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**How Teacher-Student Relationships Shape Student Engagement and Interest in
Science**

A dissertation submitted in partial fulfillment of the requirements for the degree of
Doctor of Philosophy at Virginia Commonwealth University

by

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God is within her, she will not fail

Psalms 46:5

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Abstract

The current research on emotional engagement and teacher-student relationship is abundant and acknowledges education as an environment that thrives on social interactions and causes a variety of emotions to be present in the classroom. However, research on the relationship between Black and Latinx students' teacher-student relationships and students' emotional engagement and interest in science in urban middle school science classrooms remains scarce. Unfortunately, Black and Latinx students often experience a) mixed social interactions with their teachers, b) a lack of relatability to science instruction, and c) a combination of positive and negative emotions during science instruction and activities. This phenomenological, qualitative study aimed to highlight science teachers' and Black and Latinx students' experiences and perspectives on the factors that influence their teacher-student relationships, students' emotional engagement, interest in science in an urban middle school. The questions that guided this dissertation were: 1) How do Black and Latinx students describe the factors that help or hinder their teacher-student relationships, emotional engagement, and interest in middle school science classrooms? and 2) How do science teachers describe the factors that help or hinder their teacher-student relationships, emotional engagement, and interest in middle school science classrooms? One on one interviews were conducted with a conveniently sample of science teachers (n = 5) and Black and Latinx students (n = 8). Discourse analysis added significance to the one-on-one interviews by examining the language used in regard to identity, activity, and relationships. The two major factors identified by students in the data included a) emotional awareness and support; and b) teacher personalities and caring characteristics. The three major factors that were mentioned by teachers were: understanding emotional awareness, engagement, and support, understanding their students and displaying that teachers care, and implementing

relatable, collaborative, and hands-on activities. Additionally, two sub-themes emerged from the teacher interviews: a) understanding trust development through relatability, consistency, and reciprocity; and b) providing purposeful feedback.

Keywords: science education, interest, emotional engagement, teacher-student relationships, discourse analysis, trust

Chapter I - Introduction

Administrator: *I noticed that you had three students disengaged during your lesson today and you didn't try to re-engage them in the lesson. Why is that, especially because two of them receive special education services?*

Teacher: *I think it was because they didn't have any interest in the science lesson or activity. Either that or again, it might be because those students are the same students that constantly tell me that they don't like me as their teacher.*

Administrator: *You are there to teach them and it is our expectation that every student is engaged and actively learning. Maybe you need to sit down with them and develop a better relationship with those students.*

When meeting with administrators post-observation, teachers are often told by administrators what they noticed about the students (e.g., behaviors, academic actions, and [lack of] participation) and the way the teacher taught (e.g., instructional strategies, instructional method, activities, student redirection). Teachers are often told that it is important to develop relationships with students but not necessarily shown how to use the relationships to their advantage when seeking ways to engage students, motivate them, and help them achieve academically. The declining teacher and academic expectations for Black and Latinx students demonstrate possible contributions to the academic inequities, negative social-emotional and motivational experiences, and less than welcoming learning environments that they participate in daily (Park-Taylor et al., 2022; Strayhorn et al., 2013).

There have been recent and enduring calls in the motivation literature for conducting more diverse and equitable research – including research that centers on and celebrates Black

youth (e.g., Graham, 1992; Usher, 2018). More specifically, scholars have called for (a) a stronger theoretical and methodological emphasis on the *situative nature of motivation* or the effort to emphasize social contexts alongside prominent theories (e.g., Eccles and Wigfield, 2020; Nolen, 2020) and (b) more race-reimagined and/or race-focused motivation research (DeCuir-Gunby & Schutz, 2014). Although some scholars in the field have generated critical contributions to address these gaps (e.g., Gray et al., 2018; White et al., 2019), recent findings indicate that these calls have not widely reached concerned educational psychologists – including motivation scholars (López, 2022).

The lack of motivation and emotion literature taken from an asset-based perspective (Flint & Jagers, 2021) on Black and Latinx populations (Coleman & Davis, 2020) is concerning, especially as minoritized students continue to experience systemic inequities (Huerta et al., 2020). Critical work is needed to present a clearer, more comprehensive, and accurate picture of students' motivational, emotional, and academic experiences – especially for those who have been underrepresented and understudied.

The opening conversation with the administrator and teacher only focused on 1) how the teacher and observed students did not meet the teaching and academic expectations set by the administrator and 2) what the administrator observed about the students during the lesson. There was no mention or discussion about the students' emotions or lack of motivation during the lesson, leaving the teacher with only the problem and no solutions to address the observed behavior. Inspired by the opening conversation, my teaching experience with Black and Latinx student populations, as well as the above-mentioned gaps and the urgent need to address them, I will conduct a mixed methods study to better understand the emotional, motivational, and social experiences of middle school Black and Latinx youth in science classrooms.

Problem Statement

Research on emotion with a focus on Black American and Latinx students is essential for increased engagement (Balfanz et al., 2007), trust (McClain & Cokley, 2017; Van Meale & Van Houtte, 2011), motivation (Ainley, 2006), and academic achievement (Camacho-Morles et al., 2021). *Academic emotions* are often considered “general ways of responding to achievement settings or specific emotional states aroused during a specific learning activity” (Ainley & Ainley, 2011). As a practicing middle school teacher in an urban environment, I understand the need for teachers to expand on the development of classroom environments and instructional strategies to promote engagement, trust, and motivation among minoritized students. Students’ learning and living environments provide varied academic and social experiences, which can elicit intense emotions (Randler et al., 2011). Balfanz and colleagues (2007) emphasize that students who reside in high-poverty neighborhoods have many contributing factors that can increase students’ disengagement in school. The relationships they have with their teachers are one such factor.

As students spend most of their day with their teachers, their relationships with their teachers are co-constructed through daily interactions. The quality of teacher-student relationships has the potential to make the learning environment more enjoyable for both the teacher and students (Gregory & Weinstein, 2008). For minoritized students, teacher-student relationship quality also has the potential to increase not only students’ perceptions of their teachers as valid authority figures, but also their academic motivation, engagement, and success (McClain & Cokley, 2017; Van Meale & Van Houtte, 2011).

Trust is essential in developing and maintaining teacher-student relationships (Gregory & Weinstein, 2008; McClain & Cokley, 2017; Tenenbaum & Ruck, 2007; Van Meale & Van

Houtte, 2010). *Teacher trust* can be defined as a student's trust in their teacher based on their perspective of the teacher possessing honesty, caring, reliability, openness, and competence (McClain & Cokley, 2017). Within my own personal teaching experience, I have seen the negative effect a lack of reciprocated trust can have on a relationship between a teacher and a student. Similar to the curriculum, study guides, and lab equipment within science classrooms, trust can be considered to be an essential educational resource, specifically for Black male students (Romero, 2018). I have witnessed firsthand in the classroom that the more trusting a student becomes, the more vulnerable they tend to be when needing clarification and additional help. Such help is often needed, as students often show a decline in motivation (e.g., interest), engagement, and achievement in middle school science (Bae & Debusk-Lane, 2008).

Engagement can contribute to students' higher thinking and complex reasoning in science (Sinatra et al., 2015). While engagement is also deemed necessary for active learning and furthering students' understanding of scientific concepts (Fredericks et al., 2016; Sinatra et al., 2015), engagement is often discussed on a high vs. low basis instead of exploring how all specific dimensions of engagement (cognitive, behavioral, and emotional) are present during science instruction (Bae & Debusk-Lane, 2008; Wang & Peck, 2013). Especially pertinent to this study is emotional engagement.

Emotional engagement can be conceptualized as "students' emotional reactions to academic subject areas" (Sinatra et al., 2015, p. 2). Specifically for this study, emotional engagement and *disaffection* are operationalized in the following ways: behaviorally expressed as giving up, just going through the motions, passivity, and lack of initiation, and emotionally expressed as boredom, apathy, frustration, discouragement, or dejection (Sinatra et al., 2015). A positive relationship has been found between emotional engagement and achievement (Pekrun &

Linnebrink-Garcia, 2012). Additionally, two key indicators of emotional engagement are affect and belonging (Linnenbrink-Garcia et al., 2016; Sinatra et al., 2015), suggesting that emotion and motivation are critical components of student success and well-being, particularly for minoritized students.

Driving the development of the problem statement is the clear ties between affect, trust, and teacher-student relationships in the classroom. Although some research suggests ways to promote emotional engagement during instruction and other research investigates the influential factors for building teacher-student relationships with minoritized students (e.g., teacher warmth and caring) to increase trust (Gregory & Weinstein, 2008), little research on these topics is conducted within urban, Title 1 schools. More specifically, the focus was on middle school students because of their critical development, socially and academically. Along with their social and academic development is the development of their identity and the importance placed on social interactions and relationships. This is the educational setting where they interact with and build relationships with multiple teachers because they begin to switch classes for their core content courses and electives. Additionally, there is a need for further research on the roles emotions and trust might play in students' relationship development, interest, and social interactions among minoritized students in science. There is a need to center and draw from teachers' and students' experiences, as the social-emotional experiences of teachers and students are often quantified using surveys (Patall et al., 2018; Pekrun & Linnebrink-Garcia, 2012).

Research Questions

The purpose of this study is to investigate and center Black and Latinx science students' and teachers' perspectives on the factors that foster or impede their teacher-student relationships, emotional engagement, and interest in science .

1. How do Black and Latinx students describe the factors that help or hinder their teacher-student relationships, emotional engagement, and interest in middle school science classrooms?
2. How do science teachers describe the factors that help or hinder their teacher-student relationships, emotional engagement, and interest in middle school science classrooms?

Definition of Terms

Academic Emotions: General ways of responding to achievement settings or specific emotional states aroused during a specific learning activity” (Ainley & Ainley, 2011).

Emotional engagement: students’ emotional reactions to academic subject areas (Sinatra et al., 2015) and students’ affective reactions to their surrounding environment, including their peers, teachers, and activities (Naibert & Barbera, 2022).

Disaffection: Behavioral form as giving up, just going through the motions, passivity, and lack of initiation, and in its emotional form as boredom, apathy, frustration, discouragement, or dejection (Sinatra et al., 2015).

Trust: Students’ trust in his/her teacher based on his/her perspective of the teacher possessing honesty, caring, reliability, openness, and competence (McClain & Cokley, 2017).

Relatedness: The natural need to feel linked to others and to have a sense of belonging, which can enhance motivation (Ryan & Deci, 2002).

Feedback: Information provided by an external agent regarding some aspect(s) of the learner’s task performance, intended to modify the learner’s cognition, motivation, and/or behavior for the purpose of improving performance (Duijnhouwer et al., 2012).

Interest: Refers to the psychological state of engaging or the predisposition to re-engage with particular classes of objects, events, or ideas over time (Hidi & Renninger, 2006).

Emotional Interest: Emotional interest builds when the addition of interesting but irrelevant material to a lesson energizes students so that they learn more (Mazer, 2012).

Cognitive Interest: Builds when clarity indicators such as explanative summaries influence students' cognition by promoting their structural understanding of content (Mazer, 2012).

CHAPTER II - Review of Literature

This chapter provides an overview of previous research on teacher-student relationships, emotional engagement, and interest in science for Black and Latinx students in middle school. This review specifically covers studies and their approaches centered on academic emotions and interest in relation to students' emotional engagement in science classrooms. Focus was placed on how emotional engagement and interest were explored in Black and Latinx students in science classrooms. Of particular interest was the methodology utilized to emphasize students' views and beliefs relative to science, including their perceptions of their teachers, and/or their self-beliefs related to the domain of science. The following sections briefly overview the theoretical and conceptual frameworks guiding this study. The rest of the chapter is organized into four main sections: (a) emotions in K-12 education, (b) emotional engagement, (c) interest in science, (d) minoritized student populations, and (e) teacher-student relationships.

Theoretical Framework

Student motivation (i.e., interest) often centers around questions that explore students' reasons for engaging ("Do I want to do this and why?") in a task (Eccles & Wigfield, 2002) and the ways those questions are then answered through both individual and situational experiences (Urduan & Schoenfelder, 2006). While students individually play a large role in developing their interest in science (Schunk & DiBenedetto, 2020), situated motivational perspectives highlight the ways in which contextual experiences within the classroom also play a critical role (Bathgate-schunn, 2017; Nolen, 2020; Urduan & Schoenfelder, 2006).

Self-Determination Theory

Self-determination theory (SDT) is composed of several subset theories created to explain motivation and used to investigate the essential factors of building relationships between

teachers and students (Lopez et al., 2022; Reeve, 2002; Ryan & Deci, 2020). SDT has three main elements: autonomy, competence, and relatedness, which assist with creating a supportive environment for people to pursue their passions and take on new challenges (Ryan & Deci, 2020). Central to this study, *relatedness* refers to the natural need to feel linked to others and to have a sense of belonging, which can enhance motivation (Ryan & Deci, 2020). Feeling respected and connected to others through academic outcomes, academic experiences, and social interactions and relationships can help bolster one's sense of belongingness and relatedness within an academic setting (Lopez et al., 2022). This is important to conceptualize and focus on when examining the social and emotional relationships created between teachers and students in their classrooms. Lopez and colleagues (2022) further their argument on relatedness by emphasizing that students' sense of belonging and relatedness has a potential influence on academic (e.g., student engagement, interest) and nonacademic outcomes (e.g., teacher-student relationships).

Identifying and providing examples of social and academic contexts that address the need for SDT include teacher responsiveness and awareness of students' viewpoints, "bringing more attention to student interest," and "incorporating more meaningful tasks that can engage their [students'] interest" (Ryan & Deci, 2020, p. 3-4). Engagement is considered an essential and valuable aspect of education and "is a useful concept for applying self-determination theory to educational settings" because teachers and students can use observable evidence for student motivation (Reeve, 2002, p. 194). The way the teacher can moderate engagement "becomes a question of how they create classroom conditions to support and nurture students' needs for self-determination, competence, and relatedness" (Reeve, 2002, p. 194).

Conceptual Framework

The conceptual framework for this study drew from Self-Determination Theory by interconnecting interest in science, teacher-student relationships (e.g., trust and feedback), and emotional engagement to assist with promoting more positive learning experiences and environments. Furthermore, this study expanded on how relatedness played a role in all three factors based on the perspectives of teachers and students. My teaching identity and experience, alongside the literature, have simultaneously helped develop the framework.

Emotions in K-12 Education

Emotions are different from moods and metacognitive feelings. Emotions – “multifaceted phenomena involving sets of coordinated psychological processes, including affective, cognitive, physiological, motivational, and expressive components” (Boekaerts & Pekrun, 2015, p. 76) – prepare students for starting and completing tasks. Moods are less intense and do not have a specific reference to tasks, people, or objects, and metacognitive feelings are described as feelings of knowing and confidence based on one’s judgment of their progress in learning (Ainley & Ainley, 2011).

According to Decuir-Gunby and colleagues (2009), there are two primary components of emotion: valence and activation. Whereas activation is referred to as low vs high activation, valence is referred to as pleasant vs. unpleasant emotions (Boekart & Pekrun, 2015; Decuir-Gunby et al., 2009). Examples of pleasant emotions include enjoyment of learning, hope, and pride. In contrast, anger, frustration, anxiety, and shame are examples of unpleasant emotions. More specifically, Decuir-Gunby and colleagues (2009) posit that emotions can be broken down further to pleasant-high activating (e.g., joy, hope), pleasant-low activating (e.g., contentment), unpleasant-high activating (e.g., anxiety), and unpleasant-low activating (e.g., hopelessness).

