Teaching During the Triple Pandemic:

"It's So Deeply Personal"

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Abstract

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This study explores the experiences of science and mathematics teachers during the Triple Pandemic: a pandemic of COVID-19, poverty, and racism. The intersection of COVID-19, poverty, and racism created a novel educational context for teachers to navigate. Using an intersectional qualitative case study approach, this study highlights the stories of three middle school science and mathematics teachers as they strove to meet the needs of their students during a time of crisis brought forth by COVID-19 and as pre-existing systemic inequities surfaced during the period of remote learning. Using data collected from an initial and final questionnaire (Likert scale and open-ended), semi-structured interviews, audio journal entries, and a focus group this study sought to capture the teachers' experiences, their emotions, adjustments to teaching practice, and challenges encountered. Guided by a conceptual framework integrating Sensemaking Theory, Critical Consciousness, Positional Identity, and Science Identity as a Lived Experience, this study further examined the ways teaching remotely developed, shifted, and affirmed their science and mathematics identities and the impact of sensemaking of their experiences had on their educational priorities. The findings highlight the participants' emotionally charged and challenging experiences as they made sense of their roles as science and mathematics teachers and gained an increasing awareness of systemic inequities. The three participants developed a critical consciousness through their confrontation of inequities, increased racial identity, and development of their critical agency. Additionally, the participants' sensemaking of the educational context produced by the Triple Pandemic resulted in the development of new educational priorities reflecting social justice engagement on micro and meso levels and in identity tensions as science and mathematics teachers.

Keywords: Science education, triple pandemic, social justice, teacher identity, sensemaking, critical consciousness

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Dedication

For my students, you have championed the unthinkable and continue to amaze me. Stay resilient, curious, and compassionate. This work is dedicated to you!

Chapter I

INTRODUCTION

Inequities across race and socioeconomic status permeate the field of science and mathematics education (Calabrese Barton, 2002; McLaughlin, 2014; Morales-Doyle, 2017). The onset of the COVID-19 pandemic in March 2020 brought insidious societal inequities to the forefront of the educational experiences of many students and educators. As a science educator myself, my experience teaching in the early months of 2020 was fraught with challenges, as I strove to engage my students in science learning during a tumultuous and unprecedented time, while simultaneously grappling with my own identity, emotions, and challenges as a science educator.

In mid-March 2020, K-12 schools were shuttered without much, if any, warning. Students and teachers left their classrooms with the hopes of returning in a short matter of time. As the COVID-19 virus continued to spread across the country and world, educators were faced with the reality that the return to their classrooms was not imminent. Teachers and students were left stunned and wondering how long they would find themselves in the predicament of being away from the physical classroom spaces and the company of their colleagues and peers. Learning for all students shifted to a virtual or an online format. Multiple terms have been used to describe the online format of teaching and learning where teachers and students did not exist in the same physical space or school buildings including remote, virtual, and distance learning (Crompton et al., 2021). The virtual learning approach was implemented internationally as a solution to the dangers of in-person learning during the early months of the COVID-19 pandemic (Crompton et al., 2021; Elfidoussi et al., 2020). With virtual learning, most of both teaching and learning occurred in the homes of the teachers and students. Bozkurt and colleagues (2020) specifically refer to remote teaching and learning during the COVID-19 pandemic as emergency remote education (ERE), making a clear distinction between remote education during a time of crisis and planned remote instruction. Throughout this dissertation, the terms virtual learning and remote learning are used about teaching and learning during the closure of physical classroom spaces.

Throughout this shift from traditional classroom teaching to the virtual classroom, teachers were asked to provide online learning experiences for their students using a variety of virtual platforms including Zoom, Google Meets, Padlet, and Peardeck without any or little training on educational technologies, online curriculum resources, or pedagogy for online teaching (Hodges et al., 2020). Although educational stakeholders including policymakers, administrators, and teachers originally believed that remote learning would only take place for a matter of weeks, it soon became apparent that remote learning would become a staple of teaching during the early years of the COVID-19 pandemic. Teachers across the United States continued to teach their students remotely throughout the entirety of the Spring of 2020 until the end of the academic school year.

Challenges emerged as teachers were confronted with increased professional demands and limited resources (Kim & Asbury, 2020). For example, school districts struggled to provide working devices for all their students. As students spent time in their physical homes, parents, for some children, began to fill the role of proxy educators (Davis et al., 2021). Other students were left isolated and struggled to engage in remote learning due to the inequality of access to technology, the internet, materials, and a safe space for learning. The National Center for Education Statistics (2021) found that undergraduate students experienced disruptions in enrollment, housing, and finances. Students who struggled with housing had difficulties locating a safe place to live during the early months of the pandemic. As a result, the closure of school buildings resulted in the unveiling of social and economic issues including access to childcare, healthcare, housing and technology, food insecurity, and digital learning (Elfidoussi et al., 2020) and the disproportionate impact on students and families in low-income districts (Campbell et al., 2021; Ruef et al., 2022). Therefore, the socioeconomic gaps and disparities among members of society became glaringly apparent.

Shortly after a nationwide shift to remote learning, the Spring of 2020 marked a time of societal unrest ignited by the unlawful killing of George Floyd. Protests supporting the Black Lives Matter (BLM) movement began in Minneapolis, Minnesota, and spread across the nation soon after in protest of the unlawful deaths of Breonna Taylor and Ahmaud Arbery. Media coverage shifted from a focus on covering the COVID-19 pandemic to addressing the insidious presence of systemic racism and questioning the justice system. Discussions of racism and white supremacy were catapulted to the forefront.

Throughout this dissertation, I use the term Triple Pandemic to describe the context of early 2020-- a pandemic of COVID-19, poverty, and racism. The presence of poverty and racism are not new phenomena in the United States (De Royston & Farinde, 2018; Milner, 2013) but the onset of COVID-19 highlighted foundational issues in society that had, at times, remained masked (Freeman, 2021). Within the Societal Triple Pandemic, educators simultaneously experienced the creation of an Education Triple Pandemic. In an Education Triple Pandemic students lacked access to technology, materials, and learning space to engage in school. A Triple Pandemic in education did not spontaneously form in conjunction with the outbreak of COVID-19. Deeply rooted systemic inequities and oppression have permeated the field of science and mathematics education (Battey & Leyva, 2016; De Royston & Farinde, 2018; McGee, 2020).

Yet, the field of science claims that the objectivity of science prevents the oppression of those in marginalized communities. In actuality, the claimed objectivity and misuse of quantitative measurements maintain racism, Whiteness, and White supremacy in the field of science and education (Le & Matias, 2019; McGee, 2020; Sammel, 2009).

White supremacy is defined as the systemic maintenance of a racist ideology rooted in the belief that White people are superior to people of other races, and as a result, should be viewed as dominant over others (Leonardo, 2004; Saad, 2020. Okun (2001) argues that White supremacy culture is present in all organizations that do not actively work to oppose it. Okun offers characteristics of White supremacy culture that emerge in the behaviors and attitudes of members of organizations. Okun offers characteristics including perfectionism, a sense of urgency, defensiveness, quantity over quality, worship of the written word, only one right way, paternalism, either or thinking, power hoarding, fear of open conflict, prioritizing individualism, the definition of success, objectivity, right to comfort, and lack of work delegation. She argues that these characteristics are dangerous as they are used as standards and norms within an organization without being knowingly selected as so, thus upholding a culture of White supremacy.

The concept of Whiteness relies on the notion that the “other” or “others”, or people of color, immigrants, and Indigenous, are inferior as a mechanism to maintain white supremacy (Battey & Leyva, 2015; Sammel, 2009). Rooted in a history of colonialism, Western ideologies, and Whiteness are centered in curriculum, pedagogy, teaching practice, and ethics (Matias et al., 2016; Sammel, 2009). According to Matias et al. (2016), the centering of Whiteness is the cause behind the racial achievement gaps in the field of science. Gloria Ladson Billings (2006) argues that a focus on recent data and the disparate “achievement” between students of color and white students fails to recognize the historical, sociopolitical, and economic underpinnings of their educational outcomes. She introduces the term “educational debt” as the cumulative impact over time of fewer resources and harm to students of color.

Whiteness’s normativity and pervasive nature are often rendered invisible to White educators who benefit from it (Bonilla Silva, 2006; Neimonen, 2010; Owen, 2007; Radd & Grosland, 2019). An understanding and awareness of Whiteness and White supremacy are critical in the validation of students of color in science education (Bettez et al., 2011; Duncan, 2022; Le & Matias, 2019; Mensah & Jackson, 2018). To dismantle oppressive systems, education must experience a decolonial epistemic shift for both teaching and learning (Aveling, 2012; Rosa & Mensah, 2021). To combat Whiteness, White supremacy, and a long history of oppression in science education, teacher education must prepare socially just educators in science and mathematics classrooms. Teacher education must also prioritize the development of future teacher educators’ racial literacy and racial consciousness to prepare them to engage in social justice work with preservice teachers (Mensah, 2022). Although many studies have examined how preservice teacher programs have utilized social justice as a framework for preparing teachers (Bondy et al., 2017; Cochrane Smith, 2010), fewer studies have examined how socially just teachers develop over time (Whipp, 2013). Considering Feiman- Nemser’s (2001) professional learning continuum, educators continue to grow and develop throughout their experiences in the classroom. Thus, experiences in the classroom contribute to the development of socially just educators.

During a period of unprecedented changes in education, educators are placed in novel situations with their students. Arguably, like during the induction phase of teaching, veteran teachers in novel situations continue to develop and “interpret classroom phenomena, discern important events, use routines, make predictions, judge typical and atypical events, and evaluate performance" (Feiman-Nemser, 2010, p.17). As teachers engage in the profession, their identities as educators continue to develop (Feiman- Nemser, 2010). It is critical to examine the experiences and development of teachers during the Triple Pandemic to gauge the impact of current events on teaching professionals and the future of science and mathematics education.

Research Questions

As a result of the unprecedented challenges and context of education brought on by the Triple Pandemic, my previous experiences as a science educator, and my desire to support the development of socially just science and mathematics teachers, I developed the following questions to guide my inquiry:

1. What are the lived experiences of three middle school science and mathematics teachers during the Triple Pandemic?
    a. How did these science and mathematics teachers change their teaching practice?
    b. What conflicts and challenges emerged for these three science and mathematics teachers?
    c. What emotions did they experience?
2. In what ways did teaching remotely during the Triple Pandemic, develop, shift, and affirm science and mathematics teachers' identities?
    a. In what ways did teachers' understanding of their identities change?
    b. What tensions emerged in their identities as mathematics and science teachers?
3. In what ways does sensemaking during the Triple Pandemic shape the priorities of science and mathematics teachers?

Structure of Dissertation

This dissertation is organized into eight chapters. Chapter I, the current chapter, presents the rationale for this inquiry, the research questions, and my positionality and experiences in relation to the study. Chapter II presents the literature relevant to this study including teaching science for social justice, science, and mathematics teaching during crises, teacher identity, and emotions. Additionally, the conceptual framework consisting of Sensemaking Theory, Critical Consciousness, Science as a Lived Experience, and Positional Identity is presented as a theoretical foundation of the findings.

In Chapter III, I provide an overview of the intersectional qualitative case study methodology and introduce the settings and participants. Following, I provide a detailed procedure for both the data collection and data analysis process. I also address the ethics and validity of this inquiry.

The findings of the study are presented in Chapters IV, V, and VI. Within Chapter IV, three individual cases are presented. The following Chapters V and VI present the themes generated through cross-case analysis of the three individual cases. Chapter VII contains the analysis of the findings and major findings of the study. The final chapter, Chapter VIII, presents the implications for future practice and research, limitations, and concluding thoughts.

Chapter II

LITERATURE REVIEW

Chapter two presents the literature that provides a foundation for this study. The review of the literature begins with a discussion of social justice in mathematics and science education. Following the discussion of social justice in mathematics and science education, a review of the literature presents our understanding of the experiences of teachers during COVID-19, teacher identity, and the emotionality of teaching.

Social Justice in Education

Social justice and the integration of social justice in education are described in a multitude of ways throughout the literature. At times, the term is mistakenly used interchangeably with other constructs and terminology focusing on issues of diversity and equity (Ridgeway 2019; Rodriguez & Morrison 2019). Thus, it is critical to define the meaning of social justice as well as what it means to teach science and mathematics with a social justice orientation. To define social justice, I reference Dimick's (2012) assumption "that society often operates unjustly through institutions and power relationships that promote or reinforce (and some may argue thrive upon) different forms of social inequalities, such as race, class, income, or gender inequalities" (p.992). In response, I utilize the definition provided by Bell (1997) that defines social justice as an awareness of the multitude of manifestations of oppression and privilege in our society (racism, classism, sexism, etc..) and the engagement in the dismantling of these structures. I also lean upon the definition provided by Planas and Civil (2009) that social justice is defined as creating "equal access to opportunities to participate in the social construction of reality, and . . . access to opportunities to improve the living conditions of individuals and groups” (p.392). The definitions utilized for this study encompass the variety of ways one can engage in the pursuit of an equitable and just society.

Incorporating social justice in education draws upon Freire’s (2000) notion that teaching and learning are means to free oneself from systemic oppression. In his seminal work, *Pedagogy of the Oppressed,* Freire (2000) argues for the dismantling of the banking model of education and the adoption of a problem-posing model of education. According to Freire (2000), the banking model of education positions students as passive learners and vessels in which knowledge is deposited by the teacher. He argues the banking model is oppressive and dehumanizing because the students are silenced without a voice in their education. In contrast, education can be used as a tool to liberate from oppression through problem-posing education. Problem-posing education emphasizes students’ critical thinking and asks teachers and students to work together to uncover their reality (Freire, 2000). Problem-posing education is humanizing as teachers and students can work together to transform oppressive structures.

Foundational scholars have presented frameworks for teaching in socially just ways including Culturally Relevant Teaching (Ladson Billings, 1995), Culturally Responsive Teaching (Gay, 2002), and Culturally Sustaining Pedagogy (Paris & Alim, 2013). Ladson-Billings’ (1995) theoretical model of Culturally Relevant Teaching consists of three components: student learning, cultural critique, and cultural competence. She emphasizes that teachers should not only prioritize student success and cultural competence but should support their students’ recognition, understanding, critiquing, and confronting of social inequities while under the assumption that teachers have a pre-existing understanding of the social inequities and their origin (Ladson- Billings, 1995). Building on Culturally Relevant Teaching (Ladson Billings, 1995), Gay (2002) presents the model of Culturally Responsive Teaching which is described as, "using the cultural knowledge, prior experiences, frames of reference and performance styles of ethnically diverse students to make learning encounters more relevant to and effective for them" (Gay, 2010, p.31). Similarly, Culturally Responsive Teaching also asks all students to critically question normative educational practices and the inequities present in society. The more recent framework, Culturally Sustaining Pedagogy (Paris & Alim, 2013), continues to build on the work of Ladson-Billings (1995) and Gay (2000). Paris and Alim (2013) argue that schools are spaces where cultural ways of being should be sustained rather than dismissed. Thus, all three approaches provide frameworks for teaching in socially just ways in opposition to the normativity of Whiteness and oppression in schools.

Cochrane- Smith (2010) argues that teaching for social justice is not a matter of specific techniques, but rather principles and beliefs that inform decision-making and action within a given context. Held beliefs about engagement in social justice pursuits are key determinants of a teacher's pedagogical practices in their respective content areas (Cochran Smith, 2010). Agarwal et al. (2010) further extend our understanding of integrating social justice in the classroom. They propose that teaching for social justice must include the enactment of a curriculum that questions dominant narratives and integrates multiple perspectives, support of students to develop a critical awareness of injustices present in society, and opportunities to be active participants in the learning community and discussion. As a result, students engaging in learning aims to correct social injustices and leads to student empowerment (Chubbuck & Zembylas, 2008; Upadhyay, 2010). The empowerment of students and creating and sustaining socially just relationships with students is emotional labor that involves engaging with one's own emotions and the emotions of others (Chubbuck & Zembylas, 2008). Empowering students through science and mathematics education will support their ability to critically examine power inequities in education.

Social Justice in Science and Mathematics Education

Science education scholars also discuss socially just teaching within the context of the science classroom and science teacher education (Calabrese Barton et al., 2003; Finkel, 2018; Morales- Doyle, 2018; Rivera Maulucci, 2013; Upadhyay, 2010). The scholarship of Calabrese Barton et al. (2003) presents four key principles for teaching for social justice in the science classroom including creating science communities for students, disrupting pre-existing power structures, activating student resources to increase the relevance of science to the students, and using science as a tool to achieve social change. In conjunction with opposing inequity and power structures, while learning content, Upadhyay (2010) emphasizes the importance of meeting the needs of each student as a key tenant of social just science teaching.

Expanding our understanding, Rivera Maulucci (2013) provides a comprehensive overview of the enactment of socially just teaching in the science classroom. The overview shown in Figure (1) highlights resources science teachers can actuate at the classroom, school, and community levels. Within each level of engagement, resources include material, social, symbolic, cultural, and strategic resources (Rivera Maulucci, 2013). For example, teachers can activate physical resources on a classroom, school, and community level. On a classroom level, material resources include science supplies, high-level science curricula, classroom materials, and technology. At a school level, the material resource includes access to a science lab, internet access, and a school library with science resources. While on a community level physical resources can include housing, transportation, and access to science institutions. Not all resources outlined by Rivera Maulucci (2013) are tangible items, others are cognitive. For example, social resources refer to emotional resources through a variety of relationships. To name a few, these emotional resources are activated by relationships of members of the classroom community (teacher-student and student-student), relationships amongst multiple school stakeholders, and within the broader community of the school.

Figure 1.
Socially Just Science Teaching

Resource	Micro Level (Classroom)	Meso Level (School)	Macro Level (Community/Society)
Material: Physical resources available to support science teaching	High-level science curricula, text books, kits, classroom library, charts, technology, media, paper, science supplies	Science labs, science supply room, internet access, computer hardware, library text and media resources, building maintenance, school grounds	Housing, transportation, social services, health services, science institutions, parks
Social: Emotional resources available through relationships, group membership, and social networks and institutional structures that foster development of emotional resources	Classroom tone, teacher-student and student-student relationships, culturally responsive and relevant pedagogy, problem-posing curricula, student responsibility and engagement in developing the learning community	School tone; students, parents, staff, collegial and administrator relationships; culturally responsive and relevant policies, procedures, and school-wide events; parent engagement	Neighborhood safety; community activism; social, cultural, and political engagement of community members and local government officials in addressing school and community needs and goals
Symbolic: Perceived status or importance of science teaching and learning	Time for science, importance of science relative to other curriculum areas, recognition or celebration of student achievement in science, attention to a pluralistic view of the nature of science, scientific literacy as a property of the community of learners	Science professional development time; investment in facilities and resources for science teaching; recognition or celebration of student achievement in science; positioning science as a tool to enhance student efficacy, engagement, and achievement	Promoting investment in science infrastructure in the schools or community; recognition or celebration of individual, school, or community achievement in science; using science as a responsive tool to improve the community
Cultural: Knowledge, awareness, skills, and practices for employing science as a tool for social justice and social justice as a tool for science education	Teacher knowledge of science; science teaching skills; understanding of students, the teaching context, and resources available in the school and community for developing science curricula grounded in justice issues; seeking professional development that supports socially just teaching	Science curriculum mapping and development, using the school building and grounds as a resource for science teaching and learning, family science activities, school science initiatives, school-based science professional development activities	Using the community as a resource for science teaching and learning, contributing to the local/global knowledge base of science, promoting collective scientific literacy in the community, employing science as a tool for social justice and social justice as a tool for science education
Strategic: Resources embodied in others that can be leveraged to achieve social justice goals in science	Student engagement in science, student knowledge of science, student and parent funds of knowledge	Grade-span or grade-level collaboration among teachers, working with science coaches or district science personnel	Partnerships with personnel from universities and science institutions, garnering local political support for science

Like science education, mathematics education scholars specifically address the manifestations of social justice in the mathematics classroom (Bartell, 2013; Gutstein, 2006; Gutstein, 2012; Nicol et al., 2019) Like science, teaching for social justice in mathematics classroom involves developing critical consciousness and mathematical skills (Gutstein, 2012) as well as fostering connections between mathematical content and societal inequities (Gutstein, 2006). According to Frankenstein (1983), a foundation of mathematical knowledge and literacy is critically needed when “gaining real popular, democratic control over the economic, political and social structures of our society” (p.315). Thus, gaining mathematical literacy is critical in understanding our present societal reality.

Gutstein (2003, 2006) presents a framework for social justice pedagogy that asks students to read and write the world using mathematics. Reading the world with mathematics is defined as the use of mathematics "to understand relations of power, resource inequities, and disparate opportunities between different social groups and to understand explicit discrimination based on race, class, gender, language, and other differences" (Gutstein, 2003, p.45). In comparison, he defines writing the world with mathematics as a tool to institute change and the development of agency as an agent of change (Gutstein, 2006). Reading and writing the world through mathematics can be done through an examination of discrimination in society. For example, students can use mathematics to determine whether racism is present in local housing data (Gutstein, 2003). At times, teachers struggle to reconcile the social justice and the mathematical goals of a given lesson, where ultimately, social justice goals are relegated to the end of the lesson as implications for mathematical concepts (Bartell, 2013).

Although the literature presents a multitude of definitions and perspectives for the successful embodiment of social justice efforts in the science and mathematics classroom, Horgan and Horowitz (2022) suggest that each description is rooted in their "shared call to social action and transformation at the pinnacle of the implementation" (p.910). Social justice and its integration into science and mathematics education are crucial. A commitment to justice in the educational context requires spaces to develop teachers who are willing to oppose oppressive structures defining education (Le & Matias, 2019). The extreme systemic inequities highlighted by the Triple Pandemic increase the urgency to develop science and mathematics teachers with socially just orientations toward teaching. While simultaneously, the volatile and disorienting nature of the Triple Pandemic created an environment prime for transformative learning and re-evaluation for educators.

Transformative Learning

The emerging crisis of the Triple Pandemic created a context ripe for transformative learning to occur. The concept of transformative learning is rooted in the idea that adults construct their view of life based on their experiences and personal beliefs. Transformative learning occurs as the individual encounters new experiences (disorienting dilemmas) that challenge existing beliefs and assumptions, and critically reflects on those assumptions, which ultimately, results in new perspectives and a new self (Mezirow 1978, 1991). Mezirow's (1978) seminal work on transformative learning offers ten phases: a disorienting dilemma, self-examination of assumptions, critical reflection on assumptions, recognition of dissatisfaction, exploration of alternatives, plan for action, acquisition of knowledge, experimentation of roles, competence building, and reintegration of perspectives (Mezirow, 1991). In summary, transformative learning occurs when the individual encounters something new that challenges their understanding, promotes critical self-reflection, then results in a re-evaluation of self and the adoption of new perspectives, beliefs, and assumptions. Both critical self-reflection and learning environments serve as critical elements integral to the process of transformation (Mezirow, 1991).

Transformative learning theory has been discussed in teacher education scholarship addressing the process and product of transformations, the importance of critical self-reflection, and the role of the environment and context (Brancard & Quinnwilliams, 2012; Carrington & Selva, 2010; Resch, 2023; Weinberg et al., 2020). For educators, the process of transformative learning can shift teachers' beliefs about teaching as well as their practice. For example, in a mixed methods study, Brancard and Quinnwilliams (2012) examined the product of the transformative learning that occurred as teachers engaged in professional development (PD) activity, Learning Labs, focusing on the collaborative discussion of observations collected during classroom visits. The quantitative findings of the study showed that because of the PD eighty percent of the teachers reported the implementation of new strategies in their classrooms. Next, the qualitative aspects of the study sought to understand the reasonings behind the teachers' shifts in their practices. Results showed that the teachers changed their beliefs about their students, their roles as teachers in the classroom, and their views on collaboration and professional development. Additionally, the structure of Learning Labs provided a supportive space where teachers were comfortable taking risks and both sharing and challenging their assumptions about teaching.

The literature also reveals that the product of transformative learning transcends beyond content knowledge and teaching practice. For example, a study by Resch (2023) examined the transformation process of preservice teachers during a diversity training program as the participants confronted their prior beliefs about diversity. The preservice teachers reported different categories of learning that occurred throughout their experience in the program: cognitive, social, and emotional. After encountering disorienting dilemmas, the preservice teachers gained a new understanding of the cultural norms of others (cognitive), transformed their social and communication skills (social), and developed greater empathy towards others (emotion). Another study by Weinberg et al. (2020) explored the process of transformative learning of preservice teachers enrolled in a Sustainability Science for Teachers course. The goal of the course was to introduce content knowledge about sustainability but to also cultivate a sense of responsibility and efficacy to teach about sustainability. However, the results of the study found that few of the participants experienced higher-level perspective transformation, rather, most reflected on their own consumer lifestyles and possible habits they could change. As a result, few participants viewed themselves as change agents in the field of sustainability. Weinberg's et al. (2020) findings emphasize the continued need to explore and improve the transformative potential of teacher education.

Past work has also emphasized the integral role of critical self-reflection in the process of transformative learning (Carrington & Selva, 2010; Resch, 2023). Carrington and Selva (2008) examined pre-service teachers' experiences during service field placements at partner organizations including but not limited to refugee homework centers, groups for terminally ill children and children with disabilities, and adult literacy programs. Throughout the placements, the preservice teachers maintained a reflection log. Results of the study showed that critical reflection through completion of the reflection log was integral in how teachers developed a new conceptualization of inclusive education as well as a re-imagination of their future selves as teacher activists and teacher agents of change.

The context in which learning occurs is also a critical element of transformative learning. Illeris (2009) argues that transformative learning often occurs because of a crisis-like situation where a change is urgent and necessary; a crisis like the state of education during the spring of 2020. Scholars have just begun to explore how the field of education is navigating the disorienting dilemmas manifested by the COVID-19 pandemic. For example, a study by Young et al. (2022) sought to explore the challenges and disruptions (disorienting dilemmas) teacher educators faced with the onset of the COVID-19 pandemic. Results of the study revealed that the disruptions around field placements for preservice teachers resulted in new and innovative ideas about ways to redesign teacher education including new conceptions about the role of a mentor or cooperating teacher, student portfolio use, improved reflective practice, and the development of support communities for teachers. However, considering COVID-19 in insolation does not sufficiently account for the context created by the Triple Pandemic in the spring of 2020 and the challenges encountered by educators. The crux of COVID-19, poverty, and racism provides a unique set of disorienting dilemmas, challenging science and mathematics teachers' conceptions of what it means to be a teacher.

Science and Mathematics Education in Times of Crisis

COVID-19 Pandemic

COVID-19 response and safety measures prompted teachers' transitions from their physical classroom spaces to an online learning environment. Consequently, requiring teachers to adjust their practice and evaluate what it means to be an educator, specifically a socially just educator. Unlike traditional online learning, remote learning during the COVID-19 pandemic was not a selected format of teaching for many science and mathematics teachers but rather a response to the crisis (Hodges et al., 2020). Remote learning during the COVID-19 pandemic was reactive, in a moment of crisis or emergency emphasizing the importance of differentiating between remote learning during a "crisis" and planned online learning (Khanal, 2021). Khanal (2021) identifies "crisis pedagogy" as a method to "minimize the impact of the pandemic event while educational institutions are forced to shut down and social distancing measures are in practice" (p.3). Khanal expands:

> Crisis pedagogy should be understood as crisis-aware teaching that involves the design, development, and delivery of teaching and learning activities and related assessments to better support students as they navigate through these uncertain times. (p.3)

In Khanal's (2020) study, postgraduate students experienced crisis pedagogy consisting of both synchronous and asynchronous learning components. The model of crisis pedagogy allowed students to remain safe while accessing materials and engaging in learning from home (asynchronous) and to continue to build and maintain community through Zoom (synchronous). This format of teaching and learning was in response to a crisis (COVID-19) that shifted the format of the course from its original in-person design.

The literature centering online education during the COVID-19 pandemic is growing and beginning to provide insight into the experiences of teachers and students. For example, a study by Kim and Asbury (2020) examined the initial responses of teachers in the weeks immediately following the transition to remote learning. Findings showed educators did not encounter the typical stressors of teaching including workload and behavior management. Instead, new stressors emerged, including uncertainty and navigation of new professional demands emerged. Adding to our understanding of the quick transition to remote learning, van der Spoel et al. (2020) surveyed 200 teachers across multiple grade levels. Results of their survey revealed teachers felt unprepared to teach remotely and that a teacher's knowledge and prior experiences with technology impacted their experience. For example, those with minimal and copious amounts of experience with technology had a more negative experience with remote learning than those with an average amount of experience with technology. Although revealing challenges encountered, results of the van der Spoel et al. (2020) also highlighted positive outcomes of the transition to remote learning, including moments to reflect and evaluate teaching practice and the use of technology to differentiate learning and promote student engagement.

Others have begun to highlight the long-term challenges and implications of remote learning for teachers and students (Boltz et al., 2021; Hartshorne, 2020; Niemi & Kousa, 2020). For example, a study by Boltz et al. (2021) surveyed teachers on the challenges they faced when transitioning from in-person to remote learning. Results of the survey showed that the most frequently occurring challenge amongst participants was engagement and communication, followed by equity and access, pedagogical challenges, workload, and routine, teacher experiences with technology/ online teaching, and lastly, school and district guidelines (Boltz et al., 2022). In response to survey results, Boltz et al. (2021) explored the impact of Massive Open Online Courses (MOOCs) as professional learning opportunities to support teacher practice. Furthering our understanding, Niemi and Kousa (2020) examined the experiences of teachers and students at a Finnish high school during the initial months of the COVID-19 pandemic. Their findings showed that teachers predominantly struggled with "nonauthentic interactions and a lack of spontaneity" typically associated with the craft of teaching (Niemi & Kousa, 2020, p. 352). The implications of the findings emphasized the need for teachers to uncover new strategies to build and strengthen relationships with students while learning remotely.

Recent literature has quantitatively explored the impact of the COVID-19 pandemic on teachers' mental health and emotions. A study by Lacomba -Trejo et al. (2022) sought to better understand risk factors for stress, anxiety, and feelings of depression to better protect teachers while they are teaching in "extraordinary" circumstances, like the COVID-19 pandemic. Their findings showed that educators with pre-existing health problems experienced greater struggles with emotional balance, resilience, and fears around COVID-19. A second finding revealed that female teachers were more susceptible to emotional distress than their male colleagues.

Similarly, a study by Kim et al. (2022) centered on mental health and well-being while teaching during the COVID-19 pandemic. Participants in the study identified uncertainty, negative perception of the teaching profession, concern for others, physical health, and workload as key contributors to a noticeable decline in their mental health and well-being. Extending our understanding, a study by Pressley (2021) sought to identify challenges faced by teachers that resulted in teacher burnout, a pre-pandemic educational problem. Findings showed that teachers were experiencing high levels of stress induced by new instructional requirements and anxiety about the uncertainty and state of education (Pressley, 2021).

Trauma-Informed Practices

The COVID-19 pandemic and incidences of racial violence in the spring of 2020 were traumatic experiences for both students and teachers. Trauma is defined as an event that overwhelms an individual's capacity to adapt to life, which results in negative emotions associated with the experienced threat (Blaustein, 2013). According to the Centers for Disease Control and Intervention, childhood trauma can be caused by a slew of negative experiences including neglect, abuse, and community and/or household distress (2020). Pre-pandemic research estimated that approximately forty-five percent of all children have experienced at least one adverse childhood experience (Sacks et al., 2014). It is expected that more students will present with trauma-related needs in response to the COVID-19 pandemic (Minkos & Gelbar, 2020). Additionally, the results of a study by Douglas et al. (2022) identified racial trauma as concern for teaching and learning post-COVID-19 pandemic. They argue that "Black students in particular have experienced a great deal of trauma associated with the pandemic and systemic racism, resulting in intensifying existing inequities – impacting their social, emotional and academic development" (p. 11) As a result, teachers will need to implement trauma-informed practices in their classrooms (Baweja et al., 2016; Cole et al, 2013; O'Toole, 2022; von der Embse, 2019).

