

Becoming: Adult Learners' Identity Work Toward Successful Learners of Mathematics

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DISSERTATION

Submitted as partial fulfillment of the requirements
for the degree of Doctor of Philosophy in Curriculum and Instruction in the Graduate College of
the University of Illinois at Chicago, 2020

Chicago, Illinois

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Dedications

To my wife Ashley and my son Eli. Thank you for your inspiration.

Acknowledgements

I would like to acknowledge those who have supported me through this process. Thank you to my chair, Dr. Danny Martin, and my committee: Dr. Gregory Larnell, Dr. Alison Castro Superfine, Dr. Ann Edwards, and Dr. Vilma Mesa. Your patience, feedback, and insights made me a better writer and researcher. I would also like to thank the group of teacher educators and scholars who taught me how to teach and who inspired me to begin this process: Dr. Pier Junor Clarke, Dr. Christine Thomas, Dr. Janice Fournillier, and Dr. Diesha Williams. Last, I would like to thank Dr. Stinson who deeply shaped the kind of researcher I sought to become.

I would also like to thank the group of people who shaped me as a person and a teacher, my students. So much of whom I am is because of you.

I would like to thank the others, the researchers and teachers who, through your perspective and writing, changed how I view teaching and the world: Dr. Joyce King, Dr. Gloria Ladson-Billings, Dr. Rico Gutstein, Dr. Erving Goffman, Dr. Na'ilah Nasir, Paulo Freire, Michael Foucault, Dr. Peter Bahr, Dr. Albert Bandura, and Dr. Rochelle Gutiérrez.

Last, I would like to thank the participants of this study. You made this possible.

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Abstract

This dissertation is a multi-case, life-story analysis of five adult learners' experiences of success in the context of mathematics remediation in a large, urban community college. Prior research has shown that only a small percentage of learners experience formal success in remediation. To better understand how these learners experience formal success, I examine *identity formation* and *identity work*. Identity formation directs the analysis to how learners come to see themselves as doers of mathematics and how they negotiate identity ascriptions. I examine one aspect of these negotiations as identity work, defined as the narrative and behavioral effort invoked to actualize identities. Multiple forms of data inform this study, including mathematics artifacts as well as semi-structured interviews conducted at two time points. A cross-case analysis of the data revealed two explicit school-level narratives about remediation that participants worked to overcome: mathematics remediation as an institutionally-designated pathway for access and mathematics remediation as a deficit framing of students' mathematics competencies and identities. A within-case analysis reveals how different participants navigated these narratives.

Chapter 1 - Introduction

This dissertation work was inspired by my experiences working with students in remedial mathematics courses at a large, urban community college. I worked with students as an instructor of remedial mathematics courses, and I served as a director who managed the interventions and supports in service of students in remedial courses. In my capacity as director, I routinely discussed the low pass rates and the high attrition rates of students who struggled to find success in the remedial mathematics courses at the community college. I found the discussions troubling because my experiences as an instructor had shown me a different perspective through the stories of my students, particularly the adult learners.

Many of the adult learners I taught had large gaps in their school math experiences. They had chosen a life path different than going straight to college after high school. They were employees, small business owners, veterans, mothers, fathers, sons, daughters, caretakers, and more. They had returned to school, motivated by goals such as advancing their career, finding more financial stability for their family, escaping their current life, and seeking a mathematical understanding and knowledge to better support their kids who were also in school. Because of these goals, many of the adult learners I had the fortune to teach were motivated, driven, and persistent towards finding success. And although they were generally not passionate about mathematics, they were passionate about wanting to learn.

Many of the adult learners I experienced as both director and instructor struggled to, as one participant put it, relearn how to learn. While these adults were often successful in other aspects of their life, the college math classroom was a new frontier, sometimes decades removed from their past school math experiences. This meant that their experiences in remedial math courses profoundly shaped how they viewed themselves as math learners and their trajectories

moving forward to college-level courses at the community college. Working with these students has guided my research interests to understand how adult learners negotiate their experiences as math learners in remedial mathematics courses, and how their experiences in remedial mathematics courses shape their beliefs about themselves as learners and doers of mathematics.

Trends in Mathematics Remediation

Remediation as a program has historically served individuals who sought a postsecondary degree but did not experience a traditional, college-preparatory K12 education (Boylan, 1988; Maxwell, 1979). More recently, reports suggest remediation primarily serves adult learners (Merisotis & Phipps, 2000). However, the effectiveness of remediation as a program is, broadly, in question. Some reports show that mathematics remediation presents a significant barrier to college-level mathematics courses, often multiple semesters in length with financial and graduation implications (Complete College America, 2012; Scott-Clayton & Rodriguez, 2012). Other reports state it has inconsequential effects on learners' postsecondary achievements like completion of college-level mathematics courses and degree completion (Adelman, 2004). Others state that, for the few students who complete remediation, it supports students' completion of college-level mathematics courses and degree completion (Bahr, 2008). In other words, while the program of remediation serves as a primary means for access to a postsecondary experience for learners without the traditional K12 education experience, the effectiveness of the program is questionable. Coupled with this narrative is the disproportionate placement of African American students, Latines students, and students from low-socioeconomic families into remedial mathematics programs (Attewell, Lavin, Domina, & Levey, 2006). In addition, research has shown that the effectiveness of remediation is similarly disproportionate, primarily for African American and Latines students (Bahr, 2008, 2010a).

These broader narratives about remediation at the policy level have local influence on students' perceptions and experiences at the school level. Narratives about remediation carry stigmatizing effects (Arendale, 2005; Deil-Amen & Rosenbaum, 2002), suggesting students who place into remediation experience deficit framing because the program positions them as not college-ready (Conley, 2007). As such, local, stigmatizing narratives may influence students who account for the largest proportions of learners in remediation: African American learners, Latines learners, (Bahr, 2010a; Davis & Palmer, 2010), and adult learners (Soares, 2009, 2013). Such narratives may influence who finds success in remedial mathematics programs, and more exploration is needed towards understanding how students find success in such a program (Davis & Palmer, 2010).

Success as Achievement and Identity

Research on mathematics remediation success in community colleges typically defines success through institutional metrics such as how many students pass a course, how many complete a course, how many complete a program, or how many complete a degree (Attewell et al., 2006; Bahr, 2008, 2010a, 2010b; Bettinger & Long, 2005; Scott-Clayton & Rodriguez, 2012). Less common is research that evaluates students' success in mathematics remediation as an effect on their beliefs about mathematics, such as through identity. Advocates of mathematics identity argue that identity broadens the analytic lens to extend beyond more narrow definitions of success rooted in mathematical achievement to include how learners think about themselves as learners and doers of mathematics (Cobb, Gresalfi, & Hodges, 2009; Martin, 2000). While there is research on students' beliefs in remediation and in community colleges (Fong, Zientek, Yetkiner Ozel, & Phelps, 2014; Mesa, 2012; Zientek, Yetkiner Ozel, Fong, & Griffin, 2013), this research is predominantly quantitative and evaluates change in beliefs across a semester or

compares beliefs between students in different courses (Hall & Ponton, 2005). On the other hand, identity as an analytic lens has been used to show how learners come to think of themselves as learners and doers of mathematics within broader and more local narratives of socialization (cf. Martin, 2000). Specifically, Martin (2006b) states “a mathematics identity is expressed in its narrative form as a negotiated self, the results of our own assertions and the sometimes-contested external ascriptions of others” (pp. 206-207). Specifically, identity affords the opportunity to explore how math learners negotiate broader and more local narratives as resources (Gresalfi & Hand, 2019).

Outside of the community college context, there is a growing body of research on students’ success through mathematics identity in K-12 contexts (Gholson & Martin, 2019; Gresalfi & Hand, 2019; Langer-Osuna, 2011; Martin, 2000; Miller & Wang, 2019; Varelas, Martin, & Kane, 2012; Wood, 2013; Zavala & Hand, 2017) and in 4-year postsecondary contexts (Jett, 2019; McGee, 2015; McGee & Martin, 2011a, 2011b; Solomon, 2007, 2012; Stinson, 2013) with some extended more broadly across contexts (Varelas et al., 2012). Of the research on successful mathematics learners, all draw on participants who have established histories of academic achievement; none draw on participants who have yet to establish identities around formal school mathematics success. However, some intersecting research exists such as: 4-year students’ experiences in remedial mathematics courses through a mathematics identity lens (Larnell, 2016a, 2016b; Larnell, Boston, & Bragelman, 2015), adult learners’ more general identity characteristics in community college contexts (Kasworm, 2016), the identity and self-efficacy of mathematically successful learners in community colleges (Devi, 2019), or adults as learners of mathematics (Evans, 2000). In the intersecting domains of mathematics remediation,

community colleges, adult learners, and successful or emerging successful learners, no research seems available outside of unpublished dissertation theses.

Study and Rationale

This dissertation addresses the call to better understand who finds success and how they find success in remedial mathematics programs at community colleges (Bahr, 2008; Davis & Palmer, 2010). I orient on adult learners due to their representation in community colleges (Merisotis & Phipps, 2000). This dissertation employs a life-story methodology (McAdams, 1985; 2008) and a multi-case study (Yin, 2009) of five adult learners, sampled by convenience, enrolled in a remedial mathematics program at a large, urban community college. I explore learners' academic achievements such as course grades, program completion, and degree completion. I explore learners' mathematic identities in narrative and story form (Martin, 2006b; Sfard & Prusak, 2005) through their life experiences in formal mathematics courses before they enrolled in remedial math courses, during their experiences in remedial math courses, and after their experiences in remedial math courses. The following questions guide this inquiry:

- How does this small, localized sample of five adult learners negotiate, as narrative, school mathematics experiences in and after mathematics remediation towards identifying as successful learners of mathematics?
- How do mathematics experiences around remediation inform these adult learners' mathematics identity?

Through this inquiry, the goals are as follows: to explore what social forces learners experience in and around mathematics remediation; to explore how adult learners negotiate the social forces, in particular how they make assertions as learners of mathematics; and finally, to explore how

adult learners' negotiation and assertions change once they are no longer in mathematics remediation.

Why Identity?

Although the notion of identity is not new (Erikson, 1963, 1968; Foucault, 1972; Goffman, 1963), it is a relatively recent focus in mathematics education research (Boaler & Greeno, 2000; Cobb, Gresalfi, & Hodges, 2009; Larnell, 2016; Martin, 2000; Sfard & Prusak, 2005; Solomon, 2007, 2012). Proponents of identity research argue that it presents an analytic lens that broadens researchers' gaze to extend beyond mathematical thinking and reasoning to include how students come to think about themselves as learners and doers of mathematics. In this, researchers seek to understand how learners identify with mathematics in relation to the forces of socialization that influence their participation in communities inside and outside of the classroom (Martin, 2000; Nasir, 2012; Wenger, 1998), privileging the sociocultural experiences of the learner. This study's context, mathematics remediation and the forces that surround it, plays a pivotal role in the participants' experiences with mathematics and their subsequent stories. There is emerging identity research in the context of mathematics remediation that explores learners' socialized, in these cases racialized, experiences and mathematics identities (Larnell, 2016a, 2016b; Larnell et al., 2015; Roberts, 2019) as well as research on adult learners' identities outside the field of mathematics education (Kasworm, 2016), offering precedence as a framework to explore learners' lived experiences with mathematics.

Why Success?

In studies of success from an evaluation perspective, researchers frame success of community college students in remediation through quantitative metrics like pass rates, completion rates, and graduation rates (Attewell et al., 2006; Bahr, 2008, 2010a, 2010b;

Bettinger & Long, 2005; Scott-Clayton & Rodriguez, 2012). Defining success in this way suggests a deficit framing of students in remediation, positioning them against students identified as college-ready (Conley, 2007). Such a framing perpetuates the same gap-gazing rhetoric found in achievement-gap and equity-gap discourses (Gutierrez, 2008). I argue for a similar focus of success for adult learners as employed by researchers of successful Black learners (Berry, 2008; Larnell, 2016a; Martin, 2000; McGee, 2015; Noble, 2011; Stinson, 2013). However, while I draw inspiration from the work on successful Black learners of mathematics, the participants are distinctly different. Unlike prior identity research on success, the participants in this dissertation did not enter their remedial mathematics program with a traditional academic history or a history of academic achievement. In other words, this dissertation explores participants' academic experiences before, during, and after remediation to determine how participants experienced success in mathematics, which experiences participants posited shaping their identities as successful learners of mathematics, how these experiences shaped their identities as successful learners of mathematics, and the identity work evinced as they came to think of themselves as successful. In short, while the Black participants in this dissertation could be considered candidates for current research on successful Black learners (cf. Martin, 2000; Stinson, 2013) at the time of their final interview, they would not have qualified as "academically successful" at the starting point of this research while they were enrolled in remedial mathematics courses at community college.

Why Adult Learners?

Whereas adult learners, defined in this dissertation as students over the age of 24, are the participants of this study and their identities as adult learners coincides with their identity work, I do not position this research in the domain of adult education (cf. Evans, 2000; Kasworm, 2016).

A primary reason for this decision is the structure of mathematics remediation at the community college level. In the three-tier sequence of remedial mathematics courses at the college, only the first, foundational studies of mathematics, was positioned in the adult education program. In other words, the second and third tier of courses, Beginning and Intermediate Algebra respectively, were credit-bearing and offered through the general education program. Second, while I initially collected data from a variety of students in Beginning Algebra during the first time period of the study, in remediation, I moved forward with only adult learners for several reasons.

Adult learners have lived longer than traditional college students and thus may bring a larger bank of lived experiences that inform their identities and actions. Second, adults as learners of mathematics typically bring a gap in their formal school education, which often results in placement into remedial mathematics courses (Soares, 2013). This suggests their identity as a student has faded with time, which may impact their understandings and identities of mathematics (Evans, 2000). Finally, remediation as a program once served almost exclusively adult learners (Boylan, 1988; Maxwell, 1979), which suggests their experiences in remediation may differ from the recent high school graduates whose outcomes and paths fuel current remediation reform. As such, I sought to explore the effects of remediation on learners it historically served.

Key Findings

Through a cross-case analysis of participants' narratives about their mathematics' learning experiences in remedial math courses, two common, school-level narratives about remediation emerged. These include: (1) remediation as an institutionally designated pathway for access to college-level mathematics and (2) remediation as a deficit framing of students'

mathematics competency. The latter included remediation as low-level mathematics courses, remediation as a refresher of high school mathematics, and remediation as a program for learners who were ‘bad at math.’ As resources for identity formation and identity work, these school-level narratives about remediation shaped how learners came to think of themselves as doers of mathematics. A within-case analysis shows that, for the majority of participants, this meant doing identity work around a deficit designation of their competency. As such, even as participants experienced academic achievement and formal successes during and after their remedial mathematics program, successes beyond their peers, four of the five participants struggled to identify positively as learners and doers of mathematics. This suggests that the limited availability of school-level narratives that positively framed learners’ mathematics competency afforded few opportunities to do identity work around the designation of being ‘good at math.’

Second, participants’ narratives suggest mathematics remediation at the community college invoked two salient social identities in their identity work around school-level narratives about remediation: age and race. In terms of age, being an adult learner shapes how learners make assertions as learners and doers of mathematics. For example, one participant struggles with identifying as successful because his experiences suggest his age offers limitations on what success means. Two other participants suggest that remediation was their last chance to experience formal success in mathematics. In terms of race, two participants present salient perspectives of their experiences in mathematics remediation at the community college. One offers the perspective of a Black woman from the ‘inner-city’ schools the college serves, while the other offers the complementary perspective of a white male from an affluent, suburban school.

Overview of the Dissertation

This dissertation is organized into 8 chapters. In Chapter 2, I discuss extant research on remediation, including its history, and recent evaluations and reforms. I reveal characteristics of students placed into mathematics remediation, including demographics, perceptions, and culture. I discuss research on students' success in remediation and position identity as a new and useful lens for understanding students' success. Next, I analyze research on mathematics identity, identity and student success, and adult learners' identities, drawing on research from K12 and post-secondary contexts as well as broader research on identity and success, discussing in depth research on successful African American learners as a domain to inform adult learners and success. Last, I discuss identity work as a theoretical framework for adult learners' negotiation and construction of mathematics identities.

In Chapter 3, I discuss this study's research design. I explain how the study was conducted, using a narrative, life story approach to examine the experiences of a group of adult learners as they experience mathematics remediation through a multi-case design. I describe the community college where the study took place, introduce the participants, and outline the data collection and analysis as informed by the grounded theory approach I employ.

Chapter 4, as a liminal chapter, introduces the participants. It includes my perspective of each participant. It presents narratives about participants' school math experiences before they enrolled in community college, and it presents narratives about their experiences with remediation before the first day. This chapter serves as the beginning of participants' stories with remediation.

Chapters 5 and 6 include the major findings of the study. Chapter 5 presents a cross-case and within-case analysis of participants' narratives during their final remedial mathematics course. The cross-case analysis presents two school-level narratives about remediation that participants worked to overcome: mathematics remediation as an institutionally designated pathway for access and mathematics remediation as a deficit framing of students' mathematics competency. The within-case analysis reveals how different participants navigate these narratives. In Chapter 6, I present a similar cross-case and within-case analysis, this time of participants' narratives offered in reflection of remediation. The cross-case analysis reveals that despite experiencing formal successes, the majority of participants struggle to identify positively with mathematics. The within-case analysis reveals that in their reflections of remediation, social identities of race and age uniquely shaped participants' identity work.

In Chapter 7, I offer a discussion of the findings. I suggest the emergent, school-level narratives about remediation, as the only salient narratives about remediation available, offer one potential reason why participants struggle to identify positively with mathematics. Second, I discuss remediation as an intersectional experience. Finally, in Chapter 8, I offer implications for policy, practice, and research. I discuss the limitations of the study, and I offer concluding remarks.

Chapter 2 – Literature Review

In this chapter, I discuss extant research on mathematics remediation in terms of its history, recent evaluations, and recent reforms. I reveal characteristics of students placed into mathematics remediation. I discuss research on students' success in remediation and position identity as a new and useful lens for understanding students' success. In so doing, I orient on the general consensus that few learners in mathematics remediation experience formal success, and several factors may contribute to this, including broader historical and policy-driven narratives about remediation and more local school-level narratives about remediation.