Students who display pleasant emotions might experience an increase in intrinsic motivation, while an increase in extrinsic motivation is associated with unpleasant emotions (Boekaerts & Pekrun, 2015).

The classroom is known to be an emotional environment. Academic emotions such as excitement and joy (for learning), boredom (lack of challenging and relatable activities and instruction), frustration (challenging work and assessments, overtesting, lack of help from teachers), and anger (classroom climate) can play an important role in student academic achievement and growth (Zeidner, 2014). Whereas positive emotions can assist students with envisioning goals, promoting motivation, and enhancing problem-solving skills, negative emotions can impede test performance and classroom achievement (Zeidner, 2014). For example, Ainley & Ainley (2011) found that enjoyment and interest were very closely associated and reported that enjoyment is an essential component when examining the relationship between interest in science, value and knowledge, and students' reported current and future engagement. Students' interest in learning about science mediated the effect of students' enjoyment of science.

Social emotions (e.g., admiration, gratitude, envy, social anxiety; Pekrun et al., 2002) are also important to students' interpersonal relationships that develop within the academic environment (Boekaerts & Pekrun, 2015). Such emotions are particularly important in exploring teacher-student relationships and interactions at the secondary level as they serve as social factors that can influence students' academic and social experiences and outcomes (Boekaerts & Pekrun, 2015; Goetz et al., 2006; Randler et al., 2011). Of interest, Mainthard and colleagues (2018) found that middle school students' perceptions of their teacher's influence, dominance, and warmth held influential importance to students' emotions. Specifically, findings showed that

positive social interactions between students and teachers, whereby teachers displayed warmth and authority, increased students' positive emotional experiences (Mainthard et al., 2018).

Students often display unpleasant emotions, lack of interest, and disruptive behaviors when engaging in a classroom with a teacher that lacks a warm personality (Cipriano et al., 2019).

Emotional Engagement

Science activities that promote positive emotional experiences for students tend to leave lasting impacts on their learning and engagement (Ainley & Ainley, 2011; Hidi & Renninger, 2006). Engagement is strongly connected with achievement, participation, and motivation in many educational areas, specifically in the sciences (Pekrun & Linnenbrink, 2012; Sinatra et al., 2015; Wang & Eccles, 2012; Wang et al., 2016). Promoting engagement through interactive, hands-on, and relatable activities has the potential to assist with creating a more enjoyable learning environment for diverse student populations (Bathgate-schunn, 2017; Fredericks et al., 2018; Naiber & Barbera, 2022). Bathgate and Schunn (2017) examined perceived science classroom experiences to better understand the motivational changes in middle school students and identify types of classroom experiences associated with learning the science content and found that affective engagement (a construct that closely aligns with emotional engagement) had a positive correlation with science motivation. Their findings also showed a strong positive relationship between affective engagement and fascination (a construct that closely aligns with interest). That is, students who exhibited higher levels of fascination with learning about the scientific method were more likely to report feeling joy and anticipation during science instruction than their peers who exhibited lower levels of fascination.

Social interactions between teachers and students play a strong role in the development of learning environments and the motivational and engagement levels of students. In a sequential

exploratory mixed methods study, Fredericks and colleagues (2018) examined the motivational and contextual factors that impact math and science engagement. In their findings, participants noted that interacting with passionate and engaged teachers increased their own interest and engagement. On the other hand, students who interacted with teachers who were disengaged and less passionate about their learning in science experienced decreased levels of engagement. Consistent with the findings from Bathgate and Schunn (2017), students experienced higher emotional engagement when they also had high expectancy beliefs (i.e., perceptions of their ability in science) and utility and interest value (i.e., value to participate in science activities).

An equity-focused lens is essential in studying emotions and emotional engagement in diverse and inclusive learning environments. Tas (2016) took an equitable approach to understand the importance of engagement in relation to perceived science classrooms and motivation variables. Drawing from the conceptual definition of equity – students’ perceptions that their teacher treats them equally, reflected in giving feedback, praise, and opportunities for learning (Fraser et al., 1996), Tas (2016) posited that equity is positively related to student emotional engagement (i.e., science enjoyment), and “equitable allocation of opportunities for learning, such as the teacher demonstrating a high interest in all students, distributing rewards equally among students, and having high expectations of all students” (p. 559) is needed to increase students’ engagement. Aligned with the goals of this study, Tas (2016) calls for research that examines the components of engagement separately in relation to equity (a construct that closely aligns with teacher-student relationship quality).

Teachers' race may influence the social-emotional experience of minoritized students’ schooling experiences. Finn and Voelkl (1993) found that Black students in the eighth grade who attended a school with a low count of minoritized teachers reported lower emotional engagement

(i.e., teacher attachment, teacher support, and feeling welcomed at school) as compared to Black students who attended a school with a higher count of minoritized teachers. In comparison, Brewster and Bowen (2004) found that Latinx students who perceived their teachers as supportive and had a high-quality teacher-student relationship experienced a higher level of emotional engagement.

Not only does research suggest that teachers and science instruction have the ability to affect students' emotional engagement levels, but students can also affect their own emotional engagement during instruction. Hudley and Graham (2001) found that Black students possessed an image of Black girls that encompasses being engaged in school, while Black boys and Latinx students did not identify someone of their gender or ethnicity as being highly engaged in school. All boys and girls were more likely to select pictures of Black or Latinx boys as depicting a student who is disengaged and uninterested in school (Hudley & Graham, 2001). To date, there is evidence to support a negative relationship between discrimination among minoritized students and engagement (Graham, 1994; Okagaki et al., 1996; Smalls et al., 2007).

Emotional awareness is another critical component in developing teacher-student relationships and emotional engagement within STEM classrooms. Argueadas and colleagues (2016) conducted a study to explore emotional awareness and feedback as it impacts engagement, motivation, and teachers' attitudes and feedback in science classrooms. Consistent with prior research on emotion, emotional engagement, motivation, and feedback, students who displayed positive emotions during science activities experienced a higher level of motivation and engagement. On the contrary, students who experienced negative emotions (e.g., frustration, anger, and anxiety) maintained only minimal interest in the science activity. Results also

demonstrated a significant positive correlation between emotional awareness and teachers' attitudes and affective feedback.

Interest in Science

Motivation amongst adolescents, in regard to science courses, has shown a pattern of decline as students transition through middle school grades (Cheung, 2018; Hidi & Renninger, 2006). This is a significant concern because of the academic and social outcomes connected to motivational levels. For example, research suggests that if minoritized students have not developed an interest in science by the end of their middle school years, they are less likely to develop an interest in science as they transition to high school and higher education (Williams et al., 2018).

Students often experience low emotional engagement when they view science instruction and activities as uninteresting. Hidi & Renninger (2006) recognized and defined interest as both an emotional and cognitive factor that develops over time as students positively re-engage with particular content (e.g., science). When students express interest in a science activity, they are more likely to seek future related activities and express enjoyment in the activity (Hidi & Renninger, 2006). In a study of low-income, minoritized students' viewpoints on the level of interest, relatedness, and competence in middle school science, Williams and colleagues (2018) found that sixth-grade students who reported having positive motivational experiences also displayed higher levels of engagement and science learning and interest. In another study, Cheung (2018) found that the factors affecting student interest in science include (from strongest to weakest): science self-concept, individual students' science interest, situational influences in sciences, gender, and grade level. The factors affecting student interest include (from strongest to weakest): science self-concept, individual students' science interest, situational influences in

sciences, gender, and grade level. Notably, students and teachers in this study mentioned that hands-on activities (e.g., lab experiments) and daily life applications of the science content (e.g., science field trips, science projects) increased students' interest. Interest and emotional engagement are essential for learning outcomes, as interest can influence enthusiasm and other positive emotions in the classroom and the desire to strive toward subject mastery (Ho & Devi, 2020). In a study examining changes in middle school students' interest in science lessons, Ho and Devi (2020) found that students' interest was influenced by their attention during instruction, pleasure, and curiosity, concluding that teachers' instructional practices and teaching strategies can impact students' interest in science (Ho & Devi, 2020).

Motivation and minoritized student populations

One of the challenges that arise with urban education is the one-size-fits-all definition. Underachieving and minoritized students are often disengaged in school because they do not prioritize doing well in school (Balfanz et al., 2007). If students perceive discrimination against themselves or members of their ethnic group, they may begin to develop the perception that teachers treat them unfairly, thus resulting in minoritized students having difficulty with the desire to try hard and engage in school (Graham, 1994).

Past research on motivation is mostly conducted with and centered around the Whiteness of academic motivation (Usher, 2018). Little is known about the role of interest and emotional engagement in the social-emotional and academic experiences of urban, Latinx middle school students, a student population that is important to examine given their lower educational status in the U.S. when compared to their White counterparts. It is especially crucial that researchers begin to explore and examine the factors that influence Black and Latinx adolescents' success in school because of these student populations' growth in the U.S. Researchers need to examine the

school experiences of minoritized students better to understand the differences in social-emotional and academic experiences. Urban minoritized students' interest in science is often sustained by belonging to a science learning environment with valued social interactions and relationships, connecting and aligning their future to their science experiences, and engaging in purposeful, agentic science activities (Basu & Barton, 2007). Urban students' interest is sustained and promoted when social interactions and relationships exemplify characteristics of caring, usefulness, and inclusion (Basu & Barton, 2007; Calabrese Barton, 2003; Ladson-Billings, 1994).

Currently, Black and Latinx youth's experiences remain underexplored in the motivation literature, and this work requires adopting a contextual and asset-based lens. For instance, Eurocentric curricula and predominately white teachers often result in a lack of cultural understanding and representation in the classroom (Sarraaj et al., 2015). Experiences for minoritized students are worsened in STEM fields, as opportunity structures in subjects like science afford them fewer chances to succeed and belong (Gray et al., 2018). Taken together, research examining Black and Latinx youth's motivational, emotional, and social experiences in the classroom seems to lack race-reimagined approaches, therefore emphasizing the need for more asset-based, explanatory research.

Teacher-student relationships

Teacher-student relationships are essential for fostering optimal student engagement, motivation, and achievement. Bernstein-Yamashior and Noam (2013) describe two primary elements to building respectful, supportive, and trusting teacher-student relationships, two things should happen: 1) teachers need to know and understand their students and their students' lives well (Huerta et al., 2020), which can be done by explicitly paying attention to students'

culture(s), emotions, and environments, and 2) developing trust among students (Romero, 2018; Russell et al., 2016). As a practicing teacher, I have implemented and witnessed other teachers utilize these suggested practices or similar strategies and have seen a positive impact on teacher-student relationship development. Caring and trusting relationships can be developed with the following suggested practices: teach so that students have all of their learning needs met and valued, set and communicate equitable, high expectations, implement ways for students to consistently engage in and relate to science instruction, and create a warm and welcoming environment (Jansen & Bartell, 2013).

Teachers' perceptions of teacher-student relationships are not commonly evaluated in middle school but even more so in science classrooms. On the contrary, Russell and colleagues (2016) centered teachers' voices and perspectives when examining teacher-student trust. Their reasoning for using teachers' perspectives, as opposed to students', is due to teachers interacting with a variety of students and their authoritative roles potentially, "setting the tone of the social-emotional environment of the group in comparison to students." (Russell et al., 2016, p. 244). Their results showed that teachers believe that they can develop different levels of trust with their students. The teachers in this study also mentioned that trust levels within each teacher-student relationship varied based on individual students' environments, which teachers believe have an indirect influence on teacher-student reciprocal trust levels.

Previous research investigating influential factors for building teacher-student relationships with minoritized students found support for teacher warmth and caring as factors for increasing trust (Gregory & Weinstein, 2008). It is foreseeable that the differential treatment of Black and Latinx students in urban school settings contributes to the varying quality of teacher-student relationships in school (Liang et al., 2020), specifically in science (Fisher &

Waldrip, 1999). McClain and Cokley (2017) stated, “Black adolescents report lower levels of teacher trust” (p. 127). However, the research does not consistently present trust or feedback as influential factors. Trust plays a strong component in the quality of teacher-student relationships, as this is developed after students view their teacher as warm and caring (Gregory & Weinstein, 2008; Jansen & Bartell, 2013; Russell et al., 2016).

Some evidence points to other contextual factors (e.g., caring and warm teachers, teacher perception of student teachability, teacher expectations, and students’ SES) and not necessarily emotion (Bernstein-Yamashiro & Noam, 2013; Boekaerts & Pekrun, 2015) as essential for creating and maintaining high-quality teacher-student relationships. Alongside these factors, Bernstein-Yamashiro and Noam (2013) reviewed articles highlighting contributing factors impacting student-teacher relationships and found that students reported experiencing respectful intercounters assisted with the development of teacher-student relationships. Along with respect, student perceptions of safety and connection with their teachers impacted the quality of their relationships with teachers (Bernstein-Yamashiro & Noam, 2013).

Zembylas (2005) argued that teacher beliefs surrounding teacher-student power relations or teacher roles shape their students’ emotional expression. An example of this is when teachers permit students to show some emotions while prohibiting others. Teachers often permit and encourage students to display enjoyment during introductory and interactive activities, but view expressions of boredom (e.g., sidebar conversations, asking “Do I really have to do this”) and frustration (e.g., choosing not to complete the work, walking out of class, saying “I am not doing this, it’s too hard”) during introductory and interactive activities as disruptive and inappropriate. Interestingly, Jiang and colleagues (2016) found that teacher beliefs about authority were related to the suppression of anger among students.

Feedback. Black and Latinx students and youth perceived to have low ability are often exposed to inequitable feedback experiences (Nicolai et al., in press). For example, these students are more likely to receive feedback that is (a) less encouraging, and (b) more negative. In addition, Black youth are also more likely to receive more positive feedback than their white counterparts (Andersen, 2018; Harber et al., 2012; Nicolai et al., in press). While experiencing an immense amount of positive feedback may seem promising, consistent accumulation of inauthentic, limited, and inapplicable feedback is problematic (Graham, 2020; Nicolai et al., in press). Further, teachers—the overwhelming majority of whom are white women—have shown to be overly conscious in regard to the avoidance of appearing racially biased toward their Black students (Starck et al., 2020). Thus, some teachers may refrain from providing large amounts of negative, yet important feedback, to students from historically minoritized groups (Croft & Schmader, 2012; Mendoza-Denton et al., 2010).

Teacher feedback can be perceived as positive, negative, or neutral as it relates to a student's response (e.g., right or wrong) and academic progress (i.e., improving or needing improvement). Fong and colleagues (2019) point out that negative feedback is not given nor created equally. They point out that a common consequence of negative feedback is a decline in intrinsic motivation due to the feedback explaining unsatisfactory performance. Similar to positive feedback, negative feedback can also increase students' motivation (Fong et al., 2019). However, they point out that research on negative feedback and its impact on intrinsic motivation has not solidified the direction and magnitude.