In classroom spaces, trauma-informed practices are inclusive educational practices to respond to the disrupted development, behavioral, learning, and emotional control of students who have experienced trauma (Berger & Martin, 2021). Trauma-informed practices involve creating supportive and safe spaces with consistent and positive relationships with teachers and peers (Pate, 2020). Literature specifically addressing trauma-informed practices and the COVID-19 pandemic has begun to emerge (Douglas et al., 2022; Minkos & Gelbar, 2020; Pate, 2020; Scott et al., 2021; Watson et al., 2022). For example, Pate (2020) utilizes Perry's 3 R's (n.d), Regulate, Relate, and Reason, as a framework for trauma-informed practices during distance learning. Suggested practices include but are not limited to beginning lessons with grounding, mindful exercises, creating structure and consistency throughout lessons and schedules, creating opportunities for mental and physical breaks, promoting self-regulation, providing choice, meeting student's sensory needs, modeling positive interactions, emphasizing caring connections, reducing workloads for students and self, supporting executive functioning, and ensuring videos and resources are not triggering to families. Other scholars offer recommendations for frameworks of trauma-informed practices for educators to implement in their classrooms as children return to physical classroom spaces. Scott et al. (2021) provide the following actionable recommendations:

- Practice contextual and holistic thinking.
- Seek to understand and address underlying needs.
- Build trust, connections, and relationships.
- Embody patience and calmness.
- Remain aware of the diversity.
- Exercise awareness of non-COVID-19 traumas.
- Facilitate safe environments and protect predictability.
- Operate from a strength-based perspective.
- Model and coach SEL skills.
- Increase awareness of available support services. (p. 6)

Similarly, Minkos and Gelbar (2020) emphasize the importance of social-emotional learning for students as well as preparation for intensive tiered interventions for students' trauma-related needs.

The impact of the Triple Pandemic has reshaped science and mathematics education. Although the literature has begun to highlight the positive and negative impacts of the COVID-19 pandemic on education, I argue an exploration of teacher identity provides a way to better understand the crux of the impact on science and mathematics educators during a time of crisis. Identity provides a lens to examine teacher development that extends beyond pedagogy and content knowledge (Luehmann, 2007) and as an approach to foster the development of social justice mathematics and science educators (Horowitz & Horgan, 2022). The literature has shown there is a strong connection between a teacher's identity and their teaching practice and thus shifting identities ultimately shift practice and vice versa (Gresalfi & Cobb, 2011). Further, an examination of the impact of teaching during COVID-19 does not fully encapsulate the complex and emotionally charged context of the spring of 2020 on science and mathematics teachers' identity.

Identity

Identity is a multifaceted and dynamic construct. Throughout the literature, identity is described as multidimensional and constantly evolving (Akkerman & Meijer, 2001; Avraamidou, 2014a; Beauchamp & Thomas, 2009; Cook, 2009; Chong, 2011; Flores & Day, 2006; Gee, 2001; Luehmann, 2007). Identities change because of interactions between people and life experiences (Beijaard et al., 2004; Wenger, 1998) and includes an amalgamation of our understanding of the past as well as aspirations of the future self (Beijaard, Meijer, & Verloop, 2004).

Professional identity or in the context of education, a teaching identity, is one of the many dimensions of a teacher's identity. A teacher's teaching identity consists of all aspects of teaching, an individual's history, expectations of a school context, content-specific knowledge, and teacher beliefs about what it means to be a teacher (Volkmann & Anderson, 1998). Sfard and Prusak (2005) further our understanding by including the element of how a teacher participates in the professional practice of teaching. Throughout engagement in the professional practice, a teacher's teaching identity develops and continues to develop throughout the teacher's career as the teacher encounters new professional experiences (Avraamidou, 2014a; Beauchamp & Thomas, 2009; Hong, 2010; Lasky, 2005; Mcintyre & Hobson, 2013).

Science Teacher Identity and Mathematics Teacher Identity

A science identity is a facet of a science teacher's professional teaching identity that corresponds with the content (Avraamidou, 2014a; Avraamidou, 2016a; Helms, 1998). Avraamidou (2016a) acknowledges the further multidimensional nature of a science teacher's identity. She notes that science teacher identity includes "the ways in which a teacher represents herself/ himself through her/his views, orientations, attitudes, knowledge and beliefs about science teaching, the kind of science teacher she/he envisions to be, and the ways in which she/ he is recognized by others" (2016a, p.83). The development of science identities occurs through the participation in science as a learner and a teacher (Avraamidou, 2014b; Luehmann, 2007; Mensah, 2016) and is influenced by memories and views of science (Carrier et al., 2017; Moore, 2008b), personal and life histories (Avraamidou, 2016a; Avraamidou 2016b; Moore, 2008b) and professional experiences and context (Glass, 2019; Roth, 2016). Glass (2019) refers to a science teacher identity as a community identity because it is a product of engaging in the teaching profession, which includes, includes recognition from both students and administrators (Askew

& Wade- Jaimes, 2022). Due to science's history being deeply rooted in colonialism and Whiteness, science teachers from nondominant groups may question their identities as scientists and science teachers (Seiler & Kwamboka, 2022).

For mathematics teachers, a mathematics identity is a facet of a teacher's identity related to their content specialization. The literature presents similarities between a science identity and a mathematics identity. Like science identities, a teacher's mathematics identity is heavily influenced by their experiences with mathematics as a teacher and a student (Bray, 2011; Campbell et al., 2014; Gresalfi & Cobb, 2011), working communities, (Arslan et al., 2022), experiences with mathematics outside of school (McCulloch et al., 2013), and life histories (Grootenboer & Zevenbergen, 2008). A mathematics identity incorporates beliefs about the subject, the importance of mathematical knowledge, opportunities and constraints related to mathematics, motivations to cultivate an understanding of mathematical knowledge (Martin, 2000), and beliefs about the ability to engage in mathematics (Aquirre et al., 2013; Cribbs et al., 2015; Martin, 2000).

Social Justice Identity

The construct of a teacher's content-specific identity can be dissected into different types of identities grounded in teachers' beliefs about the profession. For example, a science teacher's identity can be further deconstructed based on the teacher's positionality in the classroom and beliefs about science or teaching and learning (Luehmann, 2016; Moore, 2008b; Mensah, 2016). One such identity is that of a reform-minded science teacher. A reform-minded science teacher identity describes an identity of a science teacher who is committed to social justice and the dismantling of oppressive structures in education and society (Luehmann 2016; Saka et al., 2013). A study by Moore (2008a) presents the development of a science teacher's identity as an agent of change in social justice. Developing an identity as a social justice educator in science means that the teacher develops an understanding of how the inequities in the field of science affect historically marginalized students, reflects on issues of power and injustice, and acts against oppressive forces in science education (Rivera Maulucci, 2013). Rooted in identity, a socially just science or mathematics teacher engages persistently to work and foster equitable, caring, and empowering learning experiences on micro (classroom), meso (school), and macro (societal) levels (Chen & Mensah, 2018; Rivera Maulucci, 2013).

Dollarhide et al. (2016) further build on the description of a social justice identity by describing the identity of a social justice educator as someone who uses values of social justice to orient both one's life and teaching career. Teachers' identities as social justice educators develop over time and fluctuate between different stages (Hardiman & Jackson, 1992). Identity development of social justice educators is shaped by timing, experiences, and context (Dollarhide et al., 2016; Rivera Maulucci, 2013; Whipp, 2013). Elaborating on the impact of context and experience on identity, Farnsworth (2010) explains that a social justice teacher's identity is indicative of a teacher's experience and reflection on those experiences. Reflection can be an individual or group process as a mechanism to focus on personal growth around teaching and learning (Mensah, 2013).

Identity Development and Tensions

A wealth of literature agrees that identity is continually forming and reforming over time as one encounters new experiences in the workplace (Avraamidou, 2014; Lasky, 2005; Mcintyre & Hobson, 2013) thus influencing and altering a teacher's stance on teaching and what it means to be a teacher. The complexity of identity results in tensions and barriers during identity development as a science/ mathematics teacher and as a social justice educator. Identities are nuanced and can reflect both social markers (race, ethnicity, gender, socio-economic status, religion, and age) of disadvantage and privilege. Mensah (2012) states tensions arise when conflicting facets of identity or social markers are in opposition with one another. For example, a teacher may identify with social markers offering positions of privilege while also identifying with social markers that do not. Views of and interactions between social markers influence science identity, teaching practice, and relationships in the classroom (Mensah, 2008, 2012).

For science teachers, tensions may arise during identity development when, values and opinions on how to teach science or mathematics are in opposition to those of the school (Varelas et al., 2005), conflicts between teachers' experiences as learners and experiences of their students as science learners (Danielsson & Warwick, 2014; Pillen et al., 2013), and a misalignment perception of self and colleagues perceptions (Saka et al., 2013). Similarly, tensions may arise from external factors during identity development as a social justice educator when the teacher's identity does not align with school practices (Flores, 2007) and when a teacher's understanding of social justice conflicts with the school framing of socially just teaching (Olsen, 2008). Other tensions fester internally. Teachers may also experience internal resistance to pedagogical and or ideological change (Rodriguez, 1998; Rodriguez & Berryman, 2002) and fears about becoming agents of change in science (Moore, 2008a). Resistance originates from emotions and feelings of defensiveness and guilt when asked to reflect upon oppression within our society (Cochran-Smith, 1991). Navigation and resolution of identity tensions and a misalignment between their identities are integral to identity development (Garner & Kaplan, 2018).

Emotions

Research has explored the role of emotion in identity formation and development (Kaplan & Garner, 2017; Ibourk et al., 2022; Lee & Yin, 2011; Rivera Maulucci, 2013; Schutz et al., 2018; Zembylas, 2003) yet gaps in understanding in the literature persist. Prior studies have shown that, meaning making of emotional experiences inside and outside the classroom is an impetus behind identity development and the process of becoming (Zembylas, 2003) and that emotions serve as one way in which teachers develop and resolve tensions in their professional identities (Rivera Maulucci, 2013; Schutz, et al. 2018). Experiencing and acknowledging emotions is a key component of teaching and resides at the core of the profession (Hargreaves, 1998; Zembylas, 2003) and in teaching for social justice (Rivera Maulucci, 2013). Yet, there is limited literature on teacher emotions (Frenzel, 2014; Keller et al, 2014; Park & Flores, 2021) and even further limited literature on science and mathematics teachers' emotions (Bellocchi et al., 2014; Park & Flores, 2021).

Schutz et al. (2006) define emotions as "socially constructed, personally enacted ways of being that emerge from conscious and/or unconscious judgments regarding perceived successes at attaining goals or maintaining standards or beliefs during transactions as part of social-historical contexts" (p.344). As a result, emotional experiences are unable to be separated from the environment or context the individual resides (Uzuntiryaki-Kondakci, et al., 2022). Shari (2018) furthers our understanding of teachers' emotions through their definition of the complex interactions between the feelings experienced about their effectiveness of teaching practice, students, teaching context, and themselves as a professional in the educational community. Zembylas (2008) argues that emotions are not products of events but rather are "forces for the transformation of individuals, social interactions, and power relations" (p.280), including social justice (Freire, 2004), which ultimately, impacts how teachers interact with students, parents, and colleagues (Farouk, 2012). Holistically, emotions result from the culmination of interactions between a teacher's pedagogical beliefs, goals, school conditions, and identity (Cross & Hong, 2012).

Emotional Experience of Teaching

Classroom spaces are emotional by nature where both students and teachers experience emotional encounters (Zemblyas, 2005; Shutz, 2014). Prior literature presents both negative and positive emotional encounters that occur during the act of teaching (Chubbuck & Zembylas, 2008; Zembylas, 2004) as well as emotional indicators of different career stages **(**Chen et al., 2020; Yang, Shu, & Yin, 2021**)**. Typically, positive emotions refer to feelings of satisfaction, pride, joy, and excitement and negative emotions refer to anxiety, frustration, anger, and sadness (Hargreaves, 1998). Past studies have shown that enjoyment and anger are the most common emotions experienced during instruction (Frenzel, 2014; Sutton, 2007; Uzuntiryaki-Kondakci, et al., 2022). A quantitative study in higher education (Trigwell, 2012) showed a correlation between the experience of positive versus negative emotions and the educators' approach to teaching. Results showed that positive emotions such as motivation and pride were correlated with the implementation of a student-focused approach to teaching. In contrast, negative emotions including anxiety and embarrassment were found to be correlated with a more teacher-focused and information-transmission approach to teaching. Further, teachers with negative emotions often experience challenges in implementing lesson plans into practice (Frenzel, 2014). Other studies have indicated that a primary source of negative emotions was classroom management issues (Chang, 2013; Sutton, 2004; Uzuntiryaki-Kondakci et al., 2022).

Connections exist between a teacher's pedagogical content knowledge and the emotions they experience (Uzuntiryaki-Kondakci, et al., 2022). A lack of knowledge of instructional strategies resulted in worry, inadequacy, and hopelessness. As a result, students with anxious teachers ultimately received less content area instruction (Finlayson, 2014; Sloan, 2010). In juxtaposition, studies have shown that a teacher's positive emotions support student learning (Lee & Yin, 2011). Positive emotions are generated through engagement with students (Bahia et al, 2013; Cross & Hong, 2012) and colleagues (Chen, 2016). Due to the impact of negative emotions, teachers often conceal negative emotions to create an environment to support student learning and achieve professional goals (Lee & Yin, 2011).

Emotions and Science and Mathematics Education

Science and mathematics education scholars have explored the connection between teacher emotions and science and mathematics teaching for in-service teachers (Griffith & Brem, 2004; Lombardi & Sinatra, 2013; Uzuntiryaki-Kondakci et al., 2021; Zemblyas, 2002, 2004a; 2004b) and preservice teachers (Bellochi, 2018; Park & Flores, 2021; Riegle-Crumb et al., 2015;). The early work of Zemblyas (2002) argues emotions in science teaching have a significant role in pedagogy, curriculum planning, and relationships with colleagues and students. Studies by Zembylas (2004a, 2004b) examined the emotional labor of science teaching and the emotional influence on the science teaching of an elementary school teacher. Findings provided insight into ways in which science teachers reconcile negative emotions while teaching and how they utilize positive emotions to create an emotional tone in the classroom space. For example, the teacher in the study experienced frustration and disappointment when her priorities for teaching science did not align with school priorities. The teacher was able to utilize her frustration and disappointment as an impetus behind her self-reflection and motivation for continued growth. In contrast, moments of excitement and wonder for science teaching influenced pedagogical decisions including encouraging excitement and wonder about science with her students (Zembylas, 2004a).

A recent study by Uzuntiryaki-Kondakci et al. (2022) further explored the sources of negative and positive emotions in science teaching and emotion regulation during science instruction. The findings found that contentment, enjoyment, worry, and anger were the emotions most often experienced by science teachers. Feelings of enjoyment and contentment when students made sense of the science concepts and when the science teachers felt their students had met the unit objectives (Uzuntiryaki-Kondakci et al., 2021). Feelings of frustration emerged for the teachers when students did not engage with the science lesson and content. The findings of the study also revealed that the teachers with more teaching experience who hold mastery goal orientations, and higher levels of self-efficacy experience a higher rate of positive emotions than their peers.

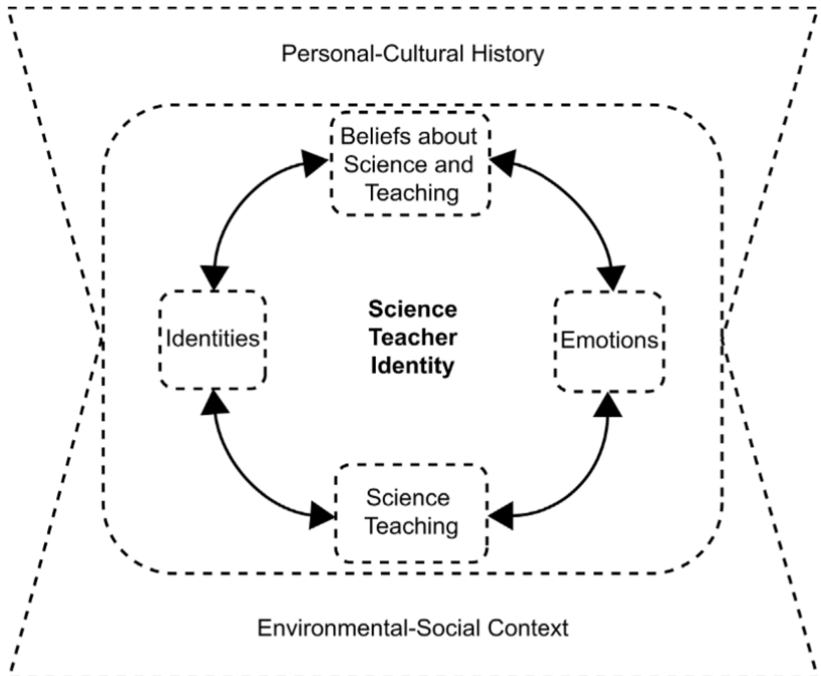
Teaching specific science content can also contribute to the emotionality of science teaching. For example, science teachers who simultaneously expressed love and affinity for the field of science experience higher levels of anxiety and negative emotions when asked to teach controversial topics such as evolution and climate change due to fear of oppositional students and negative consequences (Griffith & Brem, 2004; Lombardi & Sinatra, 2013). High levels of anxiety around teaching science and mathematics have also been noted among preservice science teachers due to their beliefs about the content (Park & Flores, 2021). Ultimately, high levels of anxiety resulted in a lower level of self-confidence to teach (Park & Flores, 2021) and a decline in the enjoyment of teaching (Marban et al., 2021). Anxiety toward science and science teaching decreased when pre-service teachers are allowed to engage in inquiry-based science content courses (Riegle-Crumb et al., 2015).

Emotions and Identity

The relationship between emotion and identity is complex and reciprocal. A teacher's identity influences both emotional and professional decisions (O'Conner, 2008). For example, caring for and about students can be an integral part of teachers' identities as educators. However, at times, caring can seem performative which takes an emotional toll. Simultaneously, caring about students required the teachers to suppress other emotions they were experiencing to maintain professionalism (O'Conner, 2008). For example, feeling too much may permeate the boundaries of the role of a teacher (O'Connor, 2008)

Rivera Maulucci (2012) addresses the relationship between the identity and emotions of science teachers through an ecological perspective. An ecological perspective encompasses the entire emotional cycle: stimulus, bodily response, perception of emotion, and action. An ecological perspective also emphasizes the importance of both the physical and social environment and its impact on learning. Adhering to an ecological perspective demonstrates how "emotions and identity dialectically construct and reconstruct each other in the ongoing streams of social life" (p.137) while simultaneously mediating beliefs about science and science teaching. As shown in Figure 2**,** the model prioritizes science teacher identity but also recognizes the impact other identities may have on the dialectical relationship of identity and emotion. For example, particular emotions may surface when a teacher feels a role that is central to their identity is fulfilled.

Figure 2.
Ecological Model of Emotions



Avraamidou (2020) through an intersectional lens suggests that emotions act as a link between our past, present, and future selves. She argues that the process of becoming "does not take place in an emotional vacuum" thus when exploring identity development, the role of emotions must be acknowledged (p.340). The later work of Rivera Maulucci (2013) further contributes to the literature by examining the linkage between emotions and the process of becoming an educator for social justice. The study presents how a female African American Caribbean preservice teacher develops a stance toward social justice. The case presented highlights the emotions expressed in becoming a social justice chemistry teacher. The teacher's emotions served an evaluative function as she reflected on her experiences as a science student. Her emotions were also a core component of her beliefs about the field of science and science teaching, her desire to teach science, and her beliefs highlighting the role of education in social justice. Additionally, her emotions played an integral role in the way in which she reflected on and responded to social justice issues at a micro (classroom), meso (community), and macro (societal) level.

Conceptual Framework

The following section presents the conceptual framework used to guide the inquiry of this study. The conceptual framework provides a model for how to examine and better understand teachers' experiences and identity development while teaching remotely during the Triple Pandemic. The framework used is rooted in Sensemaking Theory, Critical Consciousness, Positional Identity, and Science Identity as a Lived Experience.

Sensemaking Theory

Sensemaking theory is utilized in the framework to examine how teachers are interacting with their environment and the context of education as defined by the case study. Sensemaking theory provides an avenue to examine how teachers manage the new demands of the teaching profession set forth by the context of the Triple Pandemic concerning their preconceived notions and understandings of what it means to be a successful science or mathematics teacher.

Sensemaking theory was originally derived from the field of organizational theory (Weick, 1995). Foundational scholar Weick (1995) drew upon phenomenology and ethnomethodology to focus on processes through which sense can be made of an ecological change (Helms Mills et al., 2010). The concept of sensemaking addresses how both individuals and organizations assign meaning to these ecological changes and events. Scholars agree that both social and contextual factors influence the individual and their sensemaking process in response to an ecological change (Coburn 2001; Spillane et al. 2002).

According to theorists, sensemaking occurs when the individual is presented with an unfamiliar and novel situation (ecological change) different from what the individual expected or a situation where the individual does not have a framework to fully understand it (Weick, 1995; Weick et al., 2005). As a result, the novel situation creates a sense of unease and disorder. The individual is then guided by their beliefs and prior experiences to generate an understanding and make the situation more orderly by asking the following questions: “What’s going on here?” and “What do I do next?” (Weick et al., 2005, p.412). Sensemaking is an emotional and cognitive process where the learner strives to integrate new information with preexisting beliefs and knowledge (Spillane et al., 2002). Contextually, the spring of 2020 and the Triple Pandemic brought unprecedented changes to the field of education. Educators began to ask critical sensemaking questions about what is going on and what do I do next in their role as science or mathematics teacher.

Weick’s (1995) early work presents a framework of sensemaking for how individuals give meaning to both individual and collective experiences. The framework consists of seven key interrelated components. The framework elements are summarized and outlined below:

1. Every individual has an identity and their identity influences how a phenomenon is interpreted. Further, identity is constantly shaped by experiences that the individual encounters.
2. Retrospection is critical to sensemaking. The individual’s past experiences aid in the interpretation of current experiences. The current state or event is compared to what has happened in the past.

3. During sensemaking, individuals take in cues from their environment which they then interpret and respond to. Some cues from the environment are utilized and others are ignored.
4. Plausibility over accuracy. This may lead to different meanings derived from the same event.
5. Enacted environment. Sensemaking is rooted in making sense of an experience in an environment. Therefore, sensemaking is either created by or constrained by the environment that created it.
6. Use of stories and dialogue to organize, interpret and make future predictions. It is a social process.
7. An ongoing process that never fully stops.

Helms Mills et al. (2010) built upon Weick's initial framework by adding a critical lens through their creation of the Critical Sensemaking (CSM) framework. Initially, their work identified and addressed limitations within Weick's foundational framework regarding the omission of the discussion of how sensemaking is influenced by structural and discursive factors. In doing so, Helms Mills et al. (2010) acknowledge that issues of power and identity cannot be removed from the sensemaking process. CSM strives to understand why during sensemaking "some language, social practices, and experiences become meaningful for individuals, and others do not" (Helms Mills et al., 2010, p.188). Thus, acknowledging the presence of power and privilege within organizational discourse. Within CSM, Helms Mills and colleagues center identity as a key tenant of sensemaking. They note that "who we are and what factors have shaped our lives influences how we see the world" (p.184) thus emphasizing how an individual view of self influences how sense is made when encountering a new experience or ecological change. Additionally, CSM acknowledges that "organizational power and dominant assumptions privilege some identities over others and create them as meaningful for individuals" (p.188).

Although originating in the field of organization theory, sensemaking has been utilized in science education. The primary application of sensemaking in science education is to examine students' sensemaking of science phenomena and constructs (Haverly et al., 2018; Odden & Russ, 2018). A systematic review of the literature on sensemaking in science education identifies three ways in which sensemaking is utilized: sensemaking as means of communication and interaction, a cognitive process, and an approach to science learning (Odden & Russ, 2018). Odden and Russ (2018) propose a definition of sensemaking in the science classroom that synthesizes the uses of the concept throughout science education literature. They describe sensemaking "as a dynamic process of building an explanation to resolve a gap or inconsistency in knowledge" (Odden & Russ, 2018, p.200). Thus, sensemaking in science education is a powerful way in which students grapple with and build an understanding of scientific phenomena.

Science education scholars have also begun to examine the role of sensemaking in learning for administrators, science teachers, and other science education stakeholders during professional development (Allen & Penuel, 2015; Heredia, 2020) and in response to science education reform (Allen & Heredia, 2021; Haverly et al., 2022). For example, a study by Heredia (2020) found that during a multiyear longitudinal professional development, teachers experienced multiple moments of incoherence or misalignment between professional development goals and school policy. Each moment impacted the teacher's engagement and use of resources provided in professional development. The results emphasize the importance of providing opportunities for teachers to manage incoherence as teachers work to modify their teaching practice.

Sensemaking also appears in the literature around different crises focusing on how meaning is constructed by interpreting the phenomena and determining what should be done next (Boudes & Laroche, 2009; Brown, 2004; Stein, 2004; Stephens et al., 2020). A recent publication by Stephens et al (2020) provides insight into organizational communication scholars' sensemaking including their burgeoning understandings of privilege, positionality, and race. Through collective sensemaking, one scholar shared realizations about his financial privilege, race, and positionality as a scholar during a time of uncertainty. Multiple shared their racial identities as Black and Asian men along with the increased fear of hate crimes COVID-19 pandemic. The scholars' collective sensemaking is then used to propose directions for future research and exploration during the COVID-19 pandemic (Stephens et al., 2020).

Ultimately, sensemaking occurs within an individual, yet the experiences that influence the process of sensemaking occur within the context of an organization (school system), shared conversation and activity as well as feedback loops with the environment. For this study and the use of sensemaking theory, sensemaking is applied on an individual level within the context of a school system. In alignment with the literature in organizational studies and education, sensemaking is used to address how teachers are making sense of their novel experiences as educators during the Triple Pandemic. Sensemaking theory provides an avenue of exploration because, with the onset of the COVID-19 pandemic, the transition to remote learning, and the social justice movement educators found themselves in a new educational context where they were faced with the challenge of navigating what is going on and what are my next steps as an educator. Making sense of the educational context is critical for exploring how a teacher's identity is negotiated.

Critical Consciousness

The concept of critical consciousness is then integrated into the framework to provide an understanding of the result of sensemaking. Paulo Freire (2000) first conceptualized critical consciousness in his seminal work Pedagogy of the Oppressed. According to Freire, the purpose of education is to support learners to critically question and challenge their social conditions. Education then results in the development of conscientização or critical consciousness. A state of critical consciousness refers to the positioning to examine historical, economic, and political entities that construct inequitable social conditions and to empower individuals to actively change oppressive structures (Freire, 2000). Developing a critical consciousness incorporates aspects of reflective awareness and action, also referred to as praxis. To reach a state of consciousness, one must develop an awareness of the difference between inequities, power, and privilege in the social world. Freire refers to this awareness as "reading the world". Secondly, one must adopt a commitment to action for social justice (Freire, 2000). He notes that the relationship between reflection and action is reciprocal: reflection supports action and action enhances reflection. When critical consciousness is absent from a community, we are left with an environment plagued with oppression from a micro-to-macro perspective (Freire, 2000). Thus, the development of a critical consciousness limits the destructive outcome of oppression (Cohen, 2001) and promotes social action (Delia & Krasny, 2018; Watts & Hipolito-Delgado, 2015).

Throughout his work, Freire (2000) presents three stages involved in the development of critical consciousness. The three stages are not fixed linearly. Rather, the stages overlap in a constant state of flux and development. The first stage of development is called *intransitive consciousness or semi-transitive consciousness (magical consciousness)* and marks a stage in development where one does not perceive issues of inequity and oppression in society. An individual at this stage accepts the status quote. The second stage of development is *naive transitive consciousness*. At this stage, an individual oversimplifies the problems they are experiencing and or lacks interest in further exploring their position in society. The third stage of development is referred to as *critically transitive consciousness*. The movement between stages of development does not happen automatically. Instead, movement is a process rooted in education and daily experiences. When a teacher reaches a state of critical consciousness, they teach with a social justice orientation (Freire, 2000). As noted by Villegas (2007), "The fundamental disposition of an educator whose practice is informed by social justice is the tendency to act in ways that give all students access to knowledge" (p.375). Thus, developing a critical consciousness is reflective of a teacher's philosophy towards the education of their students and an enactment of their teaching identity.

The literature presents a variety of approaches to further conceptualize the Freirean concept of critical consciousness. Discrepancies emerge as scholars hold differing views on the number of components involved in critical praxis (Jemal, 2017**)**. Scholars such as Watts et al. (2011) diverge from the original Freirean conception of a two-dimensional model of reflection and action to incorporate three aspects: critical reflection, political agency or efficacy, and critical action. Critical reflection incorporates the reflection on societal inequities including economic, racial, gender, and social inequities. Political agency or efficacy encompasses an individual's perceived ability to affect change through activism. The final component, critical action, refers to the individual or collective action against unjust systems.

Scholars also acknowledge the absence of privilege from the discussion of critical consciousness (Jemal & Bussey, 2018; Tyler et al., 2020). They argue that the exclusion of those who perpetuate oppression inadvertently suggests that "oppression is a problem solely for oppressed individuals to solve" (Jemal & Bussey, 2018, p.43). Thus, this view emphasizes the importance of the development of critical consciousness in those who have greater access to power and resources to support social change (Jemal & Bussey, 2018; Thomas et al., 2014). To take critical action, one must address both the presence of oppression and the inequity of the oppression (Jemal, 2017).

The presence of identities yielding privilege is complex and situational. The inclusion of positional identity in the conceptual framework provides insight into the complexity of the facets of identity. Zamudio et al. (2009) say that one-way critical consciousness can be developed is to uncover and identify one's positioning in social structures since one may experience both oppression and privilege simultaneously. Thus, a state of critical consciousness incorporates reflection on multiple identities (Nieto et al., 2008). Positional identity provides a lens through which to view the simultaneous experience while acknowledging multiple identities.

Positional Identity

Identity is self-constructed by individuals and their lived experiences. Experiences, both professional and personal, influence the development of a teacher's identity which ultimately impacts their practice (Lampert, 1985). Holland et al. (1998) present two manifestations of a teacher's identity: figurative and positional. Positional identity relates to how a teacher's identity is in relation to others by self and others. Positional identity is described as "one's position relative to socially identified others, one's sense of social place and entitlement" (Holland et al.,1998, p.125). A teacher's sense of self is framed by historical and situational factors (Mensah, 2012).

One's positional identity incorporates multiple identifiers including race, gender, religion, ethnicity, education, and upbringing (Moore, 2008b). Moore (2008b) argues "individuals are not the construction of just gender or just race but have multiple positions that intersect and create for them their perception of the world" (p.699). Additionally, positionality focuses on power (Hazari et al., 2015). Reflecting on one's positional identity, a teacher is provided with insight into the power granted to them in their role as a science teacher and their positioning within the science classroom (Mensah, 2012, 2019; Moore, 2008b).

