [the scores].” She then turned to me to make clear, “So, Columbus Middle has always been way higher than us, because they have a very different population than we have. Their population is just very different. And so, they’ve always just naturally been way higher.” Mark added on to her statement by saying, “It’s frustrating. They have more plus classes than us, too.” Emma continued, “but we realized that we had actually scored higher than the district, and we beat Columbus Middle, that is never beaten in anything!” Mark finished the episode, pumping his fists and exclaiming, “Heck yeah!”

This excerpt demonstrates many relevant components and helps contextualize this study’s findings. First, Gator Ridge teachers are cognizant of their students’ performance in
relation to those from other schools in the district. Second, as I will discuss further in the findings specific to teacher attributions, these two teachers (and others as well) attribute other schools’ success to their “very different” student populations. Third, although this excerpt does not directly specify, the teachers were reflecting on a recently adopted small group teaching method that might have contributed to their benchmark success last year. Lastly, the comparison of students across district schools is only one of the venues where teachers feel pressure to improve their students’ test performance.

The following two sections of this chapter contextualize the actions and ideas of the math teachers at Gator Ridge. Two distinct structural components emerged as constraints that ultimately impacted their attributions for student performance and the types of learning opportunities they provided. The two emergent contextual features are 1) the expectation for teachers to implement specific initiatives dictated by school or district-level administrative officials and 2) the pressure to improve students’ scores on district and state-mandated tests. I present evidence for each emergent issue by grade level for the purpose of developing the general character of each PLC. For clarity and when necessary, I altered teachers’ direct quotes to remove potential identifiers and correct for grammatical inconsistencies.

Initiatives and the elimination of teacher autonomy. The embedded nature of the ethnographic case study approach allowed me to gather the everyday work context of Gator Ridge math teachers. As a member of the school community, I grew to understand what was expected of the teachers and the challenges they faced. This intimate understanding of the school’s context surpassed what might have been learned from interviews and focus groups alone. My time at Gator Ridge made me aware of the numerous principal and/or district-level mandated initiatives, presumably intended to support student learning.
I witnessed teachers trying to integrate several initiatives including the administration of district-wide pre-unit, benchmark, and final unit assessments (administered online within a specific window), the use of AVID strategies for organization, the utilization of formative lessons following a format similar to complex instruction (Boaler, 2016), and the participation in bi-weekly formal PLC meetings for planning and student data evaluation. However, two specific initiatives emerged by more profoundly impacting teachers’ day-to-day practice. First, teachers were required to utilize small group instruction in their classrooms. Second, they were expected to use a brand-new web-based textbook resource. The online textbook which will be referred to throughout as Breakthrough was implemented at the start of the school year without teachers having any opportunity for training.

**Initiative: Small group instruction.** Mandated by the principal, each core-subject teacher at Gator Ridge was required to provide between one and two hours of weekly small group instruction to their students. With each class-period lasting 60-minutes, teachers were expected to plan and implement small group instruction for approximately two full days per week. That, “or 20 minutes per day,” as Caroline clarified during the 8th grade focus group. By Sunday evening each week, teachers must complete an online form indicating the dates and times they expect work with small groups in the coming week, so the principal and assistant principals knew when to conduct informal observations.

It was evident early in data collection teachers had not received training or professional development regarding the best practices or specific expectations for teaching students using small groups. However, the principal had separate conversations with each PLC regarding what he expected to see in their classrooms. According to the teachers, these conversations were not specific, nor did they provide pedagogical support. Without a
coherent set of expectations detailed for the teachers, the mandate to teach using small groups was interpreted differently by each math team, resulting in noticeably different execution.

6th grade PLC. Relative to the other two math PLCs at Gator Ridge, the 6th grade PLC has worked together for the least amount of time. Kayla, who happened to be the youngest teacher on the team, had the longest tenure at Gator Ridge. Joined by Dawn, the math-interventionist-turned-lead-6th-grade-math-teacher, and Karen, a 22-year veteran yet Gator Ridge rookie, the 6th grade PLC was in the process of ironing out differences in their instructional preferences to work toward a common goal. Specific to the small group instruction initiative, the 6th grade math teachers were individually at varying stages of interpretation and implementation.

Because the small group initiative played a role in restricting teacher autonomy, I took advantage of the focus groups to ask each PLC how they interpreted the small group mandate. During the 6th grade focus group, Dawn used what she had gleaned from her interactions with the principal in her role as math interventionist to rationalize his intentions, stating, “I've recognized he is looking for more individualized instruction (Kayla: mm hmm). A small group, not because of the strength of the collaboration, but because not every student in the classroom has the same needs. So instead of delivering one-size-fits-all to everybody, the idea of the small group is that you're better able to target the instruction to meet the needs of that group.”

Affirmed by both Karen and Kayla, this interpretation identified the purpose of small group instruction as providing individualized lessons to meet the needs of every student. In 6th grade math classes, teachers implemented small groups in different ways. Typically, when
a 6th grade math teacher determined students were the most in need (based on a prior performance measure such as an exit ticket, homework assignment, or quiz score), they would be pulled from classwork activities to work as a small group on more directed practice with the teacher.

It was apparent from the first four 6th grade PLC meetings that the small group requirement was impeding more preferred teaching styles. In two consecutive meetings, Karen shared with me and her teammates that the push to work closer with the neediest students was forcing her to give underperforming students the majority of her attention. She found this to be unfair, saying to me at the conclusion of one of the PLC planning meetings, “everyone needs me, not just the low group.”

As a further point of note, Karen often used general encompassing terms like “high group,” “AIG group,” “low group,” and “inclusion group” when talking about student needs and perceived abilities. As the teacher who struggled the most with the expectation to work with students in small groups, Karen was also the most outspoken. During the focus group, she further contributed to the conversation adding, “as a teacher, there’s only so much we can offer and do to try to include everyone. Even with the different activities. I would love to do ten lessons a day, different lessons for 104 students, but we have to be reasonable. I just feel like this year, I don’t feel like I’m being 100% fair to all of my students with the way that I’m teaching.”

Although she was the most candid throughout data collection, the struggle to plan for small group instruction was not limited to Karen. Kayla expressed frustration with the top-down expectation in her interview. She specified how the expectation to teach in small groups was compounded by math being a tested subject, saying, “because math is a tested
subject, I’m expected to make these leaps and bounds in growth and teach in this way, which I think is good, but takes time to plan. Small groups, I think, are a great thing to do, but I need time to do it. I can’t just come up with that on a whim.” Kayla’s interview commentary was largely representative of opinions echoed by the math department, emphasizing the time required to meet the academic needs of all her students while preparing them to perform at a desired level.

7th grade PLC. The 7th grade PLC had been working together for four years. Emma moved to Gator Ridge at the beginning of her fourth year where she joined Mark for his first year. During data collection, they were joined by Angela, a student teacher in Emma’s class completing her final student teaching requirements. As a team, the 7th grade teachers were the most receptive to suggestions to improve their practice. With their flexibility known to the principal, they were the first team approached to pilot small group instruction last school year and tackled the challenge head-on. In my interview with Dawn, who worked with the 7th grade PLC last year in her math interventionist role, she expressed the 7th grade team’s willingness to reconfigure their classes to accommodate for small groups with her help when she explained, “7th grade was the one that most wholeheartedly jumped on the bandwagon and said, ‘well what if we did this?’ and ‘could we try this?’ and they were willing to try so many things.”

By taking on the challenge to be the first team to fully implement small group instruction into their practice, the 7th grade PLC had developed a cut-and-dry routine over the last year. Every day, they meet during their planning period to determine the activities they will provide to each group of students, and the progression each student will follow. Unlike 6th grade classes where students were pulled to work with the teacher based on need, every
7th grade math class was split into three leveled groups; a “high” group, “middle” group, and “low” group that purposefully rotated through a series of practice and instructional stations each class period.

The 7th grade PLC planning time typically involved reflecting on assignments that went well last year and mining through additional resources for the types of practice assignments appropriate for their station system. Further, much of the instruction for 7th grade math is “flipped” using an online video tool where students watch videos of their teachers providing the notes prior to class. Thus, one station was always reviewing the notes and practicing with the teacher. As I discuss further under opportunities to learn, the 7th grade interpretation of the small group instruction mandate led to a habit of providing repetitive, procedure-heavy practice to students. This habit, however, did not go unnoticed by the 7th grade teachers.

When prompted to talk about small groups during her interview, Emma reflected:

I'm worried we're spending so much time creating these tasks for the kids to be busy, so we can pull a small group, that we're not really thinking through a balanced approach for that learning opportunity. Are we providing time for the kids to really productively struggle and conceptualize what they're doing? And then be able to follow up with some procedural fluency. I think we're so pushed for time with each small group that we're like, ‘okay, just give them the content, let's do some practice, and now you rotate.’ It's like a conveyor belt. And I'm worried that we are not spending enough time providing a balanced approach or learning opportunities for the kids.
Mark expressed additional concern regarding the effectiveness of teaching students using small groups when he offered the following thoughts during his interview:

I do spend a lot of time thinking about if I am servicing them in a way that is beneficial for them or if this whole small group thing is hurting, you know? I told myself when we started that it would take a couple years for the evidence to really show, so I’m still telling myself that. But I mean, I guess I was giving easier tests before we started but if you look at test scores this year compared to when we started, they’re lower.

While the 7th grade PLCs was the most enthusiastic about changing their practice based on administrative suggestions, they were also the most reflective and curious about its long-term impact on student learning.

8th grade PLC. The 8th grade math PLC was a tight-knit two-person team comprised of Caroline and Julie. They had worked together as an 8th grade math team for 18 years, and more than either of the other grade-level PLCs, had a finish-each-other’s-sentences quality about them. They were a PLC before PLCs were lauded as effective tools for navigating student learning and have implemented countless initiatives in their time together. To them, the small group initiative was simply another initiative on the list. Again, because the push to utilize small group instruction began during the previous school year and Dawn worked within every math classroom in her role as interventionist, she could share how she felt the 8th grade team initially embraced the small group expectation. During her interview, she said, “they seemed the most defeated. They seemed most to think, ‘I agree, it's a great idea, but it's never going to work with our kids.’”
Caroline’s explanation of the principal’s small group expectation demonstrated how each PLC interpreted the mandate differently. She explained during the 8th grade focus group by saying, “For him, technically, small group time is when we are working on review skills. I'm helping fill in gaps. It's not necessarily new information. And he actually, I think prefers not to count the teaching that we do in small groups as small group time.” This interpretation of the small group expectation was remarkably different from the 7th grade interpretation, though more in line with the 6th grade PLC. The implementation of small group instruction was also unlike the implementation in other grade levels.

I completed back-to-back observations of Caroline and Julie in early October. During these observations, students in Math 8 classes (the “regular” math classes) rotated through practice stations focusing on perfect squares, square roots, perfect cubes, and cube roots. By coincidence, the consecutive observations allowed me to observe Julie and Caroline on the first and second days of the same stations, respectively. During each rotation, four or five students would work through a step-by-step mini-lesson on perfect cubes with Julie or Caroline as their guide. This meant they each taught the same mini lesson between 15-18 times over two days. The repetition weighed on both teachers as they expressed their exhaustion by the end of the day. Caroline shared that by the time she was on the 13th, 14th, or 15th time teaching a lesson, she lost the ability to form coherent sentences. Similarly, Julie began tripping over her words during the ninth and final rotation of the day and joked at the end of my observation, “why do I keep saying square? I’ve said it entirely too many times today.”

**Initiative: New textbook resource.** Middle school math teachers across the Green City School District were invited to participate in the adoption process for a new math
textbook leading up to the 2017-2018 school year. Ultimately, the district settled on the web-based *Breakthrough* textbook. Unlike typical textbooks, providing introductory information on specific topics then listing a series of related practice problems, the *Breakthrough* resource extends by offering interactive opportunities for discovery. Upon adoption, Gator Ridge math teachers believed the resource would fit well within their school-based mandate to teach in small groups as it offered differently leveled practice problems and application activities for each concept.

As of the first day of school, teachers had yet to be provided with time during workdays to acclimate themselves with the *Breakthrough* resource. From the start, the teachers struggled to find time to familiarize themselves with the units, though they recognized the need to do so. As the weeks progressed, teachers grew frustrated with the expectation to use *Breakthrough* without adequate training. Additionally, the *Breakthrough* adoption was associated with a change to the previous conceptual progression. For example, instead of beginning with long division and fraction operations, the *Breakthrough* textbook, and therefore the 6th grade pacing guide, began the year with ratios for the first time. Similar changes to instructional order and concept pacing occurred across grade-levels.

6th grade PLC. For the 6th grade PLC, the combination of adjusting to teach ratios first, acclimating to a new textbook resource, and helping students transition into middle school resulted in an overwhelming start to the school year. The 6th grade teachers uniquely struggled with the additional pressure of teaching *Breakthrough* textbook navigation on top of the required mathematics content. Almost immediately, they shared their concerns with each other, with me, and with Renee, the district-level secondary mathematics facilitator.
As early as September 8th in a PLC planning meeting with Renee, the 6th grade PLC expressed fear of falling behind the other middle schools and attributed their slow start to the gradual acclimation to the *Breakthrough* textbook and the accompanied alteration in pacing. Karen, Kayla, and Dawn shared their best efforts to utilize *Breakthrough* often and in meaningful ways but felt the lessons were too boring for students. Renee emphasized that *Breakthrough* was meant to be a tool to support them rather than an additional stressor. Within this short interaction, Karen stressed that the *Breakthrough* pacing was unrealistic, and she disagreed with ratios being taught first. This precise thread of displeasure continued throughout the fourteen weeks of data collection.

Another issue that arose with the swift adoption of the *Breakthrough* text was the content alignment with district-wide pre-tests, benchmarks, and unit tests. From a September 29th meeting, the teachers shared that *Breakthrough* failed to prepare students for the district assessments. During this meeting, Karen expressed irritation with the expectation to use the new textbook, calling the implementation process a “hot mess.” She further added “*Breakthrough* assumes students have a lot of skills they don’t have.”

Comments from December’s focus group revealed sustained frustration with *Breakthrough* among the 6th grade PLC. With agreement from Kayla, Karen shared, “it’s been a tough year with the new *Breakthrough* online math course. We’re told what to teach, and we have to follow their pacing guide, and then it seems like we have certain stipulations of what we follow for how to teach it as a classroom teacher.” Kayla added, “I feel like we’re expected to use *Breakthrough*, but no one’s really checked to make sure that we are. So, I’ve not followed it as closely as I think we’re expected to, because I don’t have the time to dive
into it and actually pull what’s good out of it. So, I’ve been doing kind of my own thing and then just used *Breakthrough* to supplement that.”