The delivery and content of teacher feedback can also play a role in student learning. Providing feedback in private, in front of others, verbally, or scribed is important to consider in regard to delivery. The content of the feedback includes “attributing performance outcomes to

one's level of effort ability; and the inclusion of praise or information about how to improve.” (Fong et al., 2019, p. 126). The interplay of emotional and motivational processes in students' academic experiences causes complexity in teacher feedback. For example, a student that receives verbal, negative feedback in front of the class from a teacher who they don't have a strong relationship with may express anger or embarrassment, potentially resulting in a decline in relationship quality, engagement, and motivation. On the contrary, a student who receives positive feedback in private may express joy, potentially resulting in increased relationship quality, engagement, and motivation, while also looking forward to receiving more feedback on future assignments or in regard to their performance. Research continues to explore potential factors that contribute to students' perceptions of teacher feedback, especially while performance gaps between minoritized and white students continue to be a social problem (Harber et al., 2012).

Despite the above-mentioned inequities and the detrimental motivational consequences that can potentially emerge from them (e.g., Fong et al., 2017; Graham, 2020), minimal work has directly explored Black and/or Latinx students' experiences with feedback, in regard to emotional engagement and teacher-student relationships. The study will directly address this gap.

Trust. Little research has examined the basic nature of teacher trust in educational settings and how it manifests within the context of teacher-student relationships. In one qualitative study of secondary school teachers' beliefs about trust in teacher-student relationships, Russell and colleagues (2016) found that trust can lead to beneficial changes in classroom climate, student behavior, and social interactions. Findings also suggested key antecedents to developing trust, such as students' home environment, instructional strategies, and interactions and actions exchanged between the teacher and student. Examples of teacher-student interactions included demonstrating caring words and actions, personal relatability and connections, and being reliable and consistent.

Trusting relationships among adolescents and their teachers tend to fluctuate as they progress throughout adolescent development (Murdock & Miller, 2008). This is especially critical for adolescents who are considered at-risk because trust has been identified as an essential precursor to engagement in educational settings (Gregory & Ripski, 2008). Teachers within one study notably stated that "trust exists within distinct dyadic relationships as well as between the teacher and the class as a whole" (Gregory & Ripski, 2008, p. 248). The teachers in this study were able to recognize that the way they give feedback and the way students perceive their feedback can impact the level of trust within that didactic relationship.

One way to work towards closing the opportunity gap among Black students is to increase the level of caring among teachers and set high expectations for said students (Gregory & Weinstein, 2008). Caring teachers and high expectations may relate to teacher trust for Black students. For example, Gregory and Weinstein (2008) found that teachers who were infrequent with negative feedback, but consistently held high expectations had optimal levels of trust and

cooperation with Black students. However, it remains unclear whether or not the need for teachers to earn trust is culturally specific to Black students or universal to all adolescents.

Purpose of the Study

The primary purpose of this qualitative study is to explore middle school science teachers' and Black and Latinx students' teacher-student relationship, students' emotional engagement, and students' interest in science. A phenomenological and asset-based approach will drive this research, along with discourse analysis, to deepen researchers' understanding of science teachers and Black and Latinx students' current social-emotional experiences in middle school science classrooms, with the aim of exploring factors that promote the development of teacher-student relationships, emotional engagement, and interest in science. In correspondence with this study's purpose, discourse will refer to ways of constructing or referencing knowledge about a particular topic (e.g., emotional engagement, trust, feedback, interest) or domain of practice (i.e., teaching, building relationships) and the ideas associated with that practice (Leistyna, 2001).

My dissertation will help to fill the gaps in the existing literature on teacher-student relationship quality by 1) examining how teacher-student relationships are created and sustained during an academic school year by centering students' and teachers' experiences and perspectives, 2) relating teacher-student relationships to emotional engagement and science interest, and 3) exploring these patterns among a) the Black and Latinx student population and b) their science teachers within an urban, Title 1, school context. It makes an important and timely contribution to the study of teacher-student relationship quality and its links to Black and Latinx science students' emotional engagement and interest in science. Finally, this study adds to the literature on social-emotional and motivational aspects within learning environments by focusing

on science teachers' and Black and Latinx students' understandings of the interpersonal aspects of science instruction.

CHAPTER III- Methodology

This chapter contains an overview of the methodology implemented in the current study. Following the description of my researcher positionality, the chapter outlines the phenomenological approach and discourse analysis within the study in detail, including the participants and setting, measures, data collection and analysis procedures, and validity concerns for each phase. The chapter concludes with a discussion of the data analysis and Institutional Review Board considerations of the study.

Researcher Positionality

This dissertation study is important to me, personally and professionally, because of the ongoing issues I have witnessed during my four years of serving as a special education urban educator. Teachers should strive to be understanding and cautious about labeling students who struggle to express and regulate their emotions. For example, teachers should not quickly mark a Black child displaying anger as aggressive or compulsive as a threat to the classroom. Teachers should not assume a student's trauma and emotional well-being based on their skin color. Other factors need to be considered (e.g., trauma, living environment, personality), especially before referring a child for diagnosis of an emotional disorder. I have seen this happen too many times as a special education teacher.

Through my practice, I have also realized that the less understood a child feels because of their teacher, the less likely they are to trust the teacher. A lack of trust can shut down the possibility of developing a positive relationship between the teacher and the student. Teachers need to take an interest in students' lives and show that they care and are open to building trust with each student. Effective and positive perceptions of each student are potential consequences of teachers recognizing and eliminating biases of certain groups (e.g., Black, Latinx, and special

education students). Prior literature regarding the development of teacher-student relationships makes me reflect on how I need to continue to check my own cultural biases and take time to understand and respect other cultural norms. I also realize how important it is to have professional development in eliminating cultural biases when reflecting on teaching practices.

My educational background and teaching experience thus far have led me to further my educational aspirations by expanding upon prior research on emotion and teacher trust and implementing my own research into the K-12 classrooms that teach in. This will allow me to advance my cultural awareness and understanding of diversity in relation to emotional regulation, trust, and academic success within the classroom and apply it to the ongoing growth of our education systems. It has also led to my desire to evaluate teachers' perceptions of trust and student emotional regulation and expression in their classrooms. What emotions do students express that make teachers hesitant when building relationships with certain students belonging to a marginalized race? Research on emotion with a focus on minoritized students, specifically Black American and Latinx students, is essential for increased STEM academic achievement, trust, and motivation. An advantage that I believe will come from the assumptions and my experiences is the opportunity to provide relevant insight when writing the discussions and implications portion of my research. It will help me examine what would be key components when eventually hosting professional development sessions in the future.

One of the disadvantages that I foresee in this research is eliminating my own biases when engaging in conversations during the interview process. One way I can try to overcome this is by listening and taking in the information presented during the conversation.

The epistemology and ontology approaches that guided this work were transformative and constructivist approaches. These worldviews allowed the negative and positive experiences to shape teacher-student relationship quality, emotional engagement, and interest in science. The research team is actively involved, honored, and centered participants' voices, building trust, and visiting the school environment in order to collaborate and collect data. These approaches allowed for closeness, subjectivity, and collaboration among participants to promote the concept that their voices, experiences, and viewpoints are invaluable to this research. I believe the epistemology and ontology that guided this work contributes to bridging the gap between research and practice. Understanding that different social and cultural positions can add power to this research is important while drawing from minoritized participants' realities and perspectives. I have taken a strong stance on the idea that the construction of knowledge will assist individuals with societal improvements.

Research questions

The present study answered two overarching research questions.

- 1) How do Black and Latinx students describe the factors that help or hinder their teacher-student relationships, emotional engagement, and interest in middle school science classrooms?
- 2) How do science teachers describe the factors that help or hinder their teacher-student relationships, emotional engagement, and interest in middle school science classrooms?

Design

Drawing from Self-Determination Theory, the current study's overarching objective was to center Black and Latinx students and science teachers' perspectives to assist the research team

with examining the relationship between teacher-student relationship quality and student emotional engagement and interest in science in middle school classrooms. Specifically, a phenomenological, qualitative design was adopted because the qualitative data and analysis were assumed to provide an understanding of each concept link and center participants' voices (Creswell & Plano Clark, 2011). Teacher and student one-on-one interviews served as the basis for data collection in this study, followed by discourse analysis between the interviewer and participants.

A phenomenological qualitative study was conducted using one-on-one teacher and student interviews to examine further participants' perspectives on the factors that impact teacher-student relationship quality, student emotional engagement, and interest in science. This study exercised a phenomenological approach to understand the "human experience better and for deriving knowledge from a state of pure consciousness" (Moustakas, 1994, p. 101) while promoting honesty and authentic responses from participants. Johnson and Christensen (2014) emphasized that phenomenology is "a form of qualitative research in which the researcher attempts to understand how one or more individuals experience a particular phenomenon" (p. 49). For this reason, because this study aimed to explore the factors of a phenomenon (teacher-student relationship development, students' emotional engagement experiences, and interest in science), the researcher chose to implement interpretative phenomenological analysis to conduct the research using the perceptions of middle school science teachers and Black and Latinx students. Using this approach allowed me to shed light on the development of teacher-student relationships, students' emotional engagement, and students' interest in science through lived experiences of science teachers and Black and Latinx students.

Discourse analysis took place to conceptualize the researchers' and participants' social interactions that are consistent with sociocultural perspectives in educational research (Gutiérrez, 2008). Rogers (2011) emphasized that language is not analyzed equally while recognizing language as a social practice. Therefore, creating a critical need for language analysis in social contexts (e.g., school contexts and research). Within Rogers' scholarly work, discourse analysis is referred to as "a broad framework that brings critical social theories into dialogue with theories of language to answer particular research questions" (Rogers, 2011, p. 3). Within my dissertation, I analyzed and made meaning of participants' word choice, knowledge, and tone when responding to the interview questions.

Participants

Drawing from the rich, previously established school partnership, my research team and I recruited 13 participants. The sample for this study included a Title 1 urban middle school's science teachers ($n = 5$) and students (grades 6-8) who identified as Black, Latinx, or both ($n = 8$). Science teachers teaching special education students in a self-contained setting were included in the recruitment for this study. When referring to an urban setting, I specifically mean a school where 75% or more of the student population receives free and reduced lunch, classifies with low SES, and/or falls within the Title I category.

Research Relationships. The chosen sample for the study was based on accessibility, convenience sampling, and professional relationships already formed. Although accessibility can be considered an advantage for this study, it can also be a disadvantage. Recruiting the teachers that the researcher has already developed relationships prior to this study can be a disadvantage because of the already formed relationships. To combat this, I worked to establish a trusting and ethical relationship by explicitly stating that participants are free to express their honest opinions and every response will be kept confidential. During this study, sampling bias and response bias may also be an issue because of the focus on a specific student population (i.e., Black and Latinx), but in doing so, there may be an overrepresentation or underrepresentation of other races and ethnicities (e.g., White) when studying this phenomenon. Response bias may also be present. Participants may respond to interview questions on their perceptions of what is socially acceptable versus what is considered truthful.

The aim of the phenomenological qualitative study was to center science teachers' and Black and Latinx students' voices and to explore their perspectives of how their teacher-student relationships impact their feedback experience, trust levels, interest in science, emotional engagement in science class.

Data Collection and Analysis

Interview Data Collection and Analysis

Interviews were conducted individually to provide maximum scheduling flexibility and ensure a safe space for participants to talk openly and provide authentic and honest responses. This allowed for the minimization of participant reactivity to their peers.

The interview protocol was designed to be informative and thought-provoking. All questions were considered open-ended in order to provide probing rich qualitative data. The

teacher and student interview protocols (see Appendices C and D) included open-ended and probing questions to explore teachers' and students' perceptions of their science teacher-student relationships. All questions were open-ended in order to provide probing, rich qualitative data. Interviews were conducted individually to ensure scheduling flexibility and a safe space for participants to talk openly and provide authentic and honest responses. The researcher wanted the teachers and students to be able to answer honestly and not feel the need to change their answers based on differing perspectives from the other participants. One-on-one interviews allowed the researcher to dive deeper into understanding each participant's experiences and beliefs regarding student emotions and teacher-student relationship quality.

After the completion of data collection, all teacher and student data were matched, and participant names were replaced with pseudonyms. Data analysis followed Moustakas's (1994) procedures for systematic analysis of phenomenological data. This process involved epoche (or bracketing or identifying significant statements), phenomenological reduction, synthesizing themes into a description of individual experiences, and constructing a composite description of the meaning.

Transcripts were read in their entirety for overall understanding by me and the graduate assistant. Phenomenological reduction was achieved through horizontalization, defined as the process of exploring and treating all pieces of data with equal value (Merriam, 2009). Transcripts were re-read, and reoccurring thoughts and perspectives among participants were noted. The graduate assistant and I met to discuss our initial reactions and potential categories that represent compelling statements from the participants, a process known as basic thematic categorization (Saldaña, 2013).

To identify themes, qualitative data was transcribed using Otter.ai and analyzed using the constant comparative method (Corbin & Strauss, 2014). Constant comparative methods required the researcher to reflect and continuously look back at the data to compare similar codes across participants to assist with theme development and eliminate redundancy. The transcripts were analyzed to look for errors and to start developing codes and themes. The codebook was developed directly from the research questions to include codes for data referencing the specific questions. The codes were divided into three broad categories, representing focal phenomena within each research question (*teacher-student relationship quality*, *emotional engagement*, and *interest*). Teacher-student relationship was then broken down into two subthemes: *trust* and *feedback*.

Discourse Analysis

Discourse continues to play a critical role in social practices (Gee, 2004; Rogers, 2004). Education thrives on social interactions between the student and individuals that make up the school environment (e.g., teachers, principals, counselors, therapists). It is important to understand and constantly reflect on language's power and dynamic in those everyday interactions. The inclusion of discourse analysis can aid educational researchers as they begin to unravel the “discourse of education and in education” (Rogers, 2011, p.15). The discourse analysis portion of this study included the study of the relationship between the language form and function at their meaning potential level. Form was referred to as “words and phrases.” Function was defined as the “meaning or the communicative purpose a form carries out” (Gee, 2004, p. 25).

James Gee (2014) points out that language and communication assist individuals in creating meaningful social relationships and identities. He mentions that seven building tasks

guide discourse analysis: significance, activities, identities, relationships, politics, connections, sign systems, and knowledge (Gee, 2014; Rogers, 2011). *Significance* refers to one's use of language to make things, people, and situations hold significance or not. For example, the language used when describing a graduation, sport event, or development of an important and new relationship can signal how significant the event holds to an individual.

Gee (2014) defines *Activities* as “a socially recognized and institutionally or culturally supported endeavor that usually involves sequencing or combining actions in certain specified ways” (p. 17). Relevant to this study, an action can be referred to as developing a trusting and positive relationship between teachers and students. In other words, exploring the language students and teachers use can potentially reveal relationship development and trust building, as well as how teachers promote student interest and engagement.

Identity, as explained by Gee (2014), is considered to be the language that we use when taking on certain roles and identities. Relevant to this study is the language used by participants that identify and assume their roles as teachers and students. Taking it a step further are the racial identities that each participant makes known to the researcher. *Relationship* is defined as the language that individuals use “to signal what sort of relationship we have, want to have, or are trying to have with our listener(s), reader(s), or other people, groups, or institutions about whom we are communicating” (Gee, 2014, p.18).

Whereas *Politics* refers to the language that individuals use to help with the “nature of the distribution of social goods” (Gee, 2014, p. 18), *Connection* refers to the language used to relate certain things to one another. For example, the language teachers use during instruction to connect the content to students’ personal lives.