Second, in service of expanding traditional definitions of success, I present research on mathematics identity, emphasizing research on identity through narrative. I further draw on research from K12 and post-secondary contexts as well as broader research on identity and success. In addition, I discuss research on successful African American learners as a domain to inform how identity might be used in service of adult learner negotiations of success.

Finally, I offer identity work as a way to examine learners' negotiations around local and broad narratives as resources for identity formation. I briefly discuss research in mathematics education that offers insight into the process of negotiation. I discuss broader research on identity work, and I orient on one framing for the study.

Defining Remediation

Since the inception of universities and colleges in the United States, programs have existed that support students who did not have sufficient educational experience to be successful in college courses (Boylan, 1988; Maxwell, 1979). These programs have ranged from tutoring services to multiple, credit-bearing courses. Their label has changed depending on the generation of the programs and their purposes, including: academic preparatory programs, remediation,

compensatory education, learning assistance programs, developmental education, and access programs (Arendale, 2005). Each label carries a different meaning and direction for the program. For example, remediation was the most common label between the 19th and 20th centuries; it followed a medical model where students were “assessed for their academic weakness and a prescriptive treatment was directed for their specific problem” (pp. 68-69). The program typically focused on basic skills (Maxwell, 1979; Ross & Roe, 1986), and the label carried a stigma for those placed into the program (Arendale, 2005; Deil-Amen & Rosenbaum, 2002) due to its deficit framing. Developmental education as a label emerged in the 1970’s, and “value-added or talent development perspective assume[d] that each student has skills or knowledge that can be developed” (Arendale, 2005, p. 72). The label suggested that any student who experiences the program, including those misplaced, would find benefit from ‘development’ within the program. However, the label did little to distance the program from the stigma that the label remediation carried.

In the context of this study, Community College, the program was officially labeled developmental education; nevertheless, the program was quite commonly referred to as remediation, particularly by administrators and more seasoned faculty. Second, while developmental education may be more common and may carry less of a stigma, as director, teacher, and researcher, I found the implication problematic. Developmental as a label carries an assumption that all students benefit from the program, despite, the stigma that remained after the change in terminology. In other words, the label suggested that there was a value to being stigmatized, to being positioned as ‘not college-ready’. For these reasons, I refer to the program as remediation in this dissertation, forefronting the stigma and the negative implications it carries.

Mathematics Remediation

History suggests colleges and universities open their doors to students when sociopolitical narratives pressure such moves, such as when US soldiers returned home from World War II, or when the civil rights movement shifted the academic landscape under desegregation (Boylan, 1988; Maxwell, 1979). History also suggests colleges and universities moved to become more selective, limiting who could gain access, like during the race to space after the launch of Sputnik or, more recently, the increasing representation of the US population seeking a post-secondary degree (Boylan, 1988; Maxwell, 1979). This fluidity of access is felt most in the programs of remediation, ostensibly created and used in service of the underserved or underprepared due to systemic societal disparities.

Remediation's history contained deep, intersectional narratives involving the histories of race, gender, class, and age in the United States (Boylan, 1988; Jones & Richards-Smith, 1987; Maxwell, 1979). As the narrative of access shifted, so too did remediation. During open-door periods of history, remedial programs were found at the top colleges and universities across the country, such as Ivy League universities (Merisotis & Phipps, 2000) and the University of Minnesota's General College (Higbee, Lundell, & Arendale, 2005). During 'selective periods of admission,' systems shifted remediation away from four-year institutions to community colleges (cf. Adelman, 2004; Bettinger & Long, 2005). This trend was most felt by those most commonly served by remedial programs and by community college systems.

Who Takes Remedial Courses

In terms of representation, "students of color, students from less affluent families, and students for whom English is a second language are greatly overrepresented in remedial courses" (Attewell et al., 2006, p. 887). In the context of community colleges, approximately 62% of

African Americans, 59% of Latines, and 43% of adult learners place into remediation (Complete College America, 2012). Other reports suggest up to 80% of students in remedial courses are adult learners (Adelman, 1994). Similarly, in their analysis of the NELS:88 data set, Attewell et al. (2006) found that 58% of students are enrolled in remedial courses. Less discussed is the increasing shift of representation of recent high school graduates, particularly those who are academically successful. Attewell and colleagues (2006) problematize this assumption:

[We] may expect that remedial coursework in college is restricted to students who leave high school having taken a less rigorous curriculum or whose academic skill levels are low. In reality, remedial/developmental education encompasses a much broader swath of students and many ability levels. The NELS tested high-school seniors on their math and reading skills before they went to college. We can classify students according to how they scored on that combined math/reading assessment in 12th grade, from the highest first quartile to the lowest-scoring fourth quartile. We find that many skilled students took some remedial coursework in college: 10% of those who scored in the top quartile on skills tests and 25% of students in the second quartile took remedial coursework. (p. 899)

In addition, Attewell and colleagues (2006) found that community colleges are more likely to place a student into remedial courses, even if they are academically successful. This result suggests that remediation no longer serves as a program of access for the underserved or underprepared, at least not fully. Rather, remediation is serving as a barrier to entry, one of the limiting agents used by colleges and universities to increase selectivity. This shift is more evident in recent program evaluations and policy shifts surrounding remediation.

Recent Reports on Remediation and Resulting Reforms

Remedial education represents over a billion dollar portion of the government-funded allocation to higher education (Merisotis & Phipps, 1998, 2000). Some 1.7 million students at both two-year and four-year institutions go through remedial courses each year, and they spend an estimated three billion dollars on these courses (Amos, 2011). Approximately 45% of all students currently enrolled in colleges attend public community colleges, and approximately 45% of all graduates in 2010-2011 who received a degree had, at some point in their scholastic

careers, attended a two-year college (Aud et al., 2011; Dowd et al., 2006). Given that such a large portion of students require remediation in some manner - more than 50% of students entering two-year colleges require remediation (Complete College America, 2012), given that “nearly 4 in 10 remedial students in community colleges never complete their remedial courses” (p. 2), and given that fewer than 1 in 10 students who require remediation do not graduate, remedial education is considered “The Bridge to Nowhere” (Complete College America, 2012, p. 1). Several reports have concluded there is little to no impact on success rates and retention rates for students who experience developmental/remedial mathematics course work as a treatment compared to those of similar characteristics who did not (Bailey, 2008; Calcagno & Long, 2008; Jaggars & Stacey, 2014; Scott-Clayton & Rodriguez, 2012).

These evaluations led to a number of reforms. Sequence reforms targeted the effects of the low pass rates of remedial courses, with creators acknowledging that the less time a student experiences the remedial pathway, the less chance there is for student failure or attrition. These reforms reduced the number of remedial courses to two, sometimes one (e.g. CUNY’s Start). Some have also pursued making mathematics remediation optional (Florida) or removing it completely (Connecticut) (Fain, 2013, June 5, 2014, April 7). Other reforms targeted content, acknowledging so few majors and careers utilize algebra or algebraic reasoning to any significant degree, splitting mathematics remediation into paths, one without algebra for those who do *not* transition to STEM fields and one with algebra for those transitioning to STEM fields. Finally, pedagogical reforms targeted the ways remedial courses are taught, integrating non-cognitive research on engagement and motivation, such as the work on productive persistence and grit, along with curricular models that emphasize student-centered learning,

questioning, and application. Quantway and Statway, for example, include content and pedagogical reforms (Howington, Hartfield, & Hillyard, 2015; Merseth, 2011; Yamada, 2014).

As evaluations of the reforms continue to emerge, emphasis, as in prior evaluations, seems focused on institutional metrics – pass rates and completion rates. Students’ experiences have played a minor role outside of the most prevalent interventions, such as growth mindset development, for example (Dweck, 2006; Dweck, Walton, & Cohen, 2011; Merseth, 2011). Considering the potential, negative experiences for students in remediation (Deil-Amen & Rosenbaum, 2002), especially for students who are academically successful and who identify as African American due to the contingencies it evokes (Larnell, 2016a; Larnell et al., 2015), research on students’ experiences in remediation and the cultures, norms, and positioning they experience becomes paramount, particularly for students who find success in it under varying characteristics (Bahr, 2008, 2010a, 2010b).

Research on Students’ Experiences in Remediation

Some research suggests the community of students who place into remediation are highly motivated and hardworking (Mesa, 2012), returning to school to seek something lost or never quite attained, such as success in school mathematics (Martin, 2007). Other research suggests the community’s agency and self-beliefs are diminished compared to those who place into college-level course work (Hall & Ponton, 2005), particularly for adult learners (Spence & Usher, 2007). One reason may be the institutions local cultures of remediation. Indeed, Acevedo-Gil and colleagues (2015) found students “experience moments of invalidation and validation within developmental education courses and outside of the classes” (p. 108) by both institutional agents (advisors, instructors, etc.) and peers. Consequently, potential invalidating moments may arise

due to the stigma of remediation, a perception that has been shown to negatively impact students' experiences (Deil-Amen & Rosenbaum, 2002; Larnell et al., 2015).

Several factors may lead to the stigmatization of remediation. Dougherty (1994) has shown that instructors' low expectations of students correlates with reduced performance – a “self-fulfilling prophecy” of sorts. Undeniably, this low expectation may derive from the positioning of remediation as a program devoted to improving basic skills deficiencies (Ross & Roe, 1986) and the positioning of students in remediation as low achieving and high risk (Kulik, Kulik, & Shwalb, 1983). Similarly, Larnell and colleagues (2015) present several facets of school-wide perceptions of remediation. In their research, students' perceptions are revealed in a salient skit performed by them that highlights expectations for experiences in an Intermediate Algebra class, presented by past students:

The skit's loose plot was intended to reflect these [remedial] classes and their typical routines, but it also showcased the student-centered perspective on what actually occurs. The skit portrayed students who were attempting to capture as much of the breakneck-paced lecture as they could, while for many of the actors this ended quickly as they instead opted to ignore the classroom activity and carry on with their social exchanges. Eventually, none of the actor-students were paying much attention to the actor-instructor, who was seemingly oblivious to the loss of audience. The skit ended abruptly as someone imitated a ringing bell (which was not a true element of the college classroom), and the actor-students dashed madly for the door, leaving their books behind. (p. 54)

In the same vignette students experience several of the school's support structures while also experiencing a threat to her identity as an academically successful Black woman. Another vignette presents a student's perception of a faculty member who teaches remedial mathematics courses; Larnell and colleagues unpack the instructor's tendency to position students' poor performance as individual deficiency – “they don't like to think” (p. 55). While invoking research on race may seem out of place at this point, it is worth recalling the overwhelming percentage of African American and Latines students that place into remediation (Attewell et al., 2006). Some students experience threats to their identities as math learners (Larnell, 2016b),

requiring identity work to navigate. Indeed, Acevedo-Gil and colleagues' (2015) findings suggest Latines students similarly navigate experiences in remediation that position them negatively. In other words, students who find success in remedial mathematics courses are profoundly rare.

Success and Remediation

It is well documented that students who place into remediation have a lower chance of completion of a college degree, particularly as the number of remedial courses required increases (Calcagno & Long, 2008; Complete College America, 2012). Peter Bahr has extensively researched the impact of remediation on students' formal success (Bahr, 2008, 2010a, 2010b). In his analysis of 85,894 freshmen enrolled across 107 community colleges, Bahr (2008) shows through hierarchical logistic regression analysis that those who successfully remediate "exhibit attainment that is comparable to that of students who achieve college math skill without the need for remediation" (p. 442). However, he also found that "three out of four remedial math students do not successfully remediate" (p. 442). In other words, some students do find success through remediation, but the vast majority do not.

In Bahr's (2010a) follow-up analysis of remediation, he focuses on racialized disparities in remediation. In his analysis of 64,170 freshmen across 104 community colleges, he finds the "odds of remediating for White students are 3.1 times the odds for Black students and 1.6 times that of Hispanic students" (p. 220). That is, Black learners and Latinx learners in remediation do not experience the same level of academic success as White learners, even when controlling for proficiency in past math courses. However, when controlling for proficiency, he suggests that the disparities between racialized groups minimizes significantly. Finally, he does find that *if* Black

and Hispanic students successfully complete remediation, there are not significant differences in academic attainment.

Summary and Synthesis

Mathematics remediation reports and research suggest that the program serves as one of the primary means of access to a postsecondary degree, particularly for students who did not experience a college-preparatory K12 education (Boylan, 1988; Maxwell, 1979). Reports and research also suggest that remediation as a program does not provide access (Complete College America, 2012). Even as institutions place large proportions of students into remediation (Attewell et. al., 2006), only a small percentage of students seem to find success in remediation (Bahr, 2008, 2010a; Complete College America, 2012). Decidedly, researchers have called for a better understanding of this small group of learners (Bahr, 2008; Davis & Palmer, 2010). Such trends have resulted in both broad and more local, school-level narratives that shape students' experiences in remediation, and these local, school-level narratives may be one reason why so few students who place into remediation find formal success in it. As research on formal definitions of success such as a pass rates and degree completion have yielded little insight as to who finds success, I turn to identity as a lens on success to broaden my analytic gaze.

Mathematics Identity

Identity, colloquially, orients on how an individual thinks about their self. Identity as a construct can be both nebulous and vague (Cobb et al., 2009; Sfard & Prusak, 2005). In theorizing it, one can draw on, for example, psychological, sociological, and anthropological traditions (Cote, 2009; Erikson, 1963a, 1963b, 1968; Holland, Lachicotte, Skinner, & Cain, 1998; Wenger, 1998). Broadly, it can be defined as participative, narrative, discursive, psychological, performative, or any combination of these (Darragh, 2016). For this study, I orient

on identity as a performative expression through narrative. In this study, identity is plural in that one possesses multiple identities that are made salient through experiences and expression.

Identity as a framework in mathematics education has become prevalent in recent decades (Darragh, 2016; Radovic, Black, Williams, & Salas, 2018). Positioning identity within the umbrella of student disposition, the National Research Council (2001) includes identity as a strand of mathematics proficiency, and the National Council of Teachers of Mathematics (2000) includes it as a major goal of school mathematics programs. Identity is positioned as the “missing link” between learning and context (Sfard & Prusak, 2005). It serves as a bridge between the environment, communities, and individuals in the context of learning and teaching (Boaler, 2002; Boaler & Greeno, 2000; Cobb et al., 2009; Martin, 2000, 2009b; Nasir, 2012; Noble, 2011). It is a tool to understand how equity, access, and power are negotiated (Gutierrez, 2007, 2013). Finally, it has served as a lens for understanding successful learners of mathematics (Berry, 2008; Martin, 2000; Stinson, 2013). In understanding how adult learners negotiate experiences in remediation, I unpack mathematics identity research around success and remediation. It is worth noting that little to no research exists on adult learners’ mathematics identities in community college remedial mathematics courses. As such, I examine broader contexts with several parameters: I draw on research in K-12 and postsecondary contexts, as well as graduate program contexts; I draw on research on beliefs that exist within common definitions of identity such as mathematics self-efficacy; and last, I draw heavily on mathematics identity research on successful African American learners.¹

¹ I draw on research of successful African American learners because adult learners’ narratives suggest similar, intersectional (Crenshaw, 1989, 1991) experiences with deficit framings due to

Identity as a Lens on Success

Before proceeding, it is worth noting that in my review of literature on success I also include research on academic achievement. I include it because academic achievement is frequently used a lens for success, despite the deficit framing of those considered ‘under-achieving’ that accompanies it (Gutierrez, 2008; Martin, 2006a). I include it to problematize success and to review potential meanings participants may construct about success, including success as academic achievement. Second, it is worth noting that the majority of research I cite on success emphasizes the success of African American learners. I orient on this literature because research on successful African American learners grew as a counternarrative to the deficit framing of African Americans through achievement as a lens for success (Martin, 2000, 2006a, 2007, 2009a, 2009b, 2012, 2009c; Martin, Gholson, & Leonard, 2010; Martin & McGee, 2009; Varelas et al., 2012). I envision a similar counternarrative forming about learners in remediation as successful, despite their deficit framing. Further, this body of research draws on intersectional theory (Crenshaw, 1989, 1991) to show the importance of race in African American learners’ mathematics identities, an outcome I anticipate for the proposed research. I see prior work as exemplars for how intersectionality may be used to frame successful learners in remediation. In this section I present research on mathematics remediation, identity, and achievement. After, I present broader, relevant research.

their age, gaps in formal education, and their positioning with reference to remediation. No other body of research repositions learners as agentic and valuable. Last, I do *not* draw on this body of research for comparisons.

Research has shown that learners with a history of academic achievement experience broader narratives about race and achievement and more local narratives about remediation (Acevedo-Gil et al., 2015; Larnell, 2016a, 2016b; Larnell et al., 2015). In a university context, Larnell (2016b) analyzes the experiences of two African American learners around the effects of identity threats relating to their more positive mathematics identities. While not the focus of the research, McGee (2015) presents an account of a learner who feels “despair” as placing into remediation because of her history with mathematics as academically successful, an experience echoed in other research (Acevedo-Gil et al., 2015).

Others, however, place into remediation with more diverse academic experiences before college. For example, Larnell and colleagues (2015) present a case of a learner who enters remediation feeling cheated in high school and not identifying as high achieving. She positions herself at the back of the class; she feels disconnected from the instructor and content, going as far as displaying an outwardly negative perception of the instructor; and in the class, she struggles to disassociate underperformance with narratives about remediation and race. Acevedo-Gil and colleagues (2015) suggest experiences in remediation affect participants’ expectations of success, offering insight into moments where participants are supported or not supported as learners of mathematics. Devi (2019) analyzes the intersectional experiences of 13 mathematically successful learners at two community colleges comparable to the context for this study. She finds that despite experiencing multiple remedial math courses, learners showed positive, success-oriented mathematics identities, particularly in their beliefs to do math. This suggests remediation can be, potentially, a place for learners to negotiate and construct meanings of success.