*7th grade PLC*. The 7th grade PLC occasionally found time to use the *Breakthrough* practice problems within their small group station rotations. However, with students working through small groups three days per week, the teachers spent less time stressing about the content and pacing of the new resource and focused more on the amount of time students might take to complete a series of practice problems within it. Renee joined a 7th grade PLC planning meeting early in the school year and attempted to encourage the teachers to incorporate *Breakthrough* application activities into their small group rotations, but they eventually relied heavily on previously used student practice materials.

A segment from the 7th grade focus group transcript reveals the teachers never really settled into a routine using *Breakthrough* as a resource, likely because they never had an opportunity to get comfortable with its components. In the midst of discussing teacher autonomy, the *Breakthrough* resource came up as an afterthought. Mark chimed in to say, “Oh, right! I did have another piece. I also feel like we’ve left out this whole, we were voluntold to do *Breakthrough* this year.” Angela and Emma both acknowledged this as an initiative they were supposed to give more attention to. Mark continued:

I think we were told “Use it however you want to use it,” and we picked it, so there was a little bit of autonomy there. We all met as a district and pardon me, sometimes I wish we could take that choice back. But I think we’ve used it. We haven’t taught through it. I don’t feel like anybody’s coming down on us hard with a hammer because we haven’t used it every day.
8th grade PLC. The nature of 8th grade math at Gator Ridge presented a different kind of challenge to the 8th grade PLC with the introduction of the Breakthrough resource. “Regular” 8th grade math classes, known as Math 8, cover the typical mathematics curriculum for 8th grade students. Additionally, the “advanced” 8th grade math class, Math I (read: “math one”), is a completely separate accelerated course. Unfortunately, two separate courses meant two separate Breakthrough interfaces. Through trial and error the first week of school, Julie and Caroline learned navigation buttons and functions were different between Math 8 and Math I, leading to additional planning time and confusion in planning meetings.

Aside from interface challenges, the issues with Breakthrough encountered by the 8th grade PLC were primarily content-specific. For example, during their first planning meeting with Renee, Caroline shared that exponents lessons “get way too hard way too fast,” and noticed some lessons were even out of order. Of all three math PLCs, the 8th grade team spent the most time during their formal and informal planning meetings looking through the activities available through the Breakthrough program to see what might work for their students. They attempted to utilize application lessons where they fit and worked to follow the assumed pacing.

Although they were the most flexible and patient with navigating two separate Breakthrough texts the first semester, Caroline and Julie encountered hiccups with implementation along the way. For instance, as Caroline shared with me in her interview, they realized late in the first quarter that Math I Breakthrough lessons were written under the assumption students had already taken Math 8, which was not the case at Gator Ridge. Eighth grade students enrolled in Math I at Gator Ridge had some exposure to Math 8 content, but primarily through an advanced, hybrid-curriculum Math 7 Plus course.
Following this discovery, she and Julie had to put more time into figuring out how to scaffold lessons intended to be independent.

**The pressure to perform.** The math department participated in their first departmental meeting after school on Monday, September 11th. Though only the start of the third week of school, Dawn felt it necessary to address the teachers’ stress after they had spent the first two weeks covering classroom rules, procedures, and engaging students in Jo Boaler’s (“Youcubed,” 2018) *Week of Inspirational Math*. During the meeting, she tells the math teachers that until they feel calmer, to:

keep thinking about the growth mindset. I want to say that the biggest shift is in *our* mindset than in our kids’ mindset. We act like right is good, and wrong is bad. We act like speed is good. We foster all the things we don’t want our students thinking. Our goal is not to get all the curriculum in their heads. Our goal is on student learning, not teaching. The biggest weakness I see right now, when I get fast, I turn off all the growth mindset in the classroom. I don’t want you all discouraged because you did the week of inspirational math. It is not a race, it is so much better if we go deeper and instill in our kids that we can do it, and want to do it, instead of checking off a list.

Dawn’s thoughtful perspective was representative of her disposition and projected how seriously she took her job as math interventionist, though she no longer fulfilled that role full time. Dawn gathered teachers were already feeling pressured early in the school year, and admittedly, even as a relative “outsider,” this sense was palpable to me.

The pressure on math teachers at Gator Ridge was apparent in a multitude of ways. As a tested subject, they are expected to help their students achieve growth from their scores
the previous year. Relatedly, time to cover the intended curriculum is precious. When students need more than the allotted time to show proficiency on a concept, the time to cover remaining concepts is sacrificed. Often, the pressure is a function of the remaining school days to adequately teach every topic. The following sections include representative portions of transcript from teachers in each PLC defining the types of pressure they felt at that time.

6th grade PLC. The following focus group excerpt is one of the most meaningful episodes of pedagogical reasoning produced by the 6th grade PLC. In this episode, teachers communicated the pressure to implement initiatives and promote students’ success in mathematics as they agreed with one another by adding onto each other’s thoughts:

Dawn: when they (the district) come up with what they think is the solution (to improving student performance), small groups and data have been some of their solutions.

Karen: It’s a lot of pressure.

Dawn: Lesson plans on the desk, (Kayla: mm hmm; Karen: Anchor charts…) AVID sentences, yeah. There’s a whole lot of "must dos" in our lessons, in our planning, and in our classroom. And overall, most of those "must dos" feel very powerful, but I feel like oftentimes, and I’ve seen this everywhere I’ve been in education, we evaluate teachers by how well they use the tools rather than how well the tools work for their kids. So, I would rather have a conversation about what my kid’s not getting and what I can do to help them than "did I have my anchor chart up? (Kayla: mm hmm) Did I have my plans on my desk? Did I have this, did I have that?"

Karen: It’s a lot of things we have to do before we teach that may not be, as a teacher, in my mind, as important as maybe the administration’s mind.
Kayla: And I also feel like, and I may be getting super off topic here but what you said, Dawn, made me think of this. With all these ideas they’re coming up with, and all of them are great ideas, that’s fine. But I feel like I’m not doing anything particularly well. I’m not doing Breakthrough well, and I’m not doing data well. Because we have all of these things that we’re expected to do. I’m spread so thin and I’m not doing any of it well.

Karen: It’s too much at times.

Dawn: And then the time we could devote to doing that then there’s the added pressure of, "well let’s do some interdisciplinary units (Kayla: Yeah), and let’s do a week of coding, and let’s do--" and there’s-- I think our district is trying to do so many things (Kayla: mm hmm) to make it a wonderful place, but the piece that we all need more than anything is time.

Kayla: mm hmm.

Karen: We have very few plannings (Dawn: Yeah) when we can actually sit down. Even with our PLCs, we’re rushed. And we don’t ever get through what we need to get through.

Dawn: Yeah. But I’ve never been in a school setting where I felt like teachers have said, "oh, I thank god for the time I have to plan." I’ve never been in that setting so I don’t feel like we’re unique in that (Kayla: Right). But I do feel like we are unique in the exceptionally hard--

Karen: A lot of new, "let’s try this, let’s try this, (Dawn: Yeah; Kayla: mm hmm) let’s do this, this week," and I’m like, "oh my gosh" *laughs* (Dawn: Yeah) give me a little bit of a break! Please! (Dawn: Yeah).
Clearly, the 6th grade teachers felt stifled by the wealth of top-down initiatives thrust onto them by school and district-level personnel.

7th grade PLC. Two distinct data sources provided evidence where the 7th grade PLC felt pressure to perform. First, Angela provided a unique insider perspective on the pressures felt by the 7th grade PLC. In her interview, she explained how Mark and Emma constantly compared themselves to teachers from other schools, saying, “I think there's a lot of pressure on the teachers with how fast the other schools are going, and they're way past where we are. I think there's that pressure that we need to move fast as well, and we need to cover these things in this amount of time.” Later in her interview, when specifically prompted on the pressures within the 7th grade PLC, she stated, “I think for at least 7th grade, because this PLC has performed so well, and they're usually always exceeding growth, at least for the past couple of years they've exceeded growth, I think there's a lot of pressure on them to be an example for other PLCs in the school. So, I think there's a lot of pressure for them to perform well.”

In this short focus group excerpt from late November, Mark and Emma explained how the pressure to implement specific initiatives manifests in practice:

Mark: It’s like trying to fit that square peg into a round hole sometimes. How are we going to make Breakthrough work in our small group, because I don’t know if it’s really designed to work that way. It’s really designed to work as a total teaching tool where you have these structured lessons, and that’s not-- I don’t know. It’s almost like the district’s trying to give us things to do, and [principal] is like, "hey, you can do whatever you want to do." But at the same time in a meeting, he’s like, "make sure you do [formative complex lessons]!" (Emma: yeah) So there is, I guess, a little bit
more to it than we let on at first. Now that I’m thinking about it.

Emma: I know we’re fortunate to be at a school where we have a lot of instructional suggestions. But then we also are in a district where it’s small enough that there are also a lot of instructional suggestions. So, you’re hearing [different things], and they’re not the same. They’re somewhat the same, but not all the same.

8th grade PLC. When the 8th PLC made specific statements about feeling under pressure, they alluded to the importance of proficient test scores. In her interview, which markedly took place in the days following the release of last year’s EVAAS scores (value added scores indicating whether a teacher is performing below, at, or above expectations dependent on the students they teach), Caroline spoke specifically about the pressure she often felt. When asked about the pressure to get students on grade level, she explained how the pressure comes from her own desire to do well, but also from mixed messages communicated by her superiors. She explained:

Most of the time it's relatively minimal. I feel like it's a lot right now between benchmarks and then with EVAAS coming out. I feel like both of those, and my benchmarks... I had 40% proficient, they got 40% correct overall, which was better than last year’s. So, I feel like that's better, and I haven't looked at all of the questions. But then you hear from [superintendent] and you hear from [principal] growth is what's important. Or we want schools to be the learning experience! But then oh yeah, we have these pesky test scores, so it feels like there's a tension there too, that we all haven't quite figured out yet. So, I feel like the pressure comes and goes with that. And some of it's from me. Some of it's from above, but some of it's from me.

I further observed the internal pressure Caroline mentioned during an 8th grade PLC meeting
when she shared, “It’s awful when you feel guilty that you didn’t work all weekend. I should not feel like that, but yeah, I do.”

**Research Question 2**

In a middle school that groups students for mathematics based on perceived ability, to what do mathematics teachers collectively attribute differential student success?

**Attribution Frequencies**

As an embedded qualitative researcher seeking to identify spoken attributions from teachers in context, my observations were particularly attuned to teachers’ conversations about student performance and what they thought caused that performance. Data from observations, interviews, and focus groups yielded 765 instances of teacher attributions for student performance department-wide.

<table>
<thead>
<tr>
<th>Teacher observations</th>
<th>PLC meeting observations</th>
<th>Interviews</th>
<th>Focus groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>98</td>
<td>463</td>
<td>144</td>
</tr>
</tbody>
</table>

Figure 4.1 demonstrates the proportional breakdown of those attributions across the department, Table 4.2 reflects the data sources for the observed attributions, and Table 4.3 provides a more succinct descriptive breakdown of the attributions teachers used. Figure 4.1 shows that across data sources, math teachers at Gator Ridge attribute student performance to student effort, knowledge gaps, student ability, student behavior, and the teacher the majority of the time.
In Figure 4.1, larger boxes reflect a greater frequency of those specific observed attributions, while smaller boxes reflect that attribution was used less frequently. For clarity, these 765 external attributions (6th grade: 322; 7th grade: 240, 8th grade: 195, departmental: 8) are a comprehensive collection of every attribution observed over the course of data collection, and are not specific to any teacher, grade level, perceived ability level, or particular level of student performance. I coded attributions as controllable or uncontrollable depending on the context of the attribution. Many attributions have both controllable and uncontrollable dimensions, but some attributions like effort, for example, are only considered along the uncontrollable dimension, as teachers recognized they lack control over the effort their students exert.
Table 4.3

<table>
<thead>
<tr>
<th>Controllable Attribution</th>
<th>Frequency</th>
<th>Uncontrollable Attribution</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher</td>
<td>52</td>
<td>Effort</td>
<td>140</td>
</tr>
<tr>
<td>Support</td>
<td>38</td>
<td>Knowledge Gaps</td>
<td>86</td>
</tr>
<tr>
<td>Enjoyment</td>
<td>38</td>
<td>Ability</td>
<td>83</td>
</tr>
<tr>
<td>Engagement</td>
<td>32</td>
<td>Behavior</td>
<td>59</td>
</tr>
<tr>
<td>Task Difficulty</td>
<td>25</td>
<td>Task Difficulty</td>
<td>48</td>
</tr>
<tr>
<td>Ability</td>
<td>12</td>
<td>Traits</td>
<td>42</td>
</tr>
<tr>
<td>Knowledge Gaps</td>
<td>9</td>
<td>Support</td>
<td>34</td>
</tr>
<tr>
<td>Stability</td>
<td>7</td>
<td>Curriculum</td>
<td>32</td>
</tr>
<tr>
<td>Access and Opportunity</td>
<td>5</td>
<td>School</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other Teacher</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>218</td>
<td></td>
<td>547</td>
</tr>
</tbody>
</table>

Broadly, as Table 4.3 demonstrates, Gator Ridge math teachers made uncontrollable attributions the majority (71.5%) of the time. *Effort*, the most frequently used attribution, is aggregated to include four sub-categories each falling within the effort attribution. A similar phenomenon materialized for the uncontrollable *knowledge gaps* attribution, which includes a sub-code for when teachers specifically attributed knowledge gaps to students’ *previous teacher(s)*.

Teachers took responsibility for student performance most often when they attributed that performance to something within their control. Arguably, each controllable attribution listed *could* have been aggregated under *teacher* because each controllable attribution was something the teacher believed they had control over. However, the differences between controllable attribution codes were delineated by the specific components they believed they controlled. For example, in a PLC meeting, Emma and Mark explained how they “upped the rigor” on their practice problems, so students could be more successful on tests. Here, they believed they contributed to student performance because they controlled task difficulty during test preparation.
In some instances, attributions overlapped with one another. For example, when Emma explained to other teachers how she helps her students achieve success, she stated during the 7th grade focus group, “I honestly feel like it's not that I'm teaching them math any differently than anyone else, it's just that I'm getting the kids to believe in themselves and celebrate any little bit of improvement or growth. And when they start tasting that little bit of improvement or growth, it's just like they continue.” Emma alludes to students believing in themselves (an uncontrollable effort attribution), but further attributes student success to her teaching style and the support she provides, both of which she can control. Moreover, by communicating her ability to help students improve in mathematics, this statement indicates Emma believes she can impact student ability. I discuss this ability attribution as a prominent feature of Emma’s equity disposition.