Positional identity fluctuates based on varied contexts and is socially positioned in relation to others (Maher & Tetreault, 2001). For example, Moore (2008b) explains that a teacher's science identity is shaped by varying contexts and experiences with science. Further, a teacher may shift their positioning in science as they develop as educators (Moore, 2008b) and as they make choices about their actions in the classroom (Hazari et al., 2015). Hazari et al. (2015) further our understanding of positional identity by presenting four categories of teacher positioning: *social, physical, contextual, and structural*. Physical positioning corresponds with how a teacher physically positions themselves (proximity, motion, physical barriers) in the classroom space in relation to their students. Structural positioning is about assigned roles in the classroom and pedagogy. Contextual cues encompass how a teacher incorporates a student's context in the classroom. The final category, social cue, is about the relationship boundaries between the teacher and student. Hazari et al. (2015) findings demonstrated that positioning through social cues increased student engagement in science learning. The context of remote learning and the Triple Pandemic resulted in a fluctuation of teacher positioning in terms of their physical proximity, social interactions, and role as science or mathematics teachers. As a result, positional identity then influences views of self as a science teacher, science teaching, and interactions with students (Mensah, 2012).

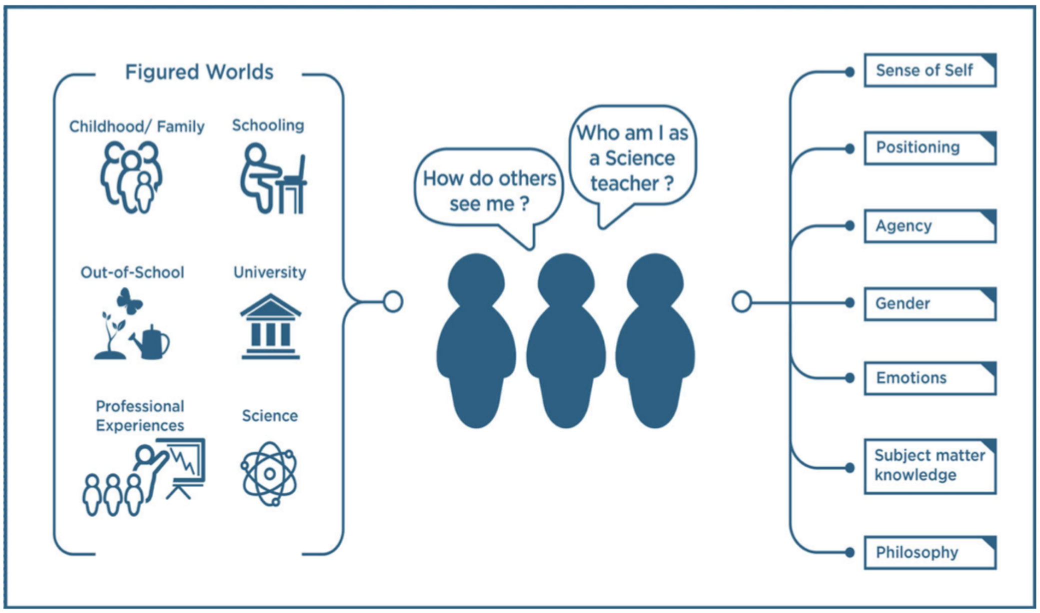
Positional identity provides a powerful lens to examine the nature of identity development for teachers of color because positional identity acknowledges the complexity of power and access granted by our identities (Rivera Maulucci, 2013; Mensah, 2016). This study uses positional identity as a framework to unpack the teachers' sense of self as mathematics and science educators and educators for social justice. Positional identity allows an examination of teachers on an individual level and within a context of a remote classroom.

Science Identity as a Lived Experience

Building upon existing literature on identity and science teacher identity, Avraamidou (2019) presents a framework as a lens to conceptualize and explore science teacher identities as lived experiences, incorporating positional identity. The framework emphasizes that identity is best conceptualized as a process of becoming rather than a product focusing on the teacher's journeys as they form their identities as science educators.

Avraamidou's (2019) framework is grounded in three features of identity. First, science teacher identity is multidimensional and includes affective and cognitive domains. Science teacher identity is also relational meaning it is shaped by and connected with other identities. Third, science teacher identity is connected to space and time and constructed by experiences. The framework includes seven key dimensions of a teacher's identity: a sense of self, philosophy of science teacher, subject matter knowledge, emotions, agency, gender, and positioning (Figure 3). The dimensions of Avraamidou's (2019) framework are not novel conceptions of science teacher identity and have been explored and dissected by earlier scholars. She identifies the work of Jennifer Helms (1998), Gail Richmond (2016), Michalinos Zembylas (2005), Maria Rivera Maulucci (2013), and Felicia Moore Mensah (2008) as contributors to the identification of the dimensions of science teacher identity as lived experience.

Figure 3.
Science Teacher Identity as a Lived Experience

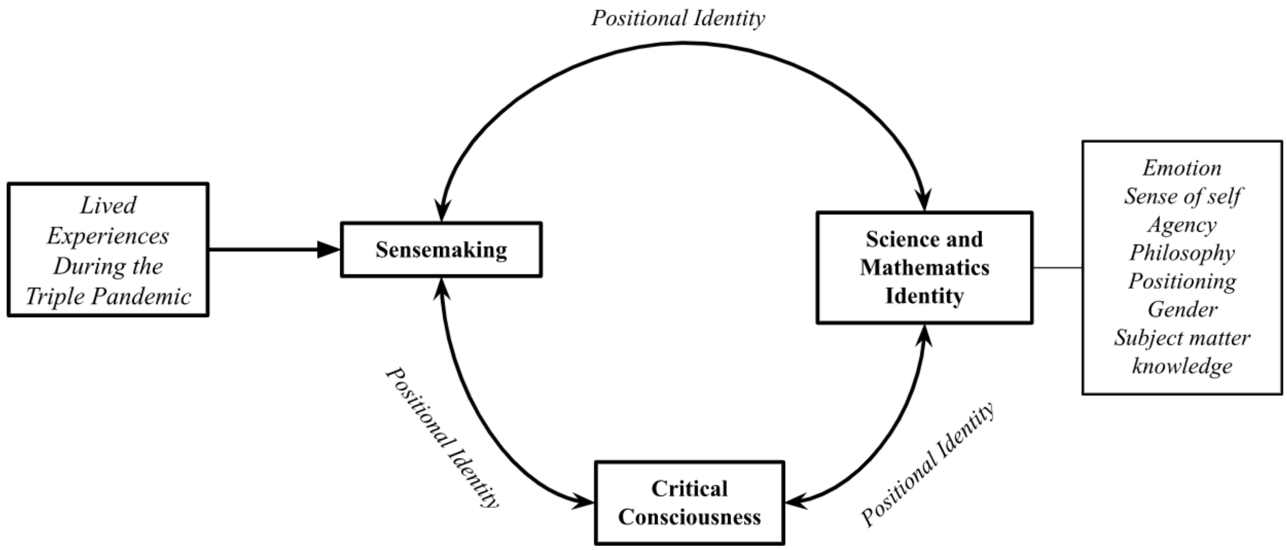


Both science and mathematics identities are entrenched in a history of Whiteness and oppression (Mensah & Jackson, 2018). Although some would argue that numbers and mathematics are void of bias, scholars identify mathematics as a political activity (Gutierrez, 2013; Joseph et al., 2019). Like science, mathematics is "shrouded in the myth of objectivity" (Joseph et al., 2019, p.135). Oppressive structures are present in mathematics "racial hierarchies" of mathematics abilities (Martin, 2009). The similarities between mathematics and science education permit the application of science (and mathematics) identity as a lived experience framework, in conjunction with other theoretical lenses, to explore the identities of mathematics educators. Science identity as a lived experience is beneficial for examining teacher identities through their experiences during the Triple Pandemic as it incorporates the multiple factors in one's experience that ultimately shape identities as educators (i.e., science and mathematics teachers).

Framework Synthesis

Considering the theoretical foundations outlined above, I propose a model for how science and mathematics teachers are grappling with the demands of teaching during the spring of 2020 (lived experiences) and how their identities and practice are shaped during this time (Figure 4). Avraamidou's (2019) framework of science teacher identity as lived experience provides a lens to examine teachers' identities as they enacted their role as science and mathematics educators during the Triple Pandemic. I call particular attention to teachers' positional identity/identities as they navigate the new context produced by the pandemic. Although the framework is constructed for science teacher identity, the dissertation utilized the framework to examine the identities of both science and mathematics teachers due to the similarities in their conceptions.

Figure 4.
Conceptual Framework



Sensemaking is employed to explore how teachers constructed the meaning of both their personal and professional lived experiences during the pandemic; both of which are dimensions influencing science identity as a lived experience. Sensemaking is fitting because the experiences of teachers were unprecedented and provided a unique opportunity for growth and increased understanding of roles in the profession. Further, a tenet of Weick's (1995) sensemaking framework is identity development. Identity influences sensemaking but is simultaneously a product of sensemaking. Avraamidou's framework and positional identity provide an expansion and closer examination of identity development while acknowledging the act of making sense of the environment or context.

Next, critical consciousness is utilized as a product of sensemaking and an enactment of teacher identity. Becoming social justice science teacher involves reaching a level of critical consciousness through reflection, agency, and action. As a result, science and mathematics teachers who develop a critical consciousness teach with socially just orientations and thus demonstrate the creation of an identity as a socially just educator. Developing a critical consciousness is reflective of a science or mathematics teacher's philosophy and agency, elements of the science identity as a lived experience framework.

The Triple Pandemic, a pandemic of racism, COVID-19, and poverty created a novel and unique context for the field of education. The proposed framework provides a lens for gaining an understanding of the impact of the Triple Pandemic on science and mathematics teachers. Utilizing science identity as a lived experience with sensemaking addresses the novelty of the context of education in the spring of 2020 while exploring teacher identity. How teachers make sense of the novel ecological changes is inextricably tied to their identity as both an influence and a product. An emphasis on positional identity allows an examination of power and privilege embedded in a teacher's identity which is necessary when examining the lived experiences during a pandemic of racism, poverty, and COVID-19. Utilizing, a critical consciousness framework in tandem with identity frameworks and sensemaking allows a unique examination of the product of sensemaking while considering a teacher's positional identity. Sensemaking of teachers' observations during the Triple Pandemic led to reflection and action and ultimately the development of critical consciousness, which in turn, reflects a teacher's science or mathematics identity.

Chapter III

METHODOLOGY

The purpose of this study was to capture the experiences of middle school science and mathematics teachers teaching remotely during the Triple Pandemic in the Spring of 2020. The study focuses on understanding teachers' experiences, the challenges they encountered, the emotions they experienced, and the adjustments they made to their teaching practice. The study then sought to understand how teachers' identities and priorities as science and mathematics teachers have been shaped by their unprecedented teaching experiences during the Triple Pandemic. The experiences and identities are unique to each participant. However, the similarities in their experiences provide insight into how the Triple Pandemic has shaped current mathematics and science educators. To pursue this inquiry, I asked the following research questions:

1. What are the lived experiences of three middle school science and mathematics teachers during the Triple Pandemic?
   a. How did these science and mathematics teachers change their teaching practice?
   b. What conflicts and challenges emerged for these three science and mathematics teachers?
   c. What emotions did they experience?
2. In what ways did teaching remotely during the Triple Pandemic, develop, shift, and affirm science and mathematics teachers' identities?
   a. In what ways did teachers' understanding of their identities change?
   b. What tensions emerged in their identities as mathematics and science teachers?
3. In what ways does sensemaking during the Triple Pandemic shape the priorities of

science and mathematics teachers?

The remainder of this chapter details the research design and methodology utilized to answer the research questions. Firstly, I provide an overview of the methodological approach selected to investigate the research questions. Next, I identify and describe the setting and participants followed by an overview of the data collection and data analysis methods. Finally, I address the ethical considerations for the study.

Impact of COVID-19 on Study

The nature of this study transformed drastically with the onset of the COVID-19 pandemic and the closure of school buildings. Transformations involved new research questions, data collection procedures, and theoretical framing. Initially, this study sought to explore the identity development of science and mathematics educators as they engaged in an Equity focused professional learning community within their school community, or "Equity Groups". With the onset of the COVID-19 pandemic, professional learning opportunities were postponed, and teachers shifted into a state of survival mode. In addition, the New York City Department of Education IRB review board altered its guidelines for research in the New York City Department of Education Schools (NYCDOE). As a critical researcher, it became evident that there was a dire need to shift the direction of the study to address the current state of science and mathematics education. From this need, this study was developed, and IRB permissions were revised. Due to the updated procedures and regulations, I did not pursue NYCDOE IRB approval.

Initial participant recruitment and virtual questionnaire completion had begun before the study's modifications (Appendix A). Twenty-one middle school teachers were recruited to complete the initial questionnaire. Once changes to the nature of the study had been confirmed, participants were asked if they would like to withdraw or continue their participation in the study. All participants opted to continue their participation. The entirety of this study was conducted using virtual platforms including Qualtrics, Zoom, and Voice Memo. At no point during this study were participants in the same physical space as me or the other participants. Nor were participants in their physical classroom spaces. Before the transition to remote learning, I had hoped to collect observations of teachers as they engaged in professional learning. Due to safety and quarantine advice, no observations were conducted. Instead, the study relied on the storytelling of teachers' experiences rather than researcher observations.

Qualitative Approach

This study utilized a qualitative research approach. Qualitative research is defined as an approach to research where the researcher collects, organizes, and interprets information using their senses (Lichtman, 2010) thus employing the researcher as the primary instrument of data collection. The researcher as the primary instrument allows a closeness to the data (Merriam, 2009). Marshall and Rossman (2011) further explain that qualitative research is "pragmatic, interpretive, and ground in lived experiences" (p.2). The provided definitions of qualitative research are critical to this study because it explores and presents the lived experiences of science and mathematics educators during the Triple Pandemic. By gaining an understanding of their lived experiences, I was able to interpret how those experiences have influenced teachers' identities and their priorities as science and mathematics educators.

Intersectional Qualitative Approach

Further, an intersectional qualitative approach was selected because it emphasizes the multiple modes of existing, knowing, interpreting, and navigating the social world. For example, "intersectionality as a research methodology is about contemplating, interrogating, naming, and simultaneously reclaiming and rejecting that nexus between the known and unknown, invisible and (hyper)visible, and humanizing and dehumanizing" (Esposito & Evans-Winters, 2022, p.4). Evans-Winters and Esposito present ways in which intersectional methodologies approach research to better understand the following questions:

1. How power and authority are concurrently fixed and static within and across social contexts.
2. How individuals and groups resist, confront, and/or placate oppressive authority and structural power.
3. How space (social and spatiotemporal) affects how social actors perceive and enact power.
4. How one's place in history and contemporary society influences their approaches to qualitative inquiry and forms of knowledge production.

(p.22)

The use of intersectionality as a methodology incorporates consistent self-reflection on power and its relation to power. Reflection involves the constant interrogation of the researcher and the participant's perception of race, ways of making meaning of social identities (of self and others), and processes of stratification, power, and differences (Esposito & Evans-Winters, 2022). By doing so, the researchers should ponder "How do our race, class, gender, sexual and other identities shape the research process?" and "How do our own identities as researchers shape participants' perceptions of us, our relationships with participants, and the research context concurrently?" (p.86)

Case Study

Qualitative research can implement a plethora of approaches to inquiry. A multiple case study was selected to pursue the inquiry presented in this study. For this study, a case study is used as both a methodology and a unit to be studied. Case studies examine either a single or multiple cases within a real-world context and experience (Yin, 2017). Each case exists as a bounded system, defined by a set place and time that offers a detailed and in-depth description generated from multiple data sources (Creswell & Poth, 2018). Thus, specific cases must be identified, bounded, and described within the set parameters of the case.

A multiple-case study involves an overview of several individual cases followed by cross-case analysis and conclusions (Yin, 2017). Multiple cases are selected because “individual case studies either (a) predict similar results (a literal replication) or (b) predict contrasting results but for anticipatable reasons (a theoretical replication)” (p.55). The use of a multiple case study approach offers several benefits. For example, findings from a multiple case study are often viewed as more fruitful than an individual case (Herriot & Firestone, 1983). Yin (2017) compares a multiple case study to the idea of conducting multiple experiences to gain insight. Thus, this approach allows the researcher to examine the how and why in multiple experiments, which ultimately leads to generalizable findings across multiple cases that can ultimately enable the development of theories (Lewis-Beck et al., 2004). For this case study, the unit of analysis was each participant, and the bounded system was their remote teaching experience in the spring of 2020 (March 2020-July 2020).

Data Collection

Recruitment Process

This study presents the case of three middle school science and mathematics teachers at Kennedy Middle School (pseudonym). Initially, participants were recruited using convenience sampling. To recruit participants, I distributed fliers and contact information to teachers during their morning commute to Kennedy Middle School containing information about my initial study (pre-COVID-19) (Appendix B). Those interested in learning more about the study were contacted and provided with an initial consent form. Twenty-one teachers expressed interest and offered their consent to participate in the study. All twenty-one teachers engaged in the first round of data collection by completing a questionnaire.[1]

After reviewing twenty-one responses to the initial questionnaire, eleven teachers were selected using purposeful sampling. Purposeful sampling allowed me to select participants based on what I wanted to discover and understand (Merriam & Tisdell, 2016). To do so, criteria were established that "reflect the purpose of the study and guide in the identification of information-rich cases" (Merriam & Tisdell, 2016, p.97). The selection criteria were that participants must teach either middle school science or middle school mathematics. Since recruitment of the study began before the transition to remote learning, once the transition occurred the following requirement was added: all participants must be current classroom teachers who began the 2019-2020 school year teaching in their in-person classrooms and were required to transition to distance or remote learning due to the onset of the COVID-19 pandemic in March 2020. Teachers with differing years of experience and middle school grade levels were asked to participate. When contacted, four of the eleven participants that met the criteria of the purposeful sampling agreed to continue their participation in the study. The four participants were asked to complete an additional consent form granting permission to engage further in the research study.

Twenty-one participants were initially recruited through convenience sampling and completed the initial questionnaire. From the questionnaire, eleven of the twenty-one were then identified as science or mathematics teachers. Only sixteen of the original twenty-one completed the final survey. Nine of the sixteen were science or mathematics teachers. Four science and mathematics teachers opted to take part in further data collection (interviews, focus group, audio journals). The cases of three teachers, Charlie, Regina, and Karrie are presented in this study.

Setting and Participants

Ultimately, three participants were selected as cases for this study as I aimed to achieve maximum variation (Glaser & Strauss, 1967). Maximum variation "increases the likelihood that the findings will reflect differences or different perspectives" (Creswell & Poth, 2018, p.158). A fourth consenting participant engaged in the data collection procedures for the study including participation in the focus group with the other participants. However, as the only male-identifying novice teacher, I chose to not include him in the analysis of the findings of this study at this time as his identifiers varied from the other participants (female veteran teachers). The three participants selected as cases and further analysis are all female veteran middle school science or mathematics teachers. At the time of the study, two of the teachers taught science and one of the teachers taught mathematics. In addition to their content area course, two of the teachers were also responsible for teaching a homeroom. The participants were also representatives of different classroom settings; they varied by grade level and student population. Two of the participants were part of a teaching partnership in an Integrated Co-Teaching (ICT) classroom model. A summary of the identification information of the three participants along with their pseudonyms is provided in Table 1.

Table 1.
Summary of Participants

Participant	Race and Gender	Discipline and Grade	Prior Experience
Charlie	White female	6th Grade Science ICT; 6th Grade Homeroom	13 years in education; 8 years in current teaching position
Regina	Black female	8th Grad Math ICT; 8th Grade Homeroom	20 years in education; 18 years in middle school; 3 years in current teaching position
Karrie	Hispanic female	6th and 7th Grade; Science	12 years in education; 3 years in current teaching position

All participants in the study were current teachers at the same urban, zoned (unscreened), public middle school (Kennedy Middle School, a pseudonym). Approximately 1300 students attended the school (grades 6-8) at the onset of the COVID-19 pandemic. At Kennedy, eighteen percent of students were classified as students with disabilities and three percent were identified as English Language Learners. Approximately a third of the students qualified for free or reduced lunch. The teaching staff at Kennedy Middle School was predominantly White, 80%. The remaining breakdown of teacher demographics was as follows: seven percent Asian, seven percent Black, and seven percent Hispanic or Latinx. Like teacher demographics, much of the student population identified as White, at about 54%. Sixteen percent of students identified as Hispanic, eighteen percent of students identified as Asian, and only seven percent of students identified as Black.

Data Collection Procedure Overview

Yin (2017) identifies six types of data sources: documents, archival records, interviews, direct observations, participant observations, and artifacts for conducting case study research.

This study utilized questionnaires (initial and final), semi-structured teacher interviews, artifacts (audio journal entries), and focus group discussions. Here, I offer a brief overview of the data sources and timeline of data collection (Table 2). All the data for this study was collected virtually. In response to the onset of the COVID-19 global pandemic, Zoom software was utilized to conduct interviews and a focus group discussion. The Zoom interviews and focus groups were recorded using the Zoom software. The recordings were then downloaded to my personal device. In March 2020, participants completed the initial questionnaire remotely using the platform Qualtrics. Participants were asked to complete the initial questionnaire within two weeks before beginning the interview sequence. All participants completed and submitted the initial questionnaire by March 31st, 2020. I then conducted a series of three semi-structured interviews that were strategically scheduled throughout the spring semester during the same week. The first interview was conducted in mid-April 2020, the second interview was conducted in May 2020 and the final interview was conducted in mid-June 2020. Between interviews, each participant completed and submitted audio journal entries. Participants were asked to complete one to two entries each month. Each participant submitted a minimum of three entries for the spring semester. Based on the participants' schedule, focus groups took place during the first week of July at the end of the school year. Next, participants completed the questionnaire. Participants were asked to complete the questionnaire no later than July 15th. Throughout the data collection process, the researcher engaged in memoing (Creswell & Poth, 2018).

Table 2.
Data Collection Timeline

Month/ Year	Data Source
March 2020 (prior to school closure)	● Recruitment ● Informed consent ● Initial questionnaire
April 2020	● Notification of changes to procedures and focus of the study ● Interview one ● Audio journal entries
May 2020	● Interview two ● Audio journal entries
June 2020	● Interview three ● Audio journal entries
July 2020	● Focus group ● Final questionnaire

Initial Questionnaire

Before selecting the three participants as individual cases, all twenty-one participants from the convenience sampling completed the initial questionnaire. The initial questionnaire consisted of background and demographic questions (Appendix C), two open-ended questions, and twenty-five Likert scale questions (Appendix D). The questionnaire was completed during the participant's own time using the Qualtrics platform. The questionnaire took around fifteen minutes to complete. As noted, the initial questionnaire was completed before the transition to remote learning brought forth by the COVID-19 pandemic. After completion, data were stored in Qualtrics, downloaded as PDFs, and stored on my secured computer.

The questionnaire consisted of ten questions to collect information about the teachers' educational and professional backgrounds. The questionnaire also asked teachers to share self-identifying demographic information. Following the background information questions, all the participants were asked to respond to twenty-five Likert scale questions. The twenty-five Likert scale items were adapted from Social Justice Scale (Torres- Harding et al., 2012) and the Dispositions for Culturally Responsive Pedagogy Scale (Whitaker & Valtierra, 2018).

Of the 25 Likert scale items, ten were adapted from the Social Justice Scale (SJS) (Torres- Harding et al, 2012). The SJS was developed by psychologists to determine undergraduate and graduate students' attitudes toward engagement in social action. In alignment with the intent of the Social Justice Scale, engaging in social actions means engaging in political and social activism, striving to empower others through career and volunteer work, changing policy, and discussing the need to empower those from "disadvantaged groups" (Torres- Harding et al., 2012, p.80).

Ten of the Likert scale items were adapted from Dispositions for Culturally Responsive Pedagogy Scale (DCRPS) (Whitaker & Valtierra, 2018). Consisting of 19 items, the DCRPS was created to assess teachers' values, attitudes, and beliefs that shape their interactions with colleagues, students, and students' families. DCRPS also examined teachers' dedication to their student's social and emotional development and their continued professional growth. The DCRPS items were sorted into three domains: Dispositions for Community, Dispositions for Praxis, and Dispositions for Social Justice. I added five additional items to inquire about teachers' beliefs about the nature of their teaching identities. A combination of Likert scale items was selected to gain insight into the participants' awareness of societal inequities and oppression present in schools, their beliefs about their engagement in social justice as teachers to combat inequities, as well as their awareness of the impact of their identity in classroom spaces.

Finally, additional Likert scale items were created and added by the researcher. The participants were provided a five-point scale and were asked to state whether they "strongly disagree", "disagree", "neither agree nor disagree", "agree", or "strongly agree" with the twenty-five statements on the questionnaire. At the end of the questionnaire, participants responded to two open-ended questions about their teaching values and prior understandings of teaching STEM (science or mathematics) for social justice.

Semi-Structured Teacher Interviews

I conducted three semi-structured interviews with each of the three participants, Charlie, Regina, and Karrie, at different points in the spring of 2020. Semi-structured interviews were selected because they allowed "the researcher to respond to the situation at hand, to the emerging worldview of the respondent, and to new ideas on the topic" (Merriam & Tisdell, 2016, p.111). Also, according to Corbin and Strauss (2008), "the interview process provides participants an opportunity to talk in-depth about issues that they hadn't talked much about before, giving them insights into their own behavior" (p.28). Each interview was strategically scheduled at different points during the spring semester, or monthly, thus providing a regular opportunity for teachers to share their experiences teaching remotely, grappling with current events, and their identities as educators. The three sequential interviews provided insight into experiences and changes in teacher identity and practice over time. Each interview lasted approximately 90 minutes. Teachers were provided an outline of the intended interview questions via email approximately forty-eight hours before the scheduled interview.

Each participant's first interview (Appendix E-1) was scheduled for April 2020. The purpose of the first interview was to learn background information about the participants and for the participants to share their initial experiences from teaching only a few weeks of remote learning. The second interview (Appendix E-2) was scheduled for May 2020, approximately halfway through the study timeline. The second interview continued to provide insight into the experiences of the participants as they continued to teach remotely during the Triple Pandemic including adjustments to their teaching practices, successes and challenges, emotions, and the nature of their interactions with students. The third and final interview (Appendix E-2) was conducted in June at the end of the school year. During the third interview, participants shared their overall experiences and reflections on their teaching and role as science and mathematics teachers since the onset of the pandemic and their identities.

Before each interview, I listened to the participants' audio journal entries for that month and journal entries. The journal entries allowed me to modify and add interview questions tailored toward the participants' experiences. During each interview, I asked participants clarifying and follow-up questions to ensure an accurate interpretation of their statements (Creswell & Poth, 2018). Additionally, I performed member checks or respondent validation during the interviews with each of the participants. Member checks (respondent validation) are described as a strategy where the researcher "solicits feedback on preliminary or emerging findings" to determine whether the researcher's interpretation of the data is accurate (Merriam & Tisdell, 2016, p.246).

Audio Journals

Throughout this study, Charlie, Regina, and Karrie were asked to complete audio journal entries. Audio journals were "personal documents" generated by each participant (Merriam & Tisdell, 2016). Documents are much like observations as they provide insight into the participant's perspective and thinking (Merriam & Tisdell, 2016). Although audio journals (personal documents) provide fruitful insight into attitudes, beliefs, and views, they are oftentimes subjective because the participant has autonomy over what is included in the recording (Merriam & Tisdell, 2016).

To complete the audio journals, participants were provided with instructions for the use of different audio recording platforms including Voice Memos and Easy Voice Recorder. Using the platform of their choice, participants were asked to use the guiding prompts (Appendix F) to complete a bimonthly journal entry. Participants had the autonomy to select the prompts they were interested in responding to during each journal recording. Each journal entry was approximately three to five minutes in length. The audio recording allowed an impromptu reflection on their unique experiences. The audio recordings were then emailed to me, downloaded to my device, transcribed, and analyzed.

Virtual Focus Group

At the beginning of July, I conducted a focus group with the three participants. However, it is important to note that a fourth teacher also participated in the focus group as he was initially recruited for the study. As discussed, his findings were not discussed in this multiple case study. Focus groups are especially fruitful when the "interviewees are similar and cooperative with each other" (Creswell & Poth, 2018, p.164). The focus group was scheduled at the end of the school year to provide a space to cogenerate reflection and dialogue on the participants' experiences during the spring of 2020. Using the Doodle scheduler, the focus group was scheduled at a time that was mutually convenient and selected by all the participants and the researcher. The focus group conversation took place on Zoom, and a semi-structured interview protocol (Appendix G) was used to guide the group discussion. Like the interviews, the focus group took approximately an hour and a half to complete. The focus group interview transcript was downloaded onto the researcher's device and later transcribed by a transcription service.

Final Questionnaire

The final questionnaire was distributed to the original twenty-one participants who completed the initial questionnaire during the first week of July 2020. Like the initial questionnaire (Appendix D), the responses were collected through Qualtrics. The Likert scale items and open-ended questions were identical to those presented on the initial questionnaire. Ultimately, sixteen teachers completed the final questionnaire, and nine of the responses were from science and mathematics teachers (including Karrie, Regina, and Charlie). For purposes of this study, only the responses of the Karrie, Regina, and Charlie were analyzed to examine change and development over time.

Data Analysis

Data Analysis Overview

Each data source was analyzed to answer the research questions driving this inquiry. A case study analysis approach was utilized to organize the data and examine the data as separate cases to share each participant's story of their teaching experiences during the bounded system of the case (Creswell & Poth, 2018). Within each case, I employed Grounded Theory as a method of analysis (Charmaz, 2014). Coding in grounded theory as a method of analysis occurs in two main phases: (1) an initial phase involving naming each word, line, or segment of data followed by (2) a focused, selective phase that uses the most significant or initial codes to sort, synthesize, integrate, and organize, large amounts of data (Charmaz, 2014). In addition, I performed Emotion Coding (Saldana, 2009) to capture the experiences of the participants more thoroughly as science and mathematics educators during the Triple Pandemic. Table 3 presents the data sources used to answer each of the research questions. A further explanation of the data analysis process for each data source is included in the following sections of this chapter.

Table 3.
Summary of Data Collection

Research Question	Data Collection Procedure
What are the lived experiences of three middle school science and mathematics teachers during the Triple Pandemic? a. How did these science and mathematics teachers change their teaching practice? b. What conflicts and challenges emerged for these three science and mathematics teachers? c. What emotions did they experience?	Interviews, Audio journal entries
In what ways did teaching remotely during the Triple Pandemic, develop, shift, and affirm mathematics and science teachers' identities? a. In what ways did teachers' understanding of their identities change? b. What tensions emerged in their identities as mathematics and science teachers?	Interviews, focus group, survey
In what ways does sensemaking during the Triple Pandemic shape the priorities of mathematics and science teachers?	Interviews, focus group, survey

Preparing to Code

All data sources were collected digitally, transcribed by the transcription service Rev, and stored securely on my device and in my Google Drive for data analysis. I used multiple computer programs to store and analyze my data including OneNote, Microsoft Word Processor, Google Drive, Google Documents, and Google Sheets. To support my data analysis, I engaged in memoing throughout the entirety of the study (during, between, and after data collection) (Creswell & Poth, 2018). My memos were kept in Google Documents and later organized in OneNote. The memos played a critical role as themes emerged from my data. I often referenced memos while coding to help me keep track of and recall past ideas.

Initial and Final Questionnaire

The questions from the initial questionnaire were used to create a profile for each of the participants including their educational and professional histories, identities, and beliefs about teaching science or mathematics. Although traditionally used for quantitative analysis, the Likert scale questions (Appendix D) were used to identify teachers' beliefs about their role in social justice, the presence of inequities and oppression and education, and views about the role of their identities at the onset of the pandemic and after the academic school year. The statements were used to affirm and corroborate findings from the interviews and audio journal entries. The questionnaire responses were removed from Qualtrics and placed into a Google spreadsheet. The spreadsheet allowed me to highlight, comment on, and sort the responses as needed.