Comparative studies offer insight into differences in students' beliefs for those who place into remediation and those who do not. In her study involving 777 students from a large suburban community college, Mesa (2012) explores the differences in beliefs between students in remedial mathematics courses and students in college-level mathematics courses. In comparison to students who place into college-level math courses, she finds that students who place into remediation show a higher perceived ability to do math, and a higher "interest in being challenged to think and work hard" (p. 80). On the other hand, Hall and Ponton's (2005) suggest students enrolled in calculus reported significantly higher beliefs in their ability to do mathematics compared to students enrolled in a remedial mathematics course ($t = 8.902$, $p < .001$). In other words, students' beliefs in their ability to do math seem institutionally driven, again suggesting local experiences shape their identities and beliefs.

Only minimal studies present insight into adult learners' experiences in remediation at community colleges. Spence and Usher (2007) find that learners' perceived ability to achieve a grade is negatively related to age ($r = -0.31$), "suggesting that older students had less confidence in their ability to perform well on the mathematics exam" (p. 276). They also found class participation and engagement was related to age ($r = 0.21$), and in their modeling, they show that age ($\beta = .161$) and learners' perceived ability to achieve a grade ($\beta = .438$) jointly predict achievement ($F[6, 157] = 11.28$, $p < .0001$). These relationships suggest characteristics of students' mathematics identity and their age impact how these learners perform in their remedial math courses.

As little research exists on success in mathematics remediation outside of formal measures of success, I turn to research on success of African American learners to more broadly situate the study. Sociohistorical narratives in mathematics framed African American learners

from a deficit perspective in achievement gap rhetoric (Gutierrez, 2008), a framing that is echoed by placement into remediation and the stigma this carries (Arendale, 2005; Deil-Amen & Rosenbaum 2002). In response to this deficit framing, mathematics identity researchers sought ‘high-achieving’ African American students to explore narratives of success. ‘High-achieving’ as success was operationalized in various yet similar forms. For example, Stinson (2013) operationalizes success:

The descriptor “demonstrated achievement and persistence in high school mathematics” was met if a participant achieved one or more of the following criteria his junior or senior year of high school: (a) completed an Advanced Placement calculus or statistics course with a grade of C (70%) or better, (b) completed a joint-enrollment calculus or statistics course with a grade of C (70%) or better, or (c) scored in the 4th quartile (top 25 %) of the mathematics portion of the Scholastic Achievement Test. (p. 74)

Noble (2011) and McGee (2009, 2015) emphasize mathematics course-work, grades, and major requirements:

The selection criteria included Black or African American self-identification, along with standard measures of high academic and mathematics achievement. The criteria for undergraduate participation were unofficial college transcripts that indicated the participants’ junior or senior status, mathematics or engineering major, maintenance of at least a 2.8 grade point average (on a 4.0 scale) in mathematics courses, successful completion of at least 10 mathematics and/or engineering-related courses, and an A or B in at least five of those classes. (McGee, 2015, p. 45)

Within research examining student characteristics such as efficacy, a component of agency, success was aligned with academic achievement similar to the community college that serves as the context for the present study, defining it as a grade of “C” or higher (Clutts, 2010; Fong et al., 2014; Spence & Usher, 2007; Zientek et al., 2013).

Next, I present a meta-synthesis of the qualitative research of studies on successful African American learners. Berry and Thunder (2015) extract five methods African American learners use to negotiate their experiences as they find success with mathematics and build positive mathematics identities (shown in Table 1).

Table 1. Findings from Berry and Thunder's (2015) Meta-synthesis.

First Finding	Learners developed identities based on values, which were affirmed by others with whom they interacted; these values were identity-affirming and supported perseverance in mathematics.
Second Finding	Learners negotiated their own definitions of success; perseverance was anchored by meeting learners' new and evolving definitions of success across time.
Third Finding	Learners encountered issues of awareness and access along their experience pathways and persevered in order to overcome these issues.
Fourth Finding	At the intersection of academic and racialized images, learners negotiated ways to persevere in mathematics.
Fifth Finding	Learners with a high sense of agency persevered with mathematics across time; they chose to pursue their own pathways to success sustained by the work ethic of practice and perseverance.

These themes include: the learner-driven *values* that inform their meanings of success, the *racialized experiences* of mathematics, issues of *access* with mathematics, and the *motivation* and *perseverance* learners' exhibit as they find success. These themes suggest that successful learners of mathematics draw on both out-of-school experiences in their communities for values that shape their identity formation as doers of mathematics. In addition, they offer insight into how learners negotiate deficit-oriented narratives that may inform how learners in this study negotiate narratives about remediation. Toward this end, I draw on these themes in my research design, most notable the survey protocol.

In summary, research of successful learners in mathematics that discuss remediation present it as a deficit-orienting experience that successful learners overcome (cf. Devi, 2019) or struggle to overcome (Larnell, 2016). Research suggests that learners in remediation negotiate local narratives of remediation around achievement, success and race (Devi, 2019; Larnell, et al., 2015; Larnell, 2016) as they overcome it. I position this study in this small group of research, adding another local context to understand how remediation shapes learners' experiences with

mathematics and success. In the final sections, I draw on extant research to define mathematics identity and negotiation as a form of identity work.

Defining Mathematics Identity

Toward explicitly defining mathematics identity, I begin with Martin's (2000) seminal work. He defines mathematics identity as a person's beliefs about "(a) ability to do mathematics, (b) the significance of mathematical knowledge, (c) the opportunities and barriers to enter mathematics fields, and (d) the motivation and persistence needed to obtain mathematical knowledge" (p. 19). He frames individuals as active agents in their identities, negotiating social identities as learners of mathematics and as African Americans. While Martin's framework for mathematics identity and socialization does not stand alone (cf. Boaler & Greeno, 2000; Nasir, 2012), it is widely represented in research on mathematics identity (Cobb et al., 2009; Grant, Crompton, & Ford, 2015; Martin, 2007, 2009b, 2012; McGee, 2015; Stinson, 2013) and in conjunction with Sfard & Prusak's (2005) framing of identity as narrative (Larnell, 2016a; Varelas et al., 2012).

Sfard & Prusak (2005) define identity as a set of stories about an individual, told by themselves and by others. They orient on three defining characteristics of these stories: *Reifying*, *Endorsing*, and *Significant*. *Reifying* stories include narrative with *is*-statements, orienting on a state rather than an action. *Endorsing* stories include narrative where the individual suggests the *Reifying* narrative reflects their self. Finally, stories are *Significant* if a change in it affects how the storytelling views or feels about the individual, including an individual's view of themselves. In this definition, Sfard & Prusak (2005) offer an ease to investigating identity expressed in narrative form, because in their definition, these stories are the individual's identity, not a window into it or reflective of it. In this study, I draw on Sfard & Prusak's (2005) definition to

code mathematics identity as narrative. Notably, Martin (2006b) states that “a mathematics identity is expressed in its narrative form as a negotiated self, the results of our own assertions and the sometimes-contested external ascriptions of others” (pp. 206-207). In so doing, he offers insight into how I can investigate learners’ identity formation and negotiation.

Negotiation as a Form of Identity Work

As Martin (2006b) posits, mathematics identity in narrative form is the negotiation of personal assertions with external ascriptions from others in social spaces. Indeed, Martin suggests ascriptions are sometimes contested, such as when a student rejects being identified as a remedial learner. In participants’ narratives, I noticed that participants sometimes accepted an ascription, and sometimes they resisted an ascription. In other words, I saw subtle differences in how and when participants *Endorsed* ascriptions, both implicitly and explicitly (Sfard & Prusak, 2005). I reasoned that broad and more locally driven narratives about remediation may inform how participants negotiate ascriptions, potentially including negotiating of ascriptions as learners of mathematics around other *social* identities like race, gender, and age (cf. Gholson & Martin, 2014; Solomon, 2012; Zavala & Hand, 2017).

Negotiation has been discussed in mathematics education research (cf. Cobb et al., 2009; Zavala & Hand, 2017), but these framings did not resonate with participants’ narratives. For example, Cobb and colleague’s (2009) orient on participants’ negotiation of classroom norms and obligations in relation to their personal assertion, and this study is not so deeply embedded in the formal classroom experience as I did not collect data around it. Zavala and Hand (2017) present counter narratives as a form of negotiation of broader, master narratives in math education. Their framing only partially captured participants’ negotiation as I saw in

participants' narrative more nuanced and subtle negotiations, outside of broader, master narratives. Undoubtedly, it was because of this that I explored research on identity work.

Much research on identity work is situated in the domain of identity at work (see Alvesson and Willmott (2002); Watson (2008) as entry points), extending to the identity work of inservice and preservice teachers as they come to negotiate external ascriptions in the work space (Chronaki, 2013; Kaasila, Hannula, & Laine, 2012). Less research orients on the identity work of students, with some exceptions (Barton & Tan, 2010; Hawkins, 2005; Mendick, 2005). Some research uses the term identity work as a slogan, with the definition assumed (cf. Hawkins, 2005). Others describe it as a process. For example, Chronaki (2013) describes identity work as “personal-social interplay and refers to the ways we narrate ourselves and how others talk about us” (p. 4). Barton and Tan (2010) describe it as a means of “trying out new identities” as individuals “work to figure themselves and be figured” (p. 192) in their experience. However, I sought a definition that could inform my methods. Recognizing the analytical challenges of identity work (Kaasila et al., 2012), I turned to Snow & Anderson's (1987) research. In their conceptualization of identity work, individuals negotiate identities through a variety of performative acts including but not limited to “the verbal construction and assertion of...identities” (p. 1348), such as expressed in narrative form. They contend that individuals' performative acts are made socially where ascriptions are offered. At times, participants *embraced* such ascriptions, suggesting it aligned with their self-concept. Other times participants in their study *distanced* from ascriptions.

Practically, Snow and Anderson's (1987) framing resonates with participants' experiences. Foremost, they position identity work as a set of performative assertions through narrative amidst external ascriptions, resonating with Martin's (2006b) conceptualization of math

identity in narrative form. Second, Snow and Anderson (1987) drawing on Goffman's (1963) work on the effects of stigma of homelessness on identity development resonates with the stigma of remediation and its effects (Arendale, 2005; Deil-Amen & Rosenbaum, 2002). Last, their frame (Snow & Anderson, 1987) orients on the roles, associations, and institutional spaces homeless experience. Remediation as a designation derives from a similar, broad set of experiences. Narratives about remediation could be implied through a role assignment (you are not in remediation); they could be implied through association or group membership (peers in remedial classroom); and they could be implied through institutional spaces like classrooms of the office of the director of developmental education. Aligned with Martin's (2006b) conceptualization of math identity in narrative form, Snow and Anderson's (1987) frame for identity work provides an analytic approach to explore how participants make assertions as learners of mathematics in social spaces around remediation and, as important, how participants were afforded or denied opportunities to make assertions due to local and broad narratives about remediation. With mathematics identity and identity work thus defined, I next present the research design I employed to explore how participants' experiences in remediation shaped their mathematics identity.

Chapter 3 – Research Design

My goal for this dissertation is to explore how a group of adult learners, defined as adults ages 24 or older (Soares, 2013) in community college remedial mathematics courses, negotiate identities towards becoming successful math learners. The following questions guide this inquiry:

- How does this small, localized sample of five adult learners negotiate, as narrative, school mathematics experiences in and after mathematics remediation towards identifying as successful learners of mathematics?
- How do mathematics experiences around remediation inform these adult learners' mathematics identity?

This chapter presents the research design for my inquiry. First, I discuss my approach to investigate participants' experiences and negotiations through a life-story methodology (McAdams, 1985; 2008) and through a dual time-point case study (Yin, 2009). Next, I present the research context, the participants, and the data I collected in service of my inquiry. I offer ethical considerations around my position as a researcher and my relationships with the participants. Last, I present the data analysis. I embed my story with this research, including a timeline for inquiry.

As this is an exploratory study, I focus on a small, localized sample of five adult learners. My intention is to add to the knowledge base that pushes against deficit framings of students and that offers alternative framings of remedial math in community college settings. Adult learner is the case, and their stories are the unit of analysis (Yin, 2009).

Narrative and Life Story Approach

As I employ mathematics identity as a lens on how adult learners come to think of themselves as successful learners of mathematics, I explore the experiences that shaped their perceptions of themselves and the identity work they employed to construct, maintain, and negotiate their selves through a variety of activities as identity work. Snow and Anderson (1987) suggest identity work involves:

...the range of activities individuals engage in to create, present, and sustain personal identities that are congruent with and supportive of the self-concept. So defined, identity may involve a number of complementary activities: (a) procurement or arrangement of physical settings and props; (b) cosmetic face work on the arrangement of personal appearance; (c) selective association with other individuals and groups; and (d) verbal construction and assertion of person identities. (p. 1348)

In this dissertation, I foreground the latter type of activities through the analysis of life narrative or life stories (McAdams, 1985, 2008, 2018; McAdams & McLean, 2013; McLean et al., 2018). Indeed, “stories are the best vehicles known to human beings for conveying how (and why) a human agent, endowed with consciousness and motivated by intention, enacts desires and strives for goals over time” (McAdams, 2008, p. 244). Stories capture both consistent and inconsistent patterns over time (McAdams, 1985), such as a person repeatedly identifying as ‘bad at math’ across interviews or as a person describing what sequence of events led them to changing their major. Stories are told in social relationships, meaning the storyteller and listener play roles in the expression and meaning of narrative (Pasupathi, 2001). Stories evolve over time, suggesting the individuals’ meanings attributed to important events may also change (Singer & Salovey, 2010). Stories are contextual (McAdams, 2013), suggesting stories are created and killed within established cultural norms and traditions. Finally, some stories carry an inherent value and others do not (King, 2001), meaning certain stories carry value in how individuals establish and maintain personal identities (cf. Nelson, 2001).

The prior principles suggest a clear alignment between life stories as a methodology and identity as a theoretical lens. Life stories provide a point of focus on an individual's identity work between their personal identities as learners of mathematics and the social identities they encounter in, for example, a formal education setting like a high school or a community college (Martin, 2000). Life stories capture both change and resilience of personal identities (Wortham, 2006). Like identity, they acknowledge the power between identifier and the identified in their construction and maintenance (Sfard & Prusak, 2005). Like the development of identity, they can be both consistent and malleable over time (Lemke, 2000). Like identity, they are derived from the cultures and communities of practice (Wenger, 1998). In short, the connections between life narratives as a methodology and identity as a theoretical framing are pervasive.

While studies suggest varying types of stories exist (McAdams & McLean, 2013), I do not attempt to categorize participants' stories. Rather, I employ life narratives to explore how participants' stories about success are shaped by their experiences in a remedial Intermediate Algebra course, and how being in this course shaped their identities as learners of mathematics (McLean et al., 2018).

Case Studies

Yin (2009) defines case study as “an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident” (p. 18). Similarly, but in greater depth, Simons (2012) defines case study research as:

...an in-depth exploration from multiple perspectives of the complexity and uniqueness of a particular project, policy, institution, programme or system in a 'real life' context. It is research-based, inclusive of different methods and is evidence-led. The primary purpose is to generate in-depth understanding of a specific topic (as in a thesis), programme, policy, institution or system to generate knowledge and/or inform policy development, professional practice and civil or community action. (p. 11)

Both position case study research within qualitative inquiry, and both are careful to denote that case study research can be employed through numerous methodologies. Simons's (2012) definition aligns with the purpose of this study: to develop an 'in-depth understanding' of how participants come to think of themselves as successful. However, as 'multiple perspectives' do not specifically denote multiple participants, I turn to Bogdan and Biklen's (2007) differentiation of multi-case from single case studies. They state multi-case studies target "two or more subjects, settings, or depositories of data" (p. 69). Toward this end, this study uses a multi-case study design (Yin, 2009), collecting data across multiple dimensions: multiple participants and multiple time-points.

Several reasons inform this decision. First, multiple cases suggest emergent themes in participants' stories can be evaluated within and across participants, which suggests findings of a multi-case study are more robust than a single-case study design (Yin, 2009). Second, multiple cases ensure multiple perspectives of a phenomenon of interest are captured (Simons, 2012). Last, Bogdan and Biklen (2007) posit "the qualitative research approach demands that the world be examined with the assumption that nothing is trivial, that everything has the potential of being a clue that might unlock a more comprehensive understanding of what is being studied" (p. 5). Toward building rich, descriptive cases, Yin (2009) and Simons (2012) suggest multiple forms of data. The bulk of my data consists of in-depth interviews (Bogdan & Biklen, 2007). I also include academic data (e.g. course grades, placement scores, etc.) and course deliverables (classwork, homework, assessments) from participants' Intermediate Algebra courses to build cases of adult learners' experiences as learners of mathematics.

Research Context

This study, much like participants' experiences with mathematics, has its own story. This research originates in my experiences, starting in January 2014, as a director of developmental education at a large community college in the Midwest, Community College (CC). This study extends through the fall of 2019. Due to its length and breadth, Figure 1 presents a timeline of the study for the reader to follow as this story of research unfolds. I embed this chapter within the timeline. My experiences at CC between 2014 and 2015 inform this section on the context for the research, and my experiences with the data between 2015 and 2019 inform the data collection and analysis. The large gap in the latter time period was due to two reasons: ending employment at CC and the birth of my son. Moving forward, I share with the reader how this study took shape as I sought to understand why students at CC were not finding success in its remedial mathematics program.

Year and Month	Event
2014	
January	Began as director of developmental education
February - April	In depth data analysis of remediation at CC
May	Received support for pilot of supplemental courses
October	Received IRB Approval
October	Supplemental courses began
2015	
January	Added Intermediate Algebra as control
April	First set of interviews conducted
November	Second round of first set of interviews
2016	
	PMENA 2016 presentation
2017	
	NCTM research conference presentation
2018	
February	Analysis of supplemental instruction
April	Order transcriptions and begin qualitative analysis
May	Phase 2 analysis begins
October	Proposal defense
	Interview DeAndre, Sandra, and Reagan
	Transcribe interviews
December	Begin analysis of second time point
2019	
January	Interview Terri and Brad
	Transcribe last 2 interviews
February	Analysis and drafting of dissertation

Figure 1. Timeline of the Research Program

To give some context, CC operated under the umbrella of a set of colleges in service of a large, urban and suburban community. Like many institutions across the United States, CC's remedial education program suffered from low pass rates and low rates of persistence. Because of the college's ties to the larger political structure of the city it served, the mayor's office worked with the college to develop a 5-year strategic initiative to improve, among other programs, remediation. As part of that plan, they created a director of developmental education

position to oversee the interventions in service of students in developmental mathematics, English, and English as a Second Language. In January of 2014, I began as the first and only director of developmental education at CC.