Sign systems and knowledge are defined as the use of “language to make certain sign systems and certain forms of knowledge and belief relevant or privileged, or not, in given situations, that is, to build privilege or prestige for one sign system or way of knowing over another.” (Gee, 2014, p. 20). Whereas sign systems are referred to as nonverbal forms of communication to build and express knowledge (e.g., formulas, tables, graphs), knowledge is known as one’s beliefs based on languages and claims.

For the purpose of my dissertation, I focused on activities, relationships, and identities. Table 2 refers to the questions proposed by Gee (2014) to consider when looking at the building tasks for discourse analysis. As *Activities, Relationships, and Identities* were the most relevant building tasks for this study, the other building tasks are not included in the table.

Table 1

Gee’s Relevant Building Tasks and Discourse Analysis Questions

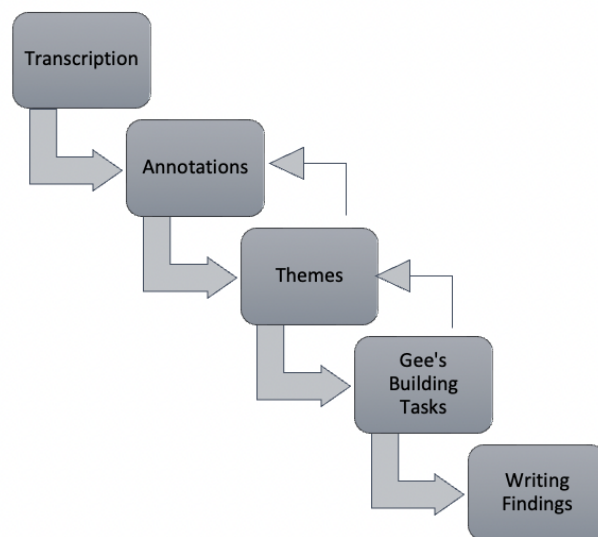
Building Tasks	Discourse Analysis Question (Gee, 2014, p. 18-19)
Activity	What practice (activity) or practices (activities) is this piece of language being used to enact (i.e., get others to recognize as going on)?
Relationship	What sort of relationship or relationships is this piece of language seeking to enact with others (present or not)?
Identity	<p>What identity or identities is this piece of language being used to enact (i.e., get others to recognize as operative)?</p> <p>What identity or identities is this piece of language attributing to others and how does this help the speaker or writer enact his or her own identity?</p>

Note. The building task and questions were considered throughout the discourse analysis process.

To assist with data organization and the extraction of themes, the researcher and graduate assistant used Google Doc and Google Sheets files to compile the data and utilized the comment feature of Google Docs in order to annotate, highlight, and code to generate themes in the column along with reflection from the researcher and graduate assistant. These steps were repeated as the researcher reviewed the data and once again for discourse analysis. The researcher and graduate assistant were content with the consistent themes found between the two of them after cross-checking the other's interpretation of the participant's responses. Therefore, no changes were needed in regard to coding or themes in the analysis of the study based on the member checking. The themes that emerged from teacher and student responses were categorized according to commonality. Figure 1 depicts the integration of qualitative data analysis and discourse analysis.

Figure 1

Interview and discourse analysis



Note. The qualitative analysis process took place in the following order: transcription, annotations, and themes. Discourse analysis occurred in reverse order after transcribing the interviews: Gee's building tasks, themes, and annotations. After the analyses concluded, the findings were discussed between the researcher and the graduate assistant.

Trustworthiness

I identified three main validity threats to the findings: (1) researcher bias; (2) reactivity to the researcher because of prior developed professional relationships; and (3) misinterpretation of what is said, either because of bias or misunderstanding. Participants might have reacted to being interviewed; specifically, they may give socially desirable answers, given my relationship with participating teachers. As previously mentioned, this could have been amplified because I had developed professional relationships with teacher participants prior to the study. To address this validity threat, I told participants multiple times that the interviews and quotes would be confidential. To help reduce participants' unwillingness to share during individual interviews, they were told the interviews were confidential. Additionally, I asked follow-up questions and followed up with clarifying statements when participants did not elaborate. The last main validity threat was the misinterpretation of information. I aimed to take notes while coding the interviews about participants' responses to target this threat. While another coder and I analyzed the interview responses, our expectations of the study's findings may have placed bias on the analysis and led to the misinterpretation of teacher and student responses.

Human Subjects Protection

The present study received ethical approval from the Internal Review Board (IRB) for Virginia Commonwealth University (VCU). Parent letters (see Appendix F) were sent home with

all students. The letter was provided in English. Parents/guardians had a week from the day the form was sent home to finalize their decisions to opt their child(ren) out of the study. Students received the assent form (see Appendix B) after school and turned in the form before beginning the interview. Teachers were given the consent form (see Appendix E) in person after confirming with the researcher that they wanted to participate in the study. During the assent and consent process, to ensure that participants did not feel pressure to agree to participate, researchers emphasized that participation was completely voluntary and that all responses would be anonymous and confidential. All interview facilitators had experience working with historically-minoritized secondary school students. Prior to completing the interviews, student participants were asked to complete a brief demographics questionnaire (see Appendix A), which took them less than five minutes to complete. After assenting to the study, the research team administered paper copy screening questions (see Appendix A) to student participants. The researchers read Assent forms aloud to ensure equitable opportunity to understand and complete the form.

Participants' names were collected to ensure that the researcher could follow up with participants at the end of the study to distribute the \$10 gift cards for participation. However, all identifiable data was electronically stored in the researcher's secure VCU staff Google Drive folder. Only the research team had access to participants' identifiers.

Chapter IV- Findings

The present study aimed to explore the perceptions and experiences of science middle school teachers and Black and Latinx students to understand teacher-student relationships, emotional engagement, and students' interest in science. Two specific research questions guided the study, with the first centering Black and Latinx students' voices and experiences and the second centering science teacher's voices and experiences. The research questions were:

1. How do Black and Latinx students describe the factors that help or hinder their teacher-student relationships, emotional engagement, and interest in middle school science classrooms?
2. How do science teachers describe the factors that help or hinder their teacher-student relationships, emotional engagement, and interest in middle school science classrooms?

Participants

The sample consisted of middle science teachers ($n = 5$) and middle school Black and Latinx students ($n = 8$). Table 3 displays the demographic information for the qualitative sample in this study. Student and teacher participants' names have been replaced with pseudonyms.

Table 2

Demographic Data

Participants	Status	Race/Ethnicity	Gender	Grade level
Ms. Johnson	Teacher	Black/ African American	F	7
Ms. Carter	Teacher	Black/ African American	F	6 and 7
Mrs. Peters	Teacher	Black/ African	F	7

		American		
Mrs. Anderson	Teacher	Black/ African American	F	8
Ms. Williams	Teacher	White	F	8
Tracy	Student	Black/ African American	F	7
Briana	Student	Black/ African American	F	6
Carmen	Student	Latinx	F	6
Alexis	Student	Multi-racial (Black/ African American and Latinx)	F	7
Amber	Student	Black/ African American	F	7
Ashley	Student	Black/ African American	F	7
Tatianna	Student	Latinx	F	7
Crystal	Student	Black/ African American	F	7

Note. All participant information was collected using a demographic survey before beginning the teacher consent and student assent process.

Research Question 1

The first research question for this study explored the personal and social experiences that middle school Black and Latinx students perceive to affect their interest in science, teacher-student relationship, and emotional engagement in science class. Interview data were analyzed for themes that identified the factors that contributed to Black and Latinx students' relationships with their science teachers, emotional engagement, and interest in science middle school courses.

Theme 1: Emotional Awareness and Support

When asked to draw on their emotional experiences, student participants repeatedly mentioned that students often displayed a range of emotions during social interactions and science instructions. The emotions mostly mentioned by student participants were boredom, frustration, and excitement during science instruction. This theme continues to support the claim that the classroom is considered an environment that brings about a variety of emotions. Students recurrently mentioned that teachers often tried to acknowledge their students' feelings when it was noticeable that a student was not having a great day, emotionally or mentally. For example, Tatianna noted, "If my teacher saw that I was crying or that I shut down during the lesson, she would ask if I could step outside of the classroom so that she could talk to me. Usually, I would talk to her, but other times I would ask to go talk to my counselor." Students thought it was essential to be able to express their emotions and that it was "okay to have bad days" because they wanted teachers to view them as humans and not just students. Emotional support and awareness between teachers and students are essential to their relationship development and emotional engagement in the classroom as it heightens students' academic attitudes, engagement, and the quality of the teacher-student relationship (Cipriano et al., 2019).

Positive emotions. During the interviews, students were asked to describe when they noticed students were most emotionally engaged and what it looked like for them when they were emotionally engaged. Implementation of technology, collaborative work, and hands-on inquiry activities increased students' emotional engagement and interest. Most of the student participants were not able or willing to provide an example of an interesting and uninteresting science activity because they collectively agreed that science is boring. On the contrary, Crystal mentioned that an interesting science activity she participated in was the “activity that allowed me and my classmates to build a light bulb.” This activity allowed students to take what they learned during the lecture and note-taking and provided them with the chance to see how electricity works while promoting creativity and collaboration. Tracey mentioned that “technology helps make learning the boring science stuff more interesting, and I pay more attention in class.” She also emphasized excitement upon entering the classroom and “seeing our teacher have lab equipment out on our desks.” This demonstrates how students' emotional experiences are contingent upon what that experience and observe when they first walk into the classroom. Crystal noted student excitement “when we saw that we got to play Kahoot or Quizizz for review.” Not only do students react emotionally, more positively when they are greeted by positivity (e.g., exciting activities, clean and orderly classrooms, and happy and friendly teachers), but their positive emotions are maintained and heightened for the duration of the class. Alexis mentioned, “I am always excited when I walk into class, and my teacher is standing at the door waiting for us to enter. Sometimes she would even ask how we were doing before entering the classroom. This made me feel happy because some of my other teachers didn't do this.” Students mentioned that when completing science activities and learning about science content, they are most excited and interested in the lesson when they engage in lab

experiments, group work, and projects. This is important to note because a teacher and students' interactions and relationships help improve students' learning environments, in this case, the science classroom (Cipriano et al., 2019).

Negative emotions. On the contrary, when asked to describe when they noticed students were most emotionally disengaged and what it looked like for them when they were emotionally disengaged, Brianna mentioned that frustration was present when “We have to test a lot on the stuff we learned last week. We are just tired of testing and not remembering what we learned.” Over testing can increase student frustration and burnout, causing students to become uninterested and emotionally disengaged in the presented task. Decuir-Gunby and colleagues (2009) refer to this as task-focusing processes (maintaining focus) and emotion-focusing processes (recognizing the individual and the emotions occurring during the task). As evident by Carmen's quote, “We got bored when all we had to do was listen to the teacher and take notes. We couldn't talk or anything.” Therefore, implying that teacher instruction and classroom activities play a role in the emotions that arise throughout a student's time in the classroom. Additionally, the above quote showed that when students became emotionally disengaged, they also demonstrated a decline in interest. The use of bored and frustration were the most common emotions used to express students' emotional engagement, emphasizing that much of the emotions experienced by students were based on teacher-chosen activities and instruction. This suggests that students are placing power on the teacher's identity regarding the emotions that are produced during instruction.

Students were also less likely to discuss what caused them to experience the present negative emotions with teachers that they did not have a positive relationship with or that they did not view as warm, caring, and friendly. Students were more willing to accept emotional support from outside resources that their teachers would refer them to during their time of need. However, providing additional resources to students began to demonstrate that “maybe this teacher does care even though all she does is yell and put students out of the class when they are angry or sad.” as stated by Ashley. Every social interaction and opportunity for a teacher to provide emotional support, sticks with students longer than teachers think or expect. Taken together, it is important that teachers and students both understand that emotional awareness and support play a critical factor in fostering or impeding students’ teacher-student relationships, interest in science, and emotional engagement in the classroom.

Theme 2: Teacher Personalities and Caring Characteristics

When students were asked about whether or not their relationships with their teachers influenced their desires to attend school, students commonly voiced that their teacher relationships played a significant role in their desire and attitude towards coming to school. Tracey explained that “When I know I have a good relationship with my teacher, it makes me feel good and excited to come to their class, especially if I have that class every day.” On the other hand, Carmen stated, “I do not have good relationships with my teachers that are mean, always yelling, or picking on the kids. When I have a teacher like that, I either skip their class or try not to say anything when I am in the class.” Furthermore, Ashley agreed that having a teacher that is constantly yelling and lacks an interest to understand and get to know their students, does not make it inviting to continue to attend class or develop a relationship with their teacher. She described:

I don't care for my science teacher because she is always rude and her attitude is always nasty. She always comes off like she doesn't care about anything we are going through and just keeps calling home when she knows it is hard at home for some of us.

Students also emphasized the importance of teachers' kind, supportive, caring attitudes, and characteristics. Participants commonly noted that they had the best relationships with teachers who showed them they mattered, showed emotional support, and cared to understand that they live in environments that produce life-long trauma. The researcher and graduate assistant noted that when students had positive relationships and social interactions with teachers, they used strong passionate verbs and phrases (e.g., “love” and “it makes me feel excited) to describe those experiences. On the contrary, students used phrases and words such as “I don't care for” and “rude” and “nasty” to describe the interactions and relationship dynamic. Alexis emphasized this through her response:

I love when my teachers take time to ask me what is wrong because that shows me that they see I am not in a good mood. When I come to school mad, my science teacher will ask me if I need a moment outside of the classroom or if I would like to talk about what is going on. I came to school crying one day because my uncle got shot and I just couldn't concentrate, but I had to take my science test. My teacher talked to me for a little bit and then let me go to the counselor. She let me take my test the next day.

Trust Development and Considering Student's Backgrounds. A common theme from student interviews was that students' familial and environmental backgrounds influence how students develop trust with individuals at school, including teachers. Of the 8 student participants, 6 noted that they have difficulty trusting people right away because of how they grew up and where they live. This is important to acknowledge because it should be considered how students build outside trusting relationships with individuals in their personal lives outside of school. Hearing from students firsthand that they develop trust with individuals differently based on their home lives was eye-opening. Everybody develops trust differently and at different rates. Carmen also noted that she "appreciated when teachers wanted to know more about her home life and wanted to find ways to relate" to her because it showed her that she "was important and everything she had experienced in life helped make her who she was today."

Trust development should be a reciprocated act between teachers and students. Brianna explained that they “don’t think that adults and teachers see the importance in trusting students. They are always quick to think we want to steal from them or that we are disrespectful.” Teachers and students should hold each other to the same expectations when building and maintaining trust across both parties while also understanding that trust is not something that is developed overnight. Furthermore, students are “trusting teachers to view them as humans and not just students or students who grew up in a place where violence and crime happen.” The phrases presented during student interviews placed strong emphasis on the activities (e.g., relatability, reciprocity) that were most important and impactful to students when developing relationships with their teachers. An example of activity emphasis was “view them as human” and “wanted to find ways to relate.” Therefore, enforcing the importance of students’ willingness to share their background experiences with teachers so that they are better understood. In accordance with Brianna, Alexis stated:

It is hard for me to trust adults because of the relationship I have with my own parents. I don’t trust that they care about me, so why would a stranger care about me? I want to trust people, but it’s just hard for me to because of everything I keep experiencing.