**Reporting Collectivity**

I center the second research question around the collectivity of attributions among teachers in each grade level. One finding links the frequency of agreement within each PLC to their years of experience working together. At Gator Ridge, the 6th, 7th, and 8th grade math PLCs are at distinctive phases of development. Three observable components interrelated across all three grade levels and emerged as contributing factors to the student evaluation and planning processes. The three components are 1) the amount of time a team has been working together 2) how often they meet with one another informally and 3) the instances of observed agreement among them. Table 4.4 provides a clear record of these components for each PLC. The longer a math PLC has worked together at Gator Ridge, the more likely they are to meet informally, and the rate of observable agreement among them increases.
Table 4.4
Frequencies of agreement and informal meetings per PLC.

<table>
<thead>
<tr>
<th>PLC</th>
<th>Years together</th>
<th>Agreement</th>
<th>Informal meetings observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>6th grade</td>
<td>&lt;1</td>
<td>43</td>
<td>3</td>
</tr>
<tr>
<td>7th grade</td>
<td>4</td>
<td>56</td>
<td>13</td>
</tr>
<tr>
<td>8th grade</td>
<td>18</td>
<td>59</td>
<td>17</td>
</tr>
</tbody>
</table>

Note. Informal meetings were coded when an informal PLC meeting was observed and also when an informal meeting was mentioned during an interview as a key PLC characteristic. Agreement is not specific to attributions or opportunities to learn, but as an observed moment of agreement among the PLC.

Episodes of pedagogical reasoning are segments of transcript selected for coding based on the teachers discussing a particular idea or practice and their associated justifications for that idea. From the relevant data sources, the episodes indicating the most agreement were generated during the focus groups. Although I might have coded an episode captured during a focus group as an instance of agreement, consensus, or shared vision, the magnitude of that episode cannot be captured by the code alone. Thus, I also report the coverage of each focus group transcript demonstrating teacher agreement for additional clarity. Table 4.5 displays this relationship.

Table 4.5
Percent of agreement in focus groups.

<table>
<thead>
<tr>
<th>Focus group transcript</th>
<th>Instances of agreement</th>
<th>Transcript coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>6th grade</td>
<td>42</td>
<td>33.9%</td>
</tr>
<tr>
<td>7th grade</td>
<td>56</td>
<td>47.3%</td>
</tr>
<tr>
<td>8th grade</td>
<td>49</td>
<td>58.2%</td>
</tr>
</tbody>
</table>

Note although the instances of agreement in the 7th grade focus group are greater than that of the 8th grade focus group, the extent to which they were in agreement was much less. This is likely due to the length of time Caroline and Julie have been working together, as they frequently complete each other’s thoughts and build upon each other’s ideas.
Collectivity of Attributions

Queries specific to each PLC revealed the attributions agreed upon by multiple members in the PLC when evaluating student performance. Table 4.6 breaks down the instances where attributions were made collectively and how often those attributions were deemed within the teachers’ control. As expected, the trend of collectivity among attributions aligns with the number of years a PLC has worked together and frequency of their informal meetings.

Table 4.6
Collective attributions per grade level.

<table>
<thead>
<tr>
<th>PLC</th>
<th>Collective attributions</th>
<th>Controllable</th>
<th>Uncontrollable</th>
</tr>
</thead>
<tbody>
<tr>
<td>6th grade</td>
<td>24</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>7th grade</td>
<td>31</td>
<td>3</td>
<td>28</td>
</tr>
<tr>
<td>8th grade</td>
<td>34</td>
<td>1</td>
<td>33</td>
</tr>
</tbody>
</table>

Note. Attributions were not necessarily in reference to student success or underperformance but were noted when teachers mentioned factors that generally contribute to student’s performance.

Across the Gator Ridge math department, attributions for student performance were agreed upon 89 times in observed PLC conversations. Of the 89 collective attributions, teachers attributed student performance to factors outside their control 79 times. Across PLCs, the most frequently utilized attributions included gaps in mathematics knowledge, systems of support from external forces like the students’ parents, and known traits associated with the student such as race or ELL status. Though this study focuses on the controllability dimension of each attribution projected from the teachers’ perspectives, it is notable that the three attributions agreed upon most often were factors additionally out of their students’ control.
Collective Attributions for Success

Attributes spoken for successful student performance were limited. In fact, the majority of observed attributions for student performance referred to factors contributing to student performance more generally. Instead of reacting to test scores with attributions as expected, teachers more commonly utilized attributions preemptively as predictive explanations for student achievement. In these moments, predictive attributions were discussed as factors to consider while planning learning opportunities.

Oftentimes, I inferred attributions for success based on the context of the conversations taking place. I identified collective attributions for success by first singling out data sources tagged for a particular PLC. Once I singled out these data sources, I searched within them for episodes dual-coded for mentions of student success or learning and any attributions. Results for success attributions are listed in Table 4.7.

<table>
<thead>
<tr>
<th>PLC</th>
<th>Number of success attributions</th>
<th>Controllable</th>
<th>Uncontrollable</th>
</tr>
</thead>
<tbody>
<tr>
<td>6th grade</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>7th grade</td>
<td>17</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>8th grade</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

The number of attributions observed for student success are limited but continue to follow the same pattern along the controllability dimension. The 7th grade made the most attributions for success during meetings and focus groups. Recall the 7th grade math PLC’s reputation for having the best scores in the school. Their relatively elevated number of success attributions are associated with the pride they have in that accomplishment. This dynamic was especially evident during their focus group when they spoke at length about teaching test-taking strategies before district and state mandated tests. Further, the 7th grade
PLC feels the most accomplished with the implementation of small group instruction in their classrooms.

Adjusted for agreement and consensus among team members, collective attributions for success are displayed for each PLC in Table 4.8.

Table 4.8

<table>
<thead>
<tr>
<th>PLC</th>
<th>Collective success attributions</th>
<th>Controllable</th>
<th>Uncontrollable</th>
</tr>
</thead>
<tbody>
<tr>
<td>6th grade</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>7th grade</td>
<td>5</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>8th grade</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Among the five agreed upon attributions for success in the 7th grade PLC, only one reflects the belief from teachers that they had any control over that success. When 7th grade teachers discussed during their focus group why a former student was now successful in 8th grade math, Mark alluded to the support he provided as a contributing factor to this student’s first “taste of success.” He said, “I think sometimes if a kid hasn't passed a math [state test] their whole life, then in 7th grade they do, I'm thinking about one kid right now who [scored proficient] last year and started running around the hallway, he was so excited. That kid has had a successful 8th grade year so far.”

Within this focus group conversation, Mark and Emma further elaborated on the strategies they used to support students such that they continued to find mathematics success in the years following 7th grade. These teachers know they lack control over student effort, the difficulty of test questions, and parental levels of support, but they agree students can be successful if they are supported in a way allowing them to show their capabilities. The
remainder of the collective attributions made for student success were those teachers deemed out of their control.

**Collective Attributions for Underachievement**

In contrast to the success attributions, teachers made attributions for student underachievement much more frequently. For clarity, I defined underachievement broadly to describe performance among students “below grade level,” who were struggling to demonstrate competence with new math concepts, or who had historically achieved below proficiency on state-mandated math tests. *Underachievement* describes the performance of students who were failing math, and for those who were achieving below the teacher’s desired level for them. I did not designate a specific cutoff for achievement to delineate success from underachievement. However, frequent frustrations and struggles were noted among teachers throughout data collection during interviews and focus groups. I asked them to articulate their own interpretation of underachievement when they explained why students “are not successful,” or why they “do not perform as expected.”

Table 4.9 outlines the frequency of underachievement attributions observed in collective settings. Similar to the success attributions, these attributions were observed in PLC meetings, focus groups, and when teachers individually discussed what their PLC believed causes students to underachieve.

<table>
<thead>
<tr>
<th>PLC</th>
<th>Number of underachievement attributions</th>
<th>Controllable</th>
<th>Uncontrollable</th>
</tr>
</thead>
<tbody>
<tr>
<td>6th grade</td>
<td>36</td>
<td>3</td>
<td>33</td>
</tr>
<tr>
<td>7th grade</td>
<td>42</td>
<td>3</td>
<td>39</td>
</tr>
<tr>
<td>8th grade</td>
<td>52</td>
<td>13</td>
<td>39</td>
</tr>
</tbody>
</table>
Considering the 8th grade teachers overall made the fewest attributions throughout data collection, it is interesting they make the most attributions for underperformance. However, the pattern for making attributions for underperformance continues to correlate with the number of years each PLC has worked together. Further, the weight of uncontrollable attributions significantly outweighs those considered controllable. Across PLCs, teachers attributed the underachievement of students to a wide variety of uncontrollable factors.

Among the 6th grade PLC, teachers most commonly attributed student underachievement to gaps in their foundational mathematics knowledge. Comments from Karen in team-settings were often similar to one captured during the focus group when she explained, “It seems to be a lot of students are not up to 6th grade level, and I know we talked about it when we met with Renee going, ‘what do we need to get these kids that don’t have the basic skills to jump into 6th grade? What are we doing for those students?’” Karen’s attributions were rarely, if ever, reciprocated by Dawn or Kayla, yet they were rarely directly rebutted. Confirmed in Table 4.10, the 6th grade teachers only outwardly agreed with each other four times when making attributions for student underachievement, and each of those attributions was judged as uncontrollable.

Table 4.10

<table>
<thead>
<tr>
<th>PLC</th>
<th>Collective underachievement attributions</th>
<th>Controllable</th>
<th>Uncontrollable</th>
</tr>
</thead>
<tbody>
<tr>
<td>6th grade</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>7th grade</td>
<td>22</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>8th grade</td>
<td>16</td>
<td>2</td>
<td>14</td>
</tr>
</tbody>
</table>

Further examination of the collective underachievement attributions revealed the types of attributions teachers agreed upon in each PLC. To better understand how the
teachers openly negotiated the actors contributing to underachievement, consider the following sample of representative quotes from each grade level. With agreement from her 6th grade teammates during their focus group, Dawn called attention to a combination of factors contributing to students’ continual math struggles, “I feel like the kids who struggle are those kids that have always been pushed, and prodded, they've failed the [state test] their whole life, and they can't read, their parents probably can’t read, their parents probably can’t do math.” In this excerpt, the 6th grade PLC evoked fixed student ability and the level of parental support as the problem, both of which are out of their control.

Conjuring similar attributions, Emma engaged in conversation with her teammates about ELL students struggling in math because their parents were unable to help them. From the 7th grade focus group, she says, “most of them have probably already gone further than their parents in school (Angela: yeah). And therefore, they don't have (Mark: yeah) the support at home to -- the parents want to help them, but they're not capable (Angela: right).” The 7th grade PLC continued to make attributions for underperformance associated with knowable, uncontrollable student traits during their focus group. In the midst of articulating the barriers keeping some students from being successful in math class and the need to overcome them, Emma mentioned students’ socioeconomic status as a factor stating, “we've got to figure out a way to say, because that's not changing - socioeconomic status - (Mark: yes), we're going to, from now until forever, have kids who come from bad home lives.”

Finally, in early October, during a PLC observation day, I observed the 8th grade PLC talking through their frustrations between classes, citing the struggle to effectively reach ELL students. Julie expressed her frustration to Caroline, who sympathized with her opinions:
We are trying so many things, and pushing so hard, and they’re still performing so low. It’s going to be heartbreaking at the end of the year. Last year we had some hope and the scores were still so low. What can we do? Should we give the lessons in Spanish? And I know we always say they’re not going to have [the test in Spanish] for them, but if they’re learning, isn’t that what we care about? It’s just not fair to them. I keep saying “we’ll get there!” but how? Somebody needs to help me. We’re not getting there. I need somebody to tell me.

Similar to 6th and 7th grade teachers, the 8th grade PLC attributed mathematics underachievement to traits associated with being ELL.

Uniquely, the 8th grade PLC was much more likely to attribute underachievement to apathy than the other PLCs. They also further connected apathy to underachieving students not being previously held accountable. In concert with Caroline, Julie used an opportunity during their focus group to add, “I feel like there’s a lot of apathy on their part (Caroline: there is) about being successful (Caroline: yeah). I mean, I feel like there’s so many students who have never been held accountable.” In context, when Julie said she felt like some students had never been held accountable, she meant by the school or the district. According to every participating teacher, administrative officials from both Gator Ridge and the district insist on passing students to the next grade even when they perform far below proficient on the state mandated tests and have maintained failing grades throughout the school year. This pattern of decision-making enforced over multiple years may be one factor contributing to students beginning the next grade level with substantial gaps in knowledge.
Attributions for Differently Perceived Ability Groups

My primary aim with this study is to identify the attributions teachers in a single school collectively hold or have co-constructed for differential student performance in a tracked setting and how those attributions impact the planning process. The math teachers at Gator Ridge made attributions for student performance prior to that performance, following that performance, and in situations unrelated to any particular performance at all. Further, although attributions frequently flowed from teachers individually, they were rarely observed in outward consensus. In this regard, recall the instance when Karen insisted students were struggling because they were well-below grade level, and the attribution was not resisted by Dawn or Kayla. Their failure to outwardly disagree with Karen’s attribution may have been interpreted by Karen as agreement. As an observer, I was unfortunately unable to interpret PLC members’ sense of agreement in this way.

To better understand how teachers make attributions for students in differently leveled math classes, the following findings focus specifically on the attributions made for students in “regular” classes versus those in “advanced” classes. After utilizing matrix coding queries specific to each PLC, I highlight patterns of attributions made for students placed in differently perceived ability groups. These queries shift my focus from attributions for success or underachievement, and instead illuminate the types of attributions made most often for students in “regular” classes or “advanced” classes, and for groups casually identified by teachers as “high” or “low.”

As previously mentioned, teachers did not always reference student performance on a specific task when they discussed factors they believed contributed to student performance. For example, Dawn explained in her interview how she believes the Common Core
curriculum has led to challenges in the classroom compounded by its interpretation by parents who “feel threatened because they're unable to help their kids with homework because it doesn't look like what they did when they were in school. So, I do think there is this sense that parents don't understand what we're trying to teach because they didn't learn that way.” Through this statement, Dawn attributed classroom outcomes to the curriculum and parental support, as factors indirectly impacting student performance. However, it was unclear whether Dawn’s curriculum and parental support attributions were responsible for student success or underperformance. By eliminating the need to look only at success or underachievement attributions, more observed attributions from the fourteen weeks were made available for analysis.

As the number of collective attributions throughout the study are limited compared to the 765 observed spoken attributions, there were instances where the representative comments for a particular grade level were not necessarily collective. However, if individual attributions were spoken in a team setting without contradiction, it is possible these personally held beliefs contributed to the PLCs shared vision, especially for the 7th and 8th grade PLCs, where agreement and collectivity are more consistent.