Remediation at CC

My first three months were spent conducting interviews with administration, faculty, and students as I struggled to understand the complexity of CC's remedial program. In mathematics, the college followed a traditional program for remediation, three sequential tiers designed to prepare students to transition to one of three college-level mathematics classes. Figure 2 shows CC's remedial math pathway.

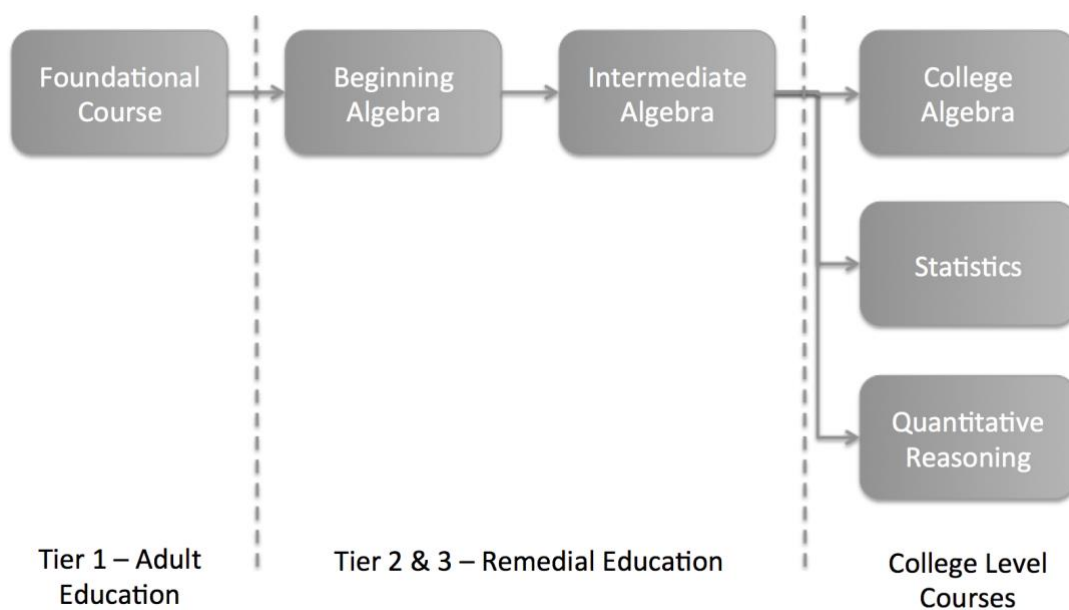


Figure 2. Remedial Mathematics Program Structure at CC.

At CC, almost 90% of incoming students placed into some type of remedial course under the disciplines of mathematics, English, and ESL. Approximately 84% of incoming students placed into remedial math courses. Three courses run under the remedial mathematics heading that tracks students towards the college-level courses: a dual-period foundational studies course that is positioned under adult education, a Beginning Algebra course, and an Intermediate Algebra

course. The math department at CC valued algebra as a preparatory experience for students, and so, the interventions I managed and created were in service of this pathway. While not explicitly the focus of the proposed research, the interventions offered are important in the context of remedial reform at CC.

Race and remediation at CC

My first three months were also spent understanding who placed into remediation at CC. Figure 3 shows the overall proportion of students the college served by ethnicity for 2015. I unfortunately did not save this information for the prior year, and it is no longer available through CC's public data. As seen, the college serves a variety of ethnicities, and the diversity of its student body is a primary reason students cite for matriculation.

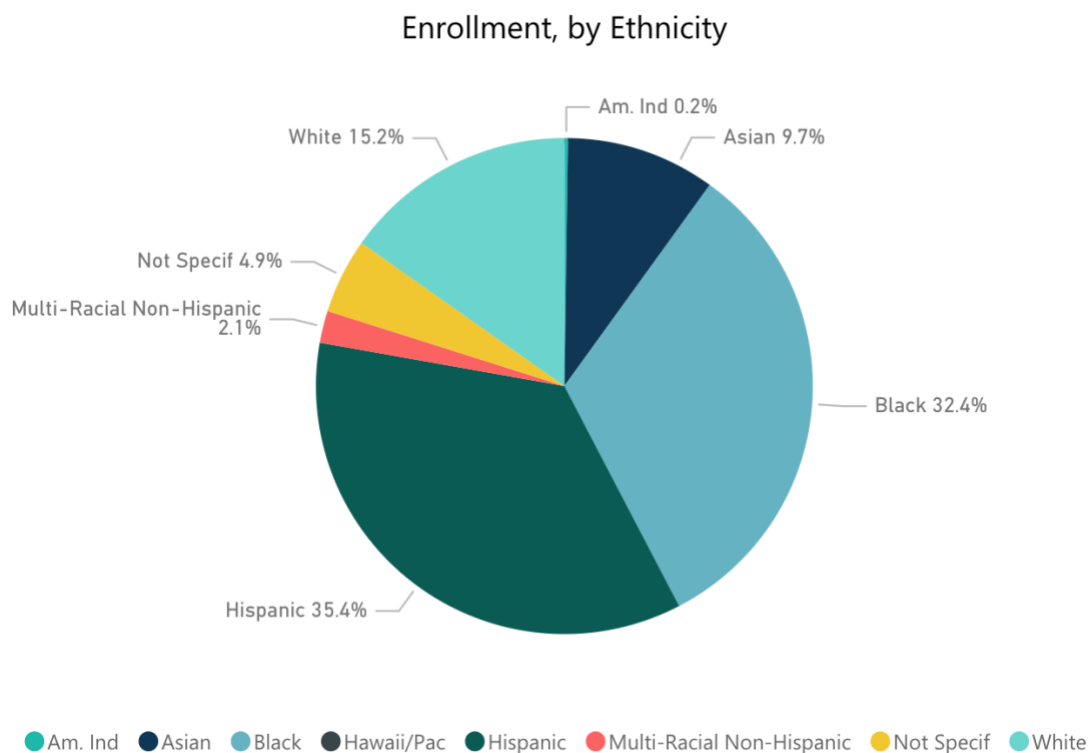


Figure 3. Enrollment by Race/Ethnicity for CC, 2015 and 2017.

In terms of gender,² 58.0% of the college's enrollment in 2015 was female.

Table 2 shows the overall population of students in remedial courses from 2011 to 2013 by ethnicity.

Table 2. Aggregate Population of Students in Beginning and Intermediate Algebra at CC, from Fall 2011 to Fall 2013.

Ethnicity	Beginning Algebra	Intermediate Algebra
Black	1,956	1,507
Hispanic	1,501	2,004
White	318	482
Asian	57	159
American Indian	15	12
Not Specified	116	151
Total	3,963	4,315

The relative amount of Black and Hispanic students placed into remediation significantly exceeds the relative amount of Black and Hispanic students who matriculate. Like other community colleges (Adelman, 2004; Attewell et al., 2006), a disproportionate amount of African American and Hispanic students were being placed into remediation.

Success and Remediation at CC

In my first month, I was given access to the college's and the district's database with research status. This meant I had access to all records kept by the college and district. I spent my first months digging into this data, creating process charts and descriptive statistics of the remedial program. As an administrator at CC, I discussed remedial courses in terms of success

² The college's database presents this variable in binary form.

rates and retention rates, or the percentage of students who earned a C or higher and the percentage of students who completed the course (or did not withdraw with a W). Table 3 shows success rates and retention rates for the 3 tiers of remedial math courses and for the credit-level, mathematics courses.

Table 3. Aggregate Rates of Success and Retention for Mathematics Courses at CC from Fall 2011 to Fall 2013.

Remedial Courses	Success Rate	Retention Rate
Adult Ed. - Arithmetic	69.47%	89.44%
Beginning Algebra	54.68%	80.80%
Intermediate Algebra	62.26%	80.70%
College-level Courses		
General Education Math	76.54%	86.90%
Introduction to Statistics	80.81%	84.48%
Trigonometry 1	92.92%	68.98%

The table does not present compounded effects. For example, of the students who enrolled in Intermediate Algebra in this time period, 80.70% completed the course, and of those, 62.26% passed, meaning 50.3% completed mathematics remediation with a ‘C’ or higher. For Beginning Algebra, only 44.18% of the students passed the course. These numbers suggest the district and the college’s emphasis on reform seemed warranted. More problematic, students’ placement into remediation and their subsequent success rates differed drastically by ethnicity. Table 4 shows the success and retention rates, categorized by ethnicity.

Table 4. Aggregate, Compound Rates of Success and Retention by Ethnicity for Beginning and Intermediate Algebra at CC, from Fall 2011 to Fall 2013.

Beginning Algebra	Success Rate	Retention Rate
Black	37.12%	78.53%
Hispanic	54.03%	84.21%
White	59.75%	87.11%
Asian	52.63%	84.21%
American Indian	33.33%	53.33%
Not Specified	47.41%	83.62%

Intermediate Algebra		
Black	42.07%	77.44%
Hispanic	55.19%	84.03%
White	64.11%	82.57%
Asian	69.18%	93.08%
American Indian	50.00%	75.00%
Not Specified	55.63%	83.44%

Considering the demographics of the college and the disproportionate amount of African American and Hispanic students who place into remediation, the racialized context of remediation seemed evident.

As director, I was responsible for a number of the interventions related to remedial mathematics. These interventions included summer bridge programs, supplemental courses, programs targeting placement exam preparation, and cohort support programs. Some, like the summer bridge program, were already in place at CC when I began as director, so I managed the intervention and reported its effectiveness to administration and the district office. Others, like the supplemental support courses, I designed, implemented, managed, and evaluated.

Supplemental Support Courses

In May of 2014, I received approval from the Dean of Instruction to run four small pilot courses designed under the supplemental instruction model. Supplemental instruction (Arendale, 2002) targets ‘at-risk’ courses and provides proactive support to students enrolled in the targeted courses. At CC, a one-hour supplemental course was created to support students in Intermediate Algebra. The supplemental course’s enrollment was capped at 15 students, and each course was assigned one instructor and two mathematics tutors. Tutors were chosen based on recommendation from the tutor director and based on tutors’ trajectories in their educational careers – all were studying to become math teachers. Enrollment in the supplemental courses was optional, made available to any student in Intermediate Algebra.

Soon after I received approval for the courses, I approached two math instructors to do research around the pilot. As all three of us were doctoral students at University of Illinois at Chicago, I saw an opportunity to work collaboratively as novice researchers to collect data on a program that, while not new, could be potentially interesting given the context, and to explore an idea I had not yet discussed with the administration or faculty at CC. I wanted to investigate the role of beliefs and identity on students' experiences in remediation. I hypothesized that both played a much larger role in students' experiences in remediation, particularly around who found success and who did not.

In October of 2014 we received approval for IRB Protocol #2014-0699: Supplemental Instruction (SI) as an Intervention in Developmental Education: Assessing the Impact on Mathematics and Academic Narratives. We had received a similar approval through CC's IRB which was, admittedly, less strict. The pilots ran as 10-week courses, and they started the same week we received approval. We had barely made it for the inaugural trial. The following is an excerpt for the study's rationale:

Our goal is to document and examine an intervention that proactively scaffolds students in their successful transition from developmental coursework to college level coursework, both from an academic perspective and one of identity. This research will be used towards our doctoral requirements.

I remind the reader I did not defend my proposal until 2018. I cannot tell if I was more naive or ambitious back then.

The following is a brief description of the structure of the intervention. Students in the supplemental course worked independently or in groups, depending on instructor preference. They had the choice to work on current homework (typically assigned through an online learning management system – MyMathLab) or on supplemental work assigned by the instructor. As part of the assessment of the intervention, diagnostics were administered to assess mathematical

competency; surveys were administered to determine change in mathematics self-efficacy; and academic performance was tracked both in the supplemental courses and in their respective Intermediate Algebra courses. Similar data was collected from the Intermediate Algebra courses so comparative analyses could be made between students who selected to take the supplemental course and students who did not.

The pilot ran in the fall of 2014, in the spring of 2015, and in the fall of 2015. I collected data for the first two semesters. The last semester, I was no longer serving as director but as an instructor of Intermediate Algebra. It was, frankly, a turbulent time for me as an educator and novice administrator (Bragelman, 2015). In 2015, we also collected data from Intermediate Algebra courses so we had a control group to make comparisons against, mostly to support continuing the intervention. I was the teacher of record for the courses in fall of 2015. The following semester was the last semester I taught remediation at CC and was a primary reason for the timelines for data collection.

Intermediate Algebra

As shown in Figure 2, Intermediate Algebra is the last tier of the three remedial mathematics courses offered by CC. The course has the following objectives (Community College, 2014):

- Develop the necessary algebraic skills required for problem solving
- Develop the ability to model relations (linear, nonlinear, etc.), including using tools such as geometric principles and graphing techniques, for solving real-world problems
- Manipulate and apply literal equations for solving real-world problems
- Appropriately communicating the results of problem solving
- Utilize technology for solving real-world problems

Students could either place into Intermediate Algebra via a placement test, COMPASS, or enter it through the sequence, by earning a 'C' or higher in Beginning Algebra. The courses are worth 5 credit hours, are 16 weeks in length, and meet twice weekly for 130 minutes. A mixture of full-time and part-time faculty at CC teach the course.

Participants

From fall 2014 to spring 2015, I recruited students from Intermediate Algebra courses at CC for the supplemental support courses and for the research my team and I were conducting on the pilot's effectiveness. The recruitment included emailing students enrolled in Intermediate Algebra one week before the semester start date, and it included a five-minute presentation made in every Intermediate Algebra course offered at the college. Students who were interested in the support courses were directed to email or see me in my office for enrollment. The research team informed students in the support courses about the study, and participation in the research was voluntary. In the spring of 2015, we began gathering data from students who were *not* enrolled in the supplemental support courses, only Intermediate Algebra, for a comparison study.

There was no limitation for participation in the supplemental instruction study based on age, race, gender, or other status except one – per CC IRB mandate, no students under the age of 18 are allowed to participate in research. Participation in the research was voluntary, and informed consent forms were distributed in the first week of the semester under research protocol #2014-0699. Students could consent to a variety of components in the original study including: pre/post diagnostics, pre/post surveys on sources of influence of mathematics self-efficacy (Usher & Pajares, 2009), general course deliverables, academic data, and audio-recorded interviews. Overall, 117 students self-selected into the study. The adult learners for this dissertation originated in this group. Within the sample of 117 students, 14 were 24 years of age

or older, and of those, eight consented to audio-recorded interviews. I approached the potential participants during the supplemental instruction study, and six of the adult learners consented to interviews, self-selecting into this study as a convenience sample. Participation in the initial interview was determined by two criteria:

- Placement into tier 1 or tier 2 of the remedial math course sequence at CC
- Identification as an adult learner (i.e. 24 years or older while in Intermediate Algebra)

Table 5 presents participants' self-identified gender and race, and it presents their academic experiences before remediation, their placement level into remediation, and the interventions they experienced while in remediation.

Table 5. Five Adult Learners From the Initial Pilot, Along with Relevant Demographic Data.

Name	Gender	Race / Ethnicity	Academic Experience Before Placement	Initial Placement	Intervention(s)
Reagan	Female	African American	GED	Foundational Course	None
Sandra	Female	African American	High school graduate	Beginning Algebra	Supplemental Course; Co-Requisite Course
Terri	Female	African American	GED	Foundational Course	Supplemental Course
Brad	Male	White	High school graduate	Beginning Algebra	Summer Bridge Program; Supplemental Course
DeAndre	Male	Latino	GED	Beginning Algebra	Supplemental Course

At the time of the first interview, all of the participants were enrolled in Intermediate Algebra. I met Sandra, Terri, and Brad through the supplemental courses I managed as a director. I met Reagan and DeAndre through the Intermediate Algebra course I taught. It is a coincidence that Reagan, Sandra, and Terri identified as African American and female, and it is a coincidence that

the participants experienced different mathematics reforms at CC. I offer the reader a deeper introduction to each case in the proceeding chapter.

Data Collection

Data collection occurred over two phases. The first phase occurred while I was working at CC, in 2014 and 2015, during the pilot of the supplemental support courses. The second phase occurred several years later, after participants had completed their remedial programs and had completed their postsecondary, college-level mathematics courses. Due to scheduling, the second interview was conducted in 2018 and 2019. The bulk of data collection originated in phase 1, so I do not differentiate the phases in this section. In the second phase, I collected only interview data.

Audio-recorded interviews

The bulk of the data for this study is interview data, fitting the life narrative (McAdams, 2008) methodology employed. While one-on-one, semi-structured interviews (Bogdan & Biklen, 2007; Denzin & Lincoln, 2005) were conducted using predefined questions, the semi-structured nature allowed flexibility to explore themes or stories not predetermined by the questions. In total, I completed two interviews with each participant. The interviews ranged in length from 41 minutes to 87 minutes. They were recorded with an Olympus VN-722PC voice recorder and transcribed through a transcription service. The first interview occurred at Community College in 2015. Three were conducted in my office when I was director in the spring; two were conducted in the students' Intermediate Algebra classroom in the fall of 2015. The first phase of interviews with all five participants occurred during the last two weeks of the participants' Intermediate Algebra course, near the end of the 2015 semesters. The second set of interviews occurred in 2018 to 2019 and were conducted at multiple locations since participants were no longer enrolled

at a common institution. Moreover, the second set occurred at a time of the participants' choice around their new schedules. Given the exploratory nature of the study and the life-story methodology, the interview questionnaire contained several categories: personal background, school experiences, perceptions of remediation, and perceptions of underrepresentation. The interview layout and general path was informed by Martin's (2000) protocol to explore African Americans beliefs about mathematics and success. The breadth of the protocol meant I could deviate to stories and themes not anticipated, including stories of success derived from participants' perceptions of remediation and representation. While the protocol (Appendix A) served as a guide for the interview, conversations were loosely structured, allowing themes to emerge organically, and follow-up questions were oriented on continued exploration of participants' life stories (McAdams, 1985).