Increase in Feedback Opportunities. Interestingly, all participants mentioned that they seldom received feedback from their science teachers. A common theme from the student interviews is that students would love to receive feedback more often so that they “can feel more confident about their learning,” as quoted by Crystal, and to “feel like we are doing something right even when we pick the wrong answers,” as stated by Amber. The majority of the student participants asked to skip the feedback questions because they could not speak to them with much detail.

Research Question 2

The second research question for this study was about the personal and social experiences that middle school science teachers perceive to affect their Black and Latinx students' interest in science, teacher-student relationships, and emotional engagement in science class. Interviews were analyzed for themes relating to what factors contributed to science teachers' relationships with their Black and Latinx students, their students' interest in science, and emotional engagement in middle school courses.

Theme 1: Understanding Emotional Awareness, Engagement, and Support

Teachers were asked questions about understanding students' emotional engagement in their science classroom. When asked to define emotional engagement, a common theme emerged that teachers lacked an understanding of how emotional engagement was defined and presented during instruction by students. This is evident in participants' responses. Ms. Johnson responded by stating, "Emotional engagement with students can be defined as having empathy for students who may or may not be experiencing a difficult time. When students are noticeably or visibly upset, check on them and just let them know that the doors open if needed." Similarly, Mrs. Peters stated, "Emotional engagement is defined as being in the mood to participate and how you feel while engaging in the lesson." Ms. Carter was honest and voiced, "I have never heard of emotional engagement. But if I had to guess, I would say it's students' willingness to participate, not needing to be reminded to stay on task and engaged without boredom. I think asking questions so like they want to know more, they're not being forced to know more." As explained and defined by Ms. Williams, emotional engagement refers to students' desires to engage in the science classroom and content.

I define emotional engagement as students wanting to be there or them not being there. Students view it as "This is science class. I have to be here to learn the content." But them feeling like your classroom is a safe space, somewhere they're comfortable being and somewhere where they feel safe commenting and learning. Because if students don't feel safe, if they don't feel seen, if they don't feel heard, they're not going to be invested in the content or the class or you, for that matter. So I think the emotional piece is them, actually, and just looping back to the first question of them being able to see that you care and feel that you care. So I think that leads into their emotional engagement.

When asked by the researcher to describe when students are more emotionally engaged and disengaged, teachers commonly said that students are most engaged when doing hands-on activities (i.e., lab experiments, inquiry-based learning) and collaborating with their classmates. As evident in Mrs. Peters' response, "They're the most emotionally engaged during again hands-on activities lessons that allow them to get up and move around the classroom." On the contrary, students are more disengaged when "completing standardized testing and local unit assessments," as stated by Ms. Johnson, and when students are "completing notes and worksheets during a lecture," as stated by Ms. Williams. When talking about engagement, teachers often used words such as distractions, redirection, and disruption to talk about student disengagement. It was noticeable that words with negative connotations were often used when teachers discussed students' disengaged behaviors and emotions.

Theme 2: Understanding Their Students and Displaying That Teachers Care

Teachers were asked to elaborate and reflect on their relationship-building practices with students and the development of safe and caring science learning environments. In doing so, they provided a variety of perspectives on why teacher-student relationships are important, what it looks like to build trust with their students, and an understanding of how social interactions with teachers contribute to students' emotional engagement and interest in the science classroom. Ms. Carter reflected on how they initiated relationship building and pointed out that "You can build relationships with your students by first, knowing their name and getting to know what they like and dislike." While taking the time to get to know students' likes and dislikes is essential and can be perceived as the initial step to developing relationships, more efforts are needed to maintain the continuous development of teacher-student relationships and to display to students that they are interested in understanding who their students are as individuals. Another common response from teachers was that they needed to be characterized as caring. Ms. Johnson noted a few ways that she ensures that students view her as caring inside and outside of the classroom.

If students have invited me to football games, shared competitions, things like that, just showing up for them because a lot of the times you may be the only person that the student is looking forward to seeing. They may not have a stable home life, so you showing up to that game or you even staying after school for extended day to tutor them, to help them. So I just feel like for us being in that role, being able to go the extra mile to show up for them really speaks volumes because, like I said, often times with the population we teach, they may not have someone in their corner rooting for them.

It was evident in Ms. Johnson's response that showing up for students outside of the classroom was just as important to students as showing up for students inside the classroom. When she stated that "you may be the only person that the student is looking forward to seeing" it placed importance not only on the activity, but the identity and relationship too. Mrs. Anderson emphasized that it is essential to employ personability and relatability within the development of every student relationship.

I build relationships with my students by letting them know that I'm there for them both inside and outside of the classroom. So just being personable and relatable to them, letting them know that I'm here to not only teach you science but also to teach you life skills. And I think when you successfully build those relationships, students are more inclined to share things with you, which can be good because those can help prevent things in the future from happening.

When asked about Black and Latinx students specifically during the interview, Ms. Williams stated that she, "Hate these questions. Like I hate the ones that are like you're black, and like, it's just your students." She placed passion and intense meaning in her response by using "hate" instead of other words, such as dislike or uncomfortable. Ms. Williams emphasized that she did not see color when she saw her students; she saw them as equal students and did not want to be forced to differentiate between races when talking about the students she taught. She also emphasized feeling uncomfortable answering questions that were race/ethnic-specific for this very reason. Similarly, Mrs. Peters emphasized, "I definitely think it's an individual student basis versus their ethnic background." She placed meaning in explicitly stating that she saw students as individuals and did not collectively group them based on race and ethnicity.

At the interview's conclusion, participants were asked if there was anything else they wanted to share. While four out of five participants stated “no,” Ms. Carter replied:

I just think that they're [emotional engagement, feedback, interest in science, and trust] all interconnected and relationships are the foundation because, again, if the students don't trust you, if they don't feel that you like them or that you have their best interests at heart, then you're going to be fighting a losing battle because they're not going to listen because they don't feel love, they don't feel appreciated, don't feel valued or heard. I think it's just important for both to understand. I think it's important for teachers and staff to understand that, yes, there are students, but there are people, too. We need to treat them in such a way. And also on the flip side for our students to understand that, yes, we are in this authoritative role to you as a teacher or a staff member, but we're people, too, and that we're here for you outside of just teaching you this content. So if everybody is just a little more open minded and understanding and giving each other grace, then we're all here to help each other. We all want everybody to succeed and be productive.

When talking about trust and teacher-student relationships, teachers often used words such as caring, care about you, support, building trust, and two-way street. Using “two-way street” placed meaning on identity and authority because teachers wanted to view themselves as equal when developing and maintaining respect and trust within their teacher-student relationships. It was evident that teacher participants believed students were worthy of earning teachers’ trust and understood that it should not be given because of their authoritative roles in the education setting. Meanwhile, students also used similar words, such as caring, supportive, and kind.

Understanding Trust Development Through Relatability, Consistency, and

Reciprocity. Demonstrating consistency in developing and maintaining trust with students was a vital component of trusting relationships. Ms. Carter stated that “Um, consistently like being able to be present every day and being consistent with showing students that I care. Kids can see how consistency plays a role in building trust.” In support of consistency being necessary, Mrs. Peters said, “I believe when students know you love them when you’re consistent and always honest and open with them.” Along with consistency, it was noted by Ms. Johnson that reliability is a critical factor that can foster trust levels and teacher-student relationships.

I define trust as a safe space with someone. So with someone that's reliable, someone that you know is going to have your best interest at heart. So when we talk about student relationships that trust, them being able to know that they can confide in me, but also understanding that if necessary, the conversation will go to a different place, and it'll be transferred to the necessary channels in order to ensure their safety and emotional and physical well being. So trust, knowing that somebody cares about you, somebody loves you, somebody has your best interest at heart, is going to do what they need to do to protect you and maintain that relationship.

Within Ms. Johnson’s response, she used the phrases “safe space,” “well-being,” and “protect you.” This was interesting to see her make a connection between trust and protection, especially in regards to the identity of teachers and the activities that are implemented to create safe, caring, and positive relationships. Mrs. Anderson noted that it is “Very important in that they can trust that I want the best for them. I'm going to do the best for them, and I can trust that they won't cause any chaos or disruption during the lesson. Trust is a two-way street.” Trust must be present amongst both individuals working to strengthen the relationship, therefore, forcing

reciprocity and consistent effort to be present for the relationship to develop continuously. Shockingly, Ms. Williams voiced that challenges have arisen due to her differing cultural background. However, it was admirable to hear that she did not allow the challenges or cultural and racial differences to hinder her ability to develop relationships with students. She pointed out, “Developing trust is challenging because I think someone doesn't necessarily choose to come to me first as their trusted adult because I have a very different background. I'm white and they're not.” She goes on to point out the importance of identifying a trusted adult in the school building by pointing out, “I just want the best for them, and I don't need to be the person to help [with]the issue.” She also understood that “doing things like that has helped students build trust with me too because they know that I just want the best for them and I'm looking out for their best interests.” This is critical to emphasize because even when teachers can not help solve all their students’ problems and provide them comfort during every situation, showing them that teachers will not let them suffer without exhausting all options and resources in the building will also help show students that they care about their wellbeing and the situations that they experience.

When asked if trust played a strong role in classroom management and teacher-student relationships, Mrs. Peters elaborated on the idea that without trust in the classroom, students will not engage in the activity, perform at their best, or trust the teacher's authority. Trust is a classroom necessity between teachers and students, not just for positive social interactions and relationship development, but for academic outcomes as well. Mrs. Peters’ quote is as follows:

I think trust plays a major role because if the students don't trust that you like them, don't trust that you care about them, don't trust that you know what you're doing, then they are going to be less likely to participate in class, be engaged in class, and listen to you. For

that matter, whether it's about behavior, you're instructing them to do something related to the content. So I think student staff trust is important because if they don't feel like you have their best interest at heart, then they're going to be less inclined to listen to you.

Ms. Williams emphasized the importance of clear expectations and re-emphasized the need to display relatability and consistency while developing trust so that teachers and students can understand what is needed from both parties. She dives deeper into her response by stating that, “I will always trust you and always provide a safe space for you and be relatable and personable and be here for you. Like I said, inside and outside the classroom. But I also expect common decency and respect back so they understand that it's a two-way street.” Ms. Johnson reported, “I make it a priority to build community with them. I do what I say I’m going to do. I am consistent in my behaviors. So they know that I am dependable; it gives them something to trust.” Ms. Carter reflected on the importance of understanding students’ triggers and backgrounds to assist in trust development, as evidenced by the quote, “Sympathy and compassion. Knowing a little about their background and triggers helps me eliminate harm and discomfort.” Mrs. Anderson was able to elaborate on the importance of relatedness when developing trust with students due to her growing up in the same neighborhood where some of her students currently reside.

I'm very honest, I let them know they can trust me. I provide them with safe options and a safe space to speak freely. I let them know how I relate to them and that I am judgment free. I often try to meet them where they are as young adults.

Teachers were also asked to consider students’ family and social economic backgrounds when developing trust. A theme that emerged was the importance of how trust is developed and sustained with family members and other members of the community. To better understand the

challenges, if applicable, that arise when trying to get students to trust them, teachers need to be willing to understand students on an individual level fully. They should be willing to learn about students' home lives, including how they describe their family relationships and what happens in and around their neighborhood. Mrs. Peters stated:

I think if students don't come from a strong foundation, whereas they have trust in the home, they have adults in the home that they know they can count on, that they feel comfortable with, that they have a good relationship with, then they can reflect that or project that onto other adults in their life (i.e., the teachers and staff in the school).

Ms. Williams made a similar statement by emphasizing the importance of developing trust with one's parents at home because that is essentially the first trusting relationship developed among children and adults. As evident by her statement, "If they don't have good relationships with their mom, that can be projected onto their female teachers and vice versa with the male teachers. It can also make it hard for them not to be defined. So if you grew up in a hostile environment and that's all you're seeing, then that's what you know. So I think it's important for us to be mindful of that in the classroom." Similarly, Ms. Carter stated that "Students who may have both parents students or who may live with one parent students or experienced loss of a parent or a guardian may have difficulty or students who don't have a positive relationship with their family members may have issues or challenges with trusting adults at school." Mrs. Anderson expressed the same concept of family background understanding by stating:

Everybody doesn't come from the same background. Everybody doesn't share the same experiences. So we do have to take into consideration those things that may play a factor in why students may behave a certain way. And with that, build those relationships, build

that trust, help to show them that just because your home life may be that way, the whole world isn't like that.

Providing Purposeful Feedback. Teachers were asked to elaborate on whether or not they perceived feedback to play an essential role in developing and maintaining teacher-student relationships. The majority of the teachers believed that feedback was a factor that influenced the teacher-student relationship dynamic based on the social interactions, intentions and meaning of the feedback, and how the feedback was presented. Ms. Johnson made this evident by stating, “I think overall, my students take their feedback and they use it to their advantage.” Mrs. Peters stated, “I think feedback is important because content-specific feedback is going to help improve student achievement. You don't know what you don't know.” However, it was evident from some of the teachers’ perspectives that students understood the importance of feedback and how to use the feedback as they continued to progress in the course and content. Ms. Carter emphasized that feedback is “actually important because then you can grow from it. But a lot of the students I think maybe aren't used to it or just don't care about it.” Likewise, Ms. Williams stated, “I think my students, in general, are appreciative of the feedback because at the end of the day, I'm not doing it for me, I'm doing it to help you.”

Lastly, when asked about their purpose for providing students with feedback, responses were all centered around academic progress, student accountability, and showing students that they care. The majority of the teachers mentioned that they give students feedback by writing comments on their assignments and less verbal feedback. Ms. Williams stated, “When grading, just leaving students notes on their paper so that they are aware again of what the goal is or if they didn't meet the go, what they needed to do to complete their goal.” As stated by Ms.

Johnson during the interview:

I give feedback to students to let them know where they stand in the class, I give it back because I want you to do better. So I want you to use this and take this moment to reflect on this is where I'm at currently and think about where you want to be. So what do you need to do to get there so we can develop the actual plan? I do it because I care. I want everybody to succeed.

Theme 3: Implementing Relatable, Collaborative, and Hands-on Activities

Teachers were asked to reflect on their students' interest in their science class. When asked to describe their students' interest in science, Ms. Johnson immediately said, "Varying, I think it depends on what we're doing today and the topic. When we do hands-on stuff, they're usually pretty good about staying engaged and relatively interested, and they're definitely more interested when I can connect the topic to their day-to-day lives." Mrs. Anderson also emphasized that it is important to have hands-on activities and lab activities in science, along with making connections between science and students' real-world experiences. As evidenced by the following quote:

We do a lot of hands on and inquiry based activities, so they do really enjoy the labs and the opportunity to collaborate and work together on those things. We participate a lot in class, so there's a lot of discourse. There's a lot of talking and think pair share.

Mrs. Peters stated that to maintain student interest and engagement in the instruction and learning activities, it is essential for her to find ways to connect the material to students' experiences. As evident by her statement, "I have to find a way to connect with them, whether it's on a humor level, whether it's something like I was saying, Virginia Beach, or even when we talk about the James River. Everybody knows the James River. It runs right through South Side, where our students are from. Just making sure that I incorporate things, like I said, that they care

about, things that they know about.” Ms. Carter and Ms. Williams also briefly mentioned content connection when promoting interest in science.