In the following sections, I outline the most commonly utilized attributions for “regular” and “advanced” students for each PLC. Nineteen of the 25 math classes at Gator Ridge were “regular” math courses. “Regular” math courses are named for their respective grade levels; Math 6, Math 7, and Math 8 respectively. Demographically, the student composition across the Math 6, Math 7, and Math 8 classes was between 25% and 50% White, and therefore between 50% and 75% minority. Across grade levels, the proportion of minority students in “regular” math classes was greater than the proportion of minority
students in the school. Demographics were determined based on a series of general classroom-wide observations and descriptions from teacher interviews. When teachers described students as minority, they were describing Hispanic or Latinx, Black or African American, Asian American, Native American, or mixed-race students.

“Advanced” math courses follow a similar naming convention for 6th and 7th grade courses, named Math 6 Plus and Math 7 Plus respectively, whereas the 8th grade “advanced” course was not an extension of Math 8, but was instead the first math course eligible for high school credit, Math I. Compared to the demographic composition of the “regular” math classes, the majority of students in the six “advanced” math classes at Gator Ridge were White; a statistic some of the math teachers and specifically the AIG specialist, Greg, have been actively attending to.

Until the 2017-2018 school year, nearly 100% of the students in “advanced” math classes at Gator Ridge were White, though the proportion of Hispanic and Latinx students in the school remained similar to that in this study. When the disproportionate placement of White students in advanced classes was brought to the attention of district officials, active measures were put into place to be more inclusive of Hispanic or Latinx and Black or African American students in those classes. As Emma described during a meeting on placement practices:

The demographics in our plus classes didn't accurately reflect our demographics as a school. We were seeing that there were a lot of kids in the minority subgroups who were underrepresented in the plus classes. So, as a district we decided that we needed to cast our net wider and really reach out for those kids who are willing to, as the [one district official] said "be scrappy enough to go in a plus class." Maybe they've never
been in a plus class, but they work hard enough, and if they want it, to put them in there and give them a try. Because up until this year, it was basically more like a socioeconomic status. Like "all of the kids in my neighborhood are in this class, so I want to be in that class, too" and parents were like "I want my kid to be in that class."

To be eligible for “advanced” classes, teachers at Gator Ridge (Greg and other curriculum support teachers) take the sixty top performing students based on previous years’ test. However, this year, students from underrepresented groups who might have otherwise missed the cut could be considered if they performed in the top 10% of their subgroup on the previous years’ test. Additional factors considered for math placement included previous course placement, student grades, teacher recommendations based on the perception of student effort, and pressure from parents.

Across the department, teachers were more likely to make attributions for student behavior, effort, gaps in knowledge, external systems of support, and knowable student traits for students in “regular” classes than for students in “advanced” classes. Further, teachers voiced lower expectations for students in “regular” classes at a higher rate when compared to students in “advanced” classes. In instances where teachers used terms like “high” or “low” to describe a group of students, this distinction was noted without regard for any specific ability group. This means when teachers casually talked about “high” students, they were not necessarily talking about students from “advanced” classes but may have been referring to a subset of students in “regular” classes. Further, there were some recorded instances where students referred to as “low” were the same students from “regular” classes.

**6th Grade PLC.** Attributions observed in 6th grade settings were the most disjointed across data sources. Table 4.11 contains a selection of the most frequently utilized
attributions by 6th grade teachers for students in “regular” classes and “advanced” classes, juxtaposed with the frequency of the same attributions for students from other perceived groups.

Table 4.11
Frequently observed 6th grade attributions for differently perceived groups.

<table>
<thead>
<tr>
<th>Attribution/Group</th>
<th>Ability (U)</th>
<th>Behave (U)</th>
<th>Effort (U)</th>
<th>Gaps (U)</th>
<th>Engage (C)</th>
<th>Support (C)</th>
<th>Teach (C)</th>
<th>High Exp.</th>
<th>Low Exp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>“high”</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>“low”</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Math 6 Plus</td>
<td>4</td>
<td>1</td>
<td>9</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td>Math 6</td>
<td>6</td>
<td>9</td>
<td>14</td>
<td>19</td>
<td>8</td>
<td>10</td>
<td>11</td>
<td>1</td>
<td>8</td>
</tr>
</tbody>
</table>

Note. Some attributions have been abbreviated to fit within the table. Behave = behavior, gaps = knowledge gaps, engage = student engagement, support = internal systems of support, teach = teacher, high exp. = high expectations, and low exp. = low expectations. (C) = controllable attribution, (U) = uncontrollable attribution.

Superficially, the most prominent attributions from 6th grade teachers conflict with the controllability trends witnessed throughout the study, as it appears the controllable internal systems of support and teacher attributions are made for “regular” students most often, behind knowledge gaps and levels of student effort. However, closer examination revealed the majority of these instances could be individually credited to Karen, who used several opportunities to tell me how she personally works to meet the needs of the students in order to make them successful. She specified during her interview how she helps her students, saying, “it’s not just academically, I’m also giving them the organization and the structure that they need.” Further, she added, “they’re learning a lot with me, but it’s not just academics, it’s structure. It’s accountability.” Interestingly, though Karen is credited with uttering the most controllable attributions, she also most frequently initiated PLC conversations blaming knowledge gaps for subpar student performance. Moreover, Karen
was the only teacher who made knowledge gap attributions for students in her Math 6 Plus class, noting in her interview, “the misconception with the AIG group is a lot of times you expect them to know everything on grade level. That's not true. You do have to back it up.”

More than any other attribution, the 6th grade teachers spent the most time making knowledge gap attributions for students in “regular” classes. The 6th grade PLC also made these attributions collectively most frequently. With agreement from her teammates, Kayla spoke in the focus group about students in her “regular” classes struggling with test-prep assignments, “our really, really low kids might not be ready because they don't have the skills first (Dawn: mm hmm), let alone the critical thinking.” Additionally, an excerpt from the focus group transcript portrays the typical back-and-forth banter between Karen and Kayla. In this instance, Karen discussed the challenges associated with providing lessons to a single classroom of “regular” students who achieve at different vastly different levels:

Karen: I've got kids on 3rd grade level, literally, and I've got kids that are on 6th grade level. And it is going to become where I have to split them into two different groups, and I take a group, and then the EC teacher takes a group. Because we're at a point now that we're getting too far away, and I need to keep pushing those forward that can go forward, and those that still need more skills need to still have that practice. Because if I keep them at the same pace, it's not going to be fair to either one of them. Kayla: I agree too. Like Dawn said, not even in small group but as a whole class.

Because number one, it's really hard for a teacher to teach when we do whole group lessons, to have kids on a 3rd grade level and kids who are scoring [at superior levels] on the [state-mandated test] in the same room. And then you end up teaching to the middle and not teaching to either.
An added difference between the attributions made for Math 6 and Math 6 Plus students was within the effort attribution. When describing how apathy comes into play for Math 6 students in the math exploration course, Dawn explained during her interview, “I think they get tired of having to work hard and think critically. And I think they are starting to feel bad about themselves because there are other kids that do not have to take a second math. So, this is the stretch of the year that I'm getting kids that say, ‘I don't want to be in here anymore.’” Further, while describing various levels of student effort, neither Karen nor Kayla mentioned apathy attributions for “advanced” students.

From the start of the school year, it was evident the 6th grade teachers held higher expectations for students in the Math 6 Plus classes than for those in Math 6 classes. During the first observed 6th grade PLC meeting, Karen spoke highly of her “advanced” class, stating that an assignment “definitely won’t take long for my plus kids,” and when explaining how the introduction to the Breakthrough textbook went, said, “my plus kids went faster, and they could follow the paper,” implying that students from her other classes could not. These differential expectations were consequential considering the different types of learning opportunities provided to the students. The difference in outward expectations was stark when Karen said, “with my lower classes, I went through this with them, but for my AIG group, they went through it on their own. I needed to make sure [regular classes] understood it, so I didn’t pass out the worksheet.” I outline findings relevant to students in differently perceived ability groups getting different learning opportunities in more detail under opportunities to learn.

7th Grade PLC. The most frequently utilized attributions by the 7th grade PLC are displayed in Table 4.12. Like the 6th grade PLC, the 7th grade teachers frequently
acknowledged that “regular” students begin 7th grade with noticeable gaps in their mathematics knowledge. However, though students being promoted to the next grade despite gaps in their knowledge is something out of the students’ control, the amount of effort exerted, and classroom behavior are within their control. Though not attributed collectively, Emma, Mark, and Angela separately specified student behavior and components of student effort as factors frequently contributing to students’ mathematics performance. Considering how often the 7th grade PLC works together and their rate of agreement while discussing student performance, they likely agree students should be more responsible for their learning by the time they begin 7th grade. Still, forcing that effort or behavior upon students is something the 7th grade teachers cannot ultimately control.

Table 4.12
_Frequently observed 7th grade attributions for differently perceived groups._

<table>
<thead>
<tr>
<th>Attribution/Group</th>
<th>Ability (U)</th>
<th>Behave (U)</th>
<th>Effort (U)</th>
<th>Gaps (U)</th>
<th>Support (U)</th>
<th>Teacher (C)</th>
<th>High Exp.</th>
<th>Low Exp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>“high”</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>“low”</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Math 7 Plus</td>
<td>9</td>
<td>3</td>
<td>13</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td>Math 7</td>
<td>5</td>
<td>15</td>
<td>30</td>
<td>11</td>
<td>6</td>
<td>9</td>
<td>5</td>
<td>10</td>
</tr>
</tbody>
</table>

When attributing classroom outcomes to student behavior, every attribution for “regular” students referenced poor student behavior as negatively impacting their ability to learn. In contrast, two of the three behavior attributions for students in Math 7 Plus explained why they might be performing well. For example, when grappling in her interview with how to provide “advanced” students with more enriching opportunities, Emma acknowledged, “we're like, ‘oh, they're good studious kids, we give them this list, they're going to get everything done.’ And then, they're playing school, they've got it.”
Perhaps the most striking result from Table 4.12 is the number of low expectations communicated for “regular” or “low” students compared to the high expectations communicated for “advanced” or “high” students, a pattern following the low-expectancy cycle (Weiner, 1976). A prime example of low expectations collectively held across the 7th grade PLC for “regular” students occurred when Emma shared in a meeting, “we have so many kids that we’ve pushed into Plus this year who were normally in regular classes. So, our regular classes do not have a huge chunk of high fliers, because most of them have been pushed into the plus class.” Further, when probed in her interview about underachieving Math 7 students, Angela explained, “I think for most of the kids that we have, their performance is what’s expected, unfortunately.”

When I juxtapose the 7th grade PLC’s expectations for “regular” students with those for “advanced” students, the low-expectancy cycle is in effect. During a 7th grade planning period amidst a full-day observation of Emma’s teaching, she and Angela discussed what they expected to see for the rest of the day. Angela referenced the Math 7 Plus class when she shared, “I think we’ll see some really great ideas next block.” During the Math 7 Plus class period later that day, Emma told the class, “since your class might move at a little faster of a pace than the other classes, if we get through with today’s activity, we can get to the challenge activity that we didn’t get to yesterday.” Finally, comments from Mark often reflected higher expectations for his “advanced” students. On multiple occasions, during PLC meetings, he made comments like, “all the plus kids did it, of course,” or “I expect my plus kids to get all of them right.”

8th Grade PLC. The most commonly elicited attributions by the 8th grade PLC are outlined in Table 4.13. Compared to the other two grade levels, the frequency of attributions
crediting “advanced” student ability in Math I is notable. During her interview, when
Caroline described her Math I class, she alluded to their ability by speaking in terms of how
smart they are, “it’s a fun class, they can do a lot. And they’re a higher Math I than Julie’s.”
She elaborated by describing one particular Math I student, “We have the smartest math
student in the school in our class. His mom just didn't want him taking Math II online, which
is why he's only in Math I.” Likewise, when Julie introduced herself to her Math I class on
the first day of school, she began by telling them directly, “being in Math I is proof that you
are already mathematically able to be at the next level.”

Table 4.13

Frequently observed 8th grade attributions for differently perceived groups.

<table>
<thead>
<tr>
<th>Attribution/Group</th>
<th>Ability (U)</th>
<th>Behave (U)</th>
<th>Effort (U)</th>
<th>Gaps (U)</th>
<th>Support (U)</th>
<th>Traits (U)</th>
<th>High Exp.</th>
<th>Low Exp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math I</td>
<td>12</td>
<td>0</td>
<td>11</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>19</td>
<td>3</td>
</tr>
<tr>
<td>Math 8</td>
<td>5</td>
<td>9</td>
<td>18</td>
<td>6</td>
<td>5</td>
<td>7</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>

Note. Attributions for groups perceived to be “high” and “low” were not prominent enough
to be featured.

Contrasting with her idea that Math I students do well in math because they are
bright, Julie explained in her interview that Math 8 students struggle because they lack the
ability exhibited by Math I students, “I don't want this to sound like I don't think my math 8
kids are smart, but with Math I students, you're just able to see that level of thinking
sometimes that you see less often in Math 8. They're not constantly questioning or pushing
themselves to think about ‘why does it happen that way?’ They, in Math 8 just want to
understand.”

Julie and Caroline collectively attributed student struggles in Math 8 to a lack of
support at home and student effort, factors both out of their control. Moreover, apathy was
attributed to “regular” math students more often among 8th grade teachers than 6th or 7th
grade. Julie described their struggle with apathy during the 8th grade focus group:

It’s discouraging, but at the same time you know well, okay, for that group of kids, I have to be even more of an advocate. I can’t let them down just because somebody else has. So, I guess for me, I feel like that’s where some of their-- and I don’t necessarily think that’s always the gap in their understanding (Caroline: mm hmm) but just their stick-with-it-ness. Their "I have nobody pushing me, you know, so if I’m the only one doing it here at school," then it’s like, they’ll do [the work] for me here at school, but then it’s like, are they going to do it anywhere else?

Effort was also frequently used as an attribution for students in Math I classes as a factor contributing to their performance. According to statements made by Julie and Caroline in interviews, there are always students in Math I who, “have never had to work at getting math done. It's always just happened, because it's always been easy.” Thus, according to the 8th grade PLC, some Math I students need to exert more effort in order to meet expectations, which are considerably higher for Math I students than Math 8 students.

Perhaps due to the nature of Math I being a completely separate accelerated course for 8th grade students, the 8th grade PLC articulated high expectations for these students three times more often than for Math 8 students. As admitted by Caroline in her interview, “I definitely make assumptions with Math I that I would not make with Math 8 as far as what they know and what they come in with and how fast I can go.” Julie added by explaining in her interview:

Math I, I think, is a little bit different because they-- Caroline and I come to that class with a little bit of a different expectation. They are where they are because they've either proven that they're definitely a self-motivated, independent learner, or they
have proven they have math skills that kind of set them apart from another group of kids. And so, we kind of come at them with a little bit different approach in that they, well we have a little bit higher expectation.