The protocol may seem initially broad to a reader. Recall, at the time of the study on supplemental instruction, I was interested in experiences that shaped students' beliefs about remediation, and my exploration of identity research around success informed the protocol. For example, Martin (2000) investigates how various narratives of socialization, from broader historic narratives to more local school narratives, inform how a person comes to identify with math. Nasir (2012) presents a compelling case for the importance of out-of-school contexts. As adult learners, particularly the participants in this study, have spent the bulk of their math experiences outside of the classroom rather than within it (Evans, 2000), I included questions to explore such experiences. Larnell (2016) presents a compelling case for experiences within remediation in a university context shaping how learners come to identify with mathematics, particularly as they also negotiate other social identities like race. The racialized differences in pass rates and retention rates, more broadly discussed in the literature on remediation (Attewell

et al., 2006) and more locally discussed in the context section, prompted questions about representation. The protocol captures early school and out-of-school experiences; it captures experiences in the intervening years common for adult learners; it captures their experiences in remediation; and it captures potential social identities that may impact their experiences in remediation. While anecdotal, mentors have suggested that it is better to capture breadth of experiences and narrow my focus through research questions. As a novice researcher who was and is aware of his shortcomings, I erred on the side of breadth.

I did not use a new interview protocol for the second interview that occurred several years later. Methodologically the choice was purposeful. Given McAdams' (2008) principles, the second interview served as a means to potentially assess how meanings attributed to events changed over time (Pasupathi, 2001); how the culture and norms of remediation at CC impacted participants' stories (McAdams, 2008); and how the value the participants held of stories (King, 2001) relating to remediation, mathematics, and success changed. Finally, it presented a means to check how my role shaped participants' stories, as my position related to the participant and remediation changed as significantly as their position with remediation and me. For example, after several years, participants may now believe that remediation was not important, served no real purpose, and had no impact on their mathematics successes, learning, or identity.

Fortunately, a number of factors suggest this is not the case: foremost, their interactions with me were always in the context of remedial mathematics, so my presence would invoke these memories; remediation played a significant part in the academic narratives as it served as a barrier/enabler of their life goals; and last, while a two-to-three-year gap between their experiences in remediation may seem large to a student who has had a continued experience with

formal education, for these participants, the gap between their education before remediation was much larger than this more recent gap, positioning remediation as a more ‘recent’ experience.

I chose the length of time, 3 years, to ensure that participants had the time to “finish” their math courses. As I was setting up interviews with the participants, I inquired about their status toward their degrees to ensure they were “finished” with math. My intent was to ensure that the participants had completed their general education math requirements (if they had continued toward their degree completion) or that they no longer were enrolled and taking classes. In other words, while I use the term ‘after remediation’ to designate this time, it is synonymous with “finished with their general education math courses or finished with a degree path.” My rationale for this time oriented on the participants’ school math experiences. Given their non-traditional experiences with K12 education, I wanted a time point to capture participants’ experiences with mathematics outside of remediation in order to understand if and how remediation continued to shape their beliefs about and their understandings of mathematics.

Course Artifacts

Course deliverables were collected over the semesters of Intermediate Algebra and the supplemental instruction courses. Artifacts included online assignments, in-class assignments, notebooks, journaling, tests, the midterm, and the final. The online assignments were conducted in either MyMathLab, the department’s preferred learning management system, or MyOpenMath, a free-ware version of MyMathLab, less robust visually but as robust content-wise. I collected these artifacts to inform how students’ academic narratives changed within remediation in the original study on the effects of supplemental instruction and in the present study to inform and corroborate students’ narratives of academic achievement.

Another key artifact was a worksheet, titled Who-I-Am, available in Appendix E. Through it, I ask learners to self-identify information ranging from racial identity to hobbies and interests. It also includes a space for a self-portrait. I have administered it on the first day of every class I have taught, and I have their responses still, dating back to my field experience course in 2010. I do not share participants' sheets for confidentiality reasons. With that said, they provided a means of fact checking specific aspects of learners' stories as well as a means of asking participants to self-identify without overt and awkward questioning. For example, the worksheets informed the demographic characteristics presented in Table 5.

Academic Data

I collected additional data for each participant: their past mathematics performance at the college, their placement scores, and their demographic data. All academic data was pulled from CC's information management and student management system. In this study, they provide context for students' academic achievement before and during remediation. In addition, they serve as a metric to once again corroborate students' narratives of academic achievement.

Ethical Considerations

It is worth noting that I do not frame participants as sources of data (Simons, 2012). Throughout our interactions, I did consider them as students, which suggests a teacher-student relationship or administrator-student relationship. However, the relationships were much deeper. A large part of my philosophy as a critical educator and administrator (Bragelman, 2015) includes building relationships with students, learning about their lives as I come to know them, and I share with them my life as they come to know me. For example, I have spoken to them about systemic oppression, my favorite beer, about being pregnant and a new father, about caring for aging family members, and about losing loved ones.

These relationships emerge in my interviews with participants, where we speak of past conversations and interactions. My position of researcher carries inherent power gradients that could lead to misinterpretation of their narratives – superimposing my beliefs, desires, or perspective on their stories. While I attempt to not ‘give voice’ to these participants, my biases as a teacher, administrator, and researcher inherently shape how I interpret their stories. In addition, participants’ biases may shape their interactions with me as a researcher. For example, participants may give responses to questions they believe a researcher wants to hear or responses that are difficult to understand. The dual time-point interview presents one way to verify participants’ narratives, verifying participants’ narratives over the course of their interviews as well as ensuring fidelity to their meaning. Finally, as my relationships with the participants are ongoing, I reached out to each of them to verify my interpretations of their narratives, as a form of member checking (Bogdan & Biklen, 2007).

With my relationships acknowledged, this study is still a retelling, my interpretation of participants’ stories, my commodification of the stories for personal gain, and my bias towards creating ‘good’ stories. In this process, I engage in the use of ‘multiple I’s’ (Connelly & Clandinin, 1990), John the administrator, John the teacher, John the researcher, John the narrative critic, and so on. I ask the reader to engage in the same use, to engage in the same critique of my interpretations of “explanations gleaned from the overall narrative” (p. 7). I present an in-depth overview of the research setting, remediation at CC, as the external ascriptions participants discuss are heavily contextualized within this space. I present multiple perspectives of each participant in their introduction to underscore the ‘multiple I’s’ of the participants. Last, I let their experiences and patterns in their experiences drive my analysis. While life stories (McAdams, 1985) as a methodology initially drove my analysis of participants’

narratives, their involvement in the analysis minimized as participants' stories did not fit neatly into descriptive constructs like stories of redemption (McAdams & McLean, 2013) or progressive narratives (Lieblich, Tuval-Mashiach, & Zilber, 1998). Rather, as the reader will see, participants' stories led me to identity work (Snow & Anderson, 1987).

Data Analysis

In continuation of the time line, data analysis occurred in several iterations throughout data collection. The first iteration investigated the original identified research question back in 2014: what experiences shape students' beliefs and identities in remediation? I do not include much of the original data analysis in this dissertation because it was in service of a different question, population, and research goal. Some results were published as conference proceedings. As my early exploration informs the current study, I include a brief synopsis of my early analyses. The remaining iterations orient on the development of participants' narratives of success around remediation in service of the current research questions.

Early Analyses

In 2016 I continued to teach Intermediate Algebra at CC. While I was no longer actively collecting data around the supplemental instruction intervention, I was still interested in the effects it had on students' experiences with mathematics. I had collected a variety of academic and demographic data, course artifacts, data on sources of mathematics self-efficacy (Usher & Pajares, 2008, 2009), and interview data. While self-efficacy, a person's belief in their ability to do math (Bandura, 1977, 1997), as a construct is no longer directly included in this study, it heavily informed my work at the time. I collected data on students' *sources* of mathematic self-efficacy as I was not particularly interested in the change in beliefs of learners in remediation. Rather, I was interested in what experiences were influencing their beliefs, in how they thought

and identified with mathematics. I include the instrument in Appendix B as some context for my initial exploration of the larger data I collected while at CC. The instrument was administered in the first week and last week of the semester as a pre-post evaluation of change in sources of influence on students' beliefs about doing math. For approximately two years, as time allowed, I progressively and iteratively worked with the data, resulting in over 30 memos. I share brief synopses of three that emerged from that data: one as a published proceeding, one as a conference poster; and one as an unpublished memo.

In 2016, at PMENA, I presented preliminary findings about the effects of remediation on learners' beliefs about mathematics (Bragelman, 2016). Please disregard inconsistencies; it was my first time drafting an empirical paper and poster for a conference as sole author. The poster is available in Appendix C. I show several trends in the initial data I collected that are worth sharing. I will attempt to do so without going deeply into self-efficacy research. For those concerned, the instrument, adapted from Usher & Pajares (2009), was validated using data from participants who completed both pre- and post- tests ($\alpha = .798$). Recall that 14 adult learners were a part of the original research endeavor, five of whom became the participants for the present study. In terms of findings, participants' sources of mathematics self-efficacy for adult learners (called post-traditional in the poster) significantly increased during their time in Intermediate Algebra ($F[1,13] = 5.596, p < .05$). In other words, experiences in a remedial math course significantly shaped students' beliefs in doing math. In addition, experiences of academic achievement in remediation did *not* significantly shape adult learners' beliefs about doing math while in a remedial math course (called mastery experiences). However, observations of peers' academic achievements (called vicarious experiences) in remediation significantly and positively shaped adult learners' beliefs about doing math ($F[1,13] = 5.034, p < .05$). I found this

interesting and noteworthy. Adult learners' beliefs about remediation were not shaped by individual instances of academic achievement (or lack thereof). Rather, my findings suggested their beliefs were being shaped more socially. In the poster I show several excerpts from Sandra and (now) DeAndre that potentially offer insight into these interactions (or, in the case of personal achievement, lack thereof).

In the spring of 2017, I presented a similar poster at NCTM. The poster was near identical in presentation, analysis, and findings as the PMENA 2016 brief (Bragelman, 2016), with one small change. In this poster, I included individual results for the change in sources of self-efficacy from pre-test to post-test for Sandra and DeAndre. While observations of peers' achievements with mathematics significantly increased across remediation for all adult learners, Sandra's did not. Hers decreased by a full point on the 5-point scale used on the instrument. Again, I hesitate for additional explanation because I no longer include self-efficacy in this study. It shows a noteworthy shift in my exploration of the phenomenon in which I had shifted to exploring individual experiences rather than aggregate experiences of a group. For example, Sandra had uniquely negative experiences in remediation that were being hidden by more positive experiences from other learners, including DeAndre's. This analytic expansion was a large reason why I shifted away from including mathematics self-efficacy in the present study. The aggregate analysis of a group was obscuring the more nuanced changes of the individuals.

I continued to explore the data and to memo through 2018, although my endeavors had slowed. My son was born in February of 2017, and my work ethic met a seemingly insurmountable challenge: a newborn. The last memo I share in Appendix D was an analysis of the effects of the intervention I managed at CC, the supplemental instruction course. Finally taking the time to aggregate and sanitize the academic data and self-efficacy data, I was able to

differentiate the control/treatment groups to explore if and how the intervention affected students' experiences with math. The bolding in the memo was done at the time, which ultimately led to finding a result that aligned with Bandura's (1997) theory: a learners' academic achievements (what he calls mastery experiences) were the most significant source of influence on a learners' beliefs about doing mathematics, at least while they were in the supplemental support courses. The memo includes odd interactions and effects across multiple repeated measures of analysis as well as notes attempting to describe them. In other words, the memo shows that I was struggling to make sense of what experiences influence how learners find success in remedial math courses and how researchers and educators could support their development of success. Most important, I was struggling to understand why mastery experiences like academic achievements were only sometimes informing learners' beliefs about their ability to do math. I knew from the academic data I had collected that students were finding achievements through various opportunities, but these achievements were not having a consistent, significant impact on students' beliefs about doing math. Something was getting in the way, shaping how they perceived achievement.

Present Study – Orienting on Identity

By now the reader may be noting two points: I have yet to discuss the interview data in the analysis, and I have yet to discuss identity. The reason is simple. I was and am much more comfortable with quantitative data than qualitative data. However, I had reached a point where I felt I could not get much more information from quantitative analyses. As I suggested in my discussion of the NCTM poster, there were stories in individuals' experiences that were being overshadowed by analyzing the entire group of students. While I had coded excerpts of the qualitative data, I had not done a rigorous analysis. I had been listening to interviews as I

commuted to work, and I was now ready to tap the rich depth of data I had initially set aside. I ordered transcriptions from an online service, and I moved the transcripts to a software I found comforting, Microsoft Excel. The transcripts were broken down by turns between the interviewer and the interviewee. At the same time, I began drafting the dissertation proposal I would eventually defend in October of 2018.

My decision to investigate identity did not emerge from the data. I had long suspected that identity would be a useful lens on success rather than the more traditional achievement-oriented definition. My work with Dr. Larnell (Larnell et al., 2015) informed this decision, as did the growing body of research on mathematics identity and success I discuss in Chapter 2. In this phase, I discuss the top-down approach I employed, coding interview data by experiences and coding for narrative identity.

Coding for Remediation and Success. My interests and my research questions informed this step of coding, orienting on participants' experiences with mathematics, particularly mathematics experiences with remediation and success. Using a-priori codes with a top-down approach, I organized narratives into stories about mathematics or a story not directly relating to mathematics. The latter provided content for the descriptions of the participants presented in the next chapter, and they were noted as potential reference for exploring additional context to the formation of stories relating to mathematics. For the former, I coded *Mathematics* when participants discussed school mathematics activity, mathematics course sequences (including after remediation), and out-of-school mathematics, following the same rationale for this choice as I discussed in my argument for the survey protocol. Following, I coded all narrative experiences for remediation and success. My rationale was that experiences with remediation and success, even those that did not occur with mathematics, may inform participants' overall

narrative identity development as learners and doers of mathematics. Indeed, through various theories, researchers suggest individual experiences, particularly on smaller scales, shape individuals' identity development over larger time periods (Herbel-Eisenmann, Wagner, Johnson, Suh, & Figueras, 2015; Lemke, 2000; Wortham, 2006). While my focus is on narrative identity development, I did not want to 'miss' a participant's experience because of a coding decision that proved to be too narrow.

For transparency, I use this excerpt from my interview with DeAndre for all levels of coding in my discussion of methods. I coded utterances that discuss remedial mathematics courses, remediation, participants' perceptions of 'being remedial' as *Remediation*. I coded *Success* when participants discuss 'college-readiness' (completion remediation or not requiring remediation, (c.f. Conley, 2007)), academic achievement (a grade, a GPA, or completion of a program or degree, or transfer to a 'higher' program such as a four-year university or graduate school), and value or goal oriented discussion outside of academic indicators ("I want to be able to teach my niece math"). The latter was informed by Berry and Thunder's (2015) meta-synthesis of identity research on successful African American learners. The following is an example narrative from the first interview with DeAndre:

- JB: So, you said you didn't understand what [Beginning Algebra] and [Intermediate Algebra] meant. What did it feel like then? You've talked to other students. What were the general perceptions?
- DeAndre: Um, before, everybody was ... Would be like, "Oh, then you're just ... You're pretty much dumb if you didn't make it. If you didn't hit, hit college level yet, you're dumb. You, you know..." [*Mathematics; Remediation, Success*]
- JB: Who said that?
- DeAndre: Like, pretty much everybody that I talked to asking about [Beginning Algebra], like even when I went into the classroom before you walked in, I was like, "So, what's this class for?" People were like, "Oh, this is where the dumb people go." And I was like, "Okay." (laughs) [*Mathematics; Remediation*]

JB: And now how does it feel?

DeAndre: Uh, at the time I was pretty dumb. (laughs)

No, but, it's like ... It's just a learning curve, you know? It's just to get me ready for [Math for Liberal Arts or Introduction to Statistics], whichever I go to. Yeah, and I think it's a step that I actually really need because I ... If I did go up to those courses, I think I'd do okay, but I want to get the grade that I expect myself to get. [*Mathematics; Remediation, Success*]

JB: If someone came and asked you what [Beginning Algebra] and [Intermediate Algebra] were like, what would you describe them to them as?

DeAndre: Um, I'd describe, describe them as, um, pretty much baby steps into college level math. [*Mathematics; Remediation*]

JB: How did it ... How did that feel? Like, when people talked about it being, like, a class for dumb people, like how did you feel?

DeAndre: I didn't feel like anything. I, I actually see myself in that category because I'd been out of school for so long, so it's like everybody that's in school at the moment knows more than I do. So, it's like I have more experience in, in the real world, while they have more experience in school. So, it's like I can't really say, you know, that they were wrong; I can't really say that we right. At the time... [*Mathematics; Remediation*]

While the number of utterances that discuss *Success* were relatively small, at least in relation to *Remediation*, their existence drove this study. Note, I did not assign value-laden differences for coding of success. In other words, I coded for *Success* when participants discussed successes and when they discussed failures. In DeAndre's second utterance above, he describes being placed into remediation as "you didn't make it...you didn't hit college level"; this is an example of the latter. With narratives contextualized, I turned to determining which narratives contributed to identity development.

Narratives That Inform Identity. Given my focus on interview data and life narrative (McAdams, 1985; 2008), I approach mathematics identity through narrative. Martin (2006b) states "mathematics identity is expressed in its narrative form as a negotiated self, the results of our own assertions and the sometimes-contested external ascriptions of others" (pp. 206-207).

Such a framing offers a window into coding narrative as identity, through differentiating assertions and external ascriptions. However, I reasoned that merely identifying assertions and ascriptions in narrative would not sufficiently capture identity. Rather, I deferred to Sfard & Prusak's (2005) conceptualization of narratives as identity to code narrative statements as *Reifying*, *Endorsing*, and *Significant* (Sfard & Prusak, 2005). Toward this, I employ an excerpt from my initial interview with DeAndre to illustrate my interpretation of *Reifying*, *Endorsable*, and *Significant* in a participant's narrative. The excerpt is discussing his interactions with peers in his first remedial math class, Beginning Algebra.