Semi Structured Interviews, Audio Journals, and Focus Group

My analysis process continued by placing the interviews and audio journal entries in chronological order. I organized my transcripts using Microsoft OneNote to create a folder of interview and audio journal transcripts and open-ended questionnaire responses for each participant allowing me to read the data chronologically. All transcripts were transcribed by the transcription service Rev. Next, I reviewed all data sources for each participant to gain a deeper understanding of each participant's experience personally and professionally during the Spring of 2020; thus, each teacher became a bounded case. I read through the transcripts while simultaneously listening to the audio recording to make any edits as needed. After reviewing and organizing the data, I began my coding process.

To code the data, copies of the transcribed data were copied into a Microsoft Word document. Then, I began a close read of each participant's interview transcripts in chronological order. During the close reading, I performed initial coding moving word-by-word and line-by-line coding using gerunds and in vivo codes. Gerunds and in vivo codes were utilized to capture the actions, processes, and words of the participants (for example: trying new strategies, “I am failing”) (Charmaz, 2014). Initial coding allowed me to remain close to the data to highlight actions and the progression of events while creating codes that best fit the data (Charmaz, 2014). During initial coding, I remained open to possible theoretical directions, coding for possibilities suggested by the data. As a result, I was able to capture the unique experiences of three science and mathematics teachers as educators during the Triple Pandemic.

Following initial coding, I conducted focused coding. During focused coding, I used codes to sort and gain an understanding of copious amounts of data (Charmaz, 2014). I completed focus coding by creating groups of my initial codes to create broader conceptual codes (Appendix H). Generating focused and initial coding was not a linear process. At times during focus coding, I would return to the data to produce additional initial codes. After coding the interviews, I followed the same coding procedure for the focus group transcript and audio journal transcripts. This allowed me to see if the emergent interpretations from the interview analysis were supported by other data sources. I found that the focused codes I generated from the interview transcripts were further supported by the experiences of the participants shared in the audio journals as well as the discussion in the focus group. I then used my conceptual framework as a guide to synthesize overarching themes from groups of focused codes. With the framework utilized as a model to understand teachers’ experiences and development during the Triple Pandemic, I considered how my focused codes aligned with the different components of the framework. For example, *the* codes outlined in Appendix H aligned with the elements of the framework contributed by Avraamidou’s (2019) Science Identity as a Lived Experience. The focused codes reflected different factors that influenced how the participants viewed themselves as science and mathematics teachers.

Next, I returned to the audio journal and interview transcripts to complete emotion coding (Saldana, 2021). The use of emotion coding was utilized to address research question one. Emotion coding involves labeling the emotions recalled by the participants or inferred by the researcher (Saldana, 2021). Emotion coding is particularly powerful when exploring the nature of a person's experience. For example, "emotions are a universal human experience, our acknowledgment of them in our research provides deep insight into the participants' perspectives, worldviews, and life conditions" (p.161). I first conducted emotion coding in each interview, starting with one participant and sequentially coding interviews one, two, and three. I then coded each audio journal entry, comparing the codes from the audio journals to the interview transcripts for each month (April, May, and June). I followed the same protocol for each participant. For each participant, patterns, and repetition of emotions were noted during each month (Appendix I).

Throughout data analysis, I implemented constant comparative methods and memoing (Charmaz, 2014; Creswell & Poth, 2018). Constant comparative methods allowed me to make comparisons of statements within each case and across cases. After the coding of each interview or focus group transcript, I engaged in the memoing process. Memoing allowed me to record my initial reflections, thoughts, and questions and to further identify and make sense of emerging themes in the data. During the interviews, I shared emerging themes ideas, and themes with participants. For example, the concept of "empowerment" emerged during the first interview (March 2020) with each of my participants. During the second interview (April 2020) we discussed the concept and what it meant to be empowered as a science or mathematics teacher. Through discussion and member checking, teachers associated not feeling empowered with their identities as science and mathematics. Teachers felt their identities as science and mathematics teachers were challenged by the new demands and context of remote learning.

Later, I read through my memos in sequential order to gain an understanding of each participant's case. I was then able to compare the themes documented in the memos to compare across cases. Each participant had unique experiences throughout the spring of 2020 filled with new perspectives, emotions, challenges, and successes. However, commonalities existed as time progressed. For example, March to April 2022 was identified as a period of *Responding* to the new demands of teaching. The month of May was a period of *Adjusting* practices and mindsets. Thirdly, the month of June was a time for *Reflecting* on their past experiences teaching during the Triple Pandemic.

Through analysis and a synthesis of the data sources, six themes emerged across the three cases: *Racial Identity Awareness, From Uncertain to Confident Science and Mathematics Identities, Marginalized and Affirmed Social Justice Science and Mathematics Teachers, Centering Student Relationships, Rethinking Classroom Priorities,* and *Beyond the Classroom: Community Engagement.* Subthemes emerged from the themes *Rethinking Classroom Priorities* and *Centering Student Relationships*.

Validity, Positionality, and Ethics

Internal Validity

Maxwell (2013) argues that:

> Validity is never something that can be proved and taken for granted. Validity is also relative: It has to be assessed in relation to the purposes and circumstances of the research, rather than being a context-independent property of methods or conclusions. (p.121)

Although qualitative methods are unable to capture "objective truth" methods can be utilized to increase the validity of the findings (Merriam & Tisdell, 2016). As a result, three strategies to enhance the internal validity of this qualitative research study were employed: triangulation, member checking, and researcher reflexivity (Merriam, 2009). Triangulation was achieved through the examination of multiple sources of data. Interview transcripts, audio journal recordings, and focus group transcripts were compared to maximize the credibility of the data source and to confirm emerging themes (Merriam & Tisdell, 2016).

Throughout data collection and analysis, I engaged in member checking (Merriam & Tisdell, 2016). Member checking allowed participants to learn about initial interpretations of the data and verify emerging categories and themes. Member checking occurred with each participant at two points during data collection and analysis. Before the start of the second and third interviews with each participant, I shared thoughts and emergent themes generated while memoing. Participants were granted the opportunity to state whether my interpretations accurately reflected their experiences. For example, I shared with participants that the concept of empowerment was emerging in the data. When asked, teachers were able to elaborate further on their understanding of what it means to be empowered, moments when they felt empowered, and when they did not provide deeper insight into their experiences. The rich and thick descriptions of the findings allow transferability of the findings to similar cases (Merriam, 2009).

Positionality

Throughout the study, as the researcher, I remained cognizant of my role and the implication it may have for participants' responses and outcomes (Merriam & Tisdell, 2016). Researcher reflexivity requires the researcher to identify their perspective, position, and values to present their positioning within the study. I needed to acknowledge and reflect upon my position as a researcher, middle school science teacher, and colleague of the participants. For instance, as the researcher and colleague of the participants, I recognized that power dynamics could emerge in our interactions. Esposito and Evans-Winters (2022) note that “there is no research involving human participants that do not involve some power dynamic” (p.87). Thus, I needed to develop a sense of trust with the participants to allow them to honestly share the stories of their experiences.

I emphasized that I would not pass judgment on the participants' professional challenges and/or successes shared during the study. I also acknowledged my identity as a White, Jewish, woman engaging with the participants, two of whom identified as women of color, in conversations about the unlawful killing of George Floyd, the Black Lives Matter Movement (BLM), and experiences with racism. By doing so, I recognized that my experiences with racism and my experience processing these events differed from that of my participants as aspects of my identity result in a positioning of privilege in society. While speaking with participants during interviews, I verbally acknowledged my identity and Whiteness along with my hope of listening and learning so that I would be able to share their stories. One participant expressed gratitude for a space to vocalize and unpack her experiences. I strove for an equitable researcher-researched relationship by continuously sharing my process as a researcher and my decision-making (Esposito & Evans-Winters, 2022).

Ethics

Qualitative researchers often confront ethical issues during data collection (Creswell & Poth, 2018) and data analysis (Esposito & Evans-Winters, 2022). The study involved human participants, none of whom experienced any harm during the data collection process. Throughout the planning and research process, I remained cognizant of potential ethical issues that could arise. Before participant recruitment, I received IRB approval to pursue my inquiry. Upon identifying participants, I was honest and upfront about the goals and intent of my study. All participants completed a consent form before any engagement in the study. When the nature of the inquiry shifted due to the onset of the COVID-19 pandemic, all participants were notified and allowed to end their participation in the study. Participants who agreed to continue in the study were asked to complete the consent form again, stating their interest and consent to participate.

During the data collection process, I strove to create and maintain the comfort and privacy of each of the participants. Before each interview, participants were reminded that they were not required to answer any question they did not want to and would not need to provide any rationale for their decision. Further, participants were reminded that the interviews were recorded and would not be shared with anyone besides myself (the researcher) and the transcription service. Once data was collected, pseudonyms were used to replace the names of each participant to protect their identity. Each participant selected their pseudonym. Complete anonymity was not possible due to other personal identifiers provided by the participants and the participant's relationship with me and one another. The identity of participants became evident during the focus group. I assured participants that the information provided would not be used in an evaluative way or shared with administrators at Kennedy Middle School. All engaging parties agreed to keep what was said in a collaborative focus group confidential.

Limitations

This study offers implications for science education and teacher education; however, like all studies, there are limitations. One limitation of this case study is the small number of participants. Ultimately only three teachers were presented as cases for analysis for this qualitative study. With three participants, it is impossible to make large-scale generalizations for all science and mathematics teachers when conducting qualitative research (Creswell & Poth, 2018). The stories of the participants' experiences and their impacts are unique to the participants of this study. However, the nature of a case study design exchanged breadth and generalizability for an in-depth examination of the cases.

Further, participation in this study was optional, and the three case study teachers opted to participate. Initial recruitment for this study was completed before the transition to remote learning. When the nature of the study shifted, participants were provided the option to remain part of the study or drop out without any repercussions or penalty. Given the stressful time and the tumultuous nature of education in the spring of 2020, the three participants-- Charlie, Regina, and Karrie-- chose to continue to share their studies and experiences. The voices highlighted by this study were of educators who felt they could engage in multiple interviews, a focus group, and complete audio journals while simultaneously balancing teaching and personal life during a pandemic. Further, when participants were initially recruited, they were aware of the focus of social justice in this research. Although their perceptions and identifications changed throughout the study, the participants who agreed to participate articulated from the beginning their perceptions of the importance of acting for social change and their identifications as socially just science and mathematics teachers.

Researcher assumptions and biases are often present in research grounded in the social sciences. As a result, it is also important to note the role and positionality of the researcher in this study. My positionality as a researcher, science teacher, New York City resident, and colleague of the participants, impacts the assumptions and biases I hold regarding teaching during the Triple Pandemic. Further, my connections with the participants cannot be ignored. I am the teacher in the science department with two participants, although different grade levels. I share this information to address the researcher as a source of bias in this study. To address this potential bias, I was cognizant of my interpretations and strove to listen to the experiences of the participants during each interview. I also presented my participants with early interpretations from memoing and emerging themes to ensure I was accurately hearing their stories and experiences.

The following three chapters will present the findings of this study. Chapter IV consists of the three participants' cases. Chapters V and VI answer research questions two and three through cross-case analysis of Charlie, Regina, and Karrie’s cases. Then, a discussion of the findings is presented in Chapter VII.

Chapter IV

FINDINGS

To address the research questions, data were collected and triangulated from a variety of sources including questionnaires, interviews, audio voice journal recordings, and a focus group discussion. The data was then analyzed using the conceptual framework of sensemaking theory, critical consciousness, positional identity, and science identity as a lived experience. This chapter begins the presentation of findings by presenting three individual cases as participant profiles. Each profile provides an overview of the teachers and their experiences teaching science or mathematics during the Triple Pandemic. Charlie, Regina, and Karrie (pseudonyms) shared background information about their identities, teaching philosophies, and backgrounds during their first interview and questionnaire responses.

Following the overview, each profile presents the teachers' experiences in chronological order throughout the Spring of 2020. The chronology is critical because it reflects the tumultuous nature of the pandemic and the development of each educator over time. A common theme of teachers' experiences emerged for each month of teaching across the three cases: Responding, Adjusting, and Reflecting. The sharing of their unique and shared experiences provides a foundation for a closer examination of the science and mathematics educators during the Triple Pandemic and its impact on the field of education.

Participant Stories

Research Question One: What are the lived experiences of three middle school science and mathematics teachers during the Triple Pandemic? (a) How did these science and mathematics teachers change their teaching practice? (b) What conflicts and challenges emerged for these three science and mathematics teachers? (c) What emotions did they experience?

Charlie: "I'm not an emotional person, and I cried"

Charlie is a 6th-grade science teacher in an ICT (integrated co-teaching) classroom. Charlie has her special education teaching license and is fulfilling the role of the special educator in the ICT partnership. Charlie identifies as a White female Jewish teacher. She is a veteran teacher and was in her thirteenth year of teaching.

As a child, Charlie's parents presented "teacher" as one of the possible professions she could pursue when she grew up. Charlie shared that she always liked working with children in the capacity of a babysitter or camp counselor. However, upon going to college Charlie thought she might want to be a lawyer and majored in history and political science. While in school, she realized that she did not want a job that required her to be in an office-like environment. She shared that she liked the "comic relief kids provide" (Charlie, First Interview, April 2020). Thinking about her future and day-to-day life she thought it would be "more enjoyable to help kids become their best selves and feel confident about learning" (Charlie, First Interview, April 2020).

After finishing her college degree, Charlie became a New York City Teaching Fellow. Upon entering the program, she decided to become dual-certified in special education. She intended to begin her career as a special education teacher and transition to a general education teacher. However, upon starting she noted that she "didn't feel like many people advocated for students with disabilities" and encountered many teachers who held deficit perspectives about students with disabilities. Ultimately resulting in her desire to remain a special educator.

Charlie described herself as a teacher who tries to "lead with kindness to everyone" and acknowledged that "subgroups of students need other things". She described her role as a science teacher as one who looks out for and anticipates how she can meet the needs of all her learners and or make sure that their learning needs are met. She emphasized that all students are held to the same achievement standards, but students need different supports to be successful. She prioritized consistency in her classroom and recognized the role of consistency in building rapport with her students. She hoped to convey the understanding to her students that each student is unique and will achieve success in different ways with different supports.

Charlie shared that she had a strong sense of who she is as a science teacher and a willingness to reflect on her identity. She did not feel that her identity as a White, female, Jewish educator influenced relationships with her students nor did her identity impact the decisions she made in her classroom. Charlie emphasized that "equity" is a core value she holds as a science teacher. Charlie strongly agreed that it was critical in her role as an educator to act for social justice. On her questionnaire, Charlie shared that, being a socially just science teacher meant "providing all students with access to education and supporting students in the ways that they need". However, when asked Charlie did not believe that schools were responsible for reproducing societal inequities.

Responding

When asked about her experience and practice as a science educator during the transition to remote learning in March 2020, Charlie shared that she was feeling unwell and was out sick the week leading up to school closures. When schools ultimately closed, she felt overwhelmed and already distant from her students due to her prior absences. She attributed her feelings of being overwhelmed to the unknown and volatile situation of teaching during an emergency. She said:

> There's no framework. So that for me was stressful and it didn't really make it easy for me to jump fully in because there was no framework. How much of what is being said today is going to change tomorrow? (Charlie, First Interview, April 2020)

Charlie was stunned by the lack of precedence and structure of remote learning in her school. She transitioned to her new role as an online or remote science teacher without prior knowledge or guidelines for what her responsibilities as a science teacher would entail.

Upon transitioning to remote learning, Charlie shared that she didn't know what actions to take as a science teacher. She questioned the role she should fulfill as an educator to support her students with access to science content, manage student behavior, and make social connections virtually. She began to inquire about and consider what her colleagues were doing and reflected on how their decisions related to her experience. While contemplating her responsibilities, she questioned the expectations set upon teachers. She expressed her wonderings and confusion when she shared "We're trying to continue business as usual, plus push forward with something unknown" (Charlie, First Interview, April 2020). Acknowledging her understanding that the field of education must persevere but simultaneously finds itself in an unprecedented context.

To contact her students, Charlie completed regular student and parent outreach. She implemented new modalities of outreach including a Google Voice number and the use of Google Meets. She hoped to schedule one on one meeting times with her students, prioritizing those she felt needed the most support as science learners and social-emotional beings. She shared that, sadly, her attempts to contact families were not always successful. When recounting her experience with student outreach and online classroom attendance she shared:

> You get nothing back. They just don't show up. So, you can't even tell like mentally are they doing okay? Like what's their circumstance? Like what's going on? Like, I've no idea what's going on with some of them. (Charlie, First Interview, April 2020)

The failed attempts to contact her students left Charlie feeling frustrated and worried about her students' safety.

Charlie and her co-teacher implemented new teaching strategies to deliver science instruction remotely. She noticed that her students were having difficulty following the sequence of lessons on their own, so she began filming instructional videos with closed captioning, giving students the ability to fast forward and rewind. She also utilized Quizlet for science vocabulary and Padlet to post multi-model science resources. For example, during the Ecosystems Unit, Charlie posted videos, text, and images focusing on different parts of a food web (decomposers, producers, etc.). Upon reflection, she realized that ultimately, she had started to create pathways for individualized instruction for her students considering the emerging vastness of remote learning needs.

Throughout her problem-solving attempts, Charlie continued to feel frustrated, defeated, and anxious. When asked about the root of her feelings, she shared:

> I suck at my job. I can't get these kids on the phone. I can't get them to complete the work. I was just doing all this stuff with zero results. And then for me, the lack of control really engages more so with my anxiety. So, I just feel anxious. (Charlie, First Interview, April 2020)

As Charlie persisted through anxiety and frustration to reach her students, she grappled with her concerns and fears of physical safety during the COVID-19 pandemic. She assumed her students were experiencing similar emotions. She rationalized and attributed the uncertainty in the world as one of the causes limiting participation in remote learning. She explained:

> It's a pandemic. Plus, your loved ones are sick family members dying. Like, you know, it's just, it's just a lot. There's a lot to take in. Like every single time I leave my apartment, I'm like how many people have tucked this doorknob before me? (Charlie, First Interview, April 2020)

Charlie felt she could not support the development of coping mechanisms within her students when she was struggling.

Charlie identified poverty as another barrier to engagement in remote learning. She felt helpless; she was unable to remedy the difficulties her students were facing because of systemic inequities. In her reflections, she identified the inequities her students faced as "much larger issues" that extended beyond that of the science classroom. She questioned the foundation of schools and their role in providing shelter and food for students, identifying the interconnectedness between schools and city infrastructure to support students' families who currently reside in transitional housing and shelters.

Adjusting

As the spring semester continued, Charlie remained frustrated and became increasingly emotional. She had difficulty processing the unlawful killing of George Floyd and witnessing the protests both in her neighborhood and nationally. She shared that "I cried today, and I was like, I'm not an emotional person. I don't cry very often but I did today". She internally struggled to focus on her obligations as a teacher such as grading and lesson planning. In her audio journal, she noted that teaching did not feel possible during a "bubbled-up moment in history".

As she grappled with her emotions, Charlie persisted in completing her daily routine of reaching out and working with students individually and in small groups. Charlie continued to emphasize how challenging the school year had been for her emotionally and professionally. Professionally, Charlie felt ineffective stemming from her lack of successful contact with students, which ultimately, prevented Charlie from supporting all her students academically. Through reflection, she realized that many of the students she struggled to successfully contact were students from “low socioeconomic backgrounds and minority groups”. She hypothesized that some students had multiple devices and areas in their homes to complete work while other students shared a device, struggled to access the internet, and completed other daily responsibilities at home that prevented them from engaging regularly in schoolwork.

Charlie’s observations resulted in increasing awareness of her students. She described a new awareness of students who were “going to fall through the cracks” in both education and society. She attributed her new awareness to not only the challenges she encountered with the structure of remote learning but to “events in society”. She elaborated on her awareness:

> And it has been extremely eye-opening. So I feel like taking that step to, and being home during the pandemic and like having that extra time to reflect and look at what’s going on in my neighborhood, there are vigils every night that lead to protests and like, you know, seeing what’s happening in our communities has kind of like, I guess like allowed me a time to do this work, but then also be like, really see the kind of like what’s happening with the pandemic in certain communities and what’s not happening with the pandemic in certain communities. (Charlie, Second Interview, May 2020)

Charlie began to witness firsthand the injustices and inequalities experienced in different communities.

Throughout remote teaching, Charlie yearned for professional collaboration with her colleagues. She missed being able to discuss her science lessons and the collaborative revision process. Not wanting to bother her colleagues who were likely experiencing difficulties at home, Charlie kept to herself. Being siloed off and alone resulted in difficulties with balancing time and boundaries. She missed her routine in the school building. Seeking positives from her experience, Charlie felt as though she was forced to become more independent and separated from her co-teacher and Science Department team.

New challenges professionally, resulted in further refining of Charlie's teaching practice and the integration of different learning technologies into her teaching. When students struggled to understand virtual simulations modeling scientific phenomena, Charlie experimented with using Screencastify to video capture her computer and model her thinking out loud. She continued to use Quizlet, Padlet, and EdPuzzle as platforms for her students to engage with the science content in different ways during April. When referencing different remote learning technologies, Charlie shared that "I never thought I would and now I do" integrate the vast array of technologies into her science teaching.

Charlie continued to utilize Google Meets to offer synchronous learning experiences to her students in conjunction with another teacher in her department. While reflecting on her use of Google Meets, Charlie noted many students interacted in the chat but did not interact by turning on their cameras and by speaking. Student engagement had drastically changed. She worried that "many of them don't want to show their faces, which is fine. But at the same time, I wonder, are you even behind that black screen". Attempting to engage the maximum number of students, Charlie began to incorporate activities and mood check-ins unrelated to science. She hoped to show students she cared.

Reflecting

Charlie’s expression of self-doubt continued throughout the spring semester. Recognizing she was probably being hypercritical of herself; she emphasized the professional challenges she faced this year were much greater than in past years. Teaching remotely resulted in Charlie feeling “stifled”. What drove Charlie as an educator was interactions with her students. In an audio journal, she shared, “I miss the facial expression when they are proud of themselves for understanding something in science, it’s empowering”. Charlie longed for in-person interactions with her students and exclaimed “It was just too much time away from them!”

Charlie continued to notice the challenges encountered by her students during remote learning in the early months of the pandemic. Many students remained without consistent working technology and internet access until the end of the academic school year. As a result, some of Charlie’s students were unable to interact with her and their peers throughout the entirety of the remote portion of the spring semester. Even those with technology struggled to remain engaged and motivated resulting in not “getting the full effect of the science curriculum”.

Charlie wondered about the pressure and expectations students encountered during remote learning. For example, because students and teachers did not share a physical space, students were asked to advocate for themselves if academic or technological support was needed. Charlie was unable to gauge her students’ levels of understanding if the student did not explicitly share verbally or through science assignments. Some students were able to seek support from their parents; however, others were alone at home without support for their learning. Charlie grew increasingly concerned about what science learning students had missed during the year. Charlie wished additional supports were in place for both students and families to limit the inequities experienced by her students. She noticed that her students whose parents were essential workers lacked consistency in their routines for engaging in science learning. She also feared that many students did not have sufficient academic support because of their parents' education. Charlie shared:

> I just wish that there were, some kind of support to put in place for families who didn't necessarily have it so, so easy or like, or maybe they don't have the ability to support their kid with their sixth-grade science because maybe their educational backgrounds are not that strong. Like I just wish there was more, more support for them. Which also means support for me. (Charlie, Third Interview, June 2020)

Charlie realized, if remote learning were to continue into the following academic year, she would need to become increasingly creative to support her students.

As the school year ended, mental exhaustion began to take a toll on Charlie. She struggled to stay motivated and productive while working from the confines of her home. Teaching became procedural and a matter of "just getting things done". Charlie also struggled with the ways teachers were presented in the media. The media representation compounded with professional challenges and fears resulted in feelings of anger towards education. Charlie shared:

> It's very easy to demonize us [teachers] and I don't like that. And I think we're often demonized for things that we're; we're just trying to be like to do. I don't want to be demonized for not going to work because I don't want to get a virus that can quickly spread to everyone around me and maybe possibly make me die. (Charlie, Third Interview, June 2020)

Charlie tried to care for herself but was frustrated by her feelings of guilt for prioritizing her social-emotional well-being. She wished "teachers would be treated as human" and space for mental health, “I want to leave it all behind, and dart to the finish line” she proclaimed. By the end of the school year, Charlie was ready to start anew.

Regina: “I can no longer be neutral”

Regina is an 8th-grade mathematics teacher in an ICT classroom setting. In the classroom, she fulfills the role of the content area teacher. Regina is a veteran teacher with twenty years of teaching experience which includes every grade level between kindergarten and 8th grade (middle school). She had spent most of her teaching career in middle school, grades five to eight. Regina identifies as a Black female.

Regina did not feel like she chose teaching as a career, but rather stumbled upon it. She moved to New York City from North Carolina to attend law school. Due to the cost of living, she decided to try teaching to earn money to fund her education, which resulted in the start of her teaching career before earning a teaching degree. She started teaching younger students in the elementary grades and then proceeded to “fall into middle school by accident” (Regina, First Interview, April 2020). She shared that she had not planned to teach middle school, but an opportunity presented itself, so she entered the middle school mathematics classroom.

When asked to describe herself as a teacher, she described herself as someone youthful, adventurous, and willing to try something new without fear of failure. As a result, she felt that her classroom may appear to be chaotic because it is always an “ongoing experiment of how to get kids interested and vested in what we are doing (mathematics)”. She said that her students would describe her as laid-back. She felt that her students at her past school would view her as even more laid back than her current students at Kennedy Middle School. At her previous school, many students viewed her as more than a teacher, and they would call her “big sister” or “auntie”. She says she has a different relationship with her current students. She believes she is well-liked by her students due to her laid-back personality. She described herself as having a good sense of humor and being hard to offend. Regina said she does not yell but will use sarcasm with her students on occasion.

When asked how her identity enters the classroom, Regina spoke of her identity as a mom of a teenage son as a major influence on her teaching. She said, “the lines are so blurred sometimes in education when you are a mom”. Regina also identifies as a member of the urban hip-hop community and believes this aspect of her identity enters the classroom. She shares that:

> Like it’s in my style of dress, it’s in my choice of music. And that also trickles into the classroom quite often when you teach, um, a population of children who are young and into those very same things. (Regina, First Interview, April 2020)

Regina described her role in the classroom as a facilitator of learning and at times a “warden” or a figure that monitors student behavior. A key value for her as a teacher is resilience. She believes that both she and the students need to be resilient in the classroom space.

When asked, Regina shared that she believes socially just teaching in mathematics includes:

> It means that while tackling your curriculum you also make students aware of social issues in meaningful ways and allow them to decide on their position on social issues and understand the impact of those decisions. (Regina, Initial Questionnaire, March 2020)

Regina shared she is not sure if she teaches mathematics in a socially just way. She shared that “culture is absent in math” and that she didn’t believe that:

> Math offers the opportunity. Like there are times where like, oh yeah, there’s a word problem with maybe, you know, culturally diverse names, but like, no, I don’t know. hose are scratch-the-surface kinds of things. (Regina, First Interview, April 2020)

However, she felt that she promoted equity in her classroom. She believed it was important to integrate student choice into her lessons and to offer extensions and challenges to further push students' critical thinking. She also prioritized assuring that her rules and expectations in the classroom reflect the students in front of her.

Responding

Regina described her experience teaching mathematics during April as "deeply personal". The experience was personal both emotionally and physically. Emotionally, she felt uncomfortable because she felt that she was "hiding pieces that I feel are maybe not appropriate for my students to know". Physically, she shared that her students had access to the inside of her home due to the structure of remote learning through virtual learning platforms like Google Meets. As a result, Regina chose to keep her camera off when interacting with students on different virtual platforms or to record her lessons ahead of time. In return, when on Google Meets many students opted to turn off their cameras as well. Regina and her students corresponded through audio only or teaching occurred through pre-recorded videos. She acknowledged that Google Meets and video calls provided a unique situation for students to get to know more about their teachers and their identities. However, she felt she was not ready or comfortable with sharing the inside of her home, family, and personal facets of her identity with her students through the camera lens.

As Regina strived to engage her students in learning she found that she was constantly questioning her teaching practice in terms of what is necessary for her students to successfully learn math. When reflecting on her practice she shared that "so much of what we had been doing was unnecessary". She was eager and excited to take risks and try out different platforms and lesson structures to engage her students. Rather than deliver mathematics content, Regina felt it was her responsibility as a teacher during remote learning to organize math learning activities. Remote learning eliminated the “behavior management piece” of teaching. She liked the idea that remote learning removed aspects of teaching that she did not like and allowed her to focus on designing mathematics instruction. Yet, this also led to her feeling “a bit useless” because she felt that she “would be doing more in the actual classroom” to support her students and facilitate learning.

Regina used the schedule flexibility of remote learning to pursue professional learning. She excitedly shared that she had just signed up for a technology professional development that she hoped to integrate into her practice. She felt like she had “more creative flexibility” during remote learning and was constantly problem-solving and “experimenting” with ways to engage her students. In addition to rethinking and reflecting on her practice, Regina shared her reflections on the structure of the school and what could be learned from teaching remotely. She wondered, do students need to be in physical school spaces? What could the flexibility of remote learning offer to her students? She thought she was in the “small percent of teachers who, if they were offering this (remote learning) as an option, um, for the future, I would definitely take it”.

However, Regina also encountered many challenges while teaching mathematics remotely. She noted that not all her students had working devices or access to the internet. She also expressed her concern for students whose parents were essential workers and not present to support or students who may be responsible for the care of siblings. Regina emphasized the importance of being lenient and flexible in response to the diverse home life scenarios of the students. Regina tried to remain positive and hopeful of the possibilities that could result from remote learning.

Adjusting

Regina's experience shifted drastically as time progressed. When we spoke in May, she was very emotional, and she shared:

> There's so much going on today with a heavy day considering what's going on in the media, around George Floyd, and just globally, like this conversation. And then the piece that education plays in that. So today was heavy. Um, I spent a good chunk of my morning in tears. (Regina, Second Interview, May 2020)

Regina was very open about the emotions she experienced after the death of George Floyd and her experiences as a mother of a Black son. Regina shared that she was not in a place to interact with students due to the fear of positioning herself to engage in a critical conversation about the death of George Floyd.

Although she was experiencing intense emotions, Regina was adamant that she wanted to share her recent teaching experiences. She shared that her perspective on remote learning had shifted:

> I was hopeful about remote learning when it was first introduced. Now I just, I don't know. I guess there are certain things that I saw hope for that just didn't work and the opportunities to get certain students, um, and reach certain students just have not happened. So maybe I'm a little disenchanted. (Regina, Second Interview, May 2020)

She had hoped to implement strategies that would make mathematics more creative than just "here is the answer". For example, she had hoped to have students create math problems that align with an answer. She felt disappointed that she had so many ideas about reinventing mathematics instruction that did not come to fruition. She attributed her disenchantment to the challenges she encountered when reaching out to her students; many students were not logging into virtual classrooms nor were they responding to any outreach.

Regina shared that she had been attempting to make individual phone calls to families and to develop personalized plans for each student to support them in completing their assignments. Regina was overwhelmed. Additionally, she began shifting her focus to ways to contact her students, even if not directly connected to math instruction. She began to post polls for students to complete and daily homeroom Google Meets meetings for students to check in and play games like Kahoot! Yet, even still, very few students attended and participated.

During a professionally and personally draining time, Regina shared the importance of her colleagues from the teaching community (both her current school and former). She described her professional learning community as the "reason why I persist". Regina continued to seek opportunities to expand and engage with members of her professional learning community by registering for additional professional development around teaching practices during remote learning.

Reflecting

As the school year ended, Regina was hopeful again but with hesitation due to the uncertainty and the tumultuous state of education. She said:

> I am really hopeful. And I think I said before that, like I think that this whole idea of remote learning presents some unique opportunities, um, whether they will actually happen and how that happens leaves me sometimes a little less hopeless. (Regina, Third Interview, June 2020)

While hopeful, Regina also shared the fear of the unknown for what will come in education learning from her experiences over the past few months.