Caroline and Julie were mindful of their different levels of expectations for each perceived ability group and realized the need to find a remedy. I documented this type of reflection on two occasions. Once, when Julie concluded her comments about holding higher expectations for Math I students during her interview, she said, “it sounds like I don’t expect the other ones to do that, but I guess that’s just kind of the way it is,” and again when Caroline and Julie described in their focus group how their expectations for Math 8 students dictate how they deliver instruction:

Caroline: How far do you let them struggle (Julie: right) before you just have to summarize everything and say, “this is what we're doing.”

Julie: Right. “This is A-squared plus B-squared equals C-squared, and this is how you do it.”

Caroline: And here’s how you do it.

**Research Question 3**

In what ways do collective attributions and beliefs about students’ mathematics capabilities influence the planning and implementation of learning opportunities for students placed in varying ability groups?

**Opportunities to Learn**

Due to the embedded nature of this study, I gathered information regarding the planning, reflection on, or implementation of learning opportunities from a variety of angles. During the analysis process, I gave special attention to the learning opportunities data to
ensure lessons, assignments, and tasks were not represented more than once for reporting. Because 19 out of the 25 math classes at Gator Ridge were “regular” math classes, the learning opportunities for “regular” classes would have been vastly overrepresented otherwise. Therefore, if a particular lesson was observed three times over the course of one day, it was only considered for analysis once, though it may have been coded once during planning, three times in field notes, and again if a worksheet from the lesson was scanned as a learning opportunity.

The learning opportunities that could be analyzed using the Task Analysis Guide (TAG; Smith & Stein, 1998) and the Eight Standards for Mathematical Practice (CCSSO, 2010) are the primary learning opportunities I reference in this section. On countless occasions, teachers mentioned students needing “more practice.” This need for more practice often manifested later as a worksheet with a series of naked-number problems. These “other” assignments were typically independent practice assignments completed in a small group station, and were not coded using the TAG, but were coded instead as practice, or reteach/review. If each of these “opportunities” had been coded using the TAG when mentioned, they would all fall within the procedures without connections or memorization categories. For a deeper description of the Task Analysis Guide and the Eight Standards for Mathematical Practice, see Appendix E.

Department wide, the math teachers at Gator Ridge began the 2017-2018 school year by implementing a series of high-quality, rigorous, meaningful mathematics lessons. Every student spent the first five to ten math classes learning classroom rules and procedures while they engaged with lessons from Boaler’s Week of Inspirational Math (“Youcubed,” 2018). In each grade level, students in “regular” math classes had access to the same learning
opportunities as students in “advanced” classes. If the Math 7 classes worked through a
lesson looking for patterns with circle diagrams, the Math 7 Plus classes did as well. The
Week of Inspirational Math lessons were heavy in opportunities to utilize the Eight Standards
for Mathematical Practice, and the nature of each task allowed it to fall within TAG category,
doing mathematics.

The implementation of high-quality learning opportunities gradually tapered in the
weeks following the Week of Inspirational Math. Across grade-levels and perceived student
levels, opportunities to learn transformed from inquiry-oriented, open-ended tasks to
procedure-oriented, practice-heavy assignments. Moreover, due to limited training and the
pressure of time constraints, teachers slowly abandoned the Breakthrough resource and
instead relied on textbooks, online resources, and activities they had grown comfortable
using from years of experience.

In particular, the 8th grade PLC continued to prioritize the Breakthrough text as a
resource for planning and implementing classroom activities throughout the month of
September. For example, their Math 8 classes engaged with a cake cutting investigation as a
way to get better acquainted with negative exponents. This activity allowed students to utilize
two mathematical practices: look for and make use of structure and look for and express
regularity in repeated reasoning. In turn, Math I classes had several opportunities to engage
with Breakthrough tasks, like one where they worked in groups to match expressions to word
problems and visual representations. This task prompted students to engage with four of the
mathematical practices: make sense of problems and persevere in solving them, construct
viable arguments and critique the reasoning of others, look for and make use of structure,
and look for and express regularity in repeated reasoning.
In some instances, the inquiry-oriented learning opportunities were not derived from any particular resource, but from a whole-group discussion prompted by the teacher. For example, Julie asked her Math 8 students to look for a pattern with perfect squares and perfect cubes and to discuss their ideas with their group members. Additionally, Karen asked the Math 6 students in her Academy Time to be teachers and show her how they are able to identify greatest common factors and least common multiples.

The teachers occasionally interspersed complex tasks while they settled into more familiar instructional patterns. However, as the weeks progressed, the equitable implementation of learning opportunities on display during the opening days dissipated. Low-level tasks became the norm in both “regular” and “advanced” classes, though much of the inequity in opportunity came into play with the speed at which teachers progressed through concepts. For example, the perception that her inclusion class was “so low” prompted Karen to hold her first and third period classes well behind her second period Math 6 Plus class and her “higher” 6th-period Math 6 class. Similar patterns emerged for 7th and 8th grade classes perceived to be “low.”

For tasks coded using the TAG, the majority fell under the procedures without connections category, particularly for Math 6 and Math 7 classes. A breakdown of coded tasks as they were implemented for each math course over the course of data collection is provided in Table 4.14.
Table 4.14
Task analysis guide learning opportunity frequencies.

<table>
<thead>
<tr>
<th>TAG level/ Math course</th>
<th>Memorization</th>
<th>Procedures without connections</th>
<th>Procedures with connections</th>
<th>Doing mathematics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 6</td>
<td>13</td>
<td>23</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>Math 6 Plus</td>
<td>0</td>
<td>7</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>Math 7</td>
<td>4</td>
<td>12</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Math 7 Plus</td>
<td>1</td>
<td>6</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Math 8</td>
<td>5</td>
<td>7</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Math I</td>
<td>1</td>
<td>5</td>
<td>6</td>
<td>2</td>
</tr>
</tbody>
</table>

Note that for each grade level, students in “regular” classes were given memorization tasks more than their “advanced” peers. This finding aligns with the aforementioned research on tracking and opportunities to learn (Oakes, 1985; Wilhelm et al., 2017). Further, most of the observed doing mathematics lessons occurred in August. Also, the primary purpose of tasks categorized as procedures without connections or procedures with connections was to prepare students for the types of questions they would see on tests.

Typically, the difference between a procedures without connections task and a procedures with connections task was the nature of the procedures with connections tasks. These tasks either led students to eventually make connections between the procedure and the bigger picture, or the teachers engaged students in conversation that contextualized the procedure. For example, when introducing integer addition and subtraction to small groups, Emma would consistently connect to students by getting them to think about earning or spending money, whether they had enough, or if they would be in debt. In comparison, Emma and Angela showed an integer addition “rap” video later in the unit with lyrics like, “Same sign, add. Different sign, subtract,” that simplified the operations to a mere procedure.

The inclination to teach with the test in mind drives every math teacher at Gator Ridge, interacts with the attributions they make for student performance, and influences the
types of learning opportunities they provide to their students. During a full-day observation with Dawn, she shared that one of the math department’s goals was to increase practice questions’ rigor to prepare students for the intensity of the state-mandated questions in May. During the 7th grade focus group, Angela explained how 7th grade teachers structure their class time to accommodate for upcoming assessments:

I don't think they've ever been exposed to such rigorous questions before (Emma: yeah). And I think it's a shock for them (Mark: yeah) when they see-- if we didn't make those study guides, I think the first test checkpoint (Emma: they would have bombed) it would have been a bomb. But they were exposed to the questions before (Mark: yeah). Different numbers, obviously, we're not teaching the test, but just the types of questions. I mean, even some of them surprised me. Like, this is a lot.

In this episode, the 7th grade PLC credits the practice problems from a preparatory study guide for student performance on a checkpoint test. The teachers take advantage of their access to test questions ahead of time and mirror those questions when creating study guides for students.

In 7th grade math classrooms, three days per week are spent in practice-heavy small group stations, one day is reserved for review, and one day is spent assessing. This schedule leaves little time for grappling with open-ended tasks. Emma expressed concern with this in her interview when she shared, “I feel like with our small group setup, we're doing a lot of procedural fluency, more direct instruction, and there's not as much conceptual discovering. I wish we could find a balance between the two while still doing small groups.”

Finally, a common point of concern among the teachers at Gator Ridge was that the students in “advanced” classes were not being provided with enough opportunities for
enrichment. When the teachers voiced this concern, it often took the shape of the “advanced” students not “having their needs met” with instructional opportunities. In contradiction to this concern, as teachers habitually provided the types of assignments that they hoped would lead to the improved scores, the steady diet of repetitive, procedural-based practice with these students remained constant.

Driven initially by Greg, the AIG specialist, and continued by the teachers in PLC meetings, the conversation surrounding insufficient learning opportunities for students in “advanced” classes is problematic when contrasted with the repetitive and remedial opportunities offered to students in the “regular” classes. As a witness to the types of learning opportunities teachers offered to Math 6 Plus and Math 7 Plus classes, Greg lamented in an observed conversation with Mark, “When are you going to let your kids run free? They’re dying down there in 6th grade, too.” Comments like these alter the equity dispositions co-constructed by the math teachers in a PLC, with outward encouragement to provide higher quality lessons to students in “advanced” classes because they “need” them. Strikingly, Greg admitted in an early September meeting that teaching practices previously considered to be special for “advanced” students (specifically, those labeled AIG) are now considered best practices for all students, and within the next five years, they’ll need to find something new to be considered extra special, because their parents will demand it. The expectation from “advanced” students’ parents that their children are entitled to higher quality learning opportunities is similar to what Cobb and Russell (2015) discovered when the middle school they were studying attempted to eliminate tracking practices.
**Equity Dispositions**

Using the model of external social motivation, the math teachers at Gator Ridge demonstrated varying equity dispositions, which I consider on a qualitative spectrum ranging from *traditional tendencies* to *equitable tendencies*. I settled on each teacher’s equity disposition (or tendency) by using the model to evaluate relevant comments made in meetings and with students. Relevant comments included anything considered mastery or performance oriented, any comments indicating adherence to the belief that some people are inherently math people, and the nature of their ability attributions for students in differently perceived groups.

Teachers who exhibited a pattern of performance-oriented comments, entity theories of mathematics ability, different ability attributions for “advanced” and “regular” students, and evaluative behaviors tend to be more grounded in traditional pedagogies and practices. Conversely, teachers observed communicating mastery-oriented comments, incremental theories of mathematics ability, attributions regarding the controllability of student ability, and thus, mastery behaviors, demonstrated more equitable tendencies concerning their teaching practice. For an overview of each teacher’s individual disposition, refer to Table 4.15.
Table 4.15
Teacher snapshots – Model of external social motivation.

<table>
<thead>
<tr>
<th>Teacher (grade)</th>
<th>Mastery comments</th>
<th>Performance comments</th>
<th>Implicit theory comments</th>
<th>Ability attributions per math course</th>
<th>Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kayla (6)</td>
<td>10</td>
<td>3</td>
<td>Incremental (2)</td>
<td>Math 6 (occasionally speaks in terms of ability, trying to speak more in terms of potential for growth)</td>
<td>Mastery (emergent)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Entity (2)</td>
<td>Math 6 Plus (speaks in terms of ability)</td>
<td></td>
</tr>
<tr>
<td>Karen (6)</td>
<td>10</td>
<td>17</td>
<td>Incremental (1)</td>
<td>Math 6 (speaks in terms of low and high ability)</td>
<td>Evaluative (established)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Entity (3)</td>
<td>Math 6 Plus (speaks in terms of high ability)</td>
<td></td>
</tr>
<tr>
<td>Dawn (6)</td>
<td>27</td>
<td>3</td>
<td>Incremental (3)</td>
<td>Math 6 (speaks in terms of potential for growth)</td>
<td>Mastery (established)</td>
</tr>
<tr>
<td>Emma (7)</td>
<td>22</td>
<td>13</td>
<td>Incremental (1)</td>
<td>Math 7 (occasionally speaks in terms of ability, trying to speak more in terms of potential for growth)</td>
<td>Mastery (emergent)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Entity (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mark (7)</td>
<td>17</td>
<td>7</td>
<td>Incremental (1)</td>
<td>Math 7 (speaks in terms of low ability)</td>
<td>Evaluative (withdrawing)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Entity (6)</td>
<td>Math 7 Plus (speaks in terms of high ability)</td>
<td></td>
</tr>
<tr>
<td>Caroline (8)</td>
<td>11</td>
<td>4</td>
<td>Entity (1)</td>
<td>Math 8 (speaks in terms of ability, but also talks about opportunities for growth)</td>
<td>Mastery (emergent)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Math I (speaks in terms of high ability)</td>
<td></td>
</tr>
<tr>
<td>Julie (8)</td>
<td>8</td>
<td>13</td>
<td>Incremental (1)</td>
<td>Math 8 (speaks in terms of low ability)</td>
<td>Evaluative (withdrawing)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Entity (2)</td>
<td>Math I (speaks in terms of high ability)</td>
<td></td>
</tr>
</tbody>
</table>
According to Dweck and Leggett (1988), teachers who subscribe to entity theories of intelligence, attribute ability as fixed and uncontrollable, and value performance or judgment goals in the classroom are more likely to exhibit evaluative behaviors toward their students. Observations of Karen, Mark, and Julie, revealed their orientations toward this combination of beliefs, and in turn, their tendency to exhibit more traditional, evaluative behaviors. Often, this traditional tendency manifested in the decision-making process when they planned learning opportunities for their students. In contrast, Kayla, Dawn, Emma, and Caroline tended to exhibit equitable, mastery behaviors most often by frequently communicating mastery goals and incremental theories of intelligence. In the sections that follow, representative samples for each teacher demonstrate how their tendencies connect with the types of opportunities they were willing to provide to each group of students.

**6th Grade PLC.** Among teachers identified to exhibit evaluative behaviors and traditional tendencies, Karen was the most firmly established. More than any math teacher, Karen referred to her students in terms of their ability and was the first to decide the needs of each group of students. The learning opportunities for Karen’s students were the most procedural and memorization based, regardless of perceived ability. However, she provided more learning opportunities to her Math 6 Plus class due to a slightly accelerated concept delivery. One of the more extreme representations of Karen’s evaluative behavior came in a PLC meeting when she said she should give the lowest performing small groups in her inclusion class “coloring when they’re not with her.”

Karen’s firm orientation toward ability attributions and performance goals may explain why the 6th grade PLC was in agreement less often than the 7th and 8th grade PLCs. While Kayla occasionally uttered fixed ideas, she would also self-correct an entity-oriented
comment when she caught herself. Influenced possibly by working in close proximity with Dawn for three years, Kayla was more likely to give students opportunities to figure out why a particular procedure works than to give them a rule to memorize. From her interview, Kayla demonstrated her emergent mastery orientation when she emphasized her hope that students from both Math 6 and Math 6 Plus learned “to be a good person, a good friend, and also that they’re able to use the math they learn, to be able to apply it to the real world, and not just do it on a paper test.”