Teachers were then asked to describe an emotionally engaged and disengaged student’s interest during the lesson. Participants emphasized that the more interest a student displayed, the more engaged they were during the lesson. Ms. Carter made this evident with her statement, “I think they're most emotionally engaged when it's something they care about.” Similarly, Ms. Johnson reflected on her emotionally engaged students’ interest and stated, “They're going to be more inclined to talk and participate in the discourse opportunities, answering questions, just more tearful, more talkative, more participatory.” Whereas, if a student was less interested and engaged in the lesson, there was more room for distraction and a higher need for constant redirection. For example, Ms. Williams stated that “I think if a student is emotionally disengaged in class, I think they will be distracted, of course so that they wouldn't be participating as much, and they require a lot more prompting and a lot more redirection to be on task and to stay on task.”

Chapter V- Discussion

The purpose of this present study was to explore and identify the factors that affect middle school Black and Latinx students' teacher-student relationships with middle school science teachers, interest in science, and emotional engagement in science. One-on-one interviews were conducted with teachers and students to highlight their voices and experiences in this phenomenological study. After transcribing and analyzing the qualitative data, discourse analysis was utilized to understand social meaning during discourse.

The following chapter is divided into five major sections: (a) the findings and interpretation of the qualitative data, (b) the implications, (c) the limitations and future directions, and (d) a brief conclusion.

Summary of Qualitative Findings

Several themes emerged to explain how teacher-student relationships shape Black and Latinx students' interest and emotional engagement in middle school science classrooms. The two major themes identified by students in the data included a) emotional awareness and support; and b) teacher personalities and caring characteristics. The three major themes that emerged from the teacher interviews included: understanding emotional awareness, engagement, and support, understanding their students and displaying that teachers care, and implementing relatable, collaborative, and hands-on activities. Two sub-themes emerged from the teacher interviews: a) understanding trust development through relatability, consistency, and reciprocity; and b) providing purposeful feedback. Lastly, the findings from the phenomenological study will be connected to the theoretical framework of this study and compared to the review of the literature.

Interpretation of Findings

Theme 1: Emotional Awareness, Support, and Engagement. Drawing from the qualitative data from this study, teachers often consider behavioral and cognitive engagement as opposed to emotional engagement during instruction. Continuing to draw attention to the unfortunate reality that minoritized students experience a decline in emotional and behavioral engagement as they continue to develop (Balfanz et al., 2007). Instructional strategies have been a part of the most recent academic reform, especially for urban middle schools and minoritized student populations (Balfanz et al., 2007).

The ability for teachers to adapt their instructional strategies towards their classes and for specific students, allows teachers to increase their emotional awareness, processes, understanding, and engagement within diverse learning environments (Mainhard et al., 2018). Additionally, it is essential to note that emotional experiences and expressions are highly individualized. It can therefore be difficult for teachers to accurately assess the emotional engagement of each individual student throughout the duration of the school day. Expanding on the emotion literature, the school environment incorporates and brings forth academic emotions stemming from teacher-student social interactions and instructional activities.

This study draws on the importance of emotions and their effect on students' engagement. More positive emotions (e.g., joy, fascination, enthusiasm) increase engagement, while negative emotions (e.g., boredom, anger, frustration) decrease engagement levels (Boekaerts & Pekrun, 2015). Across teacher and student interview responses, both groups of participants mentioned that when students were interested and engaged in the lesson it brought them joy and fascination. This was especially true for students enrolled in physical science because of the various hands-on and collaborative activities. Teachers noticed that they

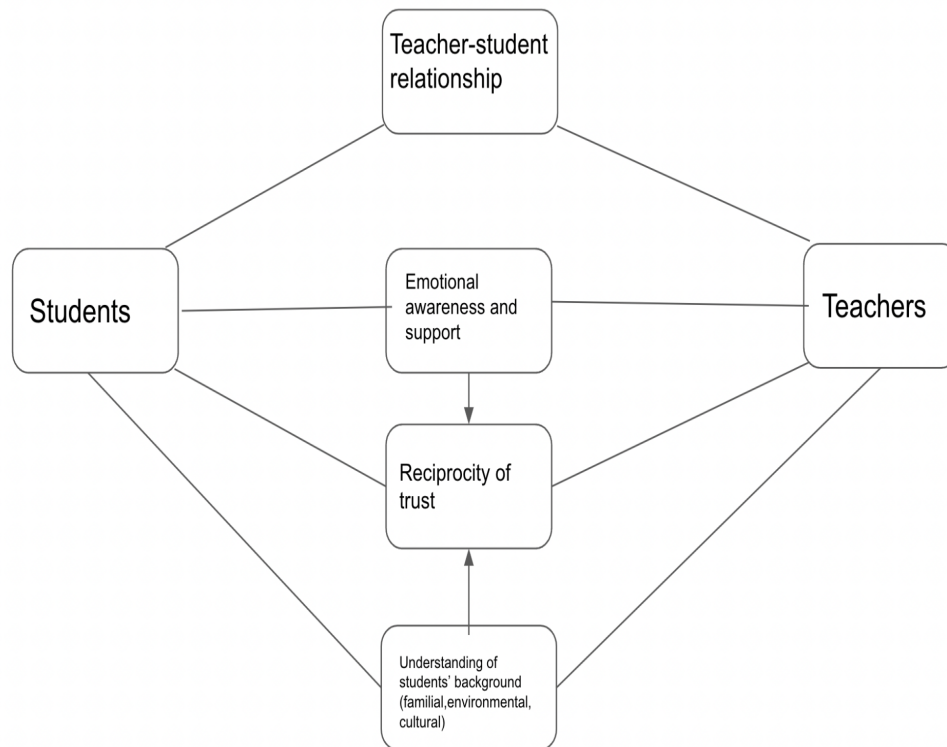
perceived emotionally disengaged students as disruptive and bored. Meanwhile, they stated that emotionally engaged students were more interested in the lesson and excited during the lesson.

Theme 2: Teacher-student Relationships. It is essential that teachers and other school personnel recognize that outside relationships in students' home environments (e.g., parents, siblings, friends) can potentially produce strengths and challenges when students try to develop trust with their teachers. Black and Latinx youth continue to experience family financial and emotional hardships (Flint & Jagers, 2021; Huerta et al., 2020). Based on the interview responses provided by both teacher and student participants, it is evident that it is essential to fully recognize and consider students' backgrounds and lived experiences when trying to better understand students, individually. Doing so could potentially eliminate or keep at minimum cultural biases when teaching a diverse population of students. It will also assist teachers with developing individualized relationships and classroom experiences with all of their students. It is extremely important to note that no two students are the same, and such should not be assumed when building relationships with students or teachers.

Consistent with teacher responses and Huerta and colleagues (2020), it is critical that school personnel and researchers a) create relationships with students inside and outside of the classroom and b) develop empathy and sensitivity for students' outside lives and experiences. In regard to the roles of students and teachers, the participants in my study voiced potential factors to consider when developing positive teacher-student relationships, as well as possible avenues for creating positive classroom interactions and experiences. Figure 2 was created to reflect the themes represented from the data.

Figure 2

Factors that Foster Positive Teacher-student Relationships



Note. Teachers and students hold important roles when developing relationships. The development of trust and positive relationships requires reciprocity for a) emotional awareness and support, and b) the understanding of students' background.

Although students and teachers mostly spoke about their positive relationships and less about negative ones, it was evident that they were aware of how to develop trust and build meaningful relationships. Responses suggest that students and teachers acknowledge the importance of teachers showing how they care about individual students through attending their extracurricular events, supporting them through emotional and social struggles, and displaying emotional awareness towards students who are displaying that they are not okay emotionally.

Caring, trusting teachers are essential to and influence students' social-emotional experiences in the classroom (Gregory & Weinstein, 2008; McClain & Cokley, 2017).

Furthermore, Figure 2 expands on my conceptual framework mentioned in previous chapters by building on my identity and experience, teacher and student voices, and Self-Determination Theory. The figure depicts an understanding that students thrive in learning environments where they feel safe, seen, and cared for (Bernstein-Yamashiro & Noam, 2013; Gregory & Weinstein, 2008; Huerta et al., 2020; Jansen & Bartell, 2013; Russell et al., 2016). Teachers and students play a crucial roles in students' individual learning experiences and environment (Boekaerts & Pekrun, 2015; Russell et al., 2016).

This study adds to the education field and research due to the factors, mentioned firsthand by minoritized students and teachers in urban settings, that contribute to the development of teacher-student relationships. This study also builds on the idea that teacher-student relationships influence the social interactions and social experiences experienced by minoritized students. However, it adds to the literature by emphasizing the need for reciprocity and less emphasis on authoritative roles. It continues to be understood by teachers and students that respect and trust are earned and not given, especially when considering one's background and lived experiences outside of school.

This study also expands on the literature on trust because it specifically looks at Black students' ability to develop trust and engage in educational settings with diverse staff. Furthermore, students reiterated that they thoroughly enjoy attending classes with teachers who they trust, view as supportive, and show an interest in their outside lives. On the other hand, they underperform in or skip the classes taught by teachers they do not trust or have a positive relationship with. This is essential due to the stigma of misbehavior and disengagement

occurring mostly amongst minoritized students (Graham, 1994; Hudley & Graham, 2001; Okagaki et al., 1996; Smalls et al., 2007).

Trust. Trust was deemed as an important component in developing and sustaining teacher-student relationships. All participants voiced that it is essential to acknowledge that trust requires reciprocity and not just the responsibility of the teacher or student alone. The findings from this study support the claims made by Russell and colleagues (2016) because they also recognized that both parties are responsible for creating trusting relationships and need to work together to maintain trust. What is referred to as student ecology (Russell et al., 2016, I refer to as students' background (e.g., family and environment). Teacher and student participants acknowledge that the relationships formed with individuals outside of the classroom are crucial when understanding students' ability and willingness to trust their teachers. Teacher responses indicated that some were aware that students had difficulty trusting their teachers because of the environments that they resided in and their family relationships. Student responses indicated that they wanted teachers to consider their outside relationships with their friends and family members because it was not them "choosing not to trust outside adults" they "didn't know how to trust others because people they love keep leaving." One student referred to her mother passing away after serving time in prison and getting excited about having her mother around for good.

It is important to note that to develop trust, it is crucial for students and teachers to possess a) emotional awareness and support and b) an understanding of students' backgrounds (Russell et al., 2016); as depicted in Figure 1. Students must be willing to ask for support from adults with whom they have built trust. Creating trusting relationships heightened students' sense of belonging and relatedness within the classroom and their relationships with teachers. Despite

the familial, cultural, and environmental differences between teachers and students, the need to belong to a community bigger than themselves, holds a strong value and importance to teachers and their students. However, it draws on the idea that sense of belonging, relatedness, and reciprocity are critical components for social interactions and relationships.

They must also believe that if the trusted adult cannot provide the necessary emotional support, they will point them in the right direction to receive the support (e.g., guidance counselor, therapeutic day treatment counselor). Teachers and students provided the examples listed in their interview responses. In return, teachers need to recognize when students are not emotionally okay. They should be willing to provide support if they have developed the appropriate relationship with their students, but also understand that they may not be the best support person at that time. Teachers should be aware of all resources available to students when outside emotional support is necessary. Based on the responses from teachers, it was evident that they knew of various emotional support resources within the school building.

Feedback. Students did not directly address their feedback experiences in science class. However, their lack of feedback experiences and responses suggests that they would benefit from having teachers who provided more opportunities and exposure to feedback to promote student academic growth and learning accountability. As voiced by teacher participants, teachers saw feedback exposure as a way to promote student learning accountability. However, it was mentioned that they do not get or give many opportunities for students to receive feedback because of the push for constant testing, checking for understanding, and other teaching responsibilities (i.e., grading, meetings, data analysis for testing). Teachers did mention that they try their best to provide written feedback to students after grading their papers but often lack the opportunity to talk about the feedback with their students or to provide feedback immediately. Noteworthy is the disconnect between teacher and students' responses about feedback. Teachers mentioned that they gave written feedback when possible; while students voiced that they did not receive feedback from teachers. This poses a potential problem while understanding that feedback is essential for student growth. A lack of feedback can hinder students' ability to assess their academic progress, ability, and need for improvement (Fong et al., 2019), especially when trying to address and improve feedback experiences for minoritized students (Croft & Schmader, 2012; Harber et al., 2012; Mendoza-Denton et al., 2010).

Boekaerts and Pekrun (2015) mentioned that feedback, especially when assessment driven, has the potential to produce positive outcomes and emotions (e.g., hope for success). This is important to mention because teachers in the current study mentioned that it was challenging to provide consistent and immediate feedback to students on their progress. Feedback experiences contribute to the emotional and social experiences that students and teachers participate in during the school year.

Theme 3: Interest in Science. In accordance with participants' responses and with Naiber and Barbera (2022), when incorporating interactive science activities into the daily lesson, it is critical for teachers to consider the level of student engagement. Therefore, it is important for teachers to examine and reflect on how emotional engagement changes and varies among every student and every class. As evident through teacher responses, teachers frequently monitor students' behavioral engagement and focus less on their emotional engagement. They recognize that the "bored, frustrated" students are the most disruptive, whereas the "enthusiastic" students are more likely to participate and display interest in group discussions actively.

Ho & Devi (2020) emphasize student interest's impact on engagement. They mention that interest influences students' emotional engagement (e.g., enthusiasm). This was evident in the findings of this study. Cheung (2018) mentioned that the factors affecting students' interest in science (from strongest to weakest) and of interest to the current study are individual student interest and grade level. The 7th and 8th-grade teachers expressed a difference in students' interest between the two courses: Physical science and Earth science. The 8th-grade teacher acknowledged that Earth science is a less interesting subject because of the content being taught and the fewer opportunities available to students to do lab experiments compared to physical science. Implementing interactive science activities can improve students' interest and engagement in science (Linnenbrink-Garcia et al., 2016).

Instructional strategies are critical in developing students' trust in teachers and interest, individually and as an entire class (Basu & Barton, 2007; Russell et al., 2016). Some teachers believed initiating and developing a trusting relationship with students was their responsibility, while others believed that students were responsible. Furthermore, Russell and colleagues (2016) state that to get students to understand and trust that teachers are not wasting their time during

class, teachers found it essential to explicitly disclose the purpose of the lesson and activities to develop trust and interest. Teacher-provided responses were drawn upon in this article to exemplify trust-building teaching instructional strategies (e.g., student teaching opportunities, feedback opportunities) and intentional teaching preparations (e.g., lack of instructional downtime). Correspondingly, Basu and Barton (2007) found that minority students experienced greater interest in science when they were a) able to establish their own meaning and purpose of the science instruction and b) students were engaged in learning environments that supported and displayed social interactions and relationships that they deemed as valuable. Implementing personal connection to the science content, helped with promoting relatedness, interest, and engagement in the science classroom. Students were more excited and interested in the content that also afforded them the opportunity to make real world connections. This was made possible due to student and teacher collaboration during instructional activities. Overall, teachers should continue to take interest in implementing various instructional activities to heighten and sustain students' interest throughout the course (Cheun, 2017).

Implications

This study demonstrated implications for research and practice. The findings highlight the noteworthy impact of teacher-student relationships with minoritized students, particularly regarding students' social-emotional experiences of emotional engagement, trust, feedback, and interest. Additionally, this study ended up being centered on minoritized female experiences and perspectives. This gave me the opportunity to look at the intersectionality of the following identities: a) historically underrepresented minority; b) female in STEM. The rich, multi-source data and representation of Black, females in science were a significant contribution to the literature and motivational theories, specifically Self-Determination Theory.