JB: So, you said you didn't understand what [Beginning Algebra] and [Intermediate Algebra] meant. What did it feel like then? You've talked to other students. What were the general perceptions?

DeAndre: Um, before, everybody was ... Would be like, "Oh, then you're just ... You're pretty much dumb if you didn't make it. If you didn't hit, hit college level yet, you're dumb. You, you know..." [*Reify*]

DeAndre suggests he experiences an external ascription when his peers suggest being in remedial math classes means you're 'bad at math'. It satisfies *Reify* because it is not an action, the action of doing math; rather, it is a description of a self, an *is*-sentence. The excerpt continues.

JB: Who said that?

DeAndre: Like, pretty much everybody that I talked to asking about [Beginning Algebra], like even when I went into the classroom before you walked in, I was like, "So, what's this class for?" People were like, "Oh, this is where the dumb people go." And I was like, "Okay." (laughs)

JB: And now how does it feel?

DeAndre: Uh, at the time I was pretty dumb. [*Endorsing*] (laughs)

No, but, uh, I ... Uh, now it's like ... It's just, like, a learning curve, you know? It's just to get me ready for [Math for Liberal Arts or Introduction to Statistics], whichever I go to. Yeah, and I think it's a step that I actually really need because I ... If I did go up to those courses, I think I'd do okay,

but I want to get the grade that I expect myself to get. [*Endorsing; Significant*]

DeAndre's peers describe Math 98, Beginning Algebra, as "this is where the dumb people go."

DeAndre's affirmation of the ascription was the necessary utterance for *Endorsement* and

DeAndre's *Reification* of the ascription. Finally, it was DeAndre's explanation for his need of remediation that justified it, and the subsequent ascription, as *Significant*. The excerpt continues.

JB: If someone came and asked you what [Beginning Algebra] and [Intermediate Algebra] were like, what would you describe them to them as?

DeAndre: Um, I'd describe, describe them as, um, pretty much baby steps into college level math.

JB: How did it ... How did that feel? Like, when people talked about it being, like, a class for dumb people, like how did you feel?

DeAndre: I didn't feel like anything. I, like ... Um, I actually s- Uh, seen myself in that category because I'd been out of school for so long, so it's like everybody that's in school at the moment knows more than I do. So, it's like I have more experience in, in the real world, while they have more experience in school. So, it's like I can't really say, you know, that they were wrong; I can't really say that we right. At the time... [*Reifying; Endorsing; Significant*]

From here, I reasoned that, as Sfard & Prusak (2005) state, identities are made up of collections of stories. A single narrative, even like above that contains all three defining features, is not sufficient to define the narrative as identity. As such, I made the analytic choice to leave narratives coded only as *Reifying*, *Endorsable*, and *Significant*. As I was most interested in the process of negotiation by the learner, or which endorsable narratives learners *Reify* or do not *Reify*, I felt this depth of coding aligned with my analytic goals.

Coding for Other Social Identities. While my research questions and past goals informed the prior coding stage for remediation and success, extant research on mathematics education informed this stage. Recent research in mathematics education has presented nuanced cases where, in the context of a math classroom, societal and local meanings for race and gender shape the experiences for *all* students (Gholson, 2014; Larnell, 2016; Oppland-Cordell, 2013;

Zavala & Hand, 2017). Indeed, this research informed my interview protocol where I ask questions about race and representation to explore such meanings. As such, in this stage, I coded participants' narratives for social identities about *Race*, *Gender*, and *Age*. I did not code for what I call implicit mentions of race, gender, and age. Rather, I made the decision to wait until the synthesis stage, after coding was complete, to re-address narratives if and when common narratives about other social identities emerged.

I use the following narrative excerpt from Reagan to show an example where a participant negotiates a *Reifying* ascription by a teacher in a remedial math course at CC:

Reagan: ...I took [Beginning Algebra] last semester. I took a [Beginning Algebra course] before that and I dropped it...I felt like he [the instructor] didn't care if we got it or not. I felt like he was one of the teachers that I had in high school, why school wasn't important to me. Because that was the normal teachers that we had, like this dude. I mean he wasn't bad. He wasn't bad, but he just really didn't care if you got it or not. He told me that I probably need to get my brain checked, because I'm older and maybe my brain's not functioning. [*Remediation*; *Age*]

In this excerpt, Reagan explicitly mentions age as a contributing endorsement to her experience as a math learner, so I code it as *Age*.

At this point in the analytic process, I had differentiated narratives and narratives that explicitly inform identity (Sfard & Prusak, 2005), and I established two contexts to focus my analysis, mathematics remediation and mathematics success. I had, in this broader process, also completed the second set of interviews and their subsequent coding. In the next phase of data analysis, I describe my process for establishing a beginning, middle, and end for participants' stories about remediation and for the analytic process.

Present Study – Establishing Context for Narrative Development

This portion of the analysis provides the rationale for my analytic choices in developing participants' broader stories around remediation. Mathematics remediation at CC has remained

the primary context for this study. In this section, I show how I organize participants' narratives into three temporal spaces towards building their story around remediation. The beginning of their story occurs on participants' first day of their first course in mathematics remediation at CC, establishing a boundary for the beginning of participants' narratives with remediation. The largest and most important time period of their stories encompasses their experiences with remediation. This time period occurs between their first day of remediation at CC to their last course in remediation before college-level math courses, at the time of their first interview. The ending time period of their stories occurs approximately three and a half years later, after completion of their postsecondary mathematics courses, establishing a boundary for the ending of their stories around remediation.

With the three periods of the story defined, I could then analyze what experiences participants discussed during their remedial mathematics courses and what narratives about remediation commonly emerged across the participants. I could also analyze what experiences participants discussed about their remedial mathematics courses as they reflected upon their experiences and what narratives about remediation, if any, remained. In addition, I similarly differentiated academic data, course artifacts, and narratives to develop an understanding of a traditional definition of academic achievement at each time point. I present the results in the following sections.

Positioning Narratives - Entering Remediation. My rationale for the first time period comes from research on remediation. It suggests stigmatizing narratives, locally and more broadly, negatively influence students' experiences in remediation as math learners (Deil-Amen & Rosenbaum, 2002). For example, Larnell and colleagues (2015) present a skit performed by learners in remediation that cue explicit and implicit negative stereotypes about students in

remediation. In my interview protocol, specific questions serve to prompt stories of learners' experiences about their first experiences with remediation, with local narratives about remediation, and with broader narratives about remediation. The purpose, as I will soon show, was to determine that participants had no experiences with remediation and its surrounding narratives until they enrolled at CC. In terms of my quantitative background, I saw this point as a pre-test of sorts, establishing a baseline for story development.

Emergent Narratives in Remediation. My rationale for the second time period is to capture learners' full set of experiences in remediation. As all had placed in tier one or tier two of the three-tier sequence of remediation at CC, the time point meant that participants had, at least, almost two full semesters of experiences in mathematics remediation. It had been my long-term goal with this research to understand what experiences in remediation were influencing students' progression through the program, capturing their experiences near the end of their program meant also capturing a broader swath of experiences. In other words, this point serves as a post-test of sorts, to capture participants' experiences at the end of remediation.

Given the prior section where I locate participants' narratives about mathematics as the beginning of their stories with remediation, locating narratives in this time period was relatively straightforward. Any narrative coded remediation in participants' first interviews was placed in this time point to save those that informed the beginning of their stories with remediation. This included broader narratives about institutional experiences with remediation, narratives about math classroom experiences with remediation, and the few narratives about math learning in spaces outside of the classroom. The latter included experiences in tutoring spaces at CC and during office hours. As participants did not speak to formal math learning contexts outside of

CC, like group work at the library for example, I encountered no problematic scenarios that required revision of this decision. Locating narratives about success followed.

Emergent Narratives Three Years Later, after Remediation. My rationale for the last time period was dependent on two factors: sufficient time to capture participants' experiences with postsecondary mathematics courses and sufficient scale to potentially make statements about participants' identity development (Lemke, 2000). In my interview, through repeated use of the interview protocol that oriented on past school experiences, I asked participants to reflect on their experiences both in math remediation and 'college-level' math. This meant participants could reflect on potentially stigmatizing narratives and potentially affirming narratives that informed their development as math learners. It also meant they could reflect on experiences with mathematics after remediation that may or may not have shaped how they came to identify as learners and doers of mathematics. However, the participants took math courses at three different institutions after CC, and so I did not perform an analytic comparison of their experiences in math courses after remediation cross-case. Nonetheless, I do compare their experiences after remediation to their experiences within remediation in my within-case analysis. I saw this time point as a repeated measure of sorts, to ascertain which experiences in remediation still held meaning and if participants' meaning of the experiences changed, as life stories are known to do (Singer & Salovey, 2010).

Present Study – Negotiation as Identity Work

At this point in the data analysis, I have presented a coding scheme that identifies narratives that may build towards an individual's identity (Sfard & Prusak, 2005); I have coded narratives to define experiences around remediation and success; and I have established three time points to inform narrative development of participants' math identities. In this step, I coded

for identity work. Snow and Anderson's (1987) framing informed two types of identity work that spoke to participants' narratives: *distancing* and *embracing*. The third type emerged from participants' narratives, not present in Snow & Anderson's (1987) frame or others I explored (cf. Cobb et al., 2009; Zavala & Hand, 2017), what I call *troubling* (Fournillier, 2011; Hossain, Mendick, & Adler, 2013; Lather & Smithies, 1997). Next I present formal definitions for the three with narrative examples of each.

Distancing

When a person may be required to enact a certain role, participate with a group of people, interact in an institutional space, an ascription is made, particularly when a local or broad narrative is attached to the role, association, or space (Snow & Anderson, 1987). If this enactment, participation, or interaction does not align with identity or their desired self-conceptions (Martin, 2006b), the individuals may choose to *distance* themselves from the role (e.g. a student in remediation), the group association (e.g. adult learner), or the institutional space (e.g. tutoring). In other words, in *distancing*, the individual does not *endorse* a designation (Sfard & Prusak, 2005). To code for *distancing*, the narrative must include, not necessarily in a single utterance, a *reifying* statement designated through a role, association, or space. The narrative must also include a suggested *distancing* action or is-statement, most typically associated with 'not', such as 'I am not...', 'I ain't...', or 'I don't...'. For example, Brad discusses his peers in remediation:

Brad: You know, and it's all adults here. And it's, everybody has the same understanding that you're adults. If you're going to text away the class, text away the class. You're paying for it. I don't care. If you want to learn math, here's math. I'll teach you math. And since I want to learn math, because I know that there's something I want to do in my life... Yeah, it was different in that way. That it's not high school. It's college. [*Remediation; Distance*]

Brad's narrative shows he makes an assertion as a learner of mathematics in the context of his remedial mathematics course. However, Brad's narrative also suggests his association with peers in his course, as learners in remediation, was incongruous with his conception of what it meant to be a math learner. His statements "You're paying for it. I don't care." shows he is *distancing* from an association with a group, his peers in remediation.

Embracing

In contrast, an individual can *embrace* a certain role, participation with a group of people, or interaction within an institutional space if it aligns with the individuals' desired conception (Snow & Anderson, 1987). For example, if an entering freshman is placed into remedial courses, the student may respond with "Oh good. I didn't take math my senior year of high school, and I need that," *embracing* a role assigned by an institution and a local narrative that remediation is a necessary program to obtain access to a postsecondary degree. In other words, *embracing* is a type of *endorsement* (Sfard & Prusak, 2005). To code for *embracing*, a narrative must include, not necessarily in a single utterance, a *reifying* statement designated through a role, association, or space. The narrative must also include a suggested *embracing* action or is-statement, most typically associated with "am," such as "I am..." "I was..." or "I do..." For example, DeAndre suggests he is *embracing* in the following narrative:

JB: So, you said you didn't understand what Math 98 and Math 99 meant. What did it feel like then? You've talked to other students. What were the general perceptions?

DeAndre: Um, before, everybody was ... Would be like, "Oh, then you're just ... You're pretty much dumb if you didn't make it. If you didn't hit, hit college level yet, you're dumb. You, you know..." [*Remediation; Success*]

JB: Who said that?

DeAndre: Like, pretty much everybody that I talked to asking about 98, like even when I went into the classroom before you walked in, I was like, "So, what's this

class for?” People were like, “Oh, this is where the dumb people go.” And I was like, “Okay.” (laughs) [*Remediation*]

JB: And now how does it feel?

DeAndre: Uh, at the time I was pretty dumb. (laughs)

No, but, uh, I ... Uh, now it's like ... It's just, like, a learning curve, you know? It's just to get me ready for, for, uh, o- 118 or 121, whichever I go to. Yeah, and I think it's a step that I actually really need because I ... If I did go up to those courses, I think I'd do okay, but I want to get the grade that I expect myself to get. [*Remediation; Success; Embrace*]

DeAndre's statement “I think it's a step that I actually really need” suggests he is *embracing* an external ascription implied by an association with an institutional program and the group membership, as a student in remediation. In addition, he complicates the *Embracement* by suggesting that it may provide additional academic support in his future math courses. His final response leads to the third type of identity talk.

Troubling

A third type of identity talk emerged in the adult learners' interviews, and it was not comparable with Snow and Anderson's (1987) types of identity work. There were instances in participants' narratives where they both *embraced* and *distanced*. In other words, a participant *distanced* from a role, association, or institutional space by *embracing* an alternate role, association, or space. Also emergent in their narratives, participants reframed the original ascription in a manner more consistent with their conception. For example, when Reagan says, “I knew it was remedial, but I guess I never thought of it like that. It just feels like I'm doing math”, she is *distancing* from a local narrative that suggests remediation is ‘low-level’ and, by ascribing remediation as ‘just math,’ she is making the assertion, *troubling* it, that the local narrative about remediation as ‘low-level math’ was incongruous with her conceptions of it. As algebra was, essentially, entirely new for her as a domain of mathematics, she could not reconcile the

ascription of it with her conceptions of it. In terms of methods, to code for *troubling*, a narrative must include, not necessarily in a single utterance but a *reifying* narrative and two contrasting assertions in response to an ascription (Sfard & Prusak, 2005). I return to the original interview excerpt with DeAndre as an example:

JB: How did it ... How did that feel? Like, when people talked about it being, like, a class for dumb people, like how did you feel?

DeAndre: I didn't feel like anything. I, like ... Um, I actually [saw] myself in that category because I'd been out of school for so long, so it's like everybody that's in school at the moment knows more than I do. So, it's like I have more experience in, in the real world, while they have more experience in school. So, it's like I can't really say, you know, that they were wrong; I can't really say that they were right [*trouble*]. At the time... [*Remediation*] I know now that I'm smarter than majority of them... (laughs)

DeAndre's narrative suggests his association with peers in remediation caused a subtle tension with his assertions as a math learner. He acknowledges, even embraces, being 'bad' at math, but he also pushes against the ascription. DeAndre suggests that his lack of experience with formal, school math is the cause for his lack of understanding in math, or being 'bad' at it. He points to his experiences outside of the formal school classroom, suggesting that successes outside of the classroom, in other endeavors, as rationale for his conception as a math learner. When he says "I can't really say they were wrong; I can't really say that they were right," DeAndre *troubles* the local narrative that being placed into remediation means one is bad at math by suggesting that it is not about being 'dumb' at math but rather about being inexperienced.

Final Points

To reiterate, I am most interested in learners' negotiation of identities, what I frame as identity work. While I present three time points to ground their narrative development around remediation, it is the movement of participants' stories captured in their identity work that afford the opportunity to investigate if and how the participants came to identify as successful learners

of mathematics in context of experiences in and after remediation. In the following chapter, I orient the reader to the beginning of the stories, introducing the participants to the reader and their experiences with mathematics up to remediation at CC. After, I present participants' narrative identity work during remediation. Finally, I present the end of their stories through their identity work in reflection of participants' experiences in remediation, after completion of their postsecondary general education mathematics courses.

Chapter 4 – The Story’s Beginning

This chapter serves as an introduction to the participants. It is liminal, serving to orient the reader to participants’ beginning of their stories with remedial mathematics courses at CC. Toward this, I present a brief description of the participants from my eyes, and I present narratives about their mathematics experiences before they enrolled in mathematics remediation at CC. I present academic achievement indicators from their K12 experiences. Finally, I present narratives of participants’ perceptions of remediation before their first day. While I orient on learners’ experiences around mathematics and remediation, particularly the lack thereof before entering CC, participants interviews suggest that, as adult learners, they brought to CC a complex and varied set of lived experiences. Participants candidly spoke of their experiences around race, age, gender, work, and as a veteran in broader contexts outside of the math classroom. These experiences sometimes enter learners’ narratives about mathematics and remediation.

Case Profiles

In this section I present the five participants as cases for this study. First, I present a narrative of the participants from my perceptions of them during our time together. After, I present narratives outlining their experiences with mathematics before remediation. Overall, none of the participants experienced what is commonly considered a traditional K12 experience. I share narratives to offer the reader insight into each participant as learners of mathematics.

Reagan – From My Eyes

Reagan stayed after her Intermediate Algebra class to interview with me. She looked nervous. She was usually in class early, and she sat in the front row, in the desk directly in front of the instructor’s desk, my desk. On the second day of class, she expressed her nervousness to

me about the content and the course, explaining she would need help throughout. This interaction began a routine of sorts; we frequently spoke before class started, sometimes about math, sometimes about other things. Her academic advisor and I had a good relationship from the time I was director. She put Reagan in my class intentionally; she felt she would do well with a teacher ‘like me.’

She is at least six feet tall, as tall me, in her mid-fifties. Brown skin, short hair, big smile, a semi-Southern slang that sometimes accompanies people born and raised on the Southside of Chicago. My words – semi-Southern, because when she spoke I would sometimes get images of the South, of home. When we spoke, my Southern drawl would sneak out. She was raised by her mom, a postal-worker, who picked up extra shifts, “because she was a hard worker,” Reagan explained. Reagan spent her youth hanging with her friends and her brothers. She got pregnant in high school. As her daughter got older, she came down with severe health issues. Reagan spends a considerable amount of time caring for her, which caused her to miss class sometimes. Her mother was declining in health as well, so she cared for her now too. She attended CC part-time, as an escape from the duties of life. She lived in the same neighborhood for almost her entire life, and her neighborhood experiences were the benchmarks she used to compare new experiences.