Formerly the math interventionist for Gator Ridge, Dawn was the teacher who most definitively and consistently demonstrated mastery behavior, making her the most firmly established as having equitable tendencies. From 6th grade PLC meetings to the vertical department meetings she led monthly, Dawn exuded mastery behavior. Dawn encouraged the math teachers to engage in a book study of Jo Boaler’s (2016) *Mathematical Mindsets*, and often refocused conversations of student struggles toward solutions to enhance learning. During her interview, Dawn described how her mastery orientation fit with the 6th grade PLC:

I may be too far over on the growth mindset and not far enough over on math facts. I understand that. I know that, and I kind of balance on that continuum, but I know I lean way over here [gestures to one side], and I'm going to say Karen leans way over here [gestures to the opposite side], and I think Kayla's just still trying to find herself in there. I don't think she has a direction right now. So, I feel like for us to move forward, we're going to have to come to some consensus on what learning is, and what learning looks like.

7th Grade PLC. The 7th grade PLC is motivated by success and is an exemplary team
among the existing PLCs at Gator Ridge. Having demonstrated excellence in previous years by improving test scores and developing positive relationships with their students, Mark and Emma take pride in having implemented small group instruction techniques first, which further encouraged the principal to mandate small group instruction across the school. Though the 7th grade PLC shares a vision for student learning, when observed individually Emma and Mark often expressed opposite ideas about differently perceived groups of students.

According to the model of external social motivation, Mark and Emma demonstrated dichotomous dispositions. Emerging in the mastery behavior category, Emma occasionally mentioned uncontrollable ability attributions, but was the most reflective of her practice when contemplating what she and Mark could do to gain more control over student learning. This reflection prompted me to note that Emma tends to lean toward equitable instructional practices. Like Dawn, Emma was cognizant of the research encouraging teachers to embrace an incremental theory of intelligence and works within her classroom to help students see their abilities as malleable. Emma’s mastery orientation was confirmed in her interview when she shared what it takes for students to find success in her Math 7 classes:

Getting them to have a growth mindset about themselves and about their abilities in math, and to adopt the thought that “I don't understand yet,” instead of “I just don't know,” and “I don't understand.” It's “I don't understand yet, but I am getting better, and I'm going to continue to get better.” And getting them to believe in themselves. And celebrating every little bit of success or growth, because then it will snowball.”

Mark is an energetic math teacher, often jovial with students and teammates alike. Perhaps due to his quickness of wit, or the fact he was always in “advanced” classes as a
child, Mark often referred to the students in his Math 7 Plus class as inherently smart. For example, in one PLC planning meeting, Mark stated, “they don’t have to finish them all. We just need to have enough in case the smart kids finish them all.” On another occasion, during a full-day observation, he shared with me how well a self-paced lesson went with the Math 7 Plus class last year, but it could have been “because they’re smart already.” These off-the-cuff remarks contributed to Mark’s designation as a teacher oriented toward evaluative behaviors. However, the frequency of informal 7th grade PLC meetings and the rate of agreement between Mark and Emma leads me to project Mark’s eventual withdrawal from evaluative behaviors and traditional tendencies toward more equitable tendencies.

Briefly, while Angela participated in one-on-one interviews and the 7th grade focus group, she was rarely my sole observational focus as she shared teaching responsibilities with Emma for much of the data collection period. However, comments from Angela relevant to the model of social motivation were noted as contextual components and indicators of the 7th grade PLCs orientation toward students in leveled groups. Possibly due to inexperience, Angela often exhibited evaluative behaviors and had a tendency to prefer more traditional pedagogies. For example, when asked to identify one thing she hoped students in Math 7 classes learned this school year, Angela stated, “Character and integrity. I mean, I can honestly throw all the math out the window, and if the majority of these kids learn about character and integrity, I think so many of our other problems would be fixed.” Later, when asked the same exact question, but for students in the Math 7 Plus class, Angela expressed her hope they would learn, “How to challenge themselves. Most of these kids, I can look at them and say, ‘You're going to be successful when you grow up.’ But I think for them to be the most successful they need to really take charge of the gift that they've been given and go
as far as possibly they can.”

8th Grade PLC. Much like the 7th grade PLC, Julie and Caroline were individually oriented toward different types of behaviors based on comments made over a series of observations. However, compared to the 6th grade PLC, the degree of difference between their individual orientations is less consequential for student learning. This was particularly true when their rate of agreement and frequency of informal meetings were taken into consideration. Caroline and Julie planned everything together, so on any given day, they were teaching the same lessons and providing the same learning opportunities.

Both Caroline and Julie communicated an entity theory of intelligence directly to the students in their Math I classes, implicitly projecting higher expectations onto these students; expectations to which those placed in “advanced” classes are accustomed. During my first full-day observation of Caroline, she took time in each class to list potential paths the students might follow after graduation. For Math 8 classes, she explained they might choose to “go to college, community college, or trade school,” but to her Math I students proclaimed plainly, “when you go to college…” Similarly, Julie voiced heightened expectations for Math I students when she shared with them how they “have proven they’re self-motivated, independent learners, or have math skills that set them apart from everyone else.”

Caroline demonstrated emergent mastery behavior by frequently mentioning the importance of learning from mistakes. On the other hand, Julie emerged as more oriented toward evaluative behaviors by frequently expressing frustration with an inability to effectively reach ELL students. Lastly, during one observation in her permanent Academy Time, Julie emphasized to her students they should be faster with completing integer operations, which demonstrates a tendency to lean toward performance or judgment goals.
CHAPTER 5: Discussion

Teachers restricted by accountability measures are continually aware of the pressure to produce quality test scores (Gutierrez, 2013b). With this study, I examined how mathematics teachers from Gator Ridge, a single, suburban middle school, functioned under those pressures to collectively evaluate student performance and plan and implement learning opportunities for differently leveled courses. As part of a district-wide expectation, each grade-level math PLC held regularly scheduled, formal meetings for planning and data evaluation. While observing these meetings, I realized how collective attributions for student performance and teacher behaviors were impacted by the pressures to produce quality scores and implement top-down initiatives. I collected additional qualitative data through teacher observations, interviews, and focus groups.

By using the model of external social motivation (Dweck & Leggett, 1988), I identified each teacher’s tendency to provide equitable learning opportunities across ability groups. Interestingly, the equity dispositions for each PLC were split with one teacher from each PLC frequently exhibiting traditional tendencies, and the other frequently exhibiting equitable tendencies. This dynamic contributed to specific collaborative dynamics for each PLC and influenced the types of learning opportunities made available to students at all levels. In the following sections, I will answer each research question with the key findings while making connections with the existing literature.

Research Question 1

How does the context of a tracked middle school impact math teachers as they collectively evaluate student learning and plan learning opportunities?
Figure 5.1 demonstrates the primary contextual features impacting math teachers’ as they collectively evaluate student learning at Gator Ridge. Further, these six features influence the teachers’ willingness and ability to implement more equitable and more cognitively demanding learning opportunities to students in each perceived ability group.

**Figure 5.1. School context for math teachers at Gator Ridge.**

The three components on the left side of Figure 5.1 represent the most consequential top-down initiatives required for the Gator Ridge math teachers to abide by and implement. The right side of Figure 5.1 communicates that the pressure on math teachers to perform, their equity dispositions, and the observed cohesiveness of each grade-level math PLC contributes to the overall context for math teaching at Gator Ridge.

I selected Gator Ridge as the site for my study because of its demographic diversity, traditional grouping of students by perceived mathematics ability for instruction, and teachers’ utilization of a PLC model as a collaborative means to evaluate students’
mathematics performance while also planning and implementing learning opportunities. Under these conditions, specific characteristics paralleled the findings of previous studies. For example, “regular” math classes were disproportionately composed of students from historically marginalized backgrounds relative to the school’s population, while “advanced” math classes contained a disproportionate number of White students (e.g. Burris, 2014; Dauber et al., 1996; Kalogrides & Loeb, 2013; Oakes, 1985). Moreover, though transitioning to be more inclusive, the procedures followed to determine math placement utilized traditional factors like teacher recommendations (Dweck, 1986; Faulkner et al., 2014), and parent involvement (e.g. Burris & Garrity, 2008; Cobb & Russell, 2015; Useem, 1992a; 1992b) even after the top 60 students were considered for “advanced” placement from their test scores.

**PLC Relationships**

Teachers in each PLC frequently agreed that top-down initiatives like the district-mandated administration of common pre-unit, benchmark, and unit tests minimized their freedom with content delivery and pushed them to cover content by a specific time. Adding to their frustration, the math PLCs were working to shift their shared visions away from a focus on content coverage toward a focus on increasing student learning; yet another top-down initiative. Thus, when teachers prioritized preparing for common assessments, they felt like they had to focus on content coverage but were *supposed* to be adjusting their instruction to ensure students were actually learning. Mixed messages from administration and the collection of initiatives being enacted impacted teachers’ attitudes and behaviors (LeChasseur et al., 2016), especially considering they so frequently attributed student performance to factors they could not control.
The model of external social motivation (Dweck & Leggett, 1988) guided my identification of implicit belief and behavior patterns among math teachers, providing clarity when interpreting group-level dynamics within each PLC. Derived from my embedded observations, the convention for labeling each PLC is useful for comparing PLCs within a school, and is based purely on my interpretations of the noteworthy relationships in qualitative data analysis.

The 8th grade PLC emerged as established based on several factors. Relative to other PLCs, Caroline and Julie have taught together the longest, made the fewest attributions, agreed most frequently, met informally most often, taught the exact same lessons, and persisted longest with Breakthrough lessons. The difference between Julie’s tendency to exhibit evaluative behaviors and Caroline’s tendency to exhibit mastery behaviors was the smallest across PLCs, and depending on the days I observed, could very well have been flipped in the opposite direction. Further, the shared vision for the 8th grade PLC is the most solid. Julie and Caroline operate under the assumption that 8th grade students are their combined responsibility, and even occasionally swap students if they think it might be beneficial for the student to hear a slightly different instructional style.

With the same factors in mind, the 7th grade PLC emerged as systematic. Compared to the 8th grade PLC, Emma and Mark have worked together for fewer years, made more attributions, agreed less often, met informally nearly as often, and also taught the exact same lessons. The 7th grade PLC rarely used Breakthrough due to the nature of their small group station rotations. Unlike Julie and Caroline, the behaviors exhibited by Mark and Emma were less likely to be flipped if I observed them on different days. Mark voiced entity-oriented comments more than any other math teacher, especially when speaking highly of his Math 7
Plus students, whereas Emma is nearly established in her mastery orientation, competing for the role of most consistently reflective math teacher at Gator Ridge. The 7th grade PLC’s shared vision is similar to 8th grade’s. Mark and Emma take responsibility for 7th grade math students broadly and reach beyond the walls of their classroom to ensure student success. In fact, while Angela assumed instructional responsibilities in October, Emma occasionally taught small groups in Mark’s class while he worked with others.

Lastly, among the same factors, the 6th grade PLC emerged as developing. The 6th grade PLC had worked together for less than a year, made the most attributions, agreed least often, rarely met informally, and rarely taught the same lessons as each other. The 6th grade teachers attempted to use Breakthrough as a resource early in the year, but eventually settled on more familiar sources when planning assignments or activities. As Dawn mentioned when she described her mastery-orientation relative to Karen and Kayla, the 6th grade teachers were the most noticeably different with the behaviors they exhibited relative to the model of external social motivation. Similar to what Grossman, Wineburg, and Woolworth (2001) dub a pseudocommunity, the 6th grade PLC rarely agreed with each other but by suppressing conflict during meetings, “paved the way for the illusion of consensus” (p. 955).

**Research Question 2**

In a middle school that groups students for mathematics based on perceived ability, to what do mathematics teachers collectively attribute differential student success?

**Attributions**

Capturing collectivity for attributions among PLC members was more challenging than anticipated. Even after fourteen weeks attending to agreement in teachers’ conversations, much of the agreement I witnessed existed on items unrelated to attributions.
Regardless of perceived student levels, student success, or student underperformance, Gator Ridge math teachers attributed student performance to factors outside their control the majority of the time. As Evans (2009) found, teachers have a need to be in control of student learning and when they attribute performance to factors perceived out of their control, their collective sense of efficacy is negatively impacted. Indeed, as voiced by teachers in focus groups, they were often frustrated by student behavior, gaps in knowledge, low levels of parental support, and limited English proficiency. When making these attributions, teachers demonstrated feelings of powerlessness associated with student learning in their PLC conversations.

Notably, the number of spoken attributions made by each PLC decreased as the years working together increased. Reflecting on the frequency of agreement within each PLC and their years of collectively making attributions, I find it plausible that many of the attributions between Julie and Caroline, for example, were unspoken and exist as collectively understood constructs influencing their planning of learning opportunities. After all, when directly asked why they think some groups are more successful than others, the 8th grade PLC was in agreement across those attributions. In contrast, teachers in the 6th grade PLC were still getting to know one another, and by frequently sharing their attributions, expressed what they believed they had the power to change.

Sixth and 7th grade teachers communicated low expectations for students in their “regular” math classes and frequently made knowledge gap attributions for their underperformance. By charging current student performance to previously missed opportunities or to the system that passed them on to the next grade without demonstrating an increase in learning, the teachers eliminated themselves from consideration when searching
for tools to rectify the existing gaps. In turn, if teachers believe they lack agency to help students fill those gaps and make learning gains, they have little incentive to implement learning opportunities at the caliber of doing mathematics (Evans, 2009). This is especially consequential at Gator Ridge, where I observed teachers implementing the highest quality tasks during the first two weeks of school before they really got to know their students.

Known student traits like ELL status, ADHD diagnosis, or household culture were frequently referenced among teachers as the cause of student struggles. Commonly discussed among the 8th grade PLC, students struggling to read and comprehend complex story problems in English felt like an insurmountable obstacle. Additionally, the heightened frequency of behavior attributions in the 7th grade PLC were associated with the presence of one Latinx male student who had been expelled in 6th grade and negatively dominated the classroom atmosphere when he was present. Emma and Angela most often attributed the negative dynamic and overall class performance in their 6th period to the attendance of this student, who they further explained was “affiliated with a gang.” Though his behavior was extreme at times, the deficit thinking (Ladson-Billings, 1995) associated with his presumed affiliation and culture prompted the teachers to utilize the behavior and traits attributions more than they did for their more affluent “advanced” class.