Although optimistic, Regina's experience during June was not void of challenges. She shared that she was not able to support students as she had hoped to or would have if they were in a physical mathematics classroom space. For example, she was only able to support students in a small group setting based on who attended, not who needed the support the most. Some students never attended and as a result, she shared that she was unable to support and assess their mathematics learning. She also shared that she missed receiving feedback from her students. At times, students would email her with questions or anecdotes of their journey engaging with the lesson. She longed for the visual response of "joy when they got it". She recognized that student-to-teacher feedback took on a different form during remote learning and was learning to appreciate any feedback she received even when it was not a visual sign of joy.

Regina continued to struggle with the personal and, at times, invasive aspects of remote learning. She was disappointed with herself for not making more videos showing her face or turning on her camera. She shared that she was still uncomfortable with allowing students into her home. She worried that her interactions with students were then interpreted as less personal due to the lack of visuals. She shared that: "I do know that some kids needed to see and hear my voice. That was probably most like the normal classroom, but I wasn't always able to give it or willing, to be honest." Regina was still not comfortable allowing students into the privacy of her home, she was not ready to share aspects of her personal life with students.

Regina continued to incorporate different technologies into her teaching practice. She was proud of her use of different platforms and referred to herself as a "champion of technology". She often felt that she was pushed outside of her comfort zone while designing instruction. She shared that she had many moments when:

> I thought I was doing great, but like, this is really like a mirror in the face. Like ways, you could have been better kind of thing. And I've really been trying to do some, I guess,

> rethinking and strategizing behind my use of technology in the world. (Regina, Third Interview, June 2020)

Due to some of her students' lack of access to technology and support at home, Regina strived to "invent ways" to make math content more accessible. For example, Regina successfully integrated Google Voice and Pear Deck platforms into her mathematics instruction and virtual classroom routines. Regina regretted that she did not film more videos of herself explaining mathematics concepts. She let her insecurities dictate her instruction.

Regina was especially reflective at the end of the school year. She actively reflected on and evaluated her practice. For example, she shared that she lacked control over policies and procedures but had control of her flexibility. Although she initially believed flexibility was necessary for supporting students who were experiencing issues with technology and access, she wondered if her flexibility was a detriment to student learning. She wondered, "Am I still servicing students academically like I'm supposed to? Am I being too flexible?" While reflecting, Regina noticed practices that were absent in her remote instruction. She spoke of elevating the equity of students' voices. She felt that she was unsuccessful but began to brainstorm ideas for her future self to implement. Regina described teachers as "champions of the situation", trying their best during unprecedented circumstances.

Building upon reflections from April, Regina further considered what she had learned about effective instruction from teaching remotely. For example, she said:

> This whole idea of changing your thinking and thinking about what's purposeful in the class versus what's purposeful online. And if it's not purposeful online, was it ever really purposeful in the classroom? Like, you know, it's a real evaluation of what you've been doing and how effective is it. You know, because, I guess, there's this whole thing. Like,

> well, if a kid can learn it in a video from watching me explain it, then why aren't we just doing that if they can't then why am I just explaining it, period? Why am I doing that in real life? (Regina, Third Interview, June 2020)

Regina wondered what it would be like to be a mathematics teacher in a post-pandemic world. "I'm questioning things. That would be a part of my new teaching philosophy" she said. Regina sought a silver lining for the challenges she faced teaching remotely during the Triple Pandemic.

Karrie: "I'm giving myself a grade; I failed"

Karrie identifies as a Hispanic female who teaches 6th and 7th-grade science. Karrie has twelve years of teaching experience and has taught middle school for the entirety of her career. She has a master's degree in education and is bilingual: speaks Spanish and English. Spanish was her first language and was the language spoken at home while she was growing up.

Karrie was encouraged as an adolescent by her parents to pursue a career in education. However, as an adult, Karrie believed it was her experience as a Latinx student that was the major impetus for why she pursued a career in education. She shared that she began her schooling experience in the public school system in New York City. When she was in high school her family moved to a suburban town in New Jersey that Karrie described as homogeneous and predominantly White. Karrie passionately shared the awakening she experienced upon transferring to the new high school. She said:

> The difference in what subjects were offered, the difference in the building, the maintenance, what I had access to in New Jersey versus New York City, um, really angered me. Um, I felt like I didn't get a good enough education in New York City. So that I guess has fueled my passion for teaching this whole time. (Karrie, First Interview, April 2020)

She also attributed her passion for science to her experience as a science student in high school. She was intellectually stimulated by the vast array of courses offered and the science equipment available for the lab portion of the courses.

Karrie had a strong sense of who she is as an educator. Karrie valued patience, retrospection, and flexibility as an educator. She describes herself as an energetic teacher who is extremely passionate about science. She is hyper-aware of her identity as a female and Latinx and how those identities impact how she interacts with her students. For example, she purposely brings the Spanish language into the classroom when introducing science vocabulary. Karrie's goal as a science teacher was to build excitement in her students and encourage them to seek science opportunities outside of the classroom. She hopes that she fosters criticality and a desire to question. Karrie prioritizes kinesthetic activities and a variety of modalities to show understanding to prioritize her students' multiple intelligences.

When asked what it meant to be a science educator for social justice, she said that an educator for social justice is always "thinking of the students, families, situations that other people might overlook as injustices and bringing it to light and being their voice to enact change" (Karrie, Questionnaire, March 2020). Karrie emphasized the importance of her awareness of injustices in education and biases she may hold as means to prevent their continuation. For example, she shared:

> So, if I'm the one stopping a kid from learning because of any, you know, um, predispositions that I have about, you know, thinking stereotypically about them, I need to check myself. (Karrie, First Interview, April 2020)

She continued to say that is not a choice but part of her job as a socially just science teacher.

Responding

When asked about her experience teaching remotely thus far during the pandemic, Karrie shared that the past few weeks had been especially difficult for her because she is a “very private person” and was uncomfortable sharing her home through video with her students. Feeling uncomfortable and the new demands she faced as a teacher, led Karrie to feel overwhelmed. She shared her frustration for not having a solution for her discomfort and challenges.

In addition to feeling overwhelmed and uncomfortable, Karrie shared that she felt stifled as a creative educator. With the limitations of teaching remotely, Karrie felt she was limited in how she was able to engage her students. She said she was unable to provide kinesthetic learning experiences and was unable to foster curiosity about science in her students. Karrie believed that kinesthetic science learning and curiosity are core elements of science teaching and learning. She shared:

> The way that I would interact with students, and the way that I present information and material is so different [than before the Triple Pandemic]. Um, that is just sometimes I just question what I’m even doing anymore. It has really shaken me philosophically. (Karrie, Audio Journal, April 2020)

When asked to elaborate on the changes, Karrie shared that teaching had become procedural and “robotic”. The stifling environment of remote learning did not provide Karrie with the opportunity to adjust her practice in response to her students’ needs; there were no “real-time adjustments” of her practice to student learning. She shared that her teaching lacked any emotion, and the social nature of her role as a science teacher was eliminated. Rather than sparking curiosity in her students about science content, Karrie felt that she solely resolved her students’ issues using technology. What she was “proud of as a teacher” was gone and the impact she typically had on students had been diminished.

Karrie also described feelings of helplessness. She shared that her feelings originated from noticing "injustices and inequities" her students experienced at home and feeling unable to support them. For example, she shared she was not always able to determine which students struggled and the cause of their struggles. Karrie wondered:

> I don't know if it's a technology issue. I don't know if it's, you know, they're living in a shelter. I don't know if you know, uh, it's so noisy where they live by the railroad tracks that they can't concentrate. Like, so these are things that are kind of outside of my control. (Karrie, First Interview, April 2020)

During reflection, she noticed that students that struggled with science content in the traditional classroom setting continued to struggle during the period of remote learning. However, at the time, she was unable to support their learning as she had hoped. Hypothetically, if students and teachers were in the school building, Karrie shared she would provide technology and space to complete work. But at the time of remote learning, her students' struggles were outside of her "sphere of influence". Additionally, Karrie pointed out how the transition to remote learning disproportionately impacted immigrant families and students with disabilities due to the support needed to engage in science content and or executive function and organization.

In addition to the struggles her students experienced at home, Karrie shared her increased awareness of the inequities present in education brought to light by the COVID-19 pandemic. For example, she noted many of her students highlighted the "technology gap which had been overcome in school". She noted that districts across the country are handled gaps in technology differently depending on their school funding, thus further highlighting the unequal distribution of educational funds.

> Yeah. I think I'm just, you know, just the distance, um, is really impacting me a lot, just like the face-to-face, um, interactions. And, and for me, I'm just having a really hard time, like figuring out what they're getting from this whole process and thinking about it, maybe that's, what's really annoying me the most- felt annoyed because she isn't able to tell what is going on with the kid. (Karrie, First Interview, April 2020)

Adjusting

Karrie's emotions and mindset shifted dramatically throughout May. In mid-May, Karrie shared that she began to feel more secure and in "less shock". However, she noted "I'm still not in the right, I guess, headspace like I used to be" about herself before the onset of the pandemic. She strived to look for "pockets of joy" in her remote teaching.

She expressed that a major change in herself since April is that she tried out new strategies with her students and sought colleagues' advice. She had not sought growth opportunities as a professional because she had been in "survival mode" and had not felt empowered as an educator. She sadly acknowledged that this was a detriment to her students but felt powerless to change. Even now with her new initiative to adapt her practice, Karrie was bored and longed for the excitement of teaching. She noted that this new way of teaching was "too routine" and void of any surprise and excitement. The routine nature of learning conflicted with Karrie's views of what it means to be successful in STEM and to learn science:

> I feel like a lot of teaching, in general, is, um, kind of like just being very flexible and being able to roll with the punches. And I think part of being a good teacher is recognizing when the kids need something different, um, to understand. And I feel like that happens in that day-to-day interaction. And I see the faces and their faces are telling me that they're totally not getting it or they are getting it. Or you could see the entry, you

could see the curiosity in them. And here it's, it's kind of, they're left to their own devices, and they only reach out if they need, um, help, but it's not really to help them to understand, I help them just finish the task. (Karrie, Second Interview, May 2020)

Karrie continued to feel limited and emphasized the need to continue to "survive". As a result, her students seemed to be engaging less and completing fewer assignments as the spring semester progressed. She shared: "We're losing kids in that, and I feel like we're losing, uh, curiosity and we're losing, um, you know, enjoyment of learning". She wondered if in addition to the monotonous nature of remote learning if this loss could also be attributed to the difficulty in assessing student understanding. Karrie frequently struggled to grasp what her students obtained from each lesson and became increasingly annoyed with the difficulties she experienced. It appeared many students were particularly overwhelmed by the demands of learning science. Karrie hypothesized that it was due to the "layered nature" of science content and how ideas built upon one another. She worried if students missed a remote lesson that they would continue to struggle and become further disengaged.

As time passed, Karrie began increasingly to rely on her science department team members and that her teammates were "essential for survival". Although she relied on her team for support, she also felt marginalized and left out of the community at large. When I probed about the meaning of what it meant to be marginalized, she explained that she felt lonely and was missing informal opportunities to brainstorm and collaborate with her colleagues, not just her department team members. She shared that these small conversations were often sources of inspiration for her science instruction. Karrie clarified that she did not feel "targeted" or "picked on" it was rather just a feeling of being on the outside of education. She felt like she had been physically placed "in the margins".

I spoke with Karrie a second time during May; once before and once after the murder of George Floyd. Karrie agreed to speak with me a second time and shared how she was feeling as a science teacher. Karrie felt a major transition in herself over the past week. Karrie continued with her responsibilities as a science educator but began to offer space for her students and other students in the school community to unpack their emotions. Karrie felt renewed purpose.

Reflecting

Come June, Karrie reflected and was disappointed yet hopeful. Karrie attributed the disappointment in herself to her lack of preparedness and problem-solving while teaching science remotely. She felt that "everything went out the window" about her skill set and pedagogy. She felt constrained in her ability to provide opportunities for her students to learn science. For example, her practice was limited to videos and interactive websites that resulted in her students not truly being able to "experience science". Further, she felt that she was never able to create a "safe learning space". As a result, she felt "kids did not learn as much as they could" from her remote teaching.

She also experienced constant concern about her students' learning environments at their homes and survival needs. Constantly she pondered if her students had access to a quiet space, adult support, access to technology, and food. She felt like she was constantly "playing catch up" concerning her students' learning needs and access to technology. She yearned for proactive measures rather than reactive measures to address inequities of access to technology. Karrie also expressed concerns about her students' fears about the COVID-19 pandemic. She continued to emphasize survival for both her and her students. Yet, Karrie was also hopeful and intended to bring what she had learned into the next school year. She recalled how she and her team began to address the social needs of their students and emphasized the importance of pausing science content to offer social-emotional learning and support during any synchronous learning.

Personally, Karrie experienced extreme unhappiness stemming from her autonomy and creativity. Karrie felt trapped in a cycle of her "own survival" that severely inhibited her teaching. She also craved autonomy to make her own decisions about her students' learning in science. She hoped that the next academic year would regenerate and foster the joy she had lost.

Case Summaries

Charlie, Regina, and Karrie's experiences teaching throughout the spring of 2020 were fraught with intense emotion and adjustments to their teaching practice. After the initial transition to remote learning, Charlie, Regina, and Karrie responded to the new demands as science and mathematics teachers. The teachers grappled with the shock of the novel situation introduced by the COVID-19 pandemic. Their experiences evoked feelings of confusion and unease as they strove to make sense of the fluctuations in their expectations as teachers. The teachers began to experiment with new virtual learning platforms including Google Meets and Padlet and brainstorm new ways to engage with their students.

As time progressed, Charlie, Regina, and Karrie entered a period of survival. The novelty of remote learning had diminished, and the teachers continued to encounter new challenges reflective of the pressures and inequities the Triple Pandemic placed on students and their families. The teachers expressed intense emotions of sadness, worry, fear, and anxiety. Charlie, Regina, and Karrie struggled to enact their roles as science and mathematics teachers and make connections with students. Although experiencing shared struggles, the teachers voiced feelings of isolation and loneliness as they preserved as educators.

Come June, the school year began to wrap up in an untraditional way. This time was defined as a period of reflection and renewed hope and possibility. The teachers continued to notice the inequities of resources and access to learning experienced by their students. Charlie, Regina, and Karrie retrospectively examined the challenges and inequities they encountered at the beginning of the pandemic and began to identify their next steps as science and mathematics teachers throughout the semester. Their reflections began to question: What would teaching be like in a post-pandemic world?

Chapter V

FINDINGS

Research Question Two: In what ways did teaching remotely during the Triple Pandemic, develop, shift, and affirm science and mathematics teachers' identities? *(a)* In what ways did teachers' understandings of their identities change? (b) What tensions emerged in their identities as science and mathematics teachers?

Included in this chapter are themes that emerged from the cross-case analysis of Charlie, Regina, and Karrie's cases. As a result of the novel teaching experiences during the Triple Pandemic Charlie, Regina, and Karrie's identities developed. Through their experiences, different aspects of Karrie, Regina, and Charlie's identities as educators were both affirmed, challenged, and developed. How the teachers spoke about their identities as educators shifted throughout the spring semester. In this section of the findings, I present the dynamic nature of each teacher's identities as they persevered as science and mathematics teachers during an unprecedented and challenging time in education. The following themes are presented: racial identity awareness, from uncertain to confident science and mathematics identity, and marginalized and affirmed science and mathematics social justice educators.

Racial Identity Awareness

Self-identified as a White, female, and Jewish science teacher, Charlie experienced multiple shifts in her understanding of the facets of her identity. Throughout the spring, Charlie described an increase in awareness of her identity as a White woman. During her interview in May 2020, she stated that she had been "discovering a lot about myself as a person" and "my understanding of my white fragility" (DiAngelo, 2018). How she spoke about her identity as a science teacher began to center around her race. In May she shared: "I mean, I can't hide that

I'm White, you know, but like, I am very aware of it". In contrast, she initially shared in March 2020 that she did not believe her identity impacted interactions with her students, nor did it influence decisions made in the classroom.

The reflection about her race as a facet of her identity was prompted by moments of solitude brought on by the quarantine guidelines of the pandemic. Charlie spent many hours alone in her apartment where she had time to reflect on her experiences as a White Jewish woman in comparison to those of members of the Black, Indigenous, and people of color community (BIPOC). Charlie's conceptions of what it meant to be White and Jewish were challenged. While reflecting she shared:

> I wasn't like as aware (of race), I would compare stories of like my discrimination as a female or a Jewish female to the discrimination to that of people, um, of the BiPOC community encounter. Um, and I just realized how that kind of discredits their experience. (Charlie, Second Interview, May 2020)

Charlie's awareness developed even further as time progressed. In our third interview, Charlie passionately shared the importance of developing racial self-awareness. She said:

> You cannot solve the issues of racial inequality if you don't learn about a person's struggle if you don't learn about, you know, your role in society if you don't look at the laws that are developing around you. (Charlie, Third Interview, June 2020)

Although Charlie was eager to articulate how her thinking and understanding of her identity had shifted, she recognized that her journey and growth were not complete. To further her understanding of her race as a White woman, Charlie decided to join a book club with several of her White co-workers and friends reading *Myself and White Supremacy* (Saad, 2020). She shared: "I am trying my best to adjust my thinking and to make sure that I'm sensitive to others' experiences and like, I want to be educated".

Self-identifying as a Black female, Regina shifted how she viewed her identity as a Black mathematics teacher throughout the Spring of 2020. In April 2020, Regina shared her insights on how she believed her different identities appeared in the mathematics classrooms and relationships with her students. When discussing the presence of her identities in her teaching she shared:

> I feel like that's where my urban hip-hop identity probably plays more into it. And for me that proceeds race, because I do have some children who are not, you know, African American or Black who are all into like the urban and, you know, hip hop culture. (Regina, First Interview, April 2020)

She described herself as a "neutral teacher of color" meaning she did not verbally share her experiences as a Black female with members of her school community as an avoidance of talking about race. Although she described herself as neutral, Regina did acknowledge that her racial identity was different from many of her students; the difference in racial identity is why she felt she must remain a neutral figure in the mathematics classroom.

As events in the Spring of 2020 occurred, beginning with the killing of George Floyd, Regina's conceptions of her identity as a Black mathematics teacher were challenged. In the wake of George Floyd's murder and the peaceful and violent protests, Regina's school community provided a space for teachers to congregate virtually to reflect and share their emotions about what was happening in the immediate community and nation. Regina opted not to participate in or attend the virtual sessions. Her decision was made because she did not feel that she would be able to positively engage in the space. She shared:

> It's nothing about the admin or my colleagues. They don't have a part in that so to speak. It's just that I'm always conscious that I am the Black teacher at Kennedy Middle School and how is that information being perceived coming from me? (Regina, Second Interview, May 2020)

At this time, Regina was hyper-aware of her racial identity and how it influenced her engagement with colleagues in conversations about race and racism, Regina was one of four Black female teachers at Kennedy. She elaborated that: "I feel like one, the topic was too close for me to be neutral, which I think sometimes is the ask of teachers". She felt to remain neutral and objective she would need to withhold her own experience as a Black female and that she would be unable to do so. At this moment in reflection, Regina was at the crux of hyper-awareness and the pressure to remain neutral.

Throughout the spring, Regina continued to navigate the tension of the expression of racial identity and the pressure of neutrality. She continued to make sense of her identity and what it meant for her positioning in the classroom throughout the Spring of 2020 as the media continued to present information about police brutality, protests, and racism in BIPOC communities. As time progressed, Regina found that her understanding of her identity as a Black female mathematics teacher had shifted. For example, Regina shared how the "historical movement" had a profound impact on how she viewed herself as a mathematics educator. She shared:

> Because like this whole big historical movement that's happening around Black Lives Matter, I feel like, um, it's also equally important that I am a Black math teacher. Um, because I feel like those things almost feel like an anomaly like I'm Black, I'm female and a math teacher is like some kind of unicorn that people don't realize exists, but not

> something that I really had thought about prior to this. (Regina, Third Interview, June 2020)

Regina described a new centering and affirmation of her racial identity within her mathematics teacher identity. As one of two mathematics teachers of color at Kennedy, Regina no longer felt she needed to present herself as race-neutral while in her mathematics classroom.

Unlike Regina and Charlie, Karrie did not experience affirmations or challenges of her racial identity. Karrie expressed a high level of self-awareness of her identity as a Hispanic female during the first interview in April 2020. She also understood how her different identities impacted her positioning in the classroom. Karrie shared that she had a "heightened awareness of marginalized groups" in reference to her students that had "identities that were in the margins". She felt her identity enabled her to make connections over shared experiences growing up as a Hispanic female in New York City.

From Confident to Uncertain Science and Mathematics Identities

Charlie, Karrie, and Regina's identities as science and mathematics teachers were challenged throughout their teaching experiences during the Triple Pandemic. From the challenges, tensions emerged between their views of past and current selves as well as hopes for their desired selves. The tensions that emerged and the negotiations of their science and mathematics identities are presented in the following portion of the findings.

Charlie's identity as a science teacher conflicted with the enactment of her teacher identity while teaching remotely. As time progressed in the spring of 2020, Charlie began to feel "more insecure" as a science teacher. She expressed insecurities about the content, her remote pedagogy, and her effectiveness in supporting student learning. She yearned for encouragement and positive feedback from colleagues and students. She recognized her insecurities resulted from the novelty and challenges of remote learning.

Charlie was extremely emotional. She reflected and attempted to rationalize her emotions and feelings she had towards herself as a science teacher, she shared:

> Like I'm aware it's a process that will evolve, but it's very, very difficult to go from something for me personally, that I feel super confident about into feeling like I have no idea what's going on. (Charlie, Audio Journal, May 2020)

Charlie was no longer sure of who she was as a science teacher. Charlie needed to reconcile her former view of self as a confident science teacher and whom she was becoming because of new demands in remote science instruction and current events (killing of George Floyd, BLM protests, COVID-19, etc…).

As the school year ended, Charlie began to view her science teacher identity in a more positive light. She reflected on what she had overcome in terms of the challenges she experienced. She used expressions such as "I'm proud of myself" when she discussed the work, she had completed during the year to support her students' science learning. She reflected on her journey and identified the tensions she negotiated in her identity. She shared:

> I really struggled, in the beginning, to understand what my role was going to be or what I should do to supplement or provide support, and that made me feel like a terrible educator. (Charlie, Third Interview, June 2020)

She then elaborated: "And I don't know if that's just because it was uncomfortable and I'm discounting myself or if I just really didn't have certain things together". Although Charlie recognized and rationalized the tensions she experienced in her identity as a science teacher, she still referred to herself as an "uneducated" teacher of remote instruction. At the end of the school year, Charlie shared that she no longer felt that she had a strong sense of who she is as a science teacher. She was in the process of re-establishing her sense of self and what it means to be a science teacher in 2020.

Karrie, like Charlie, struggled to resolve tensions in her identity as a science teacher. From the initial onset of the transition to remote learning, Karrie struggled with identity tensions and making sense of her science teacher identity. On multiple occasions, Karrie expressed that she felt like "I'm no longer teaching". Tensions emerged in her identity around what it meant to be a science educator. She experienced conflicting views of her desired past self and current self during remote teaching. She shared:

> I feel like there are two parts of me now, you know, like they're, they're two different teachers right now. Um, today right now, uh, I am a remote teacher that is distant, um, that, um, I don't know, isn't very excitable. Mmm. And I was kind of dry, I would say for verses before. Um, I was more, um, you know, eager and excited and had more joy, I think in teaching versus now kind of not the same. And I'm trying to find pockets of joy, but I don't know. I think just with other things, just with the world going on and just like personal things, it's just like, you know, just psychologically clouding me. (Karrie, Second Interview, May 2020)

The misalignment of selves was also present in the enactment of Karrie's core values. The core values central to her science educator identity were not fulfilled during remote learning. She shared:

> You know, I feel like my value of inspiring and you know, being that pusher is gone and I don't know, like, I don't know if it's, I'm not trying things enough, but, um, the way it is now if I had to like name my role of what I do now, it's no longer science teacher. I

> feel like it's like a problem solver for tech issues. (Karrie, Second Interview, May 2020)

Karrie experienced a loss of self and her identity. Karrie desired to "get back to who I am as a science teacher" but felt paralyzed from the overwhelming pressure and stress she felt teaching remotely. Karrie's negative emotions amplified her sense of loss of self. She shared:

> I think there are things I could be doing to make it feel more like me, but I, I just, I don't have like the heart, um, or the passion to push through them because I feel so, um, I don't know, like, um, I'm stopped as a person, like as, as a teacher. (Karrie, Second Interview, May 2020)

Karrie's sense of self and her ability to negotiate the tensions in her identity was impacted by her negative emotions and prevented her from bringing her "old self back". Karrie shared that she oftentimes felt "depressed" and was no longer fulfilled by the teaching profession. She consistently expressed a desire to resolve the tensions with her identity but did not know how to do so. Yet, Karrie preserved. At the end of the school year, Karrie's mentality shifted. Through her challenges, she developed a stronger sense of whom she wanted to be as a science teacher. She explained:

> I just want to create happiness. I want to create curiosity. I want to create, um, I want to inspire people to learn more about, um, science. So, I feel like all those happy things are what, um, kind of create my identity as a science teacher, but also like, you know, trying to risk having kids take risks academically… I need to go back to whom I am as a science teacher, despite being on this remote virtual spot, because it's not going to change any time for me, for us. So, I have to find a way, um, to go back to it. (Karrie, Third Interview, May 2020)

Karrie recognized the repercussions of her struggle of resolving tensions in her identity. She then shared: “If I take away anything that negative experience is what I’m learning from, um, that I don’t want it to happen again, that I didn’t like myself in it.” Navigating through the Triple Pandemic provided Karrie with a renewed sense of purpose as a science teacher. She ultimately shared that she had a more concrete understanding of who she is as a science teacher and was motivated to ensure her identity was enacted in the upcoming academic school year.

Aspects of Regina’s identity as a mathematics teacher were both affirmed and challenged by her teaching experiences during the Triple Pandemic. While teaching remotely, Regina began to view herself as a facilitator of learning or a coach. She said she did not feel like a teacher per se because she was not in front of children delivering instruction. Rather, she was behind the scenes creating opportunities for her students to independently engage with mathematics content. The role Regina had grown accustomed to had shifted. Although different, Regina remained open to the new possibilities of enacting a different role. For example, Regina was excited that she no longer viewed herself as a “warden”. While away from the classroom, Regina no longer had to worry about managing student behavior and being a “warden” to manage the behavior of students. Now in the remote environment, Regina only needed to focus on how she was creating access to mathematics content. In her new identity as a facilitator, Regina remained open to the benefits of the different roles and expanded her view of what it means to be a mathematics teacher.

Additionally, her experiences forced her to embrace her prior view of self as a “risk taker”. In novel situations, Regina constantly tried new approaches to help her students engage with the mathematics content. She reflected on how her perception shifted:

> This experience highlighted who I am, um, and you know, trying to be innovative and thoughtful about my practices. I think that I thought I was thinking out of the box until I

> had to do this, and I was really thinking outside of the box. It (remote learning) forces you to be like when you think you've got it, could think a little more. You know, this whole idea that it's, it's always changing, and the goal is always changing. Um, but I think that is part of the reason why I keep teaching. (Regina, Third Interview, June 2020)

Regina is unique in that her mathematics teacher identity was both affirmed and challenged during the pandemic. Although tensions arose between expectations in her current context and past experiences, Regina expanded her understanding of what it could mean to teach math. However, she still struggled to make sense of her identity as a mathematics teacher within the context of remote learning. She grappled with and tried to reconcile her view of self before the pandemic and her new view of self as a mathematics teacher.

Marginalized and Affirmed Socially Just Science and Mathematics Teachers

In March and April of 2020, Charlie, Regina, and Karrie expressed their identifications as socially just mathematics and science educators before the pandemic. On the initial questionnaire (March 2020), Charlie and Kerrie strongly identified as socially just science teachers and indicated that they strongly agreed that it was important to act for social justice. Regina identified with the concept of social justice but felt that she struggled to teach mathematics in socially just ways. Throughout the spring, the teachers were confronted with both challenges and affirmations of their identities as agents acting for social justice in their communities.

A key aspect of a socially just teacher identity is the agency to empower students, reflect on issues of power and injustice, and act against oppression (Rivera Maulucci, 2013). During the spring of 2020, Regina and Karrie identified times when they lacked agency and were unable to foster empowering environments for their students. For example, Regina and Karrie both used the term "marginalized" to describe themselves as teachers. Karrie and Regina both defined marginalized as lacking voice and autonomy as a science or mathematics educator. However, the structures limiting their voice and autonomy differed. Karrie felt what she described as marginalized when she did not have any control over how her students were able to engage in science learning. She felt that without autonomy over her science teaching she had “lost that impact” on students, “I felt like I had no voice”, she exclaimed. Without voice and autonomy in her teaching, Karrie was unable to make decisions for her students that created equitable and empowering learning experiences in the classroom.

Like Karrie, Regina also described herself as marginalized. During remote learning, Regina shared that she often “walk(ed) on eggshells at Kennedy in terms of what I teach” as a result she said she often just “just goes with the flow” rather than voicing her opinion or diverging from set curriculum and practice. For example, she felt she could not encourage students to question injustices present in their community and mathematics education. When pressed, she explained:

> But sometimes as a teacher, I feel marginalized. So, at Kennedy, sometimes I am not comfortable going on the fly, teaching something I feel is important and not necessarily because of the admin. Sometimes, probably 90% of the time, it’s more like how my students will receive this from me as the Black teacher at Kennedy and what backlash will come from parents who have a different idea. (Regina, First Interview, April 2020)

Regina experienced tension between her desired self and present self. To critically examine power structures and support her students in questioning she would need to escape the shroud of neutrality. In the context of the killing of George Floyd, she shared:

> Teachers I think are often asked to take a very neutral stand and not to influence children’s thoughts one way or the other. And I don’t know if I’m, I could do that in this

> situation. I know. I don’t know that I could just be neutral. (Regina, Second Interview, May 2020)

By attempting to remain a sense of neutrality, Regina was silenced and felt unempowered to make a change in her classroom and school community.

In contrast, Charlie experienced an increase in agency throughout the spring. Charlie felt both emboldened to unpack her white privilege with her students and to identify responsibilities that she felt arose from that privilege. Charlie’s agency emerged in the spring of 2020. Charlie connected her increasing awareness of her racial identity, to her agency, and her development as a socially just science teacher. As she understood more about her race and the impact it had on her experiences in education, she felt that her identity as a socially just science teacher was affirmed. She identified the experience of attending a BLM protest in her neighborhood as a transformative experience for her. While attending a BLM protest, Charlie heard the phrase “White silence is violence”. She pondered the meaning of the phrase and how it related to her. Her reflection resulted in a new understanding of the power of her voice. She explained her realization:

> Until now, I didn’t necessarily know that I would have understood that phrase or that I would have agreed with it, or really knew the effects of like my voice and like how I have just the ability to say certain things. Um, maybe that, some people don’t have the ability to. (Charlie, Second Interview, May 2020)

She felt it was extremely important for her to use her voice in her school community and within her neighborhood community. For example, Charlie noticed she felt comfortable sharing more about her identity with her students. About conversations with her students, she shared:

> It was kind of weird, but like I kind of spoke about my white privilege, and like, that’s

> something that I've never really also shared with students and like what that means to me and how I feel like it shapes, you know, certain things and like what my responsibilities are. (Charlie, Second Interview, May 2020)

She hoped that she would be a model for her students with whom she shared facets of her identity to unpack their privilege and recognize racial injustices in society.