Reagan and Math

Reagan’s experiences with high school and school mathematics were, as she suggests, contextualized in her neighborhood.

JB: What math classes did you take in high school? At ... you said [SS High School]?

Reagan: I took algebra, and it might have been pre-algebra, and it was a little geometry, but I’d start cutting by then.

JB: How about your math teachers?

Reagan: I don’t even remember them really. I can’t say nothing bad about them...

JB: What kind of grades did you get, do you remember?

Reagan: I was like, um, B, C student when I went... And when I stopped going you know? I was never ... I was always fine with math. I didn't have problems, you know, I learned fractions and ... because you know, my mother helped me ... my mother used to check our homework, but as we got older and she worked more, she didn't really check our homework ... I never had problems with fractions. You know, I kind of forgot them.

Thirty years, but I never had problems with math before. That's why it shocked me sometimes ... this math I never seen before. They didn't have this math, and if they did, they didn't have it at [SS HS].

When she says "this math," she is referring to Intermediate Algebra. Throughout our first interview, Reagan routinely returns to this point, always with a type of bewildered awe.

In her sophomore year of high school, she became pregnant and dropped out. She attended an alternative school but she did not complete her high school diploma. In the early 2000s, she attended a GED program. She spoke fondly of the program and of its teachers.

Reagan: So when I went to [GED program], it was a whole different experience for me, because it was a place where you could be wrong. You could, you know, so I started kind of liking school then.

Later in our interview, she clarified what "where you could be wrong" means, where it was acceptable to ask questions, to express a lack of understanding of the content. Her description of one teacher in particular, suggests it was the first place where she felt like she experienced a supportive learning environment.

Reagan: And the teacher I had... she was really cool. I came from... in grammar school and high school where I grew up, you just really needed to know how to fight. (laughs) You know? I mean because I don't know [what other 'normal' classroom experiences are like], this is just my perception of it. Like in class, I even see it sometimes here, when the whole class is quiet... I've been classes here where nobody's talking. [My schools weren't like that]

So when I went to [the GED program], it was a whole different experience for me, because it was a place where you could be wrong. So I started kind of liking school then.

She went on to describe experiences in her GED classes, where students would fall asleep in class, and the teacher would gently wake them up and ask them to try to stay awake. The teacher would never lose her patience. These experiences were a stark contrast to her high school, where falling asleep would get you written up and sent out of class and her teachers had an attitude of “I got mine; you need to get yours.” For Reagan, her experiences in the GED program, with that teacher, became the benchmark for the experiences she sought at CC.

Sandra – From My Eyes

When Sandra walked into my office on the eleventh floor, I already knew her by name. She had enrolled in a pilot intervention targeting a high-risk course, Intermediate Algebra. She was one of the small percent who did not find success with the supplemental course and her algebra class. It was the following semester, and she was once again in Intermediate Algebra. She was not doing well. Her eyes were afire with determination and frustration.

Sandra was of average height for a woman, dark brown hair, brown eyes, brown skin. She spoke softly most days. She was in her mid-fifties, no children. She was there to express several grievances about her experiences in remediation. She was not finding success with the math classes at CC. She explained that she felt set up by the system, set up to fail. By the end of the meeting, I had agreed to tutor her weekly in math, in large because I, as the administrator in charge of interventions for math learners like her, had no more interventions to offer her. I had failed her, administratively speaking. So, I offered her my time.

Sandra and Math

I learned from our weekly tutoring appointments and later in our interview that Sandra had completed her high school diploma in Chicago, at a vocational high school.

Sandra: [WH] had a reputation for being, before it was a schoo- ... a high school, it was a candy factory. So people laughed at us and judged us because it looked

like this big candy factory. But inside of that building they had it all structured and there are people what ... who I still keep in touch with, who chose certain paths and they're doing wonderful. There are some of them are even retiring. There was a home economics, where it wasn't just home economics, there were some chefs that came out of that school. There were health occupations. My best friend from third grade, she started out work ... 'cause they taught you [at] school, by the time you were a junior, you were working in that field. My friend started out at Cook County Hospital in the records department. This girl has her own business now.

And if she's not the only one, the ones that went in for hair...there was floor just for the people in cosmetology. I was in business because my dad put a buzz in my ear, he's like, "No, you don't ... you don't need to work hard, you need to work smart." So, in business, as long as you were in business. [They had] bookkeeping, accounting, typing, any type of clerical thing. So the general courses like math, there was no, no strain to go beyond pre-algebra.

JB: So the highest math course you took was pre-algebra?

Sandra: Pre-algebra.

JB: And when did you take that?

Sandra: I'm thinking I took that junior year, no sophomore year.

It is worth reiterating this point – her last formal school math experience with what is considered the traditional K-12 mathematics curriculum is pre-algebra. We continue:

JB: And what else?

Sandra: I probably had classes like, um, strictly classes in that business department, whatever all that stuff was, and you get your science, you get your biology, you get your history, your English classes. And then I was in drama, so there was those classes and music, but nobody really forced me to take math, because my math was bookkeeping, accounting, ah, you know, spreadsheets.

When you pick your, your career path somewhere like your sophomore year, like you come in kinda knowing which way you wanna go. But I think in your sophomore year, that's when you definitely, you know, like now, these are the classes you're gonna take. Before then you probably were just taking like your biologies and your English and things. And you stayed in those classes until your senior year. Like there was, Typing 1, Typing 2, I think up to Typing 3, there were different levels. Bookkeeping 1, Bookkeeping 2, like that.

While Sandra had little experience with traditional mathematics curriculum, courses like bookkeeping suggest she had broad experiences with applied math that was discipline focused.

Later I asked about her performance.

JB: How'd you do? Do you remember what kind of grade you got [in math]?

Sandra: I was struggling with math in high school. Yeah, I remember ... I know I couldn't bring anything. I knew I was supposed to bring home a A, but you just couldn't fail it, you know, so I knew I'd probably get ... probably a C... That was the last grade I saw on there, a C.

And following, I asked about her feelings about math, her beliefs.

JB: How did you think about yourself back then, when you were doing math?

Sandra: I still ... it's okay. 'Cause I just knew that ... I knew that math was ... I knew that math was there, I knew I had to achieve in math, but in my mind, nobody told me that there was something called statistics and calculus. Like, when I got to college and they started telling me, "What is statistic math and then you're gonna go here." That frightened me, 'cause I didn't know that when you go to a vocational school, that they just target you for what you need for your career. I knew how to get a job, I know how to get a job. I know how to, to, to do whatever it takes. I've had some pretty decent jobs, but when it came to school and math, that was always a challenge.

JB: What was challenging about learning math for you?

Sandra: I think that maybe psychologically I just knew that I was strong in words, I liked words. And numbers were just not that intriguing to me. So I knew from a young age, I knew I liked words, and I could do all kind of things with words, and I didn't know how to do that with the numbers.

JB: Is there anything you enjoyed about math?

Sandra: I can't think of one thing. (laughs)

Sandra understood she did not have a positive identity with mathematics. Last, she reflects on when she found out where she would place at CC, in Beginning Algebra:

Sandra: I had no clue where I was gonna end up with the math, but when I found it, it wasn't the beginning, beginning, I thought, "Oh, okay. Well I did remember something. Okay."

She was aware that the gap since her last school math experience and her age, her identity as an adult learner, would shape what type of math she would soon experience at CC. She knew it would be a struggle.

Terri – From My Eyes

Terri walked into my office with a “Hi Mr. Bragelman” and sat down at the table. Her actions spoke to the number of times she had been to my office. Terri was at CC on a scholarship, and the scholarship organizer was my suite-mate. The scholars routinely checked in, and we would often make small talk while they waited for their appointment. Largely, it would be about math. Terri talked about her Beginning Algebra class, and her identity with math. I talked about the supplemental math course I was about to implement next semester to support students in Intermediate Algebra. And so, Terri became one of the first students who enrolled in my pilot, and she became one of the students I would eventually interview.

Terri had brown skin, brown hair, and brown eyes. When we first interviewed, Terri was in her mid-forties. She had three children, most of them grown. Two had graduated from local universities, and their achievements and accompanying urgings motivated Terri to return to school. She had a reserved manner and talk, which I attributed to the professionalism she invoked because our meetings were contextualized around her scholarship program and my position as an administrator. When chance brought us together somewhere else in the college, she greeted me with genuine warmth. She often spoke of her feelings, about her past, about her future. It made sense, at least to me, that she planned to become a social worker.

Terri and Math

This pattern of returning to her feelings was also present in how she spoke about math. When she was young, she linked her experiences with school with trauma she was experiencing

at home. From how she spoke, her anxieties and beliefs about mathematics derived less from experiences at school and significantly more from the negative experiences she had at home. It was this that contributed to her dropping out of high school. It was not until she was forty that she pursued her GED.

JB: What was it like when you started your GED?

Terri: Ah, a challenge. It was, many nights where I was crying, where I was angry with myself ... For the most part, I blamed myself a whole lot, and I felt that I wasn't capable.

JB: Even though you were working on your GED?

Terri: Yeah. You know, I'm not saying I couldn't do it, but because of the frustration of so eagerly wanting to do, and stuff wasn't getting in, and I guess the anxiety ... I have some anxiety when it comes to testing. You know, but I'm learning how to cope with that ... I found out through the GED and going to classes, I found out about some things that were there [that] I thought wasn't there. I love to write. Um, I'm really good at it. This history class, this time, has just blown me [away]. I have to show you ... I wrote about, uh, the assassination of Fred Hampton in the Black Panther Party ... I'm just fascinated ... The words that sometime are in my head, that how it comes out... it's like, 'Wow!' ... During the GED, certain teachers noticed that...

...but there was still always, with the math, so, I worked through it...

I don't- I didn't- I don't know why, and I guess because I didn't practice [back then] ... but when it began to click, and I was like, 'oh, okay. It's not as bad'...and it was also frustrating...I'd get very angry at myself, very angry.

Terri presented a story of having to start anew, creating an academically oriented skillset and identity, against the fears and anxieties that came from her childhood that she associated with math. After her GED program, at a community college associated with CC, she enrolled in foundational mathematics courses, "with the fundamental...the basic stuff...times tables and the division...I used to hate division." When Terri moved into beginning and Intermediate Algebra at CC, her experiences with it, its social identities, and its perceptions were quite different from

the other participants, primarily because so much of her academic experience with mathematics existed at CC.

DeAndre – From My Eyes

DeAndre remained after his Intermediate Algebra class to interview with me. I had taught him for Math 98, Beginning Algebra, and now Math 99, Intermediate Algebra. Our relationship was friendly and professional. When he walked into the room for class, he normally greeted me with an upward head-nod and a “Yo, Mr. B.” He is a Puerto Rican American and grew up in a large midwestern city, in a neighborhood that was experiencing gentrification. His experiences and descriptions of it when he was growing up stood in stark contrast to the city I knew, an area under the process of heavy gentrification, anecdotally evident by my safety on runs through the park in the early and late hours of the day.

He was light-skinned with dark hair, a round face, above average height and weight, in his mid-twenties. He wore a goatee, and his face seemed to switch between two expressions: a broad smile, eyes gleaming with laughter, or a thin-lipped expression, eyes focused and determined. His laugh was genuine and loud, dominating the room. His switch to focus was immediate, and his voice emphasized it - “Yes sir.” DeAndre was a veteran, and like so many veterans, “Sirs” and “Ma’ams” accompanied his speech in a way that reminded me of my Southern heritage. DeAndre had a daughter, his driving force. His mom was a teacher, and her emphasis on academic success emerged several times in our interviews. From a large family, he had a number of brothers and sisters, some half, some full.

DeAndre and Math

In the fourth grade, DeAndre took a placement test that accelerated him two years. He attributes his quick rise in grades to his mom, her focus on learning. He earned straight A’s and,

in his words, never felt challenged by school. For example, in relation to his favorite subject [history] and his least favorite subject [writing], I asked about math.

JB: And where did math fall?

DeAndre: Math was like right in, in the middle. I was actually really good at math up until eighth grade, and after that I just stopped doing math, I didn't even care.

He echoed this perspective when I asked about his confidence. DeAndre both excelled in math and was not challenged by it. This was evinced in the emotions he carried about math.

JB: What were some enjoyable aspects of it [math]?

DeAndre: I haven't found anything enjoyable about math.

In his freshman year of high school, he was expelled from school, so he transferred to an alternative school. Within six months DeAndre dropped out of the alternative high school, at age 14, explaining that he was not challenged, that the school only cared about keeping the students from fighting. By the time he was 16, he had earned his GED and moved out of his mother's home; at 18, he enlisted. While he tried taking courses in the military, he did not return to formal school education until he was 25, after his service. He enrolled at CC, placing into Beginning Algebra. While his early academic history suggests DeAndre would excel in math at CC, DeAndre did not agree. He speaks, in his colorful manner, to how he felt about it when he first entered Beginning Algebra:

DeAndre: I came in oblivious. Completely oblivious.

I tried to push back, because of his early academic performance with math in elementary and middle school.

JB: But you're talking as if...

DeAndre: No. Because I can remember when you walked into the class and you threw a letter on the board. I swear to God, the first thing, I will never forget that because the first thing, I said, "What the fuck does that stand for?" And you said, "This is a variable," and I was like, "What the hell is a variable?"

While DeAndre was enrolled in algebra his freshman year of high school, his attendance was marginal at best. Beginning Algebra at CC was his first experience in memory with algebra.

Brad – From My Eyes

In the summer of 2014, I ran a summer bridge program for CC. The program was designed as a proactive measure to move students upward in the developmental mathematics and English pathways. Students who placed into a remedial math or English course were given a chance to participate in the program, a 6-week, intensive intervention that targeted content on the placement test. At the end of the program, students retook the placement test. Brad had signed up for the program and when he first walked into my office, we were two weeks into the course. He knew where my office was because I had told the students in the summer bridge program where my office was and that my door was always open to them. He greeted me with a “Mr. Bragelman” and a handshake. Few students shook my hand, so I remember it distinctly.

Brad was tall, six-foot tall at least, lean, with brown hair and light complexion. He identified as Caucasian [White]. He had a narrow face and wore a well-trimmed beard that day, of a length that toed the line between beard and well-tended scruff. “Can I talk to you about the instructor?” Brad was here, it seemed, to discuss the instructor of the math portion of the summer bridge program, as the instructor was having some problems with other students. He would come to my office more in the coming weeks, to discuss the summer bridge program and ask for advice on which math courses to take and which instructors seemed most worthwhile. Brad ended up becoming one of our successes in the summer bridge program, meaning he moved up a tier in the remedial sequence, from Beginning Algebra to Intermediate Algebra. Because of our meetings, he knew of the pilot supplemental instruction program I was running that fall, and he

signed up for it as well. When I spoke to the classes about the research and these interviews, he volunteered to share his story.

Brad and Math

Brad attended three high schools, two private and one public, before completing his high school diploma at the latter at age 16. He took algebra and geometry at the private schools, passing both. He described algebra as “tough for whatever reason” and geometry as “clicking pretty easily.” He did not describe himself as confident in math, expressing “numbers are fine. I can do numbers in my head, but like algebra was a struggle.” When he transferred to the public school, an alternative preparation school where he took classes in the evening, he was not required to take any additional math classes for his diploma. He speaks to his perceptions, back then, of learning math and the value of education:

Brad: Yeah, it wasn't too difficult. Usually I would see a formula and learn the formula, learn how to apply the formula and then I could apply it. I would say the privileges that I had were the things that were instilled in me outside, beyond my drive to learn. So how can I explain this. So, understanding the need for learning, looking back on that as an adult. It failed me in that environment, yeah. But I was a shithead. I just didn't want to learn. I didn't want to be in school. There was nothing that was really going to stop me. But I was a kind enough kid and intelligent enough individual to understand the importance of it. I just didn't want to do it. Didn't want to be there.

At the age of 18 he began working in the restaurant business and tended bar for over a decade before deciding to enroll at CC to go back to school. These five are the cases for this study.

Participants' Academic Achievements Before Remedial Math Courses at CC

When the participants enrolled at CC, their histories showed several commonalities. Their formal school math careers ended with pre-algebra, algebra, or geometry. Three participants completed a GED; one received her high school diploma through a vocational school; and the fifth received his high school diploma through an alternative high school. This does not position the participants as ‘bad at math,’ only relatively inexperienced with school

mathematics compared to traditional students who were particularly more advanced in mathematics content. Finally, the participants placed either into a tier-one, Foundation Mathematics course or a tier-two, Beginning Algebra course. Table 6 presents these data points.

Table 6. Five Adult Learners from the Initial Pilot, Along with Relevant Demographic Data.

Name	Academic Experience Before Placement	Most Advanced Math Course Experienced	Initial Placement
Reagan	GED	Algebra 1	Foundational Course
Sandra	High school graduate	Algebra 1	Beginning Algebra
Terri	GED	Pre-Algebra	Foundational Course
Brad	High school graduate	Geometry	Beginning Algebra
DeAndre	GED	Geometry	Beginning Algebra

Participants' Perceptions of Remediation Before the Start of Their Course Work

This section presents narrative excerpts of participants' perceptions of remediation as a program before the first day of class. I do so here to suggest that participants' experiences at CC are novel, that they came to CC with little understanding of what it means to be a learner in remediation and of the broader narratives about remediation. Participants' lack of experience with more advanced mathematics content was most evident in their narratives when they discussed the 'newness' of algebra in their Beginning Algebra courses and in their perception of remediation. When I asked what it felt like placing into Beginning Algebra, DeAndre, Brad, and Sandra respond:

DeAndre: Well, I had no idea what it even meant, like, I didn't know what 98 or 99 [Beginning or Intermediate Algebra] meant until I got to your class and you [the instructor] explained it.

Brad: No, I didn't. I mean, I understand, I understood what it was for, but I didn't know exactly what it meant. Like exactly where I was, exactly where I struggled...