The least commonly used attribution among all those which emerged during data analysis was the access and opportunity attribution. Rather than explaining a student’s history of poor performance on a lack of access to high quality learning opportunities, the teachers were inclined to attribute poor test scores to previous poor performance. Gator Ridge math teachers likely lack awareness of the gaps in opportunity provided to students beginning in elementary school when they begin to be separated based on perceived ability.
Caroline nearly touched on the opportunity gap (Wilhelm, Munter, & Jackson, 2017) during the 8th grade focus group when she expressed, “I feel like they keep getting-- I mean it's almost like the income disparity. The smart keep getting smarter, and my strugglers keep struggling more.” Unbeknownst to Caroline, the income disparity she alluded to runs adjacent to the gap in opportunities her “smart” and “struggling” students have experienced for nine years, particularly extant for the lowest performing minority students in her Math 8 classes.

**Research Question 3**

In what ways do collective attributions and beliefs about students’ mathematics capabilities influence the planning and implementation of learning opportunities for students placed in varying ability groups?

I expected the quality of learning opportunities provided to differently leveled math classes to align with previous studies (i.e. Berry, 2008; Boaler, 2016; Cobb & Russell, 2015; Oakes, 1985). Though I anticipated uncovering structural components that restrict or enable teachers to provide equitable learning opportunities across tracks, I did not anticipate teachers would primarily offer repetitive, procedurally-driven practice or review to all students.

As previously demonstrated in Figure 5.1, top-down initiatives and the pressure to perform impacted opportunities to learn for students in every math classes, regardless of their perceived ability. Based on their individual implicit self-theories, achievement goals, and ability attributions, each PLC demonstrated a tendency to provide higher quality learning opportunities to students perceived to be more “advanced.” Every participating teacher mentioned a desire to provide more enrichment opportunities to their “advanced” students.
Further, when Greg was present, the teachers spoke as though “advanced” students were entitled to better opportunities. Likewise, PLCs were more inclined to provide remedial practice opportunities to their “regular” classes in an effort to make them successful. However, teachers had a habit of continually preparing students for tests. This resulted in a steady flow of assignments intended to improve procedural fluency across perceived ability groups. The pressure on teachers to generate improved test scores seemingly overrode teachers’ equity dispositions. Thus, while the teachers demonstrated differential tendencies based on the Model of External Social Motivation (Dweck & Leggett, 1988), their observed pedagogies were primarily traditional in practice.

Students were given memorization tasks at a higher rate in 6th grade “regular” classes than anywhere else in the school because there was an insistence among the loudest teacher voices (Watson, 2014) that students must strengthen calculation skills before introducing more complex math concepts (Gill & Hoffman, 2009). Typically taking the shape of multiplication fact practice or step-by-step procedural practice of the traditional algorithm for long division (i.e. “Does Mcdonald’s Sell Burgers” being used as a tool to remember the divide, multiply, subtract, bring down steps), the knowledge gap attribution and insistence on improving basic skills contributed to the prominence of these low-quality learning opportunities. Though less cognitively demanding learning opportunities occasionally manifested in Dawn and Kayla’s classes, Karen offered them daily in her classes.

Likely restricted by superficial relationships (LeChasseur et al., 2016), the 6th grade PLC spent more time in planning meetings making attributions and determining what students needed than actually collaborating to plan classroom activities. Firmly situated in the evaluative behaviors category, Karen routinely referenced her 22 years of teaching
experience to defend the effectiveness of her techniques. Her disposition toward memorization and procedurally heavy practice was reinforced toward the end of data collection when her students scored highest on a district-level benchmark assessment. Identified by her peers as “the least pedagogically sound,” Karen spent more time teaching students to follow step-by-step directions for breaking down a story problem than how to determine appropriate solution strategies through contextual and numerical reasoning.

Within each, the 7th and 8th grade PLCs always agreed on the learning opportunities they planned to offer each class. As I conducted observations during the first part of the year, it is possible the nature of the content (integer operations for 7th grade and exponent rules for 8th grade) contributed to the implementation of more procedurally-heavy instruction and learning opportunities. However, the planning resources teachers utilized offered a variety of rich tasks they chose not to use. Perhaps if they had been supported with adequate training on the Breakthrough resource and clearer expectations for implementing small group instruction, they would have been more willing to use those tasks. This will be further discussed in the implications for practice.

A decreased sense of community among 6th grade teachers might be linked to the achievement of students in their “regular” classes. As Moller and colleagues (2013) found student achievement increased for underprivileged and minority students when their teachers’ sense of community was heightened, the opposite relationship was displayed for 6th grade students and their teachers in this study. The observed sense of community among the 6th grade PLC was the least developed and their “regular” classes, disproportionately composed of minority students, struggled to find success. A PLCs sense of community may be linked to the teachers’ observed behaviors (mastery or evaluative). When teachers’ social cognitive
constructs are closer in proximity to each other, the PLC will more likely demonstrate a heightened sense of community. This closeness of observed teacher behaviors was reflected in the 7th and 8th grade PLCs at Gator Ridge.

This study demonstrated a reciprocal relationship between the attributions made for “regular” groups and the quality of learning opportunities offered to them. For example, when Karen blamed knowledge gaps for student struggles, she provided homework to “memorize times tables,” and when the students continued to struggle with multiplication, she continued to attribute that failure to gaps in knowledge. At the same time, at Gator Ridge, math teachers lacked the agency to act on their tendencies to provide higher quality learning opportunities to “advanced” students. The pressure to ultimately produce quality test scores was interpreted, pedagogically, as requiring an emphasis on content coverage and correct answers (LeChasseur et al., 2016; Pomson, 2005).

Students subjected to repetitive procedural practice might appear successful, though the students who perform best with these more traditional tasks tend to be those who have always performed well, are in higher tracks, and have been subjected to higher expectations and better learning opportunities along the way (Cobb & Russell, 2015; Oakes, 1985; Wilhelm et al., 2017). In an effort to properly equip students with the tools and skills necessary to be productive citizens, learning opportunities in mathematics classes must prompt them to think critically, engage in numerical reasoning, and provide justification (Boaler, 2016; Lampert et al., 2010; Smith & Stein, 1998). Tasks grounded in procedural fluency will not achieve that goal. Thus, teachers need to feel empowered to implement complex instructional opportunities in their classrooms without the looming threats associated with the poor performance of their students.
Implications for Practice

Teachers need support. The pressure of high stakes work environments focused on student achievement and accountability encourages teachers to focus their efforts on test preparation and content coverage rather than conceptual engagement with the content (Blazar & Pollard, 2017; Darling-Hammond & Adamson, 2014). Though Gator Ridge had a math interventionist to support teachers with implementing quality lessons, the increased student population removed her from that role, leaving teachers without that support. During the 8th grade focus group, Caroline sensed from my questions that I support heterogeneous student grouping and the implementation of low-floor, high-ceiling tasks (Boaler, 2016). She then shared her perspective on the reality of implementing these kinds of lessons with a heterogeneous group of 8th graders:

You know, I guess you read about the ideal, "give them a rich task, and they can all take it to different levels and it has multiple points of entry, and you know, it’s a low floor- high ceiling…” And then I look at the skills and the concepts I’m supposed to teach, and there are not that many rich tasks that are going to meet these skills. At least I’m not creative enough to either find them or make them. So, to me, that would be some of it is finding the opportunities to give those things. So, I guess ideally, if I had a heterogeneous group, I feel like sometimes you would be able to reach them with some of those [types of opportunities], but sometimes you wouldn’t. And what do you do when you can’t?

Caroline recognized the need for instructional support in her classroom and with curricular resources, which would require reinstatement of a math interventionist. For the math teachers at Gator Ridge, and for middle school math teachers struggling to move away from
procedural instruction toward conceptual learning opportunities, a math interventionist, math coach, or math specialist could provide the encouragement, reflection, and one-on-one attention teachers need to feel confident making ambitious instructional changes (Gallucci, Van Lare, Yoon, & Boatright, 2010).

Much like the teachers from the study at Railside High (Boaler & Staples, 2008), math teachers need sustained professional development to feel empowered to shift toward more ambitious and equitable instructional practices. A consistent professional development program directed toward more frequently implementing cognitively demanding tasks is a powerful starting point (Burris et al., 2006, 2008). Within potential professional development programs, facilitators could observe lesson implementation and provide immediate feedback with regard to their effectiveness. Further, facilitators might also provide immediate feedback regarding any implicit messages teachers share with students promoting stable ability attributions and differential expectations for students in differently perceived and leveled courses (Horn, 2007; Oakes, 1990; Slavin, 1990). Principals and school districts should invest in this type of professional development to support math teachers with developing established, mastery-oriented behaviors.

Additionally, the dynamics of grade-level subject-specific teams are impacted by teacher turnover and reassignment (Ingersoll, 2001). In this study, teachers who worked together for more extensive periods of time were more likely to demonstrate features of an established community (Moller et al., 2013; Grossman et al., 2001). Administrators should hesitate when considering teacher reassignment for performance purposes (Grissom, Kalogrides, & Loeb, 2017) as the cohesive nature of a PLC may be dependent on more well-established relationships. Also, teams may take years to establish a shared vision, evidenced...
by Mark and Emma who had only settled on planning and lesson implementation routines in the last year.

Lastly, much like professional development, the purpose of top-down initiatives must be clearly communicated to teachers (Borko, 2004; Korthagen, 2017). Much of the dissonance between the expectations to both produce improved test scores and implement small group instruction stemmed from inconsistent communication from the Gator Ridge principal and district personnel. Administrators should be well-versed in PLC micro politics (LeChasseur et al., 2016; Pomson, 2005) when mandating instructional changes for teachers, jointly addressing PLC dynamics with the rollout of any proposed alterations to their teaching styles and instructional mandates.

**Limitations**

Findings of this study should be considered with several limitations in mind. One set of limitations relates to the collecting of data through observation. Though I chose an ethnographic case study approach (Parker-Jenkins, 2016) to minimize the Hawthorne effect (Landsberger, 1958) by becoming an embedded member of the community and establishing trust between myself and the math department, it is possible teachers altered their attitudes and behaviors in my presence regardless of their comfort level being observed. With frequent walkthrough observations, the teachers at Gator Ridge are familiar with being observed by administrators and other district officials, contributing to the culture of surveillance common in an era of accountability (Gutierrez, 2013a). However, teachers’ skepticism of my intentions as a district outsider may have impacted their behaviors during my observations.

Additionally, because I observed a single school and a small sample of teachers, findings cannot be generalized to all math PLCs in tracked middle schools. The math
teachers at Gator Ridge were interesting because they were cognizant of current research advocating for math teachers to engage with ambitious mathematics practices but felt stifled by top-down requirements and performance pressures. Several features contributed to my categorization of each PLC at Gator Ridge (years teaching together, instances of agreement, informal meeting frequency, etc.). For PLCs in another school where students are traditionally grouped, these features might not align in similar ways. However, math teachers impacted by looming standardized tests experience pressures similar to those felt by Gator Ridge math teachers (Tichnor-Wagner et al., 2016).

Another limitation is associated with the boundaries of my case (Creswell, 2013). My primary unit of analysis was the math teachers and the math PLCs at Gator Ridge. Because of this, I did not interview the principal or any other school-based administrator. I was most interested in understanding the math teaching experience at Gator Ridge through the teachers’ lens without influence from someone who might explain what teachers “should” have been doing (with small groups, for example). By including additional participants like the principal in my study, I could have achieved a more complete understanding of the expectations on teachers, but not necessarily a more complete understanding of their own experiences within those expectations.

Finally, the fourteen weeks I embedded myself as a member of the mathematics teaching community at Gator Ridge produced an expansive amount of qualitative data, though a longer period of data collection would have provided more data regarding collective attributions, as more collective attributions would have been observed. Patterns emerged that I expect extended throughout the school year, but by not carrying out additional observations,
I cannot say with certainty the observed tendencies and behaviors within each PLC have continued.

**Suggestions for Future Research**

My study serves as a descriptive foundational study of math PLCs in one tracked middle school. Future research should continue investigating dynamics among mathematics PLC members with special instructional requirements and pressures in mind. Particular consideration should be given to studying the impact of resource adoption on student learning as it is mediated by PLCs being expected to use it. There is evidence that teachers’ expectations contribute to the learning opportunities afforded to differently perceived groups of students (e.g. Burris, 2014; Horn, 2007; Oakes, 1990; Slavin, 1990; Stipek et al., 2001; Wilhelm et al., 2017). Future research should more intentionally question the quality of instructional resources PLCs have at their disposal when they consider offering opportunities to these groups.

Future studies should also continue using social cognitive components from the model of external social motivation (Dweck & Leggett, 1988) to identify teacher behaviors in action and their orientation toward equity. Specifically, a teacher’s orientation to exhibit evaluative or mastery behaviors may be dependent on school context or team dynamics. For example, if teachers in a PLC are more competitive than collaborative, this may be associated with the attributions they make for students in differently leveled math courses, leading to inequitable learning opportunities. Mixed methods and qualitative research could investigate the complexities of these relationships.

I used the model of external social motivation (Dweck & Leggett, 1988) as a theoretical guide for this study to determine the dispositions of each teacher within their
PLCs. However, this model is thirty years old and written before the era of achievement-focused accountability. Future research should revisit this model with substantial consideration for these major changes to education reform and increased expectations.

Lastly, impactful results could be generated by extending this study to investigate the effectiveness of professional development programs designed to help teachers implement equitable, ambitious instruction across differently perceived groups. In addition to measuring the effectiveness of these programs by longitudinally attending to indicators of student learning, teachers could contribute by offering how their experiences in these programs impact their practice. Survey and interview data regarding changes in teacher stress, planning, lesson implementation, attributions, achievement goals, and implicit self-theories will be a valuable future contribution to the fields of mathematics education and educational psychology.
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Washington, DC.


APPENDICES
Appendix A – Informed Consent

North Carolina State University
INFORMED CONSENT FORM for RESEARCH

Title of Study: How Middle School Math Teacher Teams Collaborate to Implement Learning Opportunities
Principal Investigator: Rebecca Kimble
Faculty Sponsor: Dr. Margareta Thomson

What are some general things you should know about research studies?
You are being asked to take part in a research study. Your participation in this study is voluntary. You have the right to be a part of this study, to choose not to participate or to stop participating at any time without penalty. The purpose of research studies is to gain a better understanding of a certain topic or issue.

You are not guaranteed any personal benefits from being in a study. Research studies also may pose risks to those that participate. In this consent form you will find specific details about the research in which you are being asked to participate. If you do not understand something in this form it is your right to ask the researcher for clarification or more information. A copy of this consent form will be provided to you. If at any time you have questions about your participation, do not hesitate to contact the researcher(s) named above.

What is the purpose of this study?
The purpose of the study is to better understand how middle school mathematics teachers work collectively as part of grade-level and vertical teams (PLCs, PLTs, departments, etc.) to plan learning opportunities. Teachers are expected to collaborate often to design instruction, assess student learning, and discuss best practices. Little research has investigated how these episodes of collaboration translate into learning opportunities for students in each individual classroom. This study will help to make those connections.