Over time, Charlie developed a strong belief that schools reproduce social inequities and it was part of her responsibility in her position as a science teacher to counteract and work against the sources of injustice. About acting for social justice in her school community, she shared:

> I don't want to talk about this anymore. Like, I don't want to talk about this issue anymore. I don't want to talk about what biases are like. I want to talk, like, I want to talk about any of this. Like at this point, like I want to know what I should be doing in order to help the cause. Like, I don't want to identify the issue anymore. There's nothing left to identify my opinion. (Charlie, Third Interview, June 2020)

Charlie was ready to act within her sphere of influence.

Like Charlie, Karrie also held a strong belief in schools perpetuating social inequities. Although Karrie reported initially feeling marginalized, Karrie experienced a drastic shift. Karrie's identity as an educator for social justice was reinvigorated by the intense emotions she experienced after grappling with "societal issues" which resulted in the regaining of her sense of agency. She explained:

> I feel more empowered now than I did the last time we spoke, and I think it's because of these societal issues that I have such strong feelings about, that I finally feel like I have a voice in it and that I feel like that there's something I can do about it versus just in the

remote-learning world, in the science world. (Karrie, Second Interview, May 2020)

She further explained:

> I feel empowered because I have confidence in my ability to share my concerns with others. So that makes me feel good. I don't feel good about what's happening in the world or anything, but I feel good in my ... we keep saying as a group, "our sphere of influence." I'm relying on my sphere of influence and my decision to influence my sphere; it makes me feel good about where I am right now. And it's not necessarily teaching, right? It's not science teaching. It's more social justice and equity lens that I'm working on right now, but it's helping me view how we need to take this social injustice and this equity talk towards next year and science. (Karrie, Second Interview, May 2020)

Karrie siloed her identity as a social justice educator from her identity as a science teacher. As a result, she regained agency not through her science teaching where she had felt marginalized but through her beliefs about her role in her community as an agent of social justice. However, she expressed the importance and desire to unite her teaching identities through the enactment of socially just science teaching practices in the classroom. She shared:

> I mean, our role is one of privilege, I think. I think we're privileged with the fact that we reach so many kids daily, that our subject matter can be interesting to kids. The natural curiosity of science is something that we could leverage, and we need to do a better job of opening our own eyes as science educators to the world of these injustices that are happening and make them relevant to our content area. (Karrie, Third Interview, June 2020)

Summary

The findings presented in this chapter highlight how teaching experiences during the Triple Pandemic develop, shift, and affirm the identities of three science and mathematics teachers. Charlie and Regina both conveyed an increase in awareness of their racial identities as White science and Black mathematics teachers respectively. While there was an increase in awareness of their racial identity, the three teachers found that their identities as science and mathematics content teachers were challenged. Veteran teachers, who once described themselves as having a strong sense of who they were as science and mathematics teachers, found themselves in a state of flux, grappling with new conceptions of what it means to be an effective science or mathematics.

Chapter VI

FINDINGS

Research Question Three: In what ways does sensemaking during the Triple Pandemic shape the priorities of science and mathematics teachers?

Included in this chapter are themes that emerged from the cross-case analysis of Charlie, Regina, and Karrie's cases. As the teachers continued to fulfill their roles as science and mathematics teachers, their priorities as educators began to shift. From mid-March to the end of June, the teachers engaged with their students remotely either in their science or mathematics class or in an advisory. At the beginning of the school year (before the pandemic) some teachers were assigned an advisory class twice a week. During remote learning, some advisory teachers continued to schedule times for students in their advisories to meet in a virtual space. Both Charlie and Regina scheduled regular advisory meetings, but Karrie was not assigned an advisory.

As Charlie, Regina, and Karrie made sense of their experiences teaching remotely during the Triple Pandemic the teachers began to recognize and acknowledge how their priorities both inside and outside of the classroom (virtual or physical) spaces were evolving. In this section, I present their new priorities as science and mathematics teachers. The following three themes are presented*: Centering Student Relationships, Rethinking Classroom Priorities, and Beyond the Classroom: Community Engagement.*

Centering Student Relationships

Building and Maintaining Relationships

Throughout my interviews and focus group discussion with Charlie, Regina, and Karrie, the importance of fostering and maintaining relationships with students in their science and mathematics classrooms was discussed along with the challenges presented by remote learning. Charlie, Regina, and Regina all felt that remote learning created distance in their relationships with most students. Yet, it simultaneously strengthened bonds with others. All mentioned the connection between fostering relationships and academic performance in their respective science and mathematics courses.

During an interview, Charlie explained that she felt she was building a “different rapport” with students who were in her advisory and science class in comparison to those who were just her science students. “I felt close to them” she shared. She attributed the closeness to students in her advisory because she felt she was learning more about herself during the conversations she had with those students in Zoom and Google Meet sessions. “Obviously the connection is going to be stronger,” Charlie shared. Thinking towards the future, Charlie hoped to build stronger relationships with students in her science class that mirrored those relationships she formed with her students in the advisory. Although Charlie was an advisory teacher during in-person learning before the pandemic, she did not feel the magnitude of the strength of the relationship with those students until they were engaging in remote learning in the spring of 2020. The challenges faced by students and teachers alike created new student-teacher bonds.

Unlike Charlie, Karrie was not assigned an advisory class she was responsible. However, she felt a strengthening of relationships with students with whom she engaged in social-emotional learning rather than “just science”. She explained that she began to exchange synchronous science learning time for time spent conducting emotional check-ins with smaller groups of students, shifting her priorities as a science educator. Her synchronous opportunities to check in were optional but felt their power and importance for strengthening her relationships with students. She wondered how she could integrate social-emotional learning and check-ins into her science teaching to continue to foster relationship-building even after her physical return to the classroom. She also pondered how she could extend the magnitude of her reach beyond that of just a handful of students who opted into synchronous time with her.

Like Charlie and Karrie, Regina emphasized the importance of building relationships and the increasing importance of relationships during times of crisis, like the COVID-19 pandemic. She explained that she realized how "relationships must proceed all teaching", like Karrie, demonstrating shifting priorities as a mathematics teacher. Regina, a mother of two children, shared that she felt like she was now a mother to all her students more so than she was before the pandemic. Like Charlie and Karrie, she felt some relationships had strengthened while others disappeared. Although Regina had an advisory class, she did not feel that her relationship was strengthened with those students. The strengthening of some relationships developed out of concern for students' well-being. Regina intentionally fostered relationships with students with whom she worried about their safety and access to resources. Regina also noted that she felt she had a deeper relationship with many of her students of color. Like Charlie, Regina also attributed the strengthening of relationships to the accessibility of new technologies such as Google Voice. Her Google Voice number allowed her to call and text students easily, especially those whom she had grave concerns about because of their home contexts during the pandemic. She shared her experience with one of her students when reaching out about concerns around his remote attendance:

> I called his cell phone and I think he was shocked that Ms. Regina called my phone, like, and his initial shock was to hang up, but he called me back. Because I feel like we have, I have well enough relationship where he realized like, damn I shouldn't have just like hung up on her. Let me call her back and make amends so to speak. (Regina, Third

Interview, June 2020)

Regina viewed these newfound relationships as silver linings of a difficult time in her teaching career.

All three teachers acknowledged that building relationships were not equally easy for all students. Charlie noted the importance she placed on building relationships with her students of color as a White educator as well as the impact that the Triple Pandemic had on those relationships. She shared that before the pandemic:

> I work extremely, extremely hard with my students of color who come into my classroom with preconceived notions about who I am and what type of person I'm going to be in their life before they even know me…. (Charlie, Second interview, May 2020)

Now, with the lack of physical proximity created by remote learning and the emotions emerging from the highlighting of racial injustices and White supremacy in the media, Charlie became even more concerned about the relationships she purposefully cultivated. She shared:

> But it is frustrating for me to know that I want to do the best job that I could possibly do for those students. And it's frustrating to have to work through so many months of building rapport to show them that like, um, I'm not going to be that stereotypical [White] person for them…. And it's just like every year I feel like I must work harder and harder to bond with students of color and I'm not blaming them at all, and I'll work that hard. But every year I must work harder because of dumb shit that's happening in this society. (Second interview, Charlie, May 2020)

Like Karrie, Regina wondered about the nature of the relationships she should develop with her students in post-pandemic school years once teachers and students return to the physical school building. Uniquely, Karrie specifically considered the power of building and fostering relationships with the families of her students. By building relationships with families, they are incorporated into the school community. Karrie expressed that families "are very far away" and siloed off as outsiders to the school community. She wondered why relationships between teachers and students' families are not prioritized as they are also stakeholders in the education of their children.

Is this trust?

Teaching remotely tested the nature of relationships between students and teachers. Charlie, Regina, and Karrie all spoke about the personal aspects of remote learning and the vulnerability they inevitably showed their students. As a result, the importance of trust in the relationship between teacher and student in the classroom became glaringly important for Charlie, Regina, and Karrie. During our focus group discussion, Karrie, Regina, and Charlie all reflected on the meaning of trust and how it might manifest in both the physical and remote classroom. Through their conversation, the idea of "perceived trust" versus "authentic trust" emerged. The teachers wondered if this idea of perceived trust could explain perhaps the difficulties they experienced while attempting to contact students and their families during remote learning. Regina shared:

> Something that I was thinking about is like before the pandemic, we had this whole idea of perceived trust. Like, oh, I looked at the kids' faces. I feel like they trust me. They talked to me, but then I think that the remote situation revealed actual trust because these kids weren't receptive to us reaching out. They weren't responding to our emails or calls or for assistance. And so, it's this whole idea. And I think it made me and the teachers very uncomfortable because what we did was, we felt we had trust because we created the classrooms and we had these conversations and lah lah lah, and I think we've checked

> ourselves into believing that what we were doing works, so to speak, like I did all these things and I have established trust. (Regina, Focus group, July 2020)

She wondered if students viewed her outreach as sincere and reflective of a trusting relationship between teacher and student. She continued to explain how the context of remote learning highlighted gaps in teacher and student relationships. She hypothesized that:

> I think that the remote learning situation revealed that maybe it wasn't on the level that we thought it had been. Because I do think that if there was real authentic trust for all of us, we would not have gotten the disengagement at the level that we have. (Regina, Focus Group, July 2020)

Both Karrie and Charlie agreed with the sentiments Regina shared. Karrie added the importance of trust as bi-dimensional. Just as educators hope their students trust them, educators must also trust their students to foster a safe learning environment. Similarly, Charlie noted that for both teachers and students, an element of authentic trust in their relationship in the classroom will ultimately lead to vulnerability for students in moments when they are nervous about science or mathematics learning. Charlie identified that if trust is missing in a relationship during remote learning, then "they(students) don't feel comfortable coming to you, and they are withdrawing and shutting down".

Regina and Charlie specifically wondered if certain groups of students struggled to develop authentic trust with teachers. Regina saw the pandemic as informative, highlighting not only gaps in access but gaps in trust. Regina shared:

> I think the pandemic revealed, I think the problem with public education and who's marginalized and because you're right, those kids who were not engaged were all our marginalized kids. I think it has a lot to do with how they view teachers, how they view

> the importance of what we're teaching. (Regina, Focus group, July 2020)

When prompted further, Regina described "marginalized kids" as students of color and those from families who struggled socioeconomically. Similarly, during an interview, Charlie shared that recent reflection on current events played a critical role in the strength of trust in relationships with her students. She shared:

> I don't blame students of color who look at me and question whether or not I'm going to do right by them… Like if I was a student of color and I walked in and looked at my lineup of teachers and they were all white people, I would have the same feelings and I would have the same thoughts. (Charlie, Second Interview, 2020)

Charlie then shared, "it's my responsibility to get them to trust me". To teach science successfully, Charlie believed she must "provide an environment where students feel comfortable to be themselves and engage with learning" centering trusting relationships within the classroom community.

Karrie and Charlie both expressed extreme concerns for what building trust might look like for future students if remote learning continued into the next academic school year, recognizing that building trusting relationships can be a difficult aspect of teaching. Karrie emphasized the importance of in-person interactions to humanize both teachers and students to develop trust. She shared, "I feel like, you know, just being a human face-to-face is where you build that trust".

Uniquely, Karrie spoke about the importance of developing trust with students' families. Many of Karrie's students lacked access to working technology and the internet throughout much of the spring of 2020. She wondered if students remained without technology due to a lack of trust between the family and the school. She wondered if families didn't trust the school would they be transparent when sharing with the school their technology needs for at-home learning? Karrie reflected on her experience as a first-generation American and shared:

> We ask families to define who they are and define their circumstances. I think of my dad and my dad is so prideful. He would never admit to anything. He would never admit to needing help, never admit to not being able to handle things. Just never admit it. So, a person like my dad would never confess to needing it. He wouldn't even acknowledge the question being asked to him. And I wonder what we can do to just make that easier, to make it where it's not a confession and I'm not seeking you out on that. It's just what can we do to make that easier for families? And it has to do with what you all were talking about like trust. I don't think there's trust. I don't think there is. And the thing is, have we been given the opportunity for them to trust us as a school? Not only as teachers, but they also feel like sometimes we try as teachers to build that trust within our students. (Karrie, Third Interview, June 2020)

Karrie realized that she needed to develop trusting relationships with students and families to maximize student learning in her remote classroom.

Reevaluating Classroom Priorities

Reimagining Curriculum and Teaching

Considering recent teaching experiences in the virtual mathematics and science classroom, Regina, Karrie, and Charlie evaluated their curriculum priorities and began to identify ways they hoped to modify their curriculum in the coming school year. Both Charlie and Karrie spoke about integrating student identity into their science curriculum. Charlie reflected upon the role of gender and the sciences and drew upon her experience as a science student to emphasize the importance of seeing oneself in the curriculum. Charlie shared:

> I love the idea of being able to have students identify with themselves in our curriculum in science. I'm a girl. I literally grew up believing I'm going to be bad at math and science because I'm a girl. I'm a history person. I naturally actually excelled at history and English. So, it reinforced that idea, but I don't think that's the truth. And I think students are often led to believe that if something there is they're not successful with, they're not necessarily going to be good at it, but maybe it's just challenging for them. (Charlie, Third Interview, June 2020)

Similarly, Karrie focused on the elevating voices of those "in the margins" of the school experience by making explicit connections to science content. Karrie noted how she had made efforts before the pandemic to integrate voices into the curriculum but did not feel like she had done enough, nor did she feel that her curriculum offered sufficient resources to support the integration. Karrie strongly felt she was responsible for more than just teaching science. She brainstormed and shared ways in which elevated her students' voices:

> But if we're talking about climate change, trying to find activists in this field, kind of what we did with our heritage months of finding people who are Black scientists, but not only leaving it to that one part. It should be part of our daily lessons. Hey, if I'm teaching you about DNA, if I'm teaching about chemistry, is there some facts, some person, something that I could include to expose our students to things that maybe they don't know about? (Karrie, Third Interview, June 2020)

Karrie acknowledged her past attempts had been isolated and has set new goals for integration in the coming academic school year. Like Karrie, Charlie developed specific examples of science content that she hoped would connect to student identity. For example, for the topic of energy, she wondered if she could highlight scientists who made advancements in the study of energy and "encourage students to be curious about people and further research". Highlighting student identity emerged as a new priority as students struggled to engage with remote learning. The teachers' wondered how integrating student identity would encourage more active participation.

In addition to the content covered in the curriculum Karrie and Charlie shared adjustments to their daily teaching practice as science teachers. Karrie emphasized her priority in the science classroom of providing space for student voices and to "give them a seat at the table because they are the ones experiencing this" and student choice. Karrie wondered, "that seems natural to me to do. And I don't understand why there's a block. So, for me right now, that's my focus". She spoke about intentionally creating space in classrooms for students to share their opinions on science learning. Karrie brainstormed:

> Um, you know, so like for example, in this geology unit, right, so if kids want to, you know, focus on a specific, um, you know, area of the earth that has a divergent boundary, or I don't know if it's like independent study opportunities, which I think could be great for this, you know, cause if we set like some parameters of, okay, you have to come up with these vocabulary words and give us examples of, and you have this time to complete that. (Karrie, Third Interview, June 2020)

Karrie shared that her idea would create space for student voice and foster autonomy for students to pursue their unique avenues of study within science. She also felt that student choice would address the inequity of access. Reflecting on her experience teaching remotely, she noticed that students' technology did not always allow them to access a particular learning platform or website. As a remedy, Karrie offered options. Why could this practice not continue in physical classroom spaces?

Charlie discussed teacher-oriented priorities. She felt that at this moment in education, more so than in the past, her priorities must focus on advocating for students and helping students develop self-esteem and with that, a love of learning. She intended to do so by focusing on building rapport, being mindful of personal situations, and "adjusting myself to best support" the students in front of her in the science classroom.

In contrast, Regina struggled to develop ways in which she might modify her mathematics curriculum. Initially (in April), when discussing the teaching of mathematics with social justice orientations, Regina was somewhat resistant. She said she believed in social justice movements and their importance but did not know how to enact practices in her classroom. Her hesitation came from past experiences that she felt "scratched the surface" and were "really cheesy". She was reflective on her practice and shared:

> That's something that I've struggled with, you know, especially with the whole idea that you know, equity of voices and perspective and I'm like, hey, they just don't come into play when you're teaching algebra. Like I don't know how to meld the two. (Regina, First Interview, April 2020)

Regina shared her fear of teaching in a way that was "tokenistic". However, as time progressed Regina's outlook shifted. In June she shared (about cultural relevance and social justice in the mathematics classroom):

> I do feel responsible for making it a part of my curriculum and I guess that's the part that has me torn. I don't know how to do that with fidelity, without it just feeling weird and off-topic and something separate, I don't know. (Regina, Third Interview, June 2020)

Although unsure, Regina was determined to move forward to embrace the challenge. She noted her experience teaching remotely shifted her understanding of what portions of mathematics lessons needed to take place synchronously in person and what could be done at home. Her new perspective would provide her with more space in her classroom to take risks. She shared her new perspective:

> You know, you want to think that you could do all these grand things and tackle equity and do these projects, but there's never any time. Like if the assignment is to do this online for homework, then I've knocked out a good chunk of classroom time. Then what opportunities does that provide for me to go deeper and wider in my instruction? (Regina, Third Interview, June 2020)

With new priorities, came agency to adjust practices in the classroom.

Engaging in Critical Conversations

Karrie, Charlie, and Regina all discussed the priority of engaging in critical conversations with their students that were not directly related to the science and mathematics curriculum. As defined by Schieble et al. (2020) critical conversations are "conversations that focus on building knowledge about power, privilege, and oppression" (p.3-4). Like the definition, participants referenced conversations around equity, civil rights, racism, and other forms of discrimination and injustice. Prioritizing critical conversations came to the forefront after the killing of George Floyd by police and the protests that followed.

For Karrie, she felt that she was recentering one of her foundational priorities as an educator that she had lost sight of during the transition to remote learning. Karrie felt it was her role to engage both her students and colleagues in critical conversations. Karrie reflected on the past few months of remote teaching and noted she stayed within the boundaries of her science curriculum as a means of survival during a trying time in education. She shared that she neglected some of her priorities as an educator. About her challenges, she shared:

> That's where I feel like I definitely changed my priorities and what I thought was important, what I thought I should deal with first. And then for me, it just shows me how going into September, how my role has to be different. I can't opt out because it's not right for me to be able to opt-out when that means negative outcomes for students. (Karrie, Third Interview, June 2020)

She was committed to engaging both her students and colleagues in conversations around issues of equity and justice. She strove to merge her critical conversations and social issues with her science teaching. Karrie began to outline action-oriented steps she intended to take in the coming school year with her students and colleagues.

In contrast, Charlie and Regina began to identify the act of engaging in critical conversations with students as a new priority resulting from their experiences over the past few months. Although recognizing the importance and power of conversation, Regina and Charlie both expressed discomfort and fear. During the interview in June, Charlie shared feeling ill-equipped and nervous to do so. She said:

> I get nervous. Like I don't ever want to say the wrong thing or, you know, like to have the conversation just not, I just, I guess, like not to be confident, like a facilitator of the conversation. I see the need, but I definitely don't always lean into the discomfort that I have about having to facilitate the conversation. Because I don't really feel fully equipped. (Charlie, Second interview, May 2020)

Charlie then shared that she was continuing to grow and hoped that she could share that sentiment with her students. She also expressed the desire to move out of her comfort zone.

Regina, like Charlie, identified the importance of having critical conversations about current events with students. However, she also expressed hesitancy that was caused by her identity and positioning to her students. Regina also questioned, when necessary, how to best bring up sensitive topics. She noted that she could "provide space if something happens" but then noted that she was "relying on an incident before it becomes important".

Regina believed students should have space to discuss and unpack sensitive topics, but she wondered about her role as the teacher to engage the students in conversation:

> Like, how do you facilitate that? It's the piece that I always struggled with. I don't mind investing the time for kids to unpack and think about this, but how much of what I say matters compared to how much of what their parents say matters. And is it just running a race that I could never win because a lot of their beliefs and understandings are rooted in their upbringing, in their family relationships. As a school community, maybe we can provide a space and a time um, a space for them to unpack it. But then like, if what we're saying is undone by parents' behavior and activities and their own personal thoughts. What I say as a teacher who likes, I'm only in their life at this span of time, it doesn't matter. (Regina, Second interview, May 2020)

When opportunities did arise where Regina was the adult facilitating the conversation, she described her approach as "careful". In June, Regina reflected more upon the root of her hesitancy. She shifted from identifying the parents as her discomfort to reflecting upon her identity as a Black teacher. She then elaborated:

> I feel like certain topics coming from me, it's not going to be well received. So, although, there's a little bit of, I guess, power taken in that sense that I don't feel comfortable addressing certain things with children, um, or having certain topics discussed. And, I guess in a real way, and not some like, I don't know, surface conversation, check the box. (Regina, Third Interview, June 2020)

She then shared:

> So, I avoid those kinds of conversations at times, which is why I hate advisory because I also feel like advisory forces this conversation that I am not always comfortable having in the room because, in some of my classes, I am the only Black person in the room. (Regina, Third Interview, June 2020)

She also wondered if she would feel different in another school setting with different community demographics.

Beyond the Classroom: Community Engagement

As the spring progressed, Charlie, Karrie, and Regina found their priorities as educators expanding beyond the confines of their science and mathematics classrooms. All three teachers felt it was their responsibility to engage with their community as activists and advocates for their students and community against systemic injustice. For example, Karrie's understanding of what it meant to be a socially just science educator had changed. She said: "I feel like what it means to be an educator for social justice nowadays has become much bigger than just what I do in the classroom". Karrie shared reflections on growth and understanding of what it means to be socially just a science educator. She shared her views on her responsibility to the school community: "I feel like I've just grown outside of the classroom and really trying to make an impact on our school, school community." She then elaborated:

> So for me right now, I feel like my hat that I'm wearing the most is the social justice, um, for the school, like for the school community, and trying to talk to an admin about hearing more school, um, student voice and including students on decisions and, and all of the data that we've had from our conversations with students, uh, around, you know, George Floyd and all this stuff, any kid that's left a comment, I'm collecting it and kind

> of separating it to present, to admin, with ideas of what they want. (Karrie, Third Interview, June 2020)

Karrie strove to highlight the voices of those in her community. Her reflections show an integration of her work in the classroom as a science educator and the impact of her work with teachers in her school community.

Regina extended her influence outside of her current school community. Over the years, Regina had grown a large professional community of educators on social media platforms. Some were former colleagues and other members of teacher affinity groups. Regina noticed that her acquaintances were posting comments that were culturally insensitive and reflected the deficit perspective of students of color. Regina began to address the comments made by the other teachers. She felt a responsibility for the students to speak on their behalf. About the teacher posting deficit comments on social media, she shared:

> And I just, I just feel so bad for any student of color that must, to any student, as a matter of fact, that has to go through her classroom because I think they're getting a clear message about who matters and what matters, whether she's trying to do that or not. (Regina, Third Interview, June 2020)

Regina's care and concern for her students extended beyond the confines of her mathematics classroom and school community. She recognized that the students in the post were not her students, but she believed as a teacher it was her responsibility to stand up for those students as she hoped another would do for her students.

Charlie also expanded her engagement in social justice. Uniquely, Charlie's expansion centered around engagement at a neighborhood and systemic level. The inequities her students faced around access to technology, the internet, and a safe environment to complete schoolwork prompted her reflection and identification of systemic inequities perpetuated by the school system. She felt a personal connection to the inequities her students experienced. She said, "I know part of the problem because I'm living it. I'm seeing it." Charlie focused on identifying problems to be solved, sharing:

> So, I think like that and itself, along with like my evolution kind of made me look at the system and be like, wow, this system is further like not really serving like specific groups of kids. And like it's not just an education problem. It's like an issue within our whole society. (Charlie, Audio Journal, May 2020)

She furthered her thinking:

> It's like everything is very connected. Like much larger issues. It's not like an educational change. Yeah. There are probably some things in education that need to be reformed. But like, when I look at this problem, I'm like, this is not like an equity problem within education. This is an equity problem. And like access to, to anything, like these families don't even have access to childcare. (Charlie, Audio Journal, May 2020)

Charlie attributed her thinking and new awareness to the plight of many students and families during the shift to remote learning. She was dumbfounded by the harsh conditions her students experienced. Charlie began to think about what she could do to prompt systemic change. She mentioned becoming an "ally" and an "advocate".

Summary

This chapter presented how sensemaking during the Triple Pandemic shifted the priorities of science and mathematics teachers. While teaching remotely, Charlie, Regina, and Karrie noticed the breadth of inequities their students experienced. From these observations, the teachers gained insight into the context of the lives of their students during the Triple Pandemic.

In response to their observations, emotions, and experiences teaching, the teachers evaluated their priorities as educators both inside and outside of classroom spaces. The findings show a new emphasis on building, maintaining, and developing trusting relationships between teacher and student. Charlie, Regina, and Karrie also expressed the importance of re-examining their science and mathematics curriculum and teaching approaches to ensure the highlighting of student identity and voice and the importance of engaging in conversation with their students around issues of oppression, power, and privilege. Findings also demonstrated a desire to engage in social justice work outside of the classroom space in conjunction with their role as science and mathematics educators.

Chapter VII

DISCUSSION

As teachers' experiences are discussed, different elements of the conceptual frameworks for this study are utilized to address aspects of Charlie, Regina, and Karrie's experience. Ultimately, the discussion and frameworks are synthesized in the culmination of the major findings of this study. In the proceeding section, each research question is discussed.

Research Question One

What are the lived experiences of three middle school science and mathematics teachers during the Triple Pandemic? (a) How did these science and mathematics teachers change their teaching practice? (b) What conflicts and challenges emerged for these three science and mathematics teachers? (c) What emotions did they experience?

Sensemaking of Teaching During the Triple Pandemic

The increasing infection rate of the COVID-19 virus was the impetus for the transition to remote learning around the globe. Teachers, without any preparation, transitioned their in-person science and mathematics classes to an online format. Remote learning, coupled with societal attest erupting in response to the brutal killing of George Floyd by police officers, highlighted pre-existing systemic inequities of poverty and racism in the teachers' daily experiences with their students. As a result, teachers began the process of making sense of the "ecological change" or a change in an unfamiliar situation manifested by the Triple Pandemic (Weick, 1995). The act of sensemaking occurred because the setting and expectations of science and mathematics teachers differed foundationally from prior understandings, beliefs, and knowledge of teaching science and mathematics (Weick, 1995). Teachers engaged in sensemaking by extracting cues from the environment reflective of the Triple Pandemic, followed by the process of interpreting and responding to them. Each strand of the Triple Pandemic (COVID-19, racism, and poverty) was fraught with change and challenge that fundamentally and uniquely impacted Charlie, Regina, and Karrie as science and mathematics teachers.

Sensemaking in Remote Teaching Transitions

The transition to remote learning presented the teachers with a novel situation of teaching virtually where they did not have a framework to understand the situation in its entirety (Weick, 1995). Charlie, Regina, and Karrie had never taught science and mathematics from their homes through different online platforms nor was it a selected by choice. The teachers were teaching from their homes in response to a crisis with the implementation of crisis pedagogy or teaching that centers the support of students through unprecedented and challenging times (Khanal, 2020). In alignment with recent literature on “crisis pedagogy”, Charlie, Regina, and Karrie’s perception of their role was to respond to a crisis and create opportunities for teaching and learning that supported student navigation of the tumultuous COVID-19 pandemic. This study expands the utility of crisis pedagogy by discussing how teachers not only modified their practice to reflect the challenges presented by COVID-19 but the challenges stemming from the presence of poverty of racism.

The presence of poverty and inequity of access to education and educational resources are not novel phenomena but have remained hidden insidiously in oppressive systemic structures including education (De Royston & Farinde, 2018; Milner, 2013). The grave impact of poverty on students’ learning was catapulted into the spotlight when students were asked to learn remotely from their homes. Although aware of the presence of unjust structures in society, Charlie, Regina, and Karrie, witnessed the detrimental impact of poverty. For example, throughout the entirety of the remote portion of the spring semester, Charlie, Regina, and Karrie, each identified students who did not engage in remote learning. The teachers noticed that the student's engagement was prevented by the absence of a working device or internet, shared devices with other siblings, the nonexistence of space to receive instruction, and the absence of parental guidance.

Charlie, Regina, and Karrie's realizations about the inequity of access are not unique to their school context and align with findings reported in early publications on the challenges encountered during the COVID-19 pandemic (Boltz et al., 2021). Their observations of the COVID-19 pandemic's disproportionate impact on students living in poverty are also supported by recent literature (Campbell et al., 2021; Ruef et al., 2022). After making observations, the teachers in this study interpreted the information and shared that before the transition to remote learning, schools masked the reality of students living in poverty and protected them by providing meals, space to learn, and access to technology and learning support. During remote learning, the students resided outside of the protection of school structures.

Like poverty, racism has historically permeated the field of education (Battey & Leyva, 2016; De Royston & Farinde, 2018; McGee,2020). Particularly, science and mathematics education due to their historical entrenchment in colonialism and the centering of Whiteness and Western ideologies (Matias et al., 2016; Rosa & Mensah, 2022; Sammel, 2009). In May 2020, the unlawful killing of George Floyd by police officers and widespread BLM protests brought the presence of systemic racism and white supremacy into the media spotlight and the minds of many teachers and students. As Charlie, Regina, and Karrie continued to teach remotely, they too processed and grappled with the impacts of racism on their positioning as science and mathematics teachers. The teachers were challenged to engage virtually with both colleagues and students in reflection and conversation around systemic racism.

At the crux of COVID-19, poverty, and racism, the sensemaking process began to create order and assign meaning to events and the changes Charlie, Regina, and Karrie experienced (Weick, 1995; Helms Mills et al., 2010). For example, the interactions between the three pandemics shifted the teachers' positioning as science and mathematics teachers (Hazari et al., 2015). Remote learning physically positioned teachers and students in completely different spaces where learning-centered interactions could only take place through Google Meet video, Google Meets chat feature, or email. The change in physical positioning was not a selective positioning maneuver by teachers, rather, safety requirements forced this positioning where teachers were unable to change their proximity to students, create movement within the classroom, or remove physical barriers between the teacher and student.

In alignment with a recent study by van der Spoel et al., (2020), Charlie, Regina, and Karrie expressed that they did not feel prepared to teach science and mathematics remotely. Given the physical restraints of remote learning, all teachers in the study felt that prior skill, pedagogy, philosophy, and approaches to teaching were null in this context. Because everyone was isolated in their homes, kinesthetic and hands-on learning, a hallmark of science education, was not possible. In addition to pedagogy, social interactions between teachers and students differed from that in a traditional classroom setting. The teachers did not have daily interactions with their students. Instead, communication between student and teacher took place through email, text, phone calls, and the occasional Google Meet video conference. Much of this was initiated by the teacher to make connections with students who did not engage in the asynchronous and or synchronous learning options. Participants in this study described teaching remotely as lacking authentic collaboration, being emotionless, and being robotic. For example, teachers were unable to respond and adjust their teaching practice based on social cues collected from the experiences of students. The teachers in the study expressed sentiments that echoed recent literature around the COVID-19 pandemic diminished the element of the spontaneity of teaching as a craft and reliance on unauthentic interactions with students (Niemi & Kousa, 2020).