When considering the theoretical implications of this work, it was important to note that majority of the motivation theories are created by and centered around White individuals (Ryan & Deci, YEAR), while few focused on minoritized populations (Bathgat-schunn, 2017). This work draws on the important notion that motivation theories are not “one-size fits all” because of the need to center and draw from diverse, minoritized voices and perspectives. Based on this study’s findings, I proposed Critical Race Theory as an useful theoretical framework to target the involvement of and focus on minoritized participants’ voices and experiences when further exploring student engagement, teacher-student relationships, and interest. The findings suggest that students are self-aware of the factors that can contribute to developing their relationships with their teachers. Similarly, teachers were self-aware and identified corresponding factors that helped shape their relationships with their students. From my conversations with all participants, the recurring concepts and phrases of *caring*, *support*, *kind*, *understanding*, and *both-sided* (reciprocity) were repeated among teachers and students when discussing their social interactions with one another.

Initially, I wanted to know what other urban teachers in a different content area, compared to what I taught, did to foster positive teacher-student relationships. As mentioned in previous chapters, the middle school years are critical for social, academic, and identity development for adolescents. Furthermore, adolescents tend to place priority on social relationships and their identity, while trying to fully define who they are. I wanted to hear from teachers and students about how to help teachers develop and maintain trust with their students. I also wanted to see if teachers understood that student engagement goes beyond behavior. It was extremely important for me to hear teachers' and students' perspectives and firsthand experiences when examining the phenomenon of developing teacher-student relationships between science

teachers and Black and Latinx students. This research is significant because of my teaching experience in urban schools.

While teachers were able to identify strategies that they use to increase student behavioral engagement, they demonstrated that they did not have a complete understanding of emotional engagement. Providing teachers with professional development on the components of engagement (i.e., cognitive, agentic, behavioral, and emotional; Bae & DeBusk-Lane, 2019) and strategies to bolster the different factors of engagement could provide meaningful support to teachers and students alike.

Similarly, the findings of this work highlight potential salient factors in developing healthy and positive teacher-student relationships. The model in Figure 1 could be especially helpful in creating informative and practical professional development sessions on a) the importance of building and maintaining teacher-student relationships, and b) increasing students' emotional engagement in science. The factors identified can potentially exemplify sustainable, equitable, and culturally responsive practices.

Limitations and Recommendations for Future Directions

It is important to acknowledge that the conceptual framework presented in this study is the beginning of a theoretical explanation for student emotional engagement, teacher-student relationships (i.e., feedback experiences, teacher trust), and interest in science to enhance the social-emotional and academic experiences for Black and Latinx youth. Although these findings provide some initial support, they of course do not prove the model. As shown in Figure 2, is an illustration of what teachers and students should do and consider fostering positive teacher-student relationships (created to answer the research questions). Further research should be

conducted to examine the role of race on student emotional engagement and teacher trust directly and indirectly.

An important shortcoming of the study was experienced during participant recruitment. A racial event occurred at the school participating in the study, causing the Latinx students to become hesitant to participate in the study. The majority of the students that identified as Latinx voiced that they wanted to talk to their parents before participating in the study because of the situation. Four out of six Latinx students never followed up with the researcher to participate in the study. This was viewed as a limitation of the study due to the study focusing specifically on Black and Latinx students, with hopes of an equal representation of both ethnicities within the study. For future research, developing a protocol for researchers to follow up with interested participants would be ideal so that researchers can maximize their participant recruitment opportunities.

Additionally, future research may also benefit from identifying and examining the ways teacher racial and ethnic group identity impact teachers' interactions and relationships with students and vice versa. In the current study, four out of five teachers identified as Black, and the remaining teacher identified as White. Therefore, one teacher participant did not match the race and ethnicity of the student participants. However, it was made known by the teacher of the opposing race that she experienced challenges when developing positive, trusting relationships with her students. In the future, a strong recommendation for researchers would be to examine how teacher-student relationships are created between heterogeneous race relationships (e.g., Black teacher and Latinx student, White teacher and Black student) and homogenous race relationships (e.g., Black teacher and student, Latinx teacher and student) to understand better if racial differences influence the development and quality of teacher-student relationships.

The different science courses the teachers in the study taught posed a limitation because different courses require various opportunities to implement lab experiments, hands-on activities, classroom collaboration, and technology for different purposes, thus influencing the teachers' overall ability to maintain and promote student interest and emotional engagement. The teacher's focus on science instructional activities can potentially influence the teacher's perception of the students' interest, emotional engagement, and teacher-student relationship. For example, the physical science, 7th-grade teachers mentioned that they could implement more group work and lab experiments, as compared to the Earth science, 8th-grade teachers. However, one of the 7th-grade teachers also mentioned that not all of her classes were afforded the same opportunity to participate in some of the group work or lab activities due to their behavior and the level of trust she had in her students to listen to her instructions and expectations completely.

Furthermore, the current study focuses on students' and teachers' perceptions of interest in science and social support (i.e., social interactions, feedback, and trust development). It did not directly explore the effect of specific instructional practices on Black and Latinx students' perceptions, beliefs, and behavior. Future investigations might examine the influence of explicit pedagogical practices on teacher-student relationships (e.g., feedback, trust), interest in science, and emotional engagement through in-person or recorded classroom observations.

A shortcoming of the study was that the student's understanding of the interview questions and the brevity of responses limited the findings of this work. Not only were their responses short, but they skipped the questions about their feedback experiences because they all stated that they do not receive feedback from their science teachers. Additionally, students stated they did not understand what constructive feedback was when they were asked the question. For

future research, the researcher should consider providing either a definition of constructive feedback or additional examples of constructive feedback. Related, teachers often mentioned feedback in the form of grading papers and providing progress reports. They mentioned why they would provide feedback and how they would want their students to perceive the feedback, but that they were not able to provide feedback as often as they would like.

It was also challenging for teachers to answer whether students' attitudes and perceptions of them were affected by the feedback students received. This was important to note as this study thrived off teachers' perspectives, as well as students. Students had made it clear during the interviews that feedback was not offered enough by teachers throughout the course of the school year. This was also supported by teachers, although teacher participants stated how they would implement purpose with their feedback in the future. Although this was viewed as a study limitation, it drives future implications for research and practice. Increasing one's understanding of what support teachers need to develop and maintain positive relationships and create personalized, positive classroom experiences may contribute to understanding student success and teachers leaving the field. There is a strong need for increasing feedback opportunities and various ways to provide feedback to students. Furthermore, research should continue to add to the feedback literature by examining how the lack of feedback can help or hinder students' learning experiences and outcomes. Teachers can potentially set aside time to meet with students one-on-one during independent instruction and activities in order to provide students with verbal feedback on their academic progress. This would help increase teachers' feedback opportunities and type of feedback given to students. This could also assist with eliminating the disconnect between teachers and students when asked if students receive feedback from their teachers.

Although this study focused only on an urban, Title 1 middle school, this work is timely and needed for all school settings and levels. With the goal of equity continuing to drive the changes needed in education, the push for understanding students' relationships and social interactions with teachers across school settings also holds importance for social changes and power dynamics within the educational field. Teachers can begin to reflect on their practices and strategies from previous year to consider what worked and what did not work during instruction and relationship development. Showing up for students by attending extracurricular activities, extending a hug, standing at the classroom door to greet students, and staying up to date on additional school resources for students that are going through hard times can make a big difference in students' daily social, emotional, and academic interactions and experiences.

Additionally, teachers' backgrounds (e.g., years of experience, college education) and student backgrounds (e.g., language level of Latinx students, years of schooling in the United States) were not collected for this study, which posed as a limitation. A more complete understanding of a teacher's background could help researchers better understand the teacher's choice for certain practices for promoting student interest and engagement. It would also help inform the researcher on what professional development sessions the teachers have attended over the course of their teaching career. Furthermore, it would also assist with creation of future professional development sessions to better their teaching and relationship-building strategies and experiences.

Although the sample of interview participants was conveniently selected, there is a possibility, given the small sample size, that students' and teachers' statements were anomalous and may be related to social and emotional differences. Future qualitative studies with larger samples are needed to confirm these findings. Lastly, a strength in this study was that all

participants were female. Male students and teachers were not excluded; however, male teachers were not employed as science teachers at the participating school. It also was noticed by the graduate assistant that it was more challenging to recruit male students. The reason for the challenge is unknown by the graduate assistant and researcher. Future research in the field should aim to diversify the student and teacher population to ensure that male and female student and teacher voices are centered and brought to light when continuing to bring attention to the development of teacher-student relationships, students' emotional engagement, and interest in science. Understanding gender differences would bring rich insight to the forthcoming literature.

Conclusion

The inclusion of participants' (i.e., students and teachers) voices and experiences are essential and critical to developing a deeper understanding of school experiences and what shapes those experiences. Huerta and colleagues (2020) emphasized the importance of humanizing youth of color within current and future research. As the literature surrounding Black and Latinx populations continues to grow, it is crucial that as we continue to center and promote participants' voices in our work, we view them as human beings. This played a key role in my research when deciding to choose qualitative methods instead of quantitative methods. It also made this timely and much-needed research richer while studying the phenomenon of lived social-emotional experiences between science teachers and Black and Latinx students in middle school.

The importance of teacher-student relationships in education and research has been well-established and increasingly explored. This study aimed to understand a) what factors help or hinder teacher-student relationships and b) whether teacher-student relationships shape Black and Latinx students' emotional engagement and interest in science. The present study

demonstrated that middle school science teachers' emotional support, trust-building skills, and interactive instructional activities are generally perceived and received by their students positively and that a few factors assist with shaping their social-emotional and classroom experiences. Whereas students who interact with and perceive their teacher as lacking emotional support, difficult to build trust with, and only implementing lecture-based activities voiced having negative classroom and social-emotional experiences in science. Taken together, these findings suggest possible supports needed to increase teachers' awareness and understanding of emotional engagement. Teachers may benefit from professional development sessions that emphasize the concepts of all forms of engagement.

We need to increase our efforts to understand the importance of teacher-student relationships and how they impact students' schooling experiences (Bernstein-Yamashiro & Noam, 2013). More research is needed to understand the impact of teacher-student relationships on student academic, emotional, and social successes and various other school-related variables. This study adds to the current literature on teacher-student relationships by emphasizing students' and teachers' emotional and social experiences by centering their lived experiences and perspectives. Also, the researcher investigated this phenomenon within the middle school STEM learning environment while focusing on minoritized middle school students. This a period where social interactions and relationships are beginning to develop and hold importance to their schooling experiences. This study also adds to the literature by celebrating the voices of Black and Latinx students as they continue to bring to light their lived social, emotional, and academic experiences in urban middle school levels. This study deemed minoritized student's experiences as valuable and acceptable, especially when compared to and discussed with their white counterparts (Coleman & Davis, 2020; Flint & Jagers, 2021; Huerta et al., 2020).

The development and sustainability of teacher-student relationships remains a critical component for youth, and even more so for minoritized youth. Continuing to celebrate the voices of students and teachers in future research will greatly assist with a) bridging the gap between research and practice and b) affording students and teachers the opportunity to be valuable participants in changing the educational systems. Identifying and bringing more attention to the factors that influence teacher-student relationships, students' emotional engagement, and interest can better assist school personnel, researchers, policy makers, and other stakeholders when striving for better social-emotional and learning outcomes in STEM classrooms. Furthermore, the lived experiences of minoritized youth are just as important and valuable as their white counterparts.

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Appendix A: Student Demographic Survey

Note. Students will be asked to complete this brief demographics survey after providing assent and project discussion. We will use an IRB-approved, paper copy to administer this survey.

Name: _____

1) What is your ethnicity and/or race?

Response options:

American Indian or Alaska Native

Asian

Black or African American

Latinx

West Asian, or commonly referred to as Middle Eastern

Native Hawaiian or Other Pacific Islander

White

Multi-racial (please specify ____)

Some other race, ethnicity, or origin; please specify (_____)

Prefer not to answer

2) What grade are you in?

3) What science class are you taking?

Appendix B: Youth Assent Form

STUDY TITLE: How Teacher-Student Relationships Shape Student Engagement and Interest in Science

RESEARCHER'S NAME: Dr. Sharon Zumbrunn, Principle Investigator

Why are we meeting with you?

I am asking you and other students to take part in a research study. A research study is a way to learn more about something. You are being asked to join this research study because we are interested in learning about middle school students' teacher-student relationships, specifically looking at feedback and trust experiences in science and how these experiences might shape their emotional engagement, interest in science, science achievement, and desire to build and maintain teacher-student relationships. After we tell you about it, we will ask if you'd like to be in this study or not.

This form may have some words that you do not know. Please ask me to explain any words that you do not know. You may take this form home to think about and talk to your parents about before you decide if you want to be in this study.

What is this study about?

You will be asked questions about your experiences in your science class and relationships with your science teacher. Because Black and Latinx students have been historically underrepresented and understudied in previous research study, we want to center and amplify your voices in this research. So, all students who participate in this research will be Black and/or Latinx.

What will happen to me if I choose to be in this study?

In this study, you will be asked to:

1. You will complete a short survey about yourself.
2. You will say "yes or no" when asked if you would like to participate in this study.
3. You will be asked to participate in one 30-45 minute interview with one or two researchers.
4. Answer questions about your emotional engagement, interest in science, science achievement, and desire to build and maintain teacher-student relationships.

Will any parts of this study make me feel bad?

Sometimes talking about these things makes people upset. You do not have to talk about anything you do not want to talk about. You can leave the group at any time. If you do become upset, the people running the group will help you.

How will this study help me?

We hope that the results are going to lead to improved experiences in science for you and other middle school students.

What do I get if I am in this study?

You get a \$10.00 gift card.

Will you tell anyone what I say?

We will not tell anyone the answers you give us. However, other members of the research group will know what you say. We will not share your answers with your teachers, parents, or friends.

If you tell us that someone is hurting you, the law says that we have to let other people know so they can help you. If you tell us that you might hurt yourself or someone else, then we have to let people know.

Do I have to be in this study?

You do not have to be in this study. It is up to you. You can say okay now and change your mind later. No one will blame you or get mad at you if you don't want to do this. All you have to do is tell us you want to stop.

Do you have any questions?

You can ask questions at any time. You can ask now or later. Just tell the researcher when you see them, or ask your parent or another adult call Dr. Sharon Zumbrunn at 804.827.2625 or skzumbrunn@vcu.edu

Before you say **yes or no** to being in this study, we will answer any questions you have now.

If you don't want to be in this study, just say so, and don't sign this form.

YOUTH ASSENT

Try to format the signature lines so that all signatures fit on a single page.