What will happen if you take part in the study?
If you agree to participate in this study, you will be asked to allow a single researcher to observe your participation in formal and informal team meetings beginning in the Spring of 2017, through the Fall 2017 semester. The researcher will be present at the school 4-5 days per week, and will observe teachers from different grade levels at different times. You will be asked to work with the researcher to schedule observation times for team meetings, and at least three full day teaching observations. You will not be asked to change your daily procedures in any way and at any time. In addition to participation in observations, you will be asked to participate in a one-on-one interview with the researcher toward the end of the research process, likely in November of 2017. Lastly, you will be asked to participate in a grade-level mathematics team focus group interview once, likely in December of 2017. Audio recordings will be utilized during grade level team meetings, individual interviews, and focus group interviews.

Risks and Benefits
There are minimal risks associated with participation in this research. It is possible that you may feel uncomfortable being observed teaching and planning lessons with colleagues, however the actions observed by the researcher are for research purposes only, and will be kept confidential. There are no direct benefits to your participation in the research. The indirect benefits include becoming more comfortable with frequent observation, and the opportunity to share the realistic day-to-day practices associated with teaching middle school mathematics with the research community. Findings from this study may help researchers develop meaningful professional development opportunities for middle school mathematics teachers, which may benefit your teaching practice in the future.

Confidentiality
The information in the study records will be kept confidential to the full extent allowed by law. Data will be stored securely both electronically and on paper. Handwritten field notes will be securely on the researcher at all times, and will be kept in a lock box when not in use. Electronic files, including audio recordings from meetings and interviews, will be kept securely on a password protected laptop or password protected external storage device. No reference will be made in oral or written reports which could link you to the
study. Pseudonyms will be utilized for the names of the school and school district, as well as the names of principals, teachers, and other school personnel.

**Compensation**
For participating in this study you will receive a $50 Target Gift Card. The gift card will be dispensed at the conclusion of the Focus Group Interview. If you withdraw from the study prior to its completion, you will not receive compensation.

**What if you are a NCSU student?**
Participation in this study is not a course requirement and your participation or lack thereof, will not affect your class standing or grades at NC State.

**What if you are a NCSU employee?**
Participation in this study is not a requirement of your employment at NCSU, and your participation or lack thereof, will not affect your job.

**What if you have questions about this study?**
If you have questions at any time about the study itself or the procedures implemented in this study, you may contact the researcher: Rebecca Kimble, 2310 Stinson Dr. #402H, Raleigh, NC, 27607, rskimble@ncsu.edu, 919-515-3221 (department phone number).

**What if you have questions about your rights as a research participant?**
If you feel you have not been treated according to the descriptions in this form, or your rights as a participant in research have been violated during the course of this project, you may contact Deb Paxton, Regulatory Compliance Administrator at dapaxton@ncsu.edu or by phone at 1-919-515-4514.

**Consent To Participate**
"I have read and understand the above information. I have received a copy of this form. I agree to participate in this study with the understanding that I may choose not to participate or to stop participating at any time without penalty or loss of benefits to which I am otherwise entitled."

Participant’s signature_______________________________________ Date _________________
Investigator’s signature_______________________________________ Date _________________
Appendix B – Semi-Structured Interview Protocol

1) Take a moment to outline your experience teaching middle school mathematics – how many years you’ve been teaching, what grade levels you’ve taught, where, etc.

2) When you began teaching at this school, how did you interpret the collaborative culture of the grade-level math teacher teams (PLCs)?

3) What do you find to be a common misconception people outside of the teaching profession have about your job as a middle school math teacher?

4) What is the most rewarding part of teaching middle school math?

5) What is the most frustrating part of teaching middle school math?

6) For each of the sections of math that you teach, can you take a moment to describe each section:

   including the level of mathematics taught, __________________________

   the general achievement level of the class, __________________________

   the demographic makeup of the students, __________________________

   and the overall atmosphere of the class? __________________________

I’d like to take some time to talk about experiences with each type of math class you’ve described. Use these questions in accordance to each course as it is described by the teacher.

7) What does it take for students in your classes to be successful?

8) Describe a good lesson you’ve taught and explain what made it a good lesson.

9) What percent of the time would you say you are confident that students are learning? How do you know? What do you look for as evidence of learning?

10) Describe a time a student was struggling. How did you know they were struggling, and what did you do to help them?

11) When students are not learning as expected, what do you typically believe to be the cause?

12) If you had to name one thing you really hope the students learn this year, what would it be?
Bring it back to the PLC:

13) Do you have any ideas you’d be willing to share about the way your grade level math team functions to provide learning opportunities to students?
   a. What works well in grade level math meetings?
   b. What could be done to improve upon time spent within grade level math team meetings?
Appendix C – Focus Group Protocol

1. As you are expected to work in PLCs to accomplish different tasks throughout the school year, what do you understand to be the purpose of the PLC?
   a. Have you been provided with guidance for how to work in a PLC?
   b. When do you feel the most accomplished as a team?

2. As a grade level team, how much control do you feel like you have over types of lessons you teach?
   a. What resources do you utilize most often?
   b. Describe the degree of freedom you have to design math lessons for your classes.
      i. What types of lessons do you wish you could teach that you don’t feel like you have the ability to implement?

3. What are some of the challenges that come with planning lessons for students at different achievement levels?

4. When students in the low-achieving groups are struggling to learn, what are some of the strategies you utilize as a team to help them?

5. When students in high-achieving groups are struggling to learn, what are some of the strategies you utilize as a team to help them?

6. What do you think are the pros and cons to grouping students by math ability?

7. Is ability grouping for math instruction necessary?

8. If students weren’t grouped for math instruction, if they were completely mixed by ability, what types of challenges would you anticipate as a team?
   a. What might be some benefits to the team if ability grouping was eliminated?
9. Lastly, can you take some time to identify some strengths and weaknesses of the PLC/teacher team model?
Appendix D – Codebook

Opportunities to Learn

Eight Standards

1 Persevere – make sense of problems and persevere in solving them

2 Reason – reason abstractly and quantitatively

3 Argue – construct viable arguments and critique the reasoning of others

4 Model – model with mathematics

5 Tools – use appropriate tools strategically

6 Precision – attend to precision

7 Structure – look for and make use of structure

8 Reasoning – look for and express regularity in repeated reasoning

Task Analysis Guide

Memorization (see Appendix E)

ProNoConn (see Appendix E)

ProYesConn (see Appendix E)

Do Math (see Appendix E)

Enrich – teachers discuss a need to provide enrichment OR an activity serves as enrichment

Practice - teachers discuss needing to have students practice (problems, procedures, etc) as part of their learning. OR - the teacher is observed providing opportunities for “practice” during class time.

Reteach review – the learning opportunity being planned or provided is to reteach or review content the students have already covered
Resource – notes a mention or use or a specific resource (e.g. Breakthrough, Ten Marks)

PLCs

Collectivity

Agree

Consensus – all members of the PLC are in agreement
Consensus-1 – all but 1 member of the PLC are in agreement

Collaboration+ - teachers talk about the positive side of collaborating as a PLC

Collaboration- - teachers talk about the hardships associated with collaborating in a PLC

Disagree – teachers outwardly disagree

Shared Vision – teachers demonstrate a shared vision

Not Shared – teachers do not have a shared vision

Meet Formal – PLC meeting is formally scheduled (data or planning)

Meet Informal – PLC meeting was informal, happened “naturally”

Planned Together – teachers used time together to plan lessons

PLC Expectations – teachers explain what they’re expected to accomplish as a PLC

PLC Meetings – teachers explain how frequently they meet

PLC Time – what PLC time is spent doing

Willing to Try – teachers express a willingness to try something new

Unwilling – teachers are not willing to change their routines/styles

Student Descriptors
Demographics - information provided by teachers during interviews

Black or African American
Latinx or Hispanic
Mixed Race
Native American
White

Personalities – teachers describe the general personality type associated with a student group

Student Level

“bubble” – the term used to describe the perceived ability of a group of students
“high” - the term used to describe the perceived ability of a group of students
“low” - the term used to describe the perceived ability of a group of students
“middle” - the term used to describe the perceived ability of a group of students

Advanced – used to designate data for “advanced” classes
Regular – used to designate data for “regular” classes
EC – used when observations were specific to conversations about EC students

Student Performance

Attribution

Ability_C – teacher indicates they can control student ability, credits that ability for student performance

Ability_U – teacher attributes performance to student ability, and does not believe they can control that ability
Access-Oppportunity – teacher attributes student performance to their access to quality instruction and opportunities to engage with those lessons

Behavior – teacher attributes student performance to student behavior

Curriculum - teacher attributes student performance to curriculum issues

Effort - teacher attributes student performance to student effort

Advocate for self – teacher attributes student performance to students being speaking up for themselves in class

Apathy - teacher attributes student performance to student apathy

Belief in self - teacher attributes student performance to the students believing they can be successful

Organized - teacher attributes student performance to students’ organizational habits

Engagement_C - teacher attributes student performance to students being engaged with the learning opportunities (teachers control the engagement potential of opportunities)

Enjoyment_C - teacher attributes student performance to students enjoying class

Frustration - teacher attributes student performance to student frustration

Knowledge gaps_C - teacher attributes student performance to gaps in student knowledge, but indicate their ability to fill in those gaps

Knowledge gaps_U - teacher attributes student performance to gaps in student knowledge
**Previous teacher** - teacher attributes student performance to failure of the students’ previous teacher to appropriately teach the necessary concepts/content/algorithms

**Math skill** - teacher attributes student performance to their math skills

**Other teacher** - teacher attributes student performance to help from other teachers

**School** - teacher attributes student performance to something at the school level such as the students’ schedule.

**Stability_C** - teacher attributes student performance to stability or instability in the math classroom.

**Support_C** - Student success is attributed to the level of support they have that can be controlled by the teacher (e.g. tutoring, lunch tutoring, academy time).

**Support_U** - Student success is attributed to the support they have, considered uncontrollable by the teacher (home life, etc.)

**Task Difficulty_C** - Teachers attribute student performance to task difficulty on a task where THEY controlled the level of difficulty.

**Task Difficulty_U** - Teachers attribute levels of student success to task difficulty where they did NOT have control over the task difficulty (ex. State-mandated tests, benchmarks, etc.)

**Teacher_C** - The teacher attributes student performance to something they did or did not do. (e.g. “I didn’t do a good job teaching that.”)
**Traits_U** - Teacher attributes student performance to a visible/observable/knowable trait associated with the student that is uncontrollable by the teacher. (e.g. language (ELL), EC (inclusion level), EC (resource level), Grade (6, 7, 8))

**Expectations** – broad code used the teacher expresses expectations for behavior or performance to the students.

- **Lower expectations** – teacher expresses low expectations for a group of students
- **Higher expectations** – teacher expresses high expectations for a group of students

**Success** – students being described or observed were successful

**Underperforming** – students being described or observed were failing/struggling/underachieving

**Expected** – students were performing as expected by their teacher

**Learning** – teacher talks about students learning

**Needs** – teacher explicitly states what different groups of students “need”

**Goal orientation**

- **Mastery** – teachers communicate a mastery orientation to students or to each other
- **Performance** – teachers communicate a performance orientation (e.g. emphasizes competition in the classroom, emphasizes speed of completion, etc.)

**Teacher**

- **Positive attitude** – teacher is clearly expressing a positive attitude
- **Negative attitude** – teacher is clearly frustrated or upset
Experience – teacher talks about experience from previous school years

Math person – teacher indicates they believe there is such thing as a “math person.”

Outside ideas – teacher shares what people from outside the math profession tend to think about their job as a math teacher. Expectations from administration coded here as well.

Relationships – teachers emphasize the importance of developing relationships with students

Struggle – teachers are struggling with a specific expectation or situation

Teacher goals – teachers articulate something they hope to bring to fruition

Time – teachers emphasize the need for more time to do their jobs

View of other grade levels – teachers talk about grade levels other than their own

X_initiatives – teachers talk about the top-down initiatives they must implement

Z_Great quotes – quotes highlighted for later use
Appendix E – Task Analysis Guide and Eight Standards for Mathematical Practice


Lower-level demands (memorization):

- Involve either reproducing previously learned facts, rules, formulas, or definitions or committing facts, rules, formulas or definitions to memory

- Cannot be solved using procedures because a procedure does not exist or because the time frame in which the task is being completed is too short to use a procedure

- Are not ambiguous. Such tasks involve the exact reproduction of previously seen material, and what is to be re-produced is clearly and directly stated.

- Have no connection to the concepts or meaning that underlie the facts, rules, formulas, or definitions being learned or reproduced

Lower-level demands (procedures without connections):

- Are algorithmic. Use of the procedure either is specifically called for or is evident from prior instruction, experience, or placement of the task.

- Require limited cognitive demand for successful completion. Little ambiguity exists about what needs to be done and how to do it.

- Have no connection to the concepts or meaning that underlie the procedure being used

- Are focused on producing correct answers instead of on developing mathematical understanding

- Require no explanations or explanations that focus solely on describing the procedure that was used

Higher-level demands (procedures with connections):

- Focus students’ attention on the use of procedures for the purpose of developing deeper levels of understanding of mathematical concepts and ideas

- Suggest explicitly or implicitly pathways to follow that are broad general procedures that have close connections to underlying conceptual ideas as opposed to narrow algorithms that are opaque with respect to underlying concepts

- Usually are represented in multiple ways, such as visual diagrams, manipulatives, symbols, and problem situations. Making connections among multiple representations helps develop meaning.
• Require some degree of cognitive effort. Although general procedures may be followed, they cannot be followed mindlessly. Students need to engage with conceptual ideas that underlie the procedures to complete the task successfully and that develop understanding.

*Higher-level demands (doing mathematics):*

• Require complex and non-algorithmic thinking—a predictable, well-rehearsed approach or pathway is not explicitly suggested by the task, task instructions, or a worked-out example.

• Require students to explore and understand the nature of mathematical concepts, processes, or relationships

• Demand self-monitoring or self-regulation of one’s own cognitive processes

• Require students to access relevant knowledge and experiences and make appropriate use of them in working through the task

• Require students to analyze the task and actively examine task constraints that may limit possible solution strategies and solutions

• Require considerable cognitive effort and may involve some level of anxiety for the student because of the unpredictable nature of the solution process required

**The Eight Standards for Mathematical Practice (taken from CCSSO, 2010)**

1. Make sense of problems and persevere in solving them
2. Reason abstractly and quantitatively
3. Construct viable arguments and critique the reasoning of others
4. Model with mathematics
5. Use appropriate tools strategically
6. Attend to precision
7. Look for and make use of structure
8. Look for and express regularity in repeated reasoning