Sensemaking of Identity and Emotions

Due to the integration of identity and power in the act of sensemaking, teachers' understanding and response to the new situational demands are reflective of their identities and teaching philosophies as science and mathematics teachers (Helms Mills et al., 2010; Weick, 1995). For example, during the interviews, Karrie and Regina specifically emphasized the discomfort and the personal nature of allowing students in their homes through the computer cameras. Charlie discussed the novelty and newness of teaching from home but did not express the same level of discomfort as her colleagues. Teachers' levels of comfort are reflective of their positioning in the classroom in relation to their students.

The teachers' identities as science and mathematics teachers also impacted how they interpreted and responded to the new demands of teaching. For example, Regina described herself as a champion of technology and viewed this experience as an opportunity for creativity and growth. Regina wondered if she could change her approach to mathematics instruction considering the use of educational technologies and the purposeful use of the limited class time. In response, Regina attended professional development and experimented with different educational technologies (Peardeck, etc..). Karrie strongly identified with the importance of fostering creativity and a lifelong love of science within her students through hands-on inquiry. Without opportunities for hands-on inquiry, Karrie felt she was unable to foster creativity and excitement. As a result, Karrie felt stifled and defeated. Charlie, a special education science teacher, prioritized meeting the unique learning needs of each of her students. This new environment presented new challenges and difficulties for Charlie to enact her goal. To address the challenges, Charlie implemented new strategies to contact her families and design opportunities for personalized learning to support her students.

The intertwining of the three pandemics manifested in an emotionally charged and challenging setting for science and mathematics teachers. The act of sensemaking is an emotional process and the teachers attempted to integrate new information into their pre-existing understanding of teaching science and mathematics. Upon the initial transition to remote learning (April 2020), teachers' emotions varied from overwhelmed to excited. Charlie and Karrie felt particularly overwhelmed with the task of teaching science remotely and the task of supporting their most struggling learners. Through the lens of sensemaking, their feelings of unease and disorder are indicative of an ecological change (Weick, 1995). In contrast, Regina's identity as a risk-taker enabled her to feel both hopeful and excited about the possibilities of teaching and learning mathematics remotely.

However, as time progressed, all three teachers experienced negative emotions grounded in the unique challenges emerging from the Triple Pandemic including making successful outreach to students, assessing student understanding, and supporting their most struggling learners. Rooted in these challenges, Charlie expressed feelings of anxiety and frustration with her inability to fulfill the expectations she set for herself as a science teacher. She also experienced anger towards the portrayal of teachers in the media through the discussion of emergency remote education. Regina felt disappointed that she was unable to enact her visions of the possibilities of remote learning. Meanwhile, Karrie expressed sadness and a lack of confidence in her perceived ineffectiveness to deliver science instruction and her inability to create science learning spaces for her students. She was also worried about the safety and emotional well-being of her students. Simultaneously, the teachers expressed intense experiences of emotion stemming from the killing of George Floyd. Regina and Charlie outwardly expressed their emotions physically through tears.

As time progressed teachers' emotions shifted from negative emotions to those of both hope and disappointment. The three participants expressed hope for the coming school year and disappointment with how the past few months had progressed. Regina and Karrie both longed for the return of joy in their teaching. Regina attributed her joy to positive interactions with students when they had learning moments in her class while Karrie hoped for her return of autonomy to foster joy as a science teacher. Charlie vocalized feelings of relief that the school year had come to an end.

The teachers' expression of emotion coincides with current literature on emotions while also adding to our understanding of teachers' emotions during the Triple Pandemic. There is a wealth of literature discussing the presence of emotion in teaching. The sources of emotional distress of teachers in this study align with prior findings. For example, Uzuntiryaki-Kondakci et al. (2021) present the relationship between pedagogical content knowledge and emotions. Their findings showed that, like teachers in this study, the lack of knowledge of instructional strategies led to feelings of worry, inadequacy, and hopelessness. Past studies also acknowledge the sources of positive emotions while teaching including engagement with colleagues (Chen, 2016) and students (Bahia et al, 2013; Cross & Hong, 2012). Charlie, Regina, and Karrie all note the absence of interactions with their students and colleagues as a source of negative emotions experienced while teaching.

Additionally, the findings of this study support recent studies investigating the intersections of teacher emotions and the COVID-19 pandemic (Kim et al., 2022; Lacomba - Trejo et al., 2022; Pressley, 2021). Like the findings of Pressley (2021), the three female teachers in this study experienced intense negative emotions and stress prompted by new instructional requirements and anxiety about the state of education. Although the cases presented do not depict the experiences of male colleagues, the duress supports the findings of Lacomba-Trejo et al. (2022) who found that female teachers experienced more emotional distress than their male colleagues. The findings of this study add to our understanding of emotions while teaching during the COVID-19 crisis because it incorporates the complexity of teaching by addressing the nuance of social conditions and the inclusion of an awareness of poverty and racism at the crux of the teachers' experiences with the COVID-19 pandemic.

Research Question Two

In what ways did teaching remotely during the Triple Pandemic, develop, shift, and affirm science and mathematics teachers' identities? (a) In what ways did teachers' understandings of their identities change? (b) What tensions emerged in their identities as science and mathematics teachers?

Throughout the following portion of the discussion of the second research question, components of the conceptual framework are utilized to address in what ways the intersections of COVID-19, poverty, and racism shaped science and mathematics teachers' identities. Teachers' identities are discussed by integrating the lenses of Critical Consciousness, Positional Identity, and Science Identity as a Lived Experience.

Racial Identity Awareness

The intersection of the pandemics of COVID-19 and racism prompted an increase in racial identity awareness. While being isolated at home after the horrific killing of George Floyd and the BLM protests that followed, the teachers in the study identified the creation of a space to reflect and process current events and their identities within the context of racism in society. The context created a particular urgency for the reflection and understanding of the teachers' racial identities and their positioning in relation to colleagues and students as teachers made sense of police brutality and racism in BIPOC communities. Utilizing a Positional Identity lens, I acknowledge that a teacher's identity incorporates multiple identifiers including race and gender and it is the intersection between these identifiers that create one's perception of the world (Chen & Mensah, 2022; Mensah, 2016; Moore, 2008b).

The teachers began to process and reflect in a variety of ways including individually, during a book club, and or during scheduled zoom conversations with colleagues and students. In alignment with Mensah (2012), reflection can be both an individual and a collective endeavor. Through individual and collective reflection, teachers in the study shared a new understanding of their racial identities in relation to the identities of their students and colleagues. Within this context, Charlie and Regina articulated a new centering of race as a critical identifier in their science and mathematics teacher identities. For example, reflection prompted Charlie to unpack her White privilege and examine how her race impacts her positioning in the science classroom relative to her students of color and her White students. Similarly, Regina shared her journey starting with feeling as though she needed to remain a race-neutral figure as a Black woman at a predominantly White school, a product of white supremacy culture (Okun, 2001). She initially presented other identifiers as more central to her positioning as a Black teacher in a predominantly White space including her identity as a mother and a member of the urban hip-hop community. Through her experiences, she transitioned to feeling as though she was no longer able to remain neutral, thus centering her identity as a Black mathematics teacher or, what she called, a unicorn. Regina and Charlie's centering of race aligns with the notion that identity is fluid (Avraamidou, 2014a; Luehmann, 2007) and the prioritizing of particular social markers reflects the fluctuating social positioning as science and mathematics teachers in a predominantly White school community (Maher & Tetreault, 2001) and in opposition of white supremacy culture (Okun, 2001).

Charlie, Regina, and Karrie all identified critical reflection and conversations around police brutality, protests, and racism in the BIPOC communities as experiences that impacted the centering of their racial identities in the classroom. Engaging in critical reflection, or reflection on injustices present in society is a key component in "praxis" to achieve a state of critical consciousness (Friere,1973; Jemal, 2017). An examination of Charlie's reflection and increasing racial identity awareness as a White woman integrates a needed understanding of privilege in the discussion of critical consciousness (Jemal & Bussey, 2018; Tyler et al., 2020).

From Confident to Uncertain Science and Mathematics Identities

In alignment with past literature and the conceptual framework used in this study, a teacher's identity is constantly forming and is shaped by experiences (Avraamidou, 2014, 2019; Lasky, 2005; Mcintyre & Hobson, 2013). Identity as a science or mathematics teacher considers gender, positioning, philosophy, science knowledge, emotion, and sense of self (Avraamidou, 2019). The novel situation of teaching science and mathematics remotely along with the unique challenges it presented during the Spring of 2020, greatly impacted teachers' views of themselves as science and mathematics teachers. Teachers strove to make sense of and reconcile these differences with their understanding of what it means to teach science and mathematics. As a result, for some teachers, tensions between past, current, and future selves emerged.

Before the onset of the pandemic, the three teachers expressed a sense of certainty about who they were as teachers. However, Charlie, Regina, and Karrie's sense of self shifted when juxtaposed with their current selves as science and mathematics teachers, reflective of how their identities were both affirmed and challenged. Tensions in their science and mathematics teachers' identities emerged from different sources for each of the three teachers, yet all were dependent on the lived experience of teaching during the Triple Pandemic. For Karrie, tensions emerged when she felt that she was no longer teaching and that she was unable to fulfill her core values as a teacher, Charlie's emerged from new insecurities around her content knowledge, pedagogy, and effectiveness, and for Regina, tensions emerged as her role as a teacher shifted from that of the teacher to a facilitator. These lived experiences in virtual classrooms prompted teachers to question who they are science and mathematics teachers. Regina, uniquely, also felt that the lived experience of teaching remotely was affirming to her view of self as a risk taker as she was challenged to engage her students in new ways.

The findings of this study support the work of prior scholarship emphasizing the role of participating in science as a teacher in the formation of a science teacher identity (Avraamidou, 2014b; Luehmann, 2007; Mensah, 2016; Peterman, 2017) and role of professional experiences and context beyond that of solely science (Glass, 2019; Roth, 2016). For example, the lived experiences culminated in a new sense of self for the teachers through a resolution of challenges to their identities. Although Karrie described initially a loss of self, she felt that over time her identity as a science teacher was affirmed by the momentary challenges she encountered. Her orientations, beliefs about teaching science, and her aspirations of how she envisions herself persevered thus prompting her to develop a stronger sense of who she was as a science teacher. In contrast, Charlie and Regina continued to question their identities. For example, teaching experiences prompted Regina to expand her understanding of what it means to teach mathematics. Charlie's experiences prompted further insecurity around what she once thought it meant to teach science and the reality of what teaching science required. She continued to strive to reconcile her new and prior conceptions of what it means to be a science teacher.

The process of becoming was an emotional experience for the teachers (Avraamidou, 2019). The role of emotions in both the formation of identity and the result of identity reflects an ecological model of emotions and a dialectical relationship between identity and emotion (Rivera Maulucci, 2012). When reflecting on her journey as a science teacher, Charlie was extremely emotional and described the feelings she felt towards herself as at times, feelings of pride and at others' discomfort. Karrie also emphasized her emotional journey of becoming. The negative emotions she experienced while teaching amplified her sense of loss of self and temporarily inhibited her ability to navigate the tensions to her identity. Further, positive emotions may surface when a teacher believes a role central to their identity is fulfilled (Rivera Maulucci, 2012). Similarly, a recent study by Ibourk et al. (2020) emphasizes the importance of positive emotions in affirming one's science identity. I apply this concept when a role is unable to be fulfilled. For example, Karrie, unable to enact her core values experienced a loss of self that manifested into feelings of depression.

Marginalized and Affirmed Socially Just Science and Mathematics Teachers

The participants in this study shared how the intersection of poverty and racism impacted their identification as socially just science and mathematics teachers. Drawing upon past literature, a socially just teacher identity incorporates the agency to empower students, reflect on issues of power and injustice, and act against oppression (Rivera Maulucci, 2013). As an application of the conceptual framework used for this study, special attention is given to teacher identity through agency and philosophy. A teacher's philosophy reflects the teacher's beliefs about social justice pursuits in their practice.

Identifying as a socially just teacher involves a commitment to understanding the impact of inequities, reflecting on power and oppression, and acting against oppressive structures (Rivera Maulucci, 2013). Socially just science and mathematics teachers' identities are intertwined with reaching a state of critical consciousness. For example, when teachers reach a state of critical consciousness, they teach with a socially just orientation (Freire, 1973) and thus enact a socially just teacher identity (Riley & Mensah, 2022). Developing a sense of agency to counter oppressive structures in education and society is a critical aspect of enacting a socially just teacher identity (Chen & Mensah, 2018; Rivera Maulucci, 2013) and an element of praxis in the development of critical consciousness (Jemal, 2017). As a result, identity and critical consciousness are discussed in tandem when considering how agency impacted teachers' identities and progression toward a state of critical consciousness.

The initial questionnaire responses for this study were collected before the transition to remote learning. As a result, teachers' responses reflect their identifications and sentiments at the onset of the Triple Pandemic. The three teachers, in March 2020 expressed their identifications as socially just science and mathematics teachers and the need to act for social justice. By doing so, sharing their understanding that society operates unjustly by enforcing inequalities across class, race, income, and gender (Dimick, 2012) and acknowledging the need to recognize and dismantle oppressive structures (Bell, 1997). Yet, given the context of the Triple Pandemic and teachers' experiences, their identities as socially just science and mathematics teachers were both affirmed and challenged by the presence or absence of agency.

All three teachers identified the role of schools in perpetuating inequities and engaged in critically reflective work as an element of praxis (Freire, 1973). The teachers' positioning in their school context impacted their agency and beliefs about the power they held to institute change in both their school community and society. Throughout the spring semester, the teachers witnessed the challenges their students faced with the inequity of access to learning and resources including the internet, devices, and safe supportive learning space. Concurrently, the teachers grappled with the media's discussion of racism. Karrie and Regina struggled with their agency as science and mathematics teachers and felt voiceless without the ability to institute change in their classrooms. For Karrie, a sense of powerlessness emerged from her lack of autonomy and inability to support students and create equitable and empowering science learning experiences while teaching remotely. However, from Karrie's perspective, her level of agency differed as she transitioned into different spaces. She did not feel agency in her classroom (micro level) as a socially just science teacher but felt she had agency as a school community leader (meso level) to facilitate conversations and share concerns about what she called "societal issues" (Rivera Maulucci, 2013).

For Regina, given the racially charged current events in the media, she felt unable to facilitate opportunities for her students to question the injustices present in society. She also felt she could not counter existing structures by questioning curriculum and pedagogy. Regina connected her agency as a Black mathematics teacher in a predominately White teaching community. In contrast, Charlie experienced an increase in her agency that she attributed to heightened awareness of her racial identity as a White science teacher. Within her school context, Charlie felt emboldened to model for students how to recognize and unpack White privilege and injustice in society. Charlie's increased agency aligned with her shifting belief that schools reproduce social inequalities and it is her responsibility as a White teacher to counter the inequitable structures in her sphere of influence.

Charlie, Regina, and Karrie's journeys support prior literature that identities as social justice educators are shaped by experiences, timing, and context (Dollarhide et al., 2016; Rivera Maulucci, 2013; Whipp, 2013) and reflection on those experiences (Farnsworth, 2010). Yet, Karrie and Regina experienced tensions in their identities as socially just science and mathematics teachers. The findings of this study emphasize the importance of the development of teacher agency as an aspect of developing a socially just science teacher identity.

Research Question Three

In what ways does sensemaking during the Triple Pandemic shape the priorities of science and mathematics teachers?

Throughout their teaching experience in the spring of 2020, Charlie, Regina, and Karrie faced novel challenges that did not align with their past experiences and understandings of what it means to be a science or mathematics teacher. A re-evaluation of teachers' priorities emerged as a product of sensemaking as well as evidence of transformative learning. The emerging priorities are addressed in the following portion of the discussion. The critical consciousness component of the framework is used to examine the priorities as a product of teachers' sensemaking of their experiences during the Triple Pandemic. Rooted in their identity as socially just science and mathematics teachers, Charlie, Regina, and Karrie identify new priorities to foster equitable, caring, and empowering learning experiences on a micro (classroom), meso (school), and macro (societal) levels (Chen & Mensah, 2018; Rivera Maulucci, 2013).

Centering Student Relationships

The teachers identified that experiences teaching remotely created insurmountable gaps in relationships with some students while simultaneously strengthening other relationships. As a product of sensemaking of their experiences interacting with their students, participants articulated new priorities as educators: building and maintaining relationships and establishing authentic trust with their students. In the context of remote learning, teachers employed new strategies to maintain relationships with their students while school buildings were closed. New strategies were necessary previously employed strategies to maintain relationships in physical classroom spaces were no longer relevant within the context of remote learning.

The impact of remote learning on student and teacher relationships has been addressed in recent COVID-19 literature (Kim et al., 2022; Niemi & Kousa, 2019; Robinson et al., 2022). Adding to our understanding, the findings of this study consider how racism and poverty, in conjunction with remote learning because of COVID-19, impacted relationships between students and teachers. For example, teachers' understanding of how to maintain relationships shifted. The teachers relied on individual outreach through phone calls and social-emotional check-ins through Google Meets. Through the application of new strategies, the teachers found that shared experiences an emphasis on the social and emotional needs of students, and trust facilitated further relationship building. All three teachers discussed the impact of fostering relationships with their students outside of the context of learning science and mathematics. These opportunities allowed teachers and students to share emotions, experiences, and aspects of their identities. For example, Charlie and Karrie identified these conversations as not only moments of rapport building by moments of learning and vulnerability.

As remote learning heightened the awareness of poverty and racism, the teachers expressed concern and the need to maintain trusting relationships with at-risk students. All participants shared their concerns about the well-being of students whose housing and access to resources were compromised by the closing of physical school buildings. The teachers noticed the disproportionate number of students of color and low-income families who lost contact with their teachers during remote learning. Due to concern, teachers made more frequent attempts at contacting students of concern. For those they were able to reach, the frequent contact strengthened their relationships through a demonstration of care and the development of trust. However, when not successful, concern was raised if students viewed the outreach as sincere and reflective of a genuinely caring relationship.

Through the process of sensemaking, teachers integrated new information with their preexisting beliefs about student and teacher relationships (Weick, 1995). Resulting in a revised teaching philosophy around the role and presence of relationships in the science and mathematics classroom, a principle of teaching for social justice in the science classroom (Calabrese Barton et al., 2003). With new understandings of how to foster relationships and the importance of trust the teachers emphasized the prioritization of continuing their work in future academic school years. From their experiences, the teachers expressed a continued desire to include social-emotional check-ins as a strategy to build relationships and integrate them into their science and mathematics classrooms to create community. They also noted the importance of the value of in-person interactions to humanize both teachers and students. The prioritization of student relationships aligns with elements of socially just teaching articulated by the work of Calabrese Barton et al. (2003) and Rivera Maulucci (2013). Student-teacher relationships are one of the social resources that teachers can actuate on a classroom level through socially just science teaching (Rivera Maulucci, 2013).

The teacher's awareness of the nuance of student relationships is reflective of the development of a critical consciousness and awareness of their positioning in the classroom. Teachers' observations noted that the pandemics disproportionately impacted the learning of students of color and students from low socioeconomic backgrounds. The understanding of their observations and the role of their identities emerged through critical reflection (Friere, 1973; Jemal, 2017). For example, Regina and Charlie specifically reflected upon and questioned the impact of their respective identities on the relationships with students and ultimately students' engagement in remote learning. They further engaged in critical praxis when, from these observations, Charlie, Regina, and Karrie all identified their responsibility of building trust with their students to create empowering learning environments for their students. The teachers demonstrated agency and presented action steps to address the disproportionate impact of the pandemic (Jemal, 2017).

Reevaluating Classroom Priorities

Like the prioritization of fostering trusting relationships, the teachers identified new priorities in their classrooms that are reflective of their development of critical consciousness and engagement in praxis (Freire, 1973; Jemal, 2017) and evidence of the teachers' transformative learning (Mezirow, 1978). This ultimately results in the enactment of socially just social, cultural, and material resources on a micro level (Rivera Maulucci, 2013). Charlie, Regina, and Karrie showed expressed a desire to adjust their practice to counter-hegemonic Whiteness in science and mathematics education. All three teachers identified ways in which they intend to revise their curriculum to both represent and empower their diverse learners. Their next steps include incorporating student identity to support engagement, elevating the voices of students and scientists of color, fostering student autonomy, self-esteem, and love of questioning and learning, and taking risks to push the boundaries of science and mathematics education, which demonstrate an alignment with principles for social justice in the science and mathematics classroom (Calabrese Barton et al., 2003; Riley & Mensah, 2023).

In addition to changes to their curriculum and pedagogy, Charlie, Regina, and Karrie addressed the increasing need to engage students in critical conversations, or conversations addressing power, privilege, and oppression (Schieble et al., 2020). Karrie felt comfortable in her ability to engage with her students; however, both Charlie and Regina expressed hesitation. It is important to note that both Charlie and Regina identified the importance of engaging in conversations with students but questioned their ability due to their positioning in relation to their students. As a White teacher, Charlie feared saying something wrong or saying something that could be misconstrued. Regina, as a Black teacher, questioned how the information would be received by her White students. She questioned whether she should be the one to facilitate the conversation in her current school setting.

To engage students in conversations around racism and other systemic inequities, teachers must first be equipped with racial literacy (Sealy Ruiz, 2013). While past scholarship has focused primarily on preparing White teachers to engage in conversations about race (Matias & Mackey, 2016), recent work by Mensah (2022) argues the equal importance of preparing teachers of color to develop racial literacy and engage in race conversations. Charlie and Regina's experiences and agency emphasize the importance of this work to prepare teachers to engage in conversations with their colleagues and students.

The teachers' adoption of new classroom priorities is evidence of transformative learning during the Triple Pandemic. In congruence with Mezirow's (1978,1991) process of transformative learning, the teachers encountered multiple disorienting dilemmas while teaching during the spring of 2020 when their teaching and outreach strategies were no longer effective, the needs of their students changed, and expectations of teachers shifted. These dilemmas emerged as a product of the inherent structure of remote learning and the inequities of access that surfaced for students. As a result, the teachers reflected and questioned their beliefs and assumptions about what it means to be an effective science or mathematics teacher. Emerging from these reflections, were new beliefs about what is important and what should take precedence in science or mathematics classrooms as well as new beliefs about the teaching profession.

Beyond the Classroom: Community Engagement

Charlie, Regina, and Karrie continued to further their engagement in praxis when considering their roles as socially just science and mathematics teachers outside of the classroom space. The three teachers expressed a commitment to and provided examples of critical action outside the classroom with the intent of improving the conditions for students inside classrooms, even if not their own. Their engagement in social action outside of their classrooms was driven by the reflection on the inequities they experienced while teaching.

The teachers felt a responsibility to their students and school community to engage in action and further actuate socially just teaching resources on meso and macro levels (Rivera Maulucci, 2013). Karrie shared her priority by facilitating conversations and professional learning for her colleagues and the school community to improve the experiences of her students. Regina felt it was her responsibility to address the biased and deficit perspectives of other educators outside of her school community. Although not her students, she felt it was her responsibility to advocate for their success. For Charlie, she began to consider steps she could take to prompt system-wide changes on a macro level that addresses the inequalities perpetuated by schools as an unjust system. The teachers expanding priorities beyond their classroom reflect their beliefs around the meaning of engaging in social justice as science and mathematics teachers.

Chapter VIII

CONCLUSION, IMPLICATIONS, AND FUTURE RESEARCH

The purpose of this study was to explore the nuances of the lived experiences of three science and mathematics teachers during the Triple Pandemic. By doing so, highlighting ways in which experiences during the Triple Pandemic shaped the three teachers' identities and priorities as science and mathematics teachers. The inquiry pursued the following questions:

1. What are the lived experiences of three middle school science and mathematics teachers during the Triple Pandemic?
    a. How did these science and mathematics teachers change their teaching practice?
    b. What conflicts and challenges emerged for these three science and mathematics teachers?
    c. What emotions did they experience?
2. In what ways did teaching remotely during the Triple Pandemic, develop, shift, and affirm science and mathematics teachers' identities?
    a. In what ways did teachers' understanding of their identities change?
    b. What tensions emerged in their identities as mathematics and science teachers?
3. In what ways does sensemaking during the Triple Pandemic shape the priorities of mathematics and science teachers?

Findings and discussion for each question were presented in Chapters IV, V, VI, and VII respectively. In this chapter, I present the major findings of the study as a synthesis across the chapters along with implications, limitations, and next steps for this research.

Summary of Major Findings

The intersection of COVID-19, poverty, and racism during the Triple Pandemic created a novel and unique educational context for teachers and students. In an unprecedented situation, science and mathematics teachers adapted their practice to meet the needs of their students during a time of crisis and continued to modify their practice as systemic inequities surfaced during the period of remote learning throughout the Triple Pandemic. Given the tumultuous nature of the pandemic, it is critical to gain a glimpse into the experiences of science and mathematics teachers and how their experiences both positively and negatively impacted the teachers. This study sought to explore, understand, and present the unique challenges, emotions, and teaching practices of three middle school science and mathematics teachers and to understand how these experiences affirmed, shaped, and challenged their identities and finally, how teachers' sensemaking of these experiences shaped their educational priorities.

From this inquiry, three major findings emerged. *First, the act of teaching science and mathematics remotely during the tumultuous Triple Pandemic was an emotionally charged experience fraught with pedagogical and personal challenges and an increasing awareness of systemic inequities.* In response to the pandemic, teachers experienced shifts in their positioning in the classroom resulting in the implementation of new teaching and communication strategies that prioritized student accessibility and relationships. Throughout the spring of 2020, the teachers constantly reconciled new demands as teachers with prior conceptions of what it meant to teach science or mathematics. These demands prompted transformative learning to occur (Mezirow, 1978;1991). The disorienting dilemmas they encountered teaching during the pandemic challenged their prior beliefs and understandings. Ultimately, these challenges resulted in a re-evaluation of self and the adoption of new perspectives and beliefs about what it means to be a science or mathematics teacher.

Throughout the spring, the teachers were asked to pivot quickly to address the new demands of teaching remotely and the fluctuating needs of their students. While doing so, the teachers experienced a breadth of emotions surrounding the atrocities presented in the media, the inequities their students experienced, and as a reflection of their science and mathematics teachers' identities. The teachers' emotions are not only products of their experiences but a source of transformation for individuals, interactions, and relationships with power (Zembylas, 2008).

Second, the three teachers developed a critical consciousness as they confronted inequities, gained racial identity awareness, and developed political agency at the intersection of COVID-19, poverty, and racism, which ultimately shaped the science and mathematics teachers' socially just teacher identities. From a Freirean (1972) perspective, developing a critical consciousness involves reflecting on the positioning of oneself to recognize inequitable social conditions and oppressive structures in society and to commit oneself to social action. Considering recent scholarship, a critical consciousness also incorporates political agency to take action against oppressive structures (Jemal, 2017). Reaching a state of critical consciousness implies that the teacher teaches with a socially just orientation.

The development and movement between stages of critical consciousness are rooted in education and experiences (Freire, 2000). The Triple Pandemic created a context ripe for engagement in praxis: engagement in critical reflection, political agency, and critical action (Jemal, 2017). The teachers in this study critically questioned and observed the social inequities experienced by their students as well as their positioning in relation to the inequities. Throughout the spring, the teachers experienced moments of increased and decreased political agency to affect change (Jemal, 2017). The fluctuations in their level of agency were intertwined with their positioning in their school community and their proximity to the experience of racism and poverty supporting the idea that agency is ecological and situated within a given context (Biesta et al., 2017). From their experiences, all teachers articulated the need for critical action and shared their intentions for redesigning the curriculum and adapting pedagogy for the following school year. Additionally, some of the teachers began to engage in critical action while isolated from their school community, by engaging in virtual conversations with colleagues about racism, police brutality, and privilege, and by participating in BLM protests.

Development of critical consciousness is reflective of a teacher's philosophies, beliefs, and agency about science and mathematics teaching and is thus, a reflection of a socially just science or mathematics teacher identity. Upon developing a critical consciousness the teachers in the study further their development as socially just science and mathematics teachers by internalizing how inequities in the field of science affect historically marginalized students, reflecting on issues of power and injustice, and acting against oppressive forces in science education (Rivera Maulucci, 2013) and in response strive to foster equitable, empower, and caring learning experiences (Chen & Mensah, 2018; Rivera Maulucci, 2013) as demonstrated in their emergent and shifting priorities.

Third, sensemaking of the new reality of teaching resulted in tensions in the teachers' identities as science and mathematics teachers and the development of new priorities in the classroom reflecting social justice engagement on micro and meso levels (Rivera Maulucci, 2013). It is important to note that emotions played an instrumental role in this process because the act of teaching is an emotional labor (Zembylas 2004a, 2004b) and a critical aspect of the act of becoming a mathematics or science teacher (Avraamidou, 2020; Ibourk et al., 2020), thus emotions cannot be removed from the discussion of teaching experiences. While faced with new challenges, the teachers in this study found their identities as science and mathematics teachers both challenged and affirmed as they were pressed to approach instruction and communication with students in novel ways. All three teachers questioned their identities as they strove to resolve the tensions and reconcile their sense of self.

The teachers also engaged in sensemaking as they grappled with current events portrayed in the media, their positioning within the discussion of systemic racism, and implications for interactions with their students. These experiences prompted a reconsideration of educational priorities resulting in avenues for social justice engagement on both micro and meso levels including building trusting relationships with students and families, centering student and historically marginalized identities in the curriculum, engaging in critical conversations, and advocating for students, families, BIPOC communities in spaces outside of the classroom.

Implications for Practice

The exploration of Charlie, Regina, and Karrie's experiences during spring 2020 generates a variety of implications for practice in the field of science and mathematics education. The three elements of the Triple Pandemic (i.e., COVID-19, racism, and poverty) continue to permeate the field of education even though students and teachers have returned to their physical classroom spaces but not yet back to teaching and learning pre-COVID-19. Thus, teachers are still grappling with teaching, learning, and caring. The implications provided in the following section address implications for supporting in-service teachers' response to a crisis and prioritizing social justice in science and mathematics education.

Supporting Inservice Teachers

In the short term, it is critical to consider how the field of education can support in-service teachers as they return to in-person teaching and learning during the Triple Pandemic after a tumultuous period of remote education while simultaneously considering how the context of science and mathematics education has shifted drastically. To frame this work, recent COVID-19 literature has addressed the implications that teaching during the COVID-19 pandemic has had on teachers' mental health and well-being (Cormier et al., 2021; Kim et al., 2022; Lacomba-Trejo et al., 2022; Pressley 2021); however, studies have not specifically addressed science and mathematics teachers. The results of the Kim et al. (2022) study highlighted teachers' negative perceptions of teaching, workload, and concern for others were all factors leading to the decline in mental health. Another study by Pressley (2020) explored sources of teacher burnout during the COVID-19 pandemic identifying new instructional requirements, stress, anxiety, and the uncertainty of the state of education as contributing factors. Lacomba-Trejo et al. (2022) findings showed that female and secondary school teachers experienced greater amounts of emotional distress (including stress and anxiety) than their male and high school counterparts respectively.

Due to the absence of studies specifically examining the experiences of science and mathematics teachers, this study offers further insight into the emotions and challenges teachers encountered around remote science and mathematics instruction. Further, the stories of Charlie, Regina, and Karrie encompass the impact of systemic racism and poverty on teachers both personally and as educators. Considering recent findings, and our knowledge of statistics around teacher attrition, gaining an understanding of teachers' experiences with COVID-19, racism, and poverty is fundamental for designing ways to support in-service teachers as they continue to navigate the Triple Pandemic in their physical classroom spaces. The stories of Charlie, Regina, and Karrie highlight sources of emotion that can be addressed to support the fostering of positive emotions and positive orientations towards education as a whole and science and mathematics education respectively. Supporting teachers' navigation of the return to the classroom is critical for the support of students as they re-enter physical classroom spaces and preventing teacher burnout.