**If you sign here, it means you agree to participate in this study.

Youth Participant's Name (Printed) _____
Date

Youth Participant's Signature _____
Date

Name of Person Conducting Assent Discussion (Printed)

Signature of Person Conducting Assent Discussion _____
Date

Principal Investigator Signature (if different from above) _____
Date

Appendix C: Student Interview Protocol

Research Question	Interview Questions
<p>How do Black and Latinx students describe the factors that foster or impede the quality of their teacher-student relationships in the science classroom?</p>	<p>How does developing teacher-student relationships influence your desire to come to school? Probe: What makes you excited to come to school?</p> <p>What is the most important factor to you when developing relationships with your teacher?</p> <p>How do you build relationships with your teacher(s)? Probe: How do you describe a teacher that you have a positive relationship with? Probe: How do you describe a teacher that you have a negative relationship with?</p> <p>What role, if any, do you think trusts plays in your relationship with your science teacher(s)? Probe: How do you know when you trust your teacher? Probe: How does a teacher lose your trust?</p> <p>What things do you do that might help build trust with your science teacher(s)?</p> <p>What factors would you like teachers to take into consideration when building relationships with you and developing trust?</p> <p>Trust: Please describe as many strategies as you can think of to develop trust with your teacher(s). Are there ways to establish trust through instruction, either through the curriculum (e.g., activities) or how they teach?</p> <p>Please describe as many strategies as you can think of to develop trust with your teacher(s) that involve social interactions, individually.</p> <p>How does your environmental and family background influence the development of trust with teachers?</p>

Probe: How does your relationships outside of school influence how you trust other adults?

Are there other characteristics or factors associated with your life background that could make it challenging to establish a trusting relationship with them?

Emotional engagement and interest:

When your teachers are unable to understand why you or other students are expressing their emotions in a negative way, what actions do they take to develop a better understanding?

When do you notice students are most emotionally disengaged? What does this look like for you?

When do you notice students are most emotionally engaged? What does this look like for you?

How does the quality of your relationship with your teacher influence your motivation in science class?

What makes science class interesting?

Probe: Please describe an activity or science lesson that you found interesting. What made it interesting compared to other lessons/activities?

Probe: Please describe an activity or science lesson that you found uninteresting. What made it uninteresting compared to other lessons/activities?

Feedback:

How do you express your emotions when your teacher gives you constructive feedback? Why do you think this is happening?

What outcomes, if any, have you seen in the way you interact with your teacher following their feedback?

Probe: How often do you receive feedback?

Probe: When would you like to receive feedback?

How do you maintain your teacher-student relationship following their constructive feedback?

	<p>Do any changes occur (e.g., attitudes toward teachers, interest, engagement, actions toward your teacher, etc.) after you receive their feedback?</p> <p>How do you express your emotions when your teacher gives you positive feedback? Why do you think this is happening?</p> <p>How do you think your level of trust in your teacher is impacted by the feedback that you receive from them?</p> <p>Is there anything else that you would like to share?</p>
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Appendix D: Teacher Interview Protocol

Research Question	Interview Questions
<p>Qualitative How do science teachers describe the factors that foster or impede the quality of their teacher-student relationships in the science classroom?</p> <p>Mixed method In what ways do Black and Latinx students and their science teachers' descriptions of the factors that foster or impede teacher-student relationships explain the variation between the quality of teacher-student relationships and student emotional engagement, interest in science, and science achievement?</p>	<p>How do you build relationships with your students?</p> <p>How do you define emotional engagement?</p> <p>How do you define trust?</p> <p>What role, if any do you think trust plays in managing your classroom?</p> <p>What things do you do that might establish trust?</p> <p>What role, if any do you think feedback play in establishing teacher-student relationships?</p> <p>How would you describe your students' interest in your classroom?</p> <p>Trust: Please describe as many strategies as you can think of to develop trust with your students that involve science instruction and your teaching. Are there ways to establish trust through instruction through the curriculum or how you teach?</p> <p>Please describe as many strategies as you can think of to develop trust with your students that involve social interactions with students, individually.</p> <p>How do socioeconomic status and family background influence the development of trust with students?</p> <p>Are there other characteristics or factors associated with a student's background that could make it challenging to establish a trusting relationship with them?</p> <p>Emotional engagement and interest: What strategies do you use to increase students' emotional engagement during instruction?</p> <p>When you cannot understand why a student is expressing their emotions negatively, what actions do you take to develop a better understanding?</p>

When do you notice students are most emotionally disengaged? How do you reflect on this for upcoming lessons and instruction?

When do you notice students are most emotionally engaged? How do you reflect on this for upcoming lessons and instruction?

How would you describe an emotionally disengaged student's interest in your class?

How would you describe an emotionally engaged student's interest in your class?

What makes science class interesting and engaging to you and your students?

Probe: Please describe an activity or science lesson that your students found interesting. What made it interesting compared to other lessons/activities?

Probe: Please describe an activity or science lesson that your students found uninteresting. What made it uninteresting compared to other lessons/activities?

Feedback:

How do Black and Latinx students express their emotions when you give them constructive feedback? Why do you think this is happening?

What outcomes, if any, have you seen in the way students interact with you following your feedback?

How do you maintain your teacher-student relationship following your constructive feedback?

Do any changes occur (e.g., attitudes toward you, interest, engagement, student actions toward you, etc.) after students receive your feedback?

How do Black and Latinx students express their emotions when you give them positive feedback? Why do you think this is happening?

Please list all the forms and purpose of your feedback? Do you give students feedback immediately?

How do you think students' level of trust in you is impacted by the feedback and s that they receive from you?

	<p>How does your feedback impact your students' interest in upcoming lessons?</p>
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Is there anything else that you would like to share?

Appendix E: Teacher Consent Form

STUDY TITLE: How Teacher-student Relationships Shape Student Engagement and Interest in Science

VCU INVESTIGATOR: Dr. Sharon Zumbrunn, Principle Investigator

ABOUT THIS CONSENT FORM

You are being invited to participate in a research study. It is important that you carefully think about whether being in this study is right for you and your situation.

This consent form is meant to assist you in thinking about whether or not you want to be in this study. Please ask the investigator or the study staff to explain any information in this consent document that is not clear to you. You may take home an unsigned copy of this consent form to think about or discuss with family or friends before making your decision.

Your participation is voluntary. You may decide not to participate in this study. If you do participate, you may withdraw from the study at any time. Your decision not to take part or to withdraw will involve no penalty or loss of benefits to which you are otherwise entitled.

AN OVERVIEW OF THE STUDY AND KEY INFORMATION

Why is this study being done?

This study is being conducted as part of a collaborative partnership between Virginia Commonwealth University and Richmond Public Schools. The purpose of this study is to explore middle school science teachers and Black and Latinx students' teacher-student relationship quality and the relationship between teacher-student relationships and emotional engagement, interest, and science achievement. You are asked to be in this study because you are an instructor in Richmond Public Schools.

What will happen if I participate?

As part of this study, you will be asked to take part in one on one interviews. The interview will focus on your perceptions of your students' engagement, interest in science, and teacher-student relationship quality. One on one interviews will be audio-recorded, and a note-taker will be present. However, your responses will remain confidential, and no names will be included in any report. You will spend approximately 30 minutes participating in the interview discussions at the location of your classroom instruction. Please note that there are no right or wrong answers to the survey and interview questions. We want to hear the many varying viewpoints and would like for everyone to contribute their thoughts. Out of respect, please refrain from interrupting others. However, feel free to be honest even when your responses counter those of other group members. Your participation in this study will last up to 30-45 minutes. Approximately 6 teaching individuals will participate in this study.

What alternative treatments or procedures are available?

You have the option to participate via Zoom instead of in-person. Ask the study staff if you would like this option.

What are the risks and benefits of participating?

There are both risks and benefits of participating in research studies.

Risks and Discomforts Benefits to You and Others

Participation in research might involve some loss of privacy. There is a small risk that someone outside the research study could see and misuse information about you. The study questionnaires ask questions that are sensitive/personal in nature and may make you feel uncomfortable. There is no guarantee that you will receive any benefits from being in this study. However, We hope the information learned from this study will provide more information about social-emotional and instructional practices and strategies, which can be used to better science classroom instruction, learning environments, and relationship development with students.

WILL I BE PAID TO PARTICIPATE IN THE STUDY?

There are no costs for participating in this study other than the time you will spend participating in the interview discussion. A \$10.00 gift card will be offered as a token of appreciation for taking part in this study.

CAN I STOP BEING IN THE STUDY?

You can stop being in this research study at any time. Leaving the study will not affect your medical care, employment status, or academic standing at VCU or VCU Health. Tell the study staff if you are thinking about stopping or decide to stop.

If you leave the study before the final regularly scheduled visit, your decision to participate or not to participate will not affect your relationship with your school or Virginia Commonwealth University.

Your participation in this study may be stopped at any time by the investigator without your consent. The reasons might include:

- the investigator thinks it necessary for your health or safety
- the sponsor has stopped the study
- you have not followed study instructions
- administrative reasons require your withdrawal

HOW WILL INFORMATION ABOUT ME BE PROTECTED?

VCU has established secure research databases and computer systems to store information and to help with monitoring and oversight of research. Your information may be kept in these databases but are only accessible to individuals working on this study or authorized individuals who have access for specific research related tasks.

Identifiable information in these databases are not released outside VCU unless stated in this consent or required by law. Although results of this research may be presented at meetings or in publications, identifiable personal information about participants will not be disclosed. Personal information about you might be shared with or copied by authorized representatives from the following organizations for the purposes of managing, monitoring and overseeing this study:

Representatives of VCU

Officials of the Department of Health and Human Services

In general, we will not give you any individual results from the study. Project findings and reports prepared for dissemination will not contain information that can reasonably be expected to be identifiable. Studies that will or might use information for future research studies. In the future, identifiers might be removed from the information you provide in this study, and after that removal, the information could be used for other research studies by this study team or another researcher without asking you for additional consent.

WHOM SHOULD I CONTACT IF I HAVE QUESTIONS ABOUT THE STUDY?

The investigator and study staff named below are the best person(s) to contact if you have any questions, complaints, or concerns about your participation in this research: If you have any questions, complaints, or concerns about this research, contact Dr. Sharon Zumbrunn at 804.827.2625 or skzumbrunn@vcu.edu. If you have any questions about your rights as a participant in this study, you may contact the VCU Office of Research at 804.827.2157. You may also contact the VCU Office of Research for general questions, concerns, or complaints about this research. Please call this number if you cannot reach the research team or wish to talk to someone else.

Additional information

If you have general questions about your rights as a participant in this or any other research, or if you wish to discuss problems, concerns or questions, to obtain information, or to offer input about research, you may contact:

Virginia Commonwealth University Office of Research
800 East Leigh Street, Suite 3000, Box 980568, Richmond, VA 23298
Phone: (804) 827-2157

<https://research.vcu.edu/human-research/hrppirb/research-participants/>

Do not sign this consent form unless you have had a chance to ask questions and have received satisfactory answers to all of your questions.

STATEMENT OF CONSENT

I have been provided with an opportunity to read this consent form carefully. All of the questions that I wish to raise concerning this study have been answered. By signing this consent form, I have not waived any of the legal rights or benefits to which I otherwise would be entitled. My signature indicates that I freely consent to participate in this research study. I will receive a copy of the consent form for my records.

FERPA Statement:

Under the Family Educational Rights and Privacy Act (FERPA) of 1974, updated January 2009, I understand that my educational records cannot be released without my written permission. I authorize the release of my academic records from Virginia Commonwealth University for the purpose of this study. I understand that I have the right to rescind this release agreement of my academic records at any time.

Signature Block for Enrolling Adult Participants

Adult Participant Name (Printed)

Adult Participant's Signature

Date

Name of Person Conducting Consent Discussion (Printed)

Signature of Person Conducting Consent Discussion

Date

Appendix F: Parent Letter

Virginia Commonwealth University Parental Permission For Child's Participation in Research

Study Title: How Teacher-Student Relationships Shape Science Engagement and Interest in Middle School

Researcher: Sharon Zumbrunn, Ph.D.

This is a parental permission form for research participation. It contains important information about this study and what to expect if you permit your child to participate. We understand if you would not like for your student to participate. If that is the case, please call or email the researcher by May 1, 2023 with your child's name so they won't be included.

Your child's participation is voluntary. Please consider the information carefully. Feel free to discuss the study with your friends and family and ask questions before deciding whether or not to permit your child to participate.

Purpose: This research project aims to better understand and ultimately improve the academic and social-emotional experiences of middle school students in science. We are especially interested in learning about middle school students' emotions and social experiences in science, and how these experiences might play a role in shaping their emotional engagement, motivation, achievement in science, and the quality of their teacher-student relationships. Due to Black and Latinx students having been historically underrepresented and understudied in previous research study, we wish to center and amplify their voices in this research. As a result, all students who participate in this research will be Black and/or Latinx.

Procedures/Tasks: Approximately 25-35 students will be selected to take part in in-person one-on-one interview, with the option of Zoom interviews, during school hours; specifically during their elective times to ensure instructional time is not being lost.. These interviews will be audio recorded. However, students are welcome to turn their videos off and use a pseudonym if they would prefer.

Duration: The total expected duration of your child's participation in the interview is approximately 30 minutes. Your child may leave the study at any time. If you or your child decides to stop participating in the study, there will be no penalty and neither you nor your child will lose any benefits to which you are otherwise entitled. Your decision will not affect your future relationship with Virginia Commonwealth University. We may also decide to end your student's participation in the study if it appears that your student is experiencing any emotional discomfort.

Confidentiality:

Efforts will be made to keep your study-related information confidential. We may share our data from our study with other researchers; however, if we do, we will remove any information identifying your student before sharing. Other researchers may then use those data for future research without additional informed consent from the subject or the legally authorized representative. However, there may be circumstances where this information must be released. For example, personal information regarding your participation

in this study may be disclosed if required by state law. Also, your records may be reviewed by the following groups (as applicable to the research):

- Office for Human Research Protections or other federal, state, or international regulatory agencies;
- The Virginia Commonwealth University Institutional Review Board or Office of Responsible Research Practices;
- The sponsor, if any, or agency (including the Food and Drug Administration for FDA-regulated research) supporting the study.

Risks and Benefits: Your child's data will be kept confidential and never shared without your expressed permission (unless required by state law). Also, your child's record may be reviewed by the following groups (as applicable to the research: Office of Human Research Protections or other federal, state, or international regulatory agencies; Virginia Commonwealth University Institutional Review Board or Office of Responsible Research practices; or the sponsor, if any, or agency supporting the study. There is also a small risk of breach of confidentiality if student records are obtained by individuals outside the research team. There is also a risk that your child may experience emotional discomfort reflecting on and discussing their experiences. There are no direct benefits to individual participants. However, as a result of this study, middle schools in the Richmond Public Schools division and the state of Virginia can better understand Black and Latinx students' experiences in middle school science classrooms and ultimately improve the academic and social-emotional experiences of middle school students in science. We are especially interested in learning about middle school students' emotions and trust experiences in science and how these experiences might shape their sense of belonging, motivation, science performance, and desire to build and maintain teacher-student relationships.

Incentives: As a small token of our appreciation, every participating student will receive a \$10 gift card.

Participant Rights: You or your child may refuse to participate in this study without penalty or loss of benefits to which you are otherwise entitled. If you or your child is a student or employee at Virginia Commonwealth University, your decision will not affect your grades or employment status. If you and your child choose to participate in the study, you may discontinue participation at any time without penalty or loss of benefits. .

An Institutional Review Board responsible for human subjects research at Virginia Commonwealth University reviewed this research project and found it to be acceptable, according to applicable state and federal regulations and University policies designed to protect the rights and welfare of participants in research.

Contacts and Questions: For questions, concerns, or complaints about the study you may contact Dr. Sharon Zumbrunn at skzumbrunn@vcu.edu . For questions about your child's rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact:

Virginia Commonwealth University Office of Research
800 East Leigh Street, Suite 3000, Box 980568, Richmond, VA 23298
(804) 827-2157; <https://research.vcu.edu/human-research/>