Further, to support in-service teachers we must address the trauma and mental health stressors that teachers experienced during the Triple Pandemic; trauma not only induced by COVID-19 but by racial violence. Participants in a study by Douglas et al. (2022) identified racial trauma and related stress as a major concern for the education of Black students after the pandemic upon their return to physical classroom spaces. Therefore, teachers are often called upon to implement trauma-informed practices with their students (Baweja et al., 2016; Cole et al, 2013; O'Toole, 2022; von der Embse, 2019). At times, secondary or shared trauma emerges for teachers who support populations of students who have experienced trauma (Lawson et al.,2019). Teachers, particularly, teachers of color are at risk of not only secondary trauma but trauma from their experiences with COVID-19 and racial violence. The voices of Charlie, Regina, and Karrie along with an understanding of trauma-informed practices for students can inform the field of education on how to support teachers with the processing and navigating of trauma. Education can do so by considering the emotional and social safety of teachers, developing trust and transparency, fostering teacher voice and empowerment, and creating opportunities for teacher collaboration.

For long-term purposes, understanding the three teachers' observations and responses to the Triple Pandemic highlighted in this study can provide insight into the challenges faced by other teachers and school communities and their implications for practice, and thus, can then be utilized to plan for future educational crises and develop plans to provide teachers with needed supports. The transition to remote learning in the spring of 2020 was unprecedented and shed light on how ill-equipped schools were for their students to learn remotely. Teachers had no training in educational technologies, online pedagogy, or online curriculum resources (Hodges et al., 2020) nor did schools have the infrastructure to provide students with devices and internet access. Now, with this insight, we can better anticipate the inequities students and teachers may encounter and be proactive in building structures to address them. For example, designing an infrastructure that allows quick distribution of technology and access to safe space to engage in learning.

Charlie, Regina, and Karrie's pedagogical practices and rationales for their practices emerged as they supported their students who were navigating traumatic experiences at the crux of COVID-19, racism, and poverty (Appendix K). Teachers can prepare to support students who have experienced trauma during future educational crises by considering Charlie, Regina, and Karrie's successful implementation of instructional practices, communication strategies, purposeful time to foster relationships and community, and revisions to science and mathematics curricula to engage students as a model of trauma-informed instruction. Schools can also anticipate the support teachers need to implement trauma-informed practices and crisis pedagogy when education is disrupted in an unexpected or novel way. For example, as of November 2022, schools in New York City have welcomed over 7200 refugee students into the public school system (Montaya- Galvez, 2022). These students have been displaced from their homes, and some, their families. Considering what has been learned from the educational crisis set forth by the COVID-19 pandemic and the systemic inequities encountered, crisis pedagogy allows schools to support their students both inside and outside of the science and mathematics classrooms. Student support may include, creating safe spaces to engage in learning when they do not have safety or stability in their housing, creative ways to connect with families who may speak other languages or be living in another geographic location, prioritizing the building of trusting relationships with students who may have experienced trauma, and adapting curriculum to reflect the diverse identities and backgrounds of the students in the classroom.

Prioritizing Social Justice in Science and Mathematics Education.

Entrenched in a deeply rooted history of Colonialism, Whiteness, and Western ideologies are permeated throughout science and mathematics pedagogy, teaching practice, and curriculum (Matias et al., 2016; Rosa & Mensah, 2021; Sammel, 2009). To counter, teachers are needed as a mechanism to shift the paradigm of teaching and learning by developing an understanding and commitment to practices of social justice pedagogy (Aveling, 2012). Yet, teachers, especially White teachers, are rarely prepared to engage in the work. For example, conversations around race, bias, and prejudice can be particularly difficult for White teachers and teacher educators who often benefit from Whiteness (Matias et al., 2016) and as a result perpetuate.

Although Charlie, Regina, and Karrie furthered their development during the Triple Pandemic, the findings of this study show an urgency to continue to support the development of teacher agency as socially just science and mathematics teachers within and beyond teacher education as preservice teachers so that they are best able to enact change and social action in their classroom spaces as in-service teachers. It is the responsibility of teacher education to foster social justice and the development of teachers who are willing to question and push against oppressive structures in education (Le & Matias, 2019). To push against oppressive structures, a teacher must develop agency as to their ability to enact change. This study provides a snapshot of how teachers continued to develop as socially just science and mathematics teachers throughout their experiences in the remote classroom.

Charlie, Regina, and Karrie identified new priorities aligning with the enactment of socially just resources in the classroom including building and maintaining trusting relationships, engaging in critical conversations, and redesigning science and mathematics curriculum and teaching (Riley & Mensah, 2023; Rivera Maulucci, 2013). The teachers also expressed initiative to integrate these practices into their teaching in the coming school year. Given the interconnectedness of identity and practice (Gresalf & Cobb, 2011), the development of socially just science and mathematics teachers' identities must be at the forefront of professional learning for in-service teachers if socially just teaching practices are to be integrated into classrooms.

Although not addressed in the three cases presented in this study, in addition to Charlie, Regina, and Karrie, thirteen other teachers (six of those were science and mathematics teachers) completed the initial and final questionnaires probing teachers' awareness of inequities and oppression present in schools, beliefs about social justice engagement as teachers, and awareness of the impact of identity in classroom spaces. A preliminary analysis of questionnaires showed an alignment with responses shared by Charlie, Regina, and Karrie. For example, holistically, participants shared an overall increase in awareness of ways in which schools perpetuate systemic inequities and the importance of acknowledging systems of power privilege, and oppression thus demonstrating a shifting of teachers' orientations and beliefs around their engagement in social justice further emphasizing the need to continue to support teachers integrate practices reflective of their beliefs into the classroom.

As teachers continue to grapple with their reflections on their experiences with systemic oppression and inequity, in-service teachers would benefit from professional learning that provides space and time to reflect and challenge prior assumptions (Mensah, 2013, 2023) and to engage in prolonged work within a community of educators (Battey & Franke, 2015; Le & Matias, 2019). As evidenced in the study, the unique context of the Triple Pandemic created space for teachers to engage in critical reflection that allowed them to recognize their own identities of power and privilege and the systemic inequities present in education. The charge remains how to best leverage these experiences to foster the continued development of critically conscious, socially just science and mathematics educators.

Future Research

This study provides avenues and opportunities for future research on science and mathematics education during the continuation of the Triple Pandemic. The intertwined nature of the Triple Pandemic presented a novel situation that has continued to persist for three years. Literature continues to emerge examining the experiences of teachers and students and presenting ways in which educators can be supported during a crisis and tumultuous time of the COVID-19 pandemic (Boltz et al., 2021; Bookbinder, 2022; McPherson & Pearce, 2022; Nadeem et al., 2022; Ruef et al., 2022; Tobin et al., 2021). However, the literature specifically addressing the experiences of and implications for science and or mathematics teachers is limited (Bookbinder, 2022; McPherson & Pearce, 2022; Tobin et al., 2021). Although another transition to complete remote education is unlikely, past experiences can be used to better prepare the field of science and mathematics education for future crises and challenges in education. Further, poverty and racism are endemic in the educational structures. Challenges confronting these inequities and discrimination continue to persist on micro, meso, and macro levels in society.

I propose an avenue of future research to explore the long-term experiences and impact of the Triple Pandemic on science and mathematics educators. As evidenced by the findings in this study, science and mathematics teachers' emotional journey during the pandemic was fraught with challenges, a new awareness of systemic inequities, challenges and affirmations to teaching identities, and new emerging educational priorities. The Triple Pandemic has not ended and continues to pose challenges to teachers. As time continues to pass, what are the long-term impacts on science and mathematics teachers? What challenges persist, and what new challenges have emerged for teachers post-remote learning? How have teaching practices changed since the return to in-person learning? How have teachers' identities continued to develop as science and mathematics teachers as well as socially just science and mathematics teachers? Do current teacher practices align with new emerging priorities?

This study identified new classroom priorities of three science and mathematics teachers. I propose a second avenue of future research to explore the implications of the new classroom priorities for fostering student belonging to prevent targeted violence in schools. Targeted violence is defined as premeditated violence towards specific groups, individuals, or locations (SchoolSafety.gov, n.d). Sadly, as a country, the United States has seen an increase in targeted violence. For example, the incidence of hate crimes increased by over eleven percent from 2020 to 2021 (Department of Justice, 2023). Sabic- El Rayess' (2021) model of educational displacement proposes a link between student belonging and violence. A sense of belonging occurs when an individual is connected to the community and does not feel subject to isolation due to their race, sex, culture, sexual orientation language, or other differences (Gardiner et al., 2015). Belonging increases within a school community when students feel accepted by others, respected, included, supported, and that their needs are important (Johnson, 2009)

Thus, belonging is critical in educational spaces as it is a tool to prevent educational displacement and future violence (Sabic-El-Rayess, 2021). Sabic- El- Rayess explains that educational displacement occurs when "individuals encounter prevailing social narratives in educational systems about themselves and society around them, which for some can be marginalizing and trigger feelings of exclusion, invisibility, and underrepresentation in the mainstream curriculum and narrative of education" (p. 8). When students feel ignored, mistreated, or pushed out of the classroom spaces, they may turn to other sources that offer a sense of belonging, including those others with extreme ideologies, which may ultimately lead to radicalization and targeted violence (Sabic-El-Rayess, 2021). Thus, I wonder, in what ways does the implementation of Charlie, Regina, and Karrie's classroom practices (Appendix K) aid in the prevention of educational displacement, and ultimately, targeted violence in schools?

This study explored the experiences and implications of the Triple Pandemic on the priorities and identities of three veteran female middle school scene and mathematics teachers. Another avenue of exploration is to continue to explore the effect of the Triple Pandemic on elementary science and mathematics teachers and to expand the study to incorporate a larger variety of teaching identities including the experiences of male science and mathematics teachers and novice teachers. Or, by expanding the research to explore the experiences of science and mathematics teachers in other school communities. Expanding the research will provide a more complete understanding of the long-term implications of the Triple Pandemic on the field of science and mathematics education. Understanding the experiences of teachers provides insight into the support needed as they continue to provide mathematics and science instruction during a tumultuous time. Ultimately, providing support for teachers enables the teachers to maximize their ability to provide productive and supportive learning experiences for their science and mathematics students.

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Appendix A

Recruitment Script for Verbal recruitment

Hello –

Are you a middle school teacher?

My name is Andrea Horowitz and I am a doctoral candidate in Science Education at Teachers College. I am hoping to talk to you about participating in my research study. For my upcoming dissertation research project, I plan to explore if and how teachers' identities as social justice educators develop over time.

You're eligible to be in this study because you are a middle school teacher.

Participation in this research study will include (a) completing a background information questionnaire and (b) two surveys. If you decide to participate in the study, the background questionnaire will take about 5 minutes and each survey will take about 10-15 minutes of your time. The background questionnaire and survey will be completed before March 15th 2020 and the second survey will be completed in July 2020. If you choose to participate your total time commitment will be 25-35 on two separate days.

Remember, this is completely voluntary. You can choose to be in the study or not. If you'd like to participate, would you mind giving me your email address so I can send you the link to the background information questionnaire and survey? If you need more time to decide if you would like to participate, you may also call or email me with your decision.

Do you have any questions for me at this time?

If you have any more questions about this process or if you need to contact me about participation, I may be reached at amh2293@tc.columbia.edu or 404-313-0952.

Thank you so much.

Appendix B: Recruitment Flyer

Are you a middle school teacher? Are you willing to complete two 15-minute surveys?

If yes, we need you!

This study is being done to gain an understanding of how middle school teachers identify as educators for social justice and how their identities change over time. The study also aims to gain an understanding of middle school teachers' orientations towards social justice and culturally responsive teaching.

Participation will involve completing an online survey on two separate days, once in March 2020 and once in July 2020. The survey may be completed anonymously. There is no compensation for your participation, but your insights will help improve the field of teacher education. There is minimal risk involved in this study. If you feel uncomfortable you may decline to respond to any question and leave the study at any time.

If you are a STEM teacher, you may be asked to participate further in the study by engaging in one interview. If you are willing, the researcher will contact you about further participation and you will be asked to consent to participate in the second part of the study.

I am interested!
amh2293@tc.columbia.edu

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Appendix C: Background Information Questionnaire

Question	Response
Name (optional)	
Age	• 18-24 • 25-35 • 35-44 • 45-54 • 55-64 • 65+
Gender	• Male • Female • Other • Decline to respond
Select one of the following that best describes how you identify	• American Indian or Alaskan Native • Black or African American • Asian • Pacific Islander • White • Hispanic or Latino • Other
Teaching experience (years):	
Subject area taught:	
Language spoken at home:	
Highest level of education:	
Email (optional):	
Phone number (optional)	

Appendix D: Pre and Post Teacher Questionnaire (Open Ended and Likert Scale)

To what extent do you agree with the following statements. Please circle your response. If you do not feel comfortable responding or do not understand the question, leave the line blank.		Strongly disagree	Disagree	Neither Agree nor disagree	Agree	Strongly agree
1	I have a strong sense of who I am as a teacher	1	2	3	4	5
2	My identity as a teacher has changed throughout my time in the classroom	1	2	3	4	5
3	My identity influences my interactions with students	1	2	3	4	5
4	My identity impacts the decisions I make in classroom	1	2	3	4	5
5	I am aware of my cultural background	1	2	3	4	5
6	I am willing to examine my own identities	1	2	3	4	5
7	I am willing to reflect experiences in the classroom around issues of equity.	1	2	3	4	5
8	I am willing to take advantage of professional development opportunities focused on issues of diversity	1	2	3	4	5
9	I value developing personal relationships with students	1	2	3	4	5
10	I value dialog as a way to learn about students' out of school lives	1	2	3	4	5
11	I am comfortable with conflict as an inevitable part of teaching and learning processes	1	2	3	4	5
12	I believe it is important to acknowledge how issues of power are enacted through schools	1	2	3	4	5
13	I believe that schools can reproduce social inequities	1	2	3	4	5
14	I believe that hot topic conversations (e.g., race gender, sexuality, religion, etc.) should be had in class when necessary and/ or relevant	1	2	3	4	5
15	I value equity (giving each student what they individually need) over equality (giving each student the same thing)	1	2	3	4	5

16	I believe that it is important to talk to others about societal systems of power, privilege, and oppression	1	2	3	4	5
17	I believe that it is important to try to change larger social conditions that cause individual suffering and impede well-being	1	2	3	4	5
18	I believe that it is important to respect and appreciate people's diverse social identities	1	2	3	4	5
19	I believe that it is important to act for social justice	1	2	3	4	5
20	I am confident that I can have a positive impact on others' lives	1	2	3	4	5
21	I am certain that I possess an ability to work with individuals and groups in ways that are empowering	1	2	3	4	5
22	Other people around me are engaged in activities that address social injustices	1	2	3	4	5
23	Other people around me feel that it is important to engage in dialogue around social injustices	1	2	3	4	5
24	Other people around me are supportive of efforts that promote social justice	1	2	3	4	5
25	Other people around me are aware of issues of social injustices and power inequalities in our society	1	2	3	4	5

26. What values are important to you as a teacher? As a STEM educator (if applicable)?

27. From your perspective, what does it mean to be an educator for social justice?

Are you a STEM Teacher? If yes, would you be willing to be contacted to engage in further conversation about your Identity as an educator?

Appendix E-1: Semi-Structured Interview #1

Purpose	Questions and Script
Welcome	Thank you for taking the time to participate in this interview and speak with me today. My name is Andrea Horowitz, and your name is ________________________. The purpose of my research project is to explore shape middle school STEM teachers' identities and their development as social justice educators. I am going to audio record the interview to ensure that I have an accurate record of our discussion today. Is it okay with you that I audio record? There is no right or wrong answer to any of the questions. I hope to gain insight into who you are as a teacher and your experiences in the classroom. Do you have any questions before we begin?

Identity	1. How would you describe yourself or your identity as a STEM teacher?
	2. How do think your students would describe you as a STEM teacher?
	3. Why did you go into teaching?
	4. What facets of your identity are present in your teaching? Remote teaching?
	5. How do you position yourself in your classroom setting prior to remote learning? Now?
	    a. You may provide a visual representation.
	6. In what ways do you see yourself as an educator for social justice?
	    a. Would you consider yourself an educator for social justice?
	7. How do you think other teachers see your identity related to social justice and equity?
	How would you describe your teaching philosophy in relation to equity and social justice?

Understanding and Teaching for Social Justice and Equity	1. What do you believe is your role in social justice?
	2. How do you promote equity in your classroom? Now with remote learning?
	3. How do you create opportunities for all students to learn?
	    a. Do you engage your students of color differently? If so, in what ways?
	4. Do facets of your identity influence your interactions with students in the classroom? If so how?
	5. What does social justice look like in a science/ STEM classroom?
	    a. Can you give an example of what socially just teaching looks like in your classroom?
	    b. How about now with remote learning?

Wrap Up	Thank you for sharing your thoughts and experiences with me today. I have no more questions at this time. Are there any questions or topics that you would like to discuss before we finish the interview?

Appendix E-2: Teacher Semi Structured Interview #2 and #3

Purpose	Questions and Script
Welcome	Thank you for taking the time to participate in this interview and speak with me today. My name is Andrea Horowitz and your name is ________________________. The purpose of my research project is to explore middle school STEM teachers' identities and their development as social justice educators. I am going to audio record the interview to ensure that I have an accurate record of our discussion today. Is it okay with you that I audio record? There is no right or wrong answer to any of the questions. I hope to gain insight into who you are as a teacher and your experiences in the remote classroom. Do you have any questions before we begin?
Identity	1. How would you describe yourself or your identity as a STEM teacher? a. Has your description changed since we last spoke on____________? 2. In what ways has your remote teaching and learning influenced how you view yourself as a teacher since the last interview? 3. Have any other factors influenced your identity or how you view yourself since the last interview? 4. In what ways do you see yourself as an educator for social justice? Have your views changed? Explain. a. Would you consider yourself an educator for social justice? 5. How do you think other people see you related to social justice and equity?
Understanding and Teaching for Social Justice and Equity	1. Based on your experiences remote teaching, how would you describe your role in social justice? 2. Can you give an example of what socially just teaching looks like in your remote classroom? a. Has it changed since our last interview? If so, how? 3. What equitable teaching practices have you been focusing on since the last interview? a. How have you implemented the practices? b. What has your experience been like integrating the equitable teaching practices in your classroom? 4. How would you describe your interactions with your students since the last interview? If so, can you provide an example What is your teaching philosophy? Please review your teaching philosophy you shared during the first interview (show transcript). How would you change it to reflect your current teaching philosophy?

Teaching Experience	1. How has your experience remote teaching been so far this year? 2. In your voice journal you mentioned_______________________ can you elaborate? 3. In your voice journal you mentioned feeling__________________.... can you elaborate? 4. In your voice journal you mentioned wondering _____________________ … can you elaborate? 5. What aspects of remote learning had the greatest impact on you as a STEM educator? a. As an individual? 5. From your perspective as a teacher, how should new teachers be supported through engaging in work around equity and social justice while teaching remotely?
Wrap Up	Thank you for sharing your thoughts and experiences with me today. I have no more questions at this time. Are there any questions or topics that you would like to discuss before we finish the interview?

Appendix F: Audio Journal Reflection Prompts

Please complete an audio journal entry twice a month from April 2020- June 2020. You may complete the journal entries on days of your choice.

Record a brief audio journal entry considering the following prompts:

1. What questions do you have after teaching remotely this week?
2. What feelings or emotions do you have after teaching remotely this week?
3. What were your successes teaching remotely this week? What were your frustrations teaching remotely this week?
4. What did you learn teaching this week, about yourself, your students, and/or the digital learning platforms?
5. Do any moments or interactions stand out to you from this week's remote teaching and learning? If yes, explain.
6. Additional thoughts?

Audio Recording Instructions:

Voice Memo (iPhone/ App Store)	Easy Voice Recorder (Google Play)
1. Open "Voice Memo" application 2. Click the red button at the bottom of the screen to begin recording 3. Click the red button again at the bottom of the screen to end recording 4. Click the (…) icon below the recording 5. Click share and email voice recording to amh2293@tc.columbia.edu	1. Open "Easy Voice Recorder" application 2. Click the red button with the microphone icon to begin recording 3. Click the red button with two vertical lines to pause recording 4. If needed, to restart the recording click the red button with the microphone icon again 5. Click the check mark icon to end the recording 6. Click the "listen" icon 7. Click the (…) icon next to the recording 8. Click share and email voice recording to amh2293@tc.columbia.edu

Appendix G: Virtual Focus Group

Purpose	Questions and Script
Welcome	Thank you for taking the time to participate in this focus group today. The purpose of my research project is to explore middle school STEM teachers' identities and experiences during remote learning. Before we begin, I ask that you all will keep all comments made during the focus group confidential and not discuss what happened during the focus group outside the meeting to protect each other's confidentiality. I am going to audio record the focus group to ensure that I have an accurate record of our discussion today. Is it okay with you all that I audio record? There is no right or wrong answer to any of the questions. I hope to gain insight into who you all are as a teacher and your experiences in the remote classroom. Do you have any questions before we begin?
Questions	1. What has your experience been like during remote learning? 2. How has your teaching practice changed during remote learning? 3. Have you grown as an educator? If so, what has contributed to your growth? 4. What issues around equity and access did you encounter during remote learning? 5. Has teaching remotely changed your understanding of what it means to teach for social justice and equity? If so, how? 6. How have you incorporated student voice during remote learning? 7. How have you empowered your students during remote learning? 8. How do you envision your teaching practice will change in years to come based on your experiences? 9. Part of my role as a researcher is to share your stories and experience- is there anything else that you would like to share about your experience?
Wrap Up	Thank you for sharing your thoughts and experiences with me today. I have no more questions at this time. Are there any questions or topics that you would like to discuss before we finish the focus group?

Appendix H: Charlie Interview Codes

Open	Focused	Themes
Losing impact Feeling trapped Lacking impact Trying to survive I’m the worst teacher right now Teaching is only routine Feeling lack of growth Losing sense of self I’m no longer a science teacher I don’t view myself the same I am two different teachers	Feeling ineffective as a science teacher	*From Confident to Uncertain Science and Mathematics Identities*
No room for me now Need to bring back my old self Feeling like sacrificing self Comparing self to others Feeling stuck I’m not right Going to try my best to be better Questioning how to support	Conflicting past and current self	
Questioning what it means to teach science New role emerging Learning new things Realizing the need for growth	Developing a new understanding of science teaching	

Appendix I: Regina Emotion Coding

April	May	June
Optimistic	Overwhelmed	Guilt
Inspired	Sadness	Hopeful
Curious	Grief	Tired
Shocked	Isolated	Disappointment
Helpless	Vulnerable	
Vulnerable	Stressed	
Worried	Worried	

Appendix J: Informed Consent

INFORMED CONSENT

Protocol Title: An Exploration of Identity Development as an Educator for Social Justice
Principal Researcher: Andrea Horowitz, NY, Teachers College
404-313-0952, amh2293@tc.columbia.edu

INTRODUCTION You are invited to participate further in this research study called "An Exploration of Identity Development as an Educator for Social Justice." You may qualify to take part in this research study because you are over 18 years older, a middle school STEM (Science, Technology, Engineering, and Mathematics) teacher**,** and have at least one year of teaching experience**.**
Approximately four people will participate in this portion study and will be asked to participate in one focus group. You will be asked to participate in one focus group session one day in July. The focus group will take 1 to 1.5 hours of your time.
WHY IS THIS STUDY BEING DONE? This study is being done to understand if and how teachers identify as educators for social justice and how their identities change over time.
WHAT WILL I BE ASKED TO DO IF I AGREE TO TAKE PART IN THIS STUDY? If you decide to participate further in the study, the primary researcher will ask you to complete a…
Focus Group Session:

- During the focus group session you will be asked to discuss your views on equity and social justice and your experience as a classroom teacher teaching during the COVID-19 pandemic with other educators.
- The focus group session will be audio-recorded. Audio recordings will be sent to a transcription service to be written down (transcribed) then the audio recordings will be deleted. If you choose to be audio-recorded, the researcher will notify you when the audio-recorder is started and stopped. If you do not wish to be audio-recorded, you will still be able to participate. The researcher will just take hand-notes.
- You will be given a pseudonym or false name in order to keep your identity confidential.
- The focus group will take place virtually using Zoom/Skype at a time of your choice outside of workday hours and will last about 1 hour – 1.5 hours.
- During focus group sessions, the researcher cannot guarantee full confidentiality. I will share with all focus group participants that "*Your identity will be known to other focus group participants and the researcher(s) cannot guarantee that others in the group will respect the confidentiality of the group. As a researcher, I ask that you will keep all comments made during the focus group confidential and not discuss what happened during the focus group outside the meeting.*"

WHAT POSSIBLE RISKS OR DISCOMFORTS CAN I EXPECT FROM TAKING PART IN THIS STUDY? This is a minimal risk study, which means the harms or discomforts that you may experience are not greater than you would ordinarily encounter in daily life while taking routine physical or psychological examinations or tests. However, there are some risks to consider. You might feel uncomfortable sharing your ideas about identity, race, and teaching practice. Although the researcher will aim to make you feel comfortable, you do not have to answer any questions or share anything you do not want to talk about. Additionally, you will be asked to spend time outside of your workday to participate in the focus group. You can stop participating in the study at any time without penalty.

The primary researcher is taking precautions to keep your information confidential and prevent anyone from discovering or guessing your identity, such as using a pseudonym instead of your name and keeping all information on a password protected computer and locked in a file drawer.

WHAT POSSIBLE BENEFITS CAN I EXPECT FROM TAKING PART IN THIS STUDY? There is no direct benefit to you for participating in this study. Participation may benefit the field of teacher education to better understand how teachers' identities develop and how to support teachers throughout the identity development process.

WILL I BE PAID FOR BEING IN THIS STUDY? You will not be paid to participate. However, your transportation costs (or time and effort) will be covered. There are no costs to you for taking part in this study.

WHEN IS THE STUDY OVER? CAN I LEAVE THE STUDY BEFORE IT ENDS? This portion of the study, focus group, is over when you have completed when you have participated in one focus group in July 2020. However, you can leave the study at any time even if you have not finished.

PROTECTION OF YOUR CONFIDENTIALITY The primary researcher will keep all written materials locked in a desk drawer. Any electronic or digital information (including audio recordings) will be stored on a computer that is password protected. What is on the audio recording will be written down and the audio recordings will then be destroyed. There will be no record matching your real name with your pseudonym. The researcher will store materials for three years. After three years the material will be destroyed.

The focus group recording will be sent to a professional transcription service. The transcription service will be required to complete a non-disclosure form, which requires their signature agreeing to maintain full confidentiality in regard to the audio recordings they receive. A copy of this agreement will be provided to you. For quality assurance, the study team, the study sponsor (grant agency), and/or members of the Teachers College Institutional Review Board (IRB) may review the data collected from you as part of this study. Otherwise, all information obtained from your participation in this study will be held strictly confidential and will be disclosed only with your permission or as required by U.S. or State law.

HOW WILL THE RESULTS BE USED? The results of this study will be used to complete the primary researchers Ed.D dissertation in Science Education at Teachers College, Columbia University. The results of this study may be published in journals and presented at academic conferences. Your identity will be removed from any data you provide before publication or use for educational purposes. Your name or any identifying information will be removed. Your name or any identifying information about you will not be published. The researcher will store materials for three years. After three years the material will be destroyed.

CONSENT FOR AUDIO RECORDING Audio recording part of this research study. You can choose whether to give permission to be recorded. If you decide that you don't wish to be recorded, **you will still be able to participate** in this research study.

______I give my consent to be recorded ____

Signature

______I **do not** consent to be recorded____

Signature

WHO MAY VIEW MY PARTICIPATION IN THIS STUDY

___I consent to allow written and/or audio-recorded materials viewed at an educational setting or at a conference outside of Teachers College, Columbia University

____

Signature

___I **do not** consent to allow written and/or audio-recorded materials viewed outside of Teachers College, Columbia University

____

Signature

OPTIONAL CONSENT FOR FUTURE CONTACT

The primary researcher may wish to contact you in the future. Please initial below to indicate whether or not you give permission for future contact.

The researcher may contact me in the future for other research opportunities:

Yes ______________________ No______________________

Initial Initial

The researcher may contact me in the future for information relating to this current study:

Yes ______________________ No______________________

Initial Initial

WHO CAN ANSWER MY QUESTIONS ABOUT THIS STUDY?

If you have any questions about taking part in this research study, you should contact the primary researcher, Andrea Horowitz, at 404-313-0952 or at amh2293@tc.columbia.edu.

If you have questions or concerns about your rights as a research subject, you should contact the Institutional Review Board (IRB) (the human research ethics committee) at 212-678-4105 or email IRB@tc.edu or you can write to the IRB at Teachers College, Columbia University, 525 W. 120th Street, New York, NY 10027, Box 151. The IRB is the committee that oversees human research protection for Teachers College, Columbia University.

PARTICIPANT'S RIGHTS

- I have read the Informed Consent Form and have been offered the opportunity to discuss the form with the researcher.
- I have had ample opportunity to ask questions about the purposes, procedures, risks, and benefits of this research study.
- I understand that my participation is voluntary. I may refuse to participate or withdraw participation at any time without penalty.
- The researcher may withdraw me from the research at the researcher's professional discretion.
- If during the course of the study, significant new information that has been developed becomes available which may relate to my willingness to continue my participation, the researcher will provide this information to me.
- Any information derived from the research study that personally identifies me will not be voluntarily released or disclosed without my separate consent, except as specifically required by law.
- Your data will not be used in further research studies.
- I should receive a copy of the Informed Consent Form document.

My signature means that I agree to participate in this study:

Print name: ____ **Date**: ______________

Signature: ____

Appendix K: Teaching During the Triple Pandemic

	Practice (with Example)	Rationale
Classroom Structures and Routines	Strategic student groupings • Small group meetings • One-on-one teacher and student conference	To provide targeted academic support and foster relationships.
	Community building activities • Mood check-ins • Games (ex. Kahoot) • Sharing of interests, activities, and identity	To build relationships and learn about members of the learning community. To check in about community members' wellbeing.
	Opportunities for students to provide teachers with feedback • Feedback Friday • Collect and discuss student ideas and data	To empower students to share ideas and have a voice in future instructional decision-making. To elevate student voices.
	Designated class time for discussion • Designated space to discuss current events • Teacher modeling of vulnerability and reflection	To create a space to engage in critical conversations with members of learning community.
Instruction and Curriculum	Creating pathways for individualized instruction • Quizlet, Padlet resource board, Ed Puzzle, Peardeck, videos	To provide avenues of learning that are flexible to account for students' access to materials, technology, and learning preference.
	Opportunities for independent study and exploration • Research an energy and heat phenomena of interest	To empower students to explore science and mathematics phenomena that are relevant and of interest students and to foster autonomy.
	Incorporating diverse identities into the curriculum • Highlighting scientists of color working in scientific fields of study	To elevate voices and provide opportunities for students to see themselves in the curriculum.
	Incorporating current events into units of study	To make connections between students' experiences during

	• COVID-19 and impact on the environment integrated into Ecology unit	COVID-19 crisis and science learning.
	Multiple modalities for students to showcase understanding of content • Written, audio recording, visual	To provide flexibility in student assessment due to students' access to materials, technology, and learning preference.
Student Outreach	Personalized communication strategies • Google Voice text and call, emails, Google classroom, Google Meets, newsletter	To be mindful of families' access to technology, time, and resources.