Sandra: Oh, I didn't care. When they showed me the English, I was like, "Okay, so it will be a refresher." You know, because I haven't written a paper in a long time. And they give you the opportunity to do a little essay, while you're on the computer doing that test. So like I like words, I figured I was strong, but I probably, at that time, had been all over the place with punctuation marks, so I needed that. I needed that. The math, I had no clue where I was gonna end up. But when I found it wasn't the beginning, beginning, I thought, "Oh, okay. Well I did remember something. Okay."

Reagan and Terri position their understanding against their prior experiences with mathematics.

Reagan described her experiences with Beginning Algebra framed against her K-12 mathematics experiences "Can you believe this is [baby] math?...I didn't get this math at [my high school]."

Terri's first experience with mathematics was at one of the city's community colleges in a GED program and then moving through each tier of the remedial program at CC. She spoke of her experience relearning foundational mathematics in the first tier course of the remedial sequence:

Terri: ...but there was still...always with the math...I worked through it, I worked through it. I remember, even coming here, back in '06, and seeing one of the math tutors, this guy...who used to tutor here, white guy, and he was just amazing, you know, he was just amazing with me. He worked with me...you know...timetables...and the division. ... I used to hate division.

After her GED program and her foundational mathematics courses, she transitioned into Beginning Algebra and later Intermediate Algebra. For her, remediation was the path.

Participants' narratives suggest they had little to no understanding of the term 'remedial,' the more local connotations it carried at CC, or the broader narratives attached to it. All were relatively inexperienced with school mathematics, particularly compared to recent high school graduates, and none would describe their relationship with mathematics as positive. Finally, none identified career or educational goals tied to mathematics.

Chapter 5 – In the Middle: Identity Work During Remediation

In this chapter, I present a cross-case and within-case analysis of participants' identity work evidenced in narratives situated during participants' Beginning Algebra and Intermediate Algebra remedial mathematics courses at CC, the time period I describe as During Remediation. In the first section, I present a cross-case analysis of participants' identity work in remediation. First, I present an achievement-oriented narrative of participants' Intermediate Algebra course. Next, I present several narratives about remediation common across participants' narratives: remediation as an institutional pathway to college-level mathematics and remediation as a deficit framing such as being low-level mathematics, a program for those 'bad at math,' and a refresher course for recent high school graduates. After, I present how the narratives shaped participants' overall identity work. Following, I present aggregate instances of identity work evidenced in participants' narratives during remediation, showing no trends exist. Last, I discuss three participants' identity work around the social identity age. Finally, in the within-case analysis, I show how participants evidence differing identity work in relation to mathematics experiences and narratives of remediation, noting when participants speak to social identities of age.

Analysis of Participants' Identity Work in Remediation

In this section, I present a cross-case analysis of participants' identity work in remediation. First, I present academic achievement indicators. Second, I present narratives about remediation that emerge across participants, and I present insight on the effects of these narratives as resources in participants' identity work. Finally, I present several emergent patterns in participants' identity work in mathematics remediation. In other words, the following serve as three perspectives on participants' stories.

Academic Achievement Indicators in Intermediate Algebra

Table 6 displays participants' enrolled math course during the first interview, their grade in that course, and their subsequent mathematics course.

Table 7. Participants' Math Course During the First Interview, Grade for the Course, and Subsequent Mathematics Course.

	Enrolled Course at First Interview	Earned Grade for the Course	Subsequent Math Course
Reagan	Intermediate Algebra	C	Math for Liberal Arts
Sandra	Intermediate Algebra	F	Math for Liberal Arts w/ Mandatory Co-Req
Terri	Intermediate Algebra	C	Math for Liberal Arts
Brad	Intermediate Algebra	A	College Algebra
DeAndre	Intermediate Algebra	A	College Algebra

As shown, two participants earned a 'C' for the course. Institutionally this was considered a success. In the findings section, I will show participants' perceptions of a 'C' were mixed. Two participants earned an 'A,' and one participant, Sandra, failed her course. All five transitioned to college-level mathematics. Sandra transitioned to college-level mathematics through a pilot, co-requisite support program. DeAndre and Brad both moved to College Algebra, the STEM pathway at CC. At this point in the story, it could be argued that 80% of participants found institutional success in remediation. Sandra's success in remediation would be determined by her pilot course. Two of the participants, having earned A's in Intermediate Algebra and subsequently transitioning to a STEM path for mathematics, would be considered successful in regards to traditional, achievement-oriented metrics for success, such as those used in participant

selection for research on successful mathematics learners (cf. Noble, 2011; Stinson, 2013).

However, this is only one perspective on participants' stories.

Available Narratives about Remediation

Across the five participants' narratives, multiple narratives emerged from their experiences in remediation that, as I will show, informed their identity work as learners of mathematics. The first originates in the institutionally-driven narrative about remediation that presents it as a necessary experience, as a required pathway to college-level math courses and a postsecondary degree. The other narrative originates in the locally-driven narrative about remediation that presents it through a deficit framing, positioning remedial math as 'low-level' and learners in remediation as 'bad at math'.

Remediation as a Required Pathway. The first common narrative about remediation that emerged in all participants' interviews oriented on remediation as a required program before students at CC can transition to college-level courses. For example:

Sandra: So they looked at all my grades from wherever, and they said you're gonna have to take a placement test, 'cause you've been out [of school] so long. And when I took that placement test, that placement test said this is the math you're gonna need to take, and this is the English you're gonna need to take.

Like many students, the five participants assumed the institutionally determined pathway is appropriate. None questioned their placement, or the placement test's determination of their mathematical ability. The majority assumed their placement into remediation occurred because of the long gap in their academic careers. For example, Sandra continued:

Sandra: I needed that. The math, I had no clue where I was gonna end up with the math, but when I found it wasn't the beginning, beginning, I thought, "Oh, okay. Well I did remember something. Okay."

Brad responded similarly, "Okay, foundation. Yes, I need to get that foundation. And then just going through it, understanding, that it was necessary." This perception of remediation as a

necessary program or experience tied heavily into participants' initial understanding of remediation. They understood their mathematics histories, and they accepted the institutional response to their histories. As Brad suggests, remediation as "that foundation" was necessary for their academic path as learners of mathematics and as successful learners.

Remediation as a Deficit Framing. The second narrative emerged as I prompted participants to discuss what it meant to be "remedial". It was a leading question, but I had hypothesized that if there was *not* a stigma attached to remediation at CC, their answer to the question would result in an answer similar to the institutional narrative. In their responses, two groups shaped participants' perception of what it meant to be remedial: peers in their courses and faculty of remedial courses. DeAndre discussed his first encounter with peers' perceptions of remediation:

DeAndre: Before, everybody was like, "Oh, then you're just ... You're pretty much dumb if you didn't make it. If you didn't hit college level yet, you're dumb. You know... pretty much everybody that I talked to asking about 98 [Beginning Algebra], like even when I went into the classroom before you walked in, I was like, "So, what's this class for?" People were like, "Oh, this is where the dumb people go." And I was like, "Okay." (laughs)

DeAndre spoke to peers' reactions to placing into remedial courses, framing them against placing into college-level mathematics courses, the opposite of college-ready (Conley, 2007). His account spoke directly to peers' perceptions of what it meant to be in remedial classes at CC— "this is where the dumb people go." Brad echoed this perception of 'dumb':

Brad: It was just you saying you need to do this...And me understanding, "Okay, foundation. Yes, I need to get that foundation." And then just going through it, understanding that it, it was necessary...

... Not that there was something wrong with me or that, you know, it's not a dumb thing. It's just that it's necessary. You need to get this foundation before you move on.

Sandra framed this perception of ‘bad at math’ in the context of her past school experiences that illuminated the negative framing of being positioned as ‘dumb’:

Sandra: When I hear the word remedial, I think about...people who have not met ... in grammar school there was a class called PZ. PZ was a class that you didn’t quite make it to third grade. You were in between third and somewhere between fourth, but they called it PZ...They’re in between so it means something’s wrong with you, you didn’t quite make it. You didn’t get something. Something ain’t working right. So it’s a negative. So remedial, it means it’s a negative.

In these excerpts of the interviews conducted during Intermediate Algebra, participants touch on the deficit framing of remediation at CC. This negative perception of students’ mathematics ability was not limited to participants’ interactions with peers.

In three instances, participants spoke to instructors’ perceptions of their ability to do and understand mathematics. Sandra discusses an experience about learning the concepts of domain and range in her Intermediate Algebra class, and she referenced statements her professor frequently made in class – “this is a refresher”; “you’ve already learned this”; “you just need to remember”.

Sandra: It feels like I missed something. It feels like had I been taught this back then, that something would spring up, something would refresh my memory... By now it should be like, ah, it should be [bringing those memories back] ... [but] it’s not in me.

For many of the students in the intermediate class, recent high school graduates, perhaps the course *was* a refresher. But for the adult learners in this study, Intermediate Algebra was completely new content. Positioning it as a refresher meant participants were required to do identity work around this.

These two narratives were not the only narratives about remediation at CC, but they were the only common narratives discussed across the five participants. Second, the two narratives present opposing perspectives of remediation. Acceptance of remediation as a necessary

experience to achieve ‘college-ready’ status meant also, potentially, acceptance of the deficit-narrative, that being in remediation meant one was also ‘bad at math’. These narratives served as resources for learners’ identity work (Gresalfi & Hand, 2019).

Effects on Identity Work. The availability of these narratives informed how participants evidenced identity work during their remedial mathematics courses. All participants *embraced* experiences when the salient narrative about remediation was its institutional necessity. Of the five participants, only DeAndre *embraced* experiences when the driving narrative was through its deficit framing. The remaining participants only *distanced* or *troubled* experiences where this narrative was salient. For example, when Brad states, “it’s not a dumb thing. It’s just that it’s necessary. You need to get this foundation before you move on,” he *troubles* what it means to be a learner in remediation, showing he was doing identity work around multiple narratives about remediation. However, in his acknowledgement of remediation as a foundational necessity to transition to college-level math, he also supports the narrative that remediation was ‘low-level’. Only Reagan’s identity work suggests reframing remediation completely, that it should be ‘just math’.

General Trends of Identity Work

Following, I broke down types of identity work by participants, which I present in Table 8. It shows the aggregate instances of participants’ identity work evidenced in narratives about mathematics experiences during their remedial math program.

Table 8. Identity Work Evidenced in Participants’ Narratives During Remediation.

	Identity Work Evidenced in Narratives				
	Sandra	DeAndre	Terri	Brad	Reagan
Distancing	5	2	1	4	2
Embracing	1	7	1	3	3
Troubling	1	3	5	3	5

As shown, participants do not uniformly *Distance*, *Embrace*, or *Trouble* in their narratives. This suggests participants' experiences in remedial math courses may not uniformly affect their identity work. Indeed, all participants evidence all three types as well. This suggests that their identity work as math learners may not be uniform while in remediation. In other words, I cannot offer trends across participants' identity work at this level of analysis.

Identity Work Around Social Identities

Across the cases, participants did not mention explicit experiences in mathematics remediation that involved social identities of race. In fact, the only social identity that emerged across the participants was their identities as adult learners. Three of the five participants spoke to experiences that made their age salient. Of interest, the narratives did not emerge categorically negative or positive. Reagan dropped a course when a professor stated she would not find mathematics success because of her age. Reagan, Sandra, and DeAndre evidence narratives where their age and the resulting life experiences presented more established values and beliefs to draw upon for motivation and persistence in making assertions in a formal school context after a significant break from it. This is not to say that social identities like race or gender were not salient in participants' experiences in remediation; rather, I only state that these identities were not explicitly discussed in participants' narratives. As participants' experiences around their social identities as adult learners differed, I discuss the social identity more deeply in the following, within case analysis.

Narratives about Mathematics Remediation and Success by Case

In this section I present a within case analysis of participants' identity work in remediation. Recall that narratives in this section are bounded by their first day of class in remediation at CC and by the time of their first interview, conducted in the last two weeks of

their Intermediate Algebra Course. For each case, I present narratives and an analysis of each case's evidenced identity work. I do so to suggest that while no trends across the cases emerged in participants' identity work, several nuanced differences emerge in a within case analysis. Of note, participants are presented in the same order in each chapter of this study so the reader may, if they so choose, move through participants' narrative individually and chronologically.

Reagan – It's Just Math

As shown in Table 8, Reagan does not evidence a single type of identity work. In her narratives about remediation at CC, she *distances*, *embraces*, and *troubles*. Overall, Reagan struggles to make assertions as a math learner in her remedial math courses. Following, I present Reagan's evidenced identity work, orienting on what it meant to her to be in remediation and on her learning experiences in remedial math courses.

Identity Work around Math Experiences. Reagan did not immediately move into Beginning Algebra, waiting a year. She admitted that this caused her issues when she eventually took it. After her break, her experiences in Beginning Algebra, the first time she took it, did not go well.

Reagan: In 98 [Beginning Algebra], I took [Beginning] last semester. I took a [Beginning Algebra course] before that and I dropped it...I felt like he didn't care if we got it or not. I felt like he was one of the teachers that I had in high school, why school wasn't important to me. Because that was the normal teachers that we had, like this dude. I mean he wasn't bad. He wasn't bad, but he just really didn't care if you got it or not. He told me that I probably need to get my brain checked, because I'm older and maybe my brain's not functioning. [*Remediation; Distance; Age*]

It is telling that Reagan describes a teacher who tells her to get her brain checked because she is older as "not bad". Reagan's description of her Beginning Algebra teacher as "one of the teachers I had back in high school" suggests her experiences with mathematics courses in high school were not supportive. However, her experiences in her GED program, with a teacher who

offered a supportive environment to learn mathematics, provided a counter to her high school experiences. In her interviews, Reagan would go on to describe her mathematics experiences as 'like high-school' or 'like the GED program'. The interpretation was either a classroom environment that did not afford math learning experiences or one that did. Because she had experienced both types, Reagan avoided classroom experiences similar to her high-school ones. She dropped the course, to find a better experience.

In the next excerpt, she describes her experiences in Beginning Algebra, the second time:

Reagan: I had Ms. Y next...A lot of students didn't really like her, because they couldn't understand her...I didn't have a problem understanding her...I liked that she controlled her class...And I could tell she wanted us to get it...She gave me every chance to try and get it, and I passed.

In her second attempt at Beginning Algebra, she found a teacher more like her old one in the GED program, and with it she passed the class, experiencing a measure of achievement.

In terms of her progression through remediation, she had only Intermediate Algebra remaining. She enrolled in it immediately, in my class as suggested by her advisor. In the following excerpt, she describes her perceptions of my class:

Reagan: You are really one of the good teachers, because you try to make it fun for us. And you make it fun for us and you give us a place where we could say, "Hold up, I don't understand that." You know, I'm older now. Now I could say I don't understand wherever I'm at, and I really don't care, you know? Say like with Mr. X's class [Foundational Studies]. Mr. X is cool. I just said I don't understand because I'm old [and can now]. (laughs)

Ain't no boy in the class I like, and I ain't embarrassed [to admit I don't know something]...I can say...what I don't understand. [a lot of young people don't feel that way].

But in your class, I think you give the young people a place where they could say what they want, [what they don't know]. Teachers don't give that. That's why I think most people don't really like math. [*Remediation; Mathematics; Success; Age*]

It is difficult to discuss this excerpt as my identities as researcher and teacher are both salient. I will say this: while I emphasized creating a safe space in my class where students could make mistakes and ask questions freely, I have never had my class broken down this way. Reagan suggests her identity as an adult learner affords her opportunities to make assertions as a math learner, to question when she does not understand. She feels younger students are not normally afforded opportunities to make similar assertions. I followed up, asking her how she felt about math in the class:

Reagan: So I didn't have problems. I never had problems if I was at school. You know, if I had ... even, even kind of right now, if I could really apply myself more, if I didn't have a lot of other stuff going on, I could probably do much better in this class. 'Cause it's not like I don't ... it's not like I don't understand it forever. You know, after you explain it to me a couple times ... What I notice in our class, it go too fast for me. [*mathematics; success; trouble*]

Reagan suggests that she's not bad at math, and that she can eventually understand a concept if given the time. Reagan also speaks to a common issue adult learners experience when they return to school. They bring a variety of obligations ranging from work to family, and these obligations limit the resources they can devote to their learning. Reagan suggests that once she finds a classroom environment where opportunities for learning exist, her access to those opportunities are limited by her available resources – primarily time. That semester, she missed a number of classes, and her performance on the tests directly related to the number of classes she missed. In spite of this, she passed my class, easily if I may add. However, as I will discuss later, Reagan did not perceive passing as representative of math learning.

On Being a Learner in Remediation. Throughout her interview in, Reagan described her courses as “so fast”. It gave the impression that Reagan felt that just as she was about to “get” a concept, the class moved on to the next one. This struggle to meet a level of

understanding she desired with a curriculum that felt face-paced resulted in experiences that influenced her identity work as a math learner. For example:

Reagan: I didn't know (laughs) I wasn't good at math until I came here because it goes so fast. If I was good at it I would be able to keep up with the class.

Despite previously acknowledging the effects of her obligations to family on her school experiences, she does not acknowledge them here. Despite passing every math class she completed, she did not end Intermediate Algebra believing she was “good at math”. The speed of the curriculum that Reagan points to throughout her academic experiences in remediation at CC suggests she does not feel she was given sufficient opportunities to show mastery or understanding. The following excerpt complicates this notion:

Reagan: You know what? You know, you say remedial classes (laughs) but I don't look at this as remedial (laughs) classes, you know? I know it don't count. I know it don't count. [as in they don't count towards a degree]

JB: What do you look at them as?

Reagan: Math. You know, I don't really get into the remedial part. I guess I should, but I don't think of it as remedial... It doesn't feel like that. It feels like you're just in math. [*trouble*]

I interpret this to mean that Reagan is suggesting that she was not afforded opportunities to identify with being ‘good at math’ as the only narrative available was that being in remedial math courses meant she was ‘bad at math’. She *troubles* it, pushes at it. Like her view of different instructors after her GED program, Reagan attempts to find an experience with a narrative that supports her conception and goals as a math learner. However, in remediation, Reagan only has the narrative of remediation as ‘low level math’, as ‘bad at math’ to draw upon. Her troubling suggests she found it insufficient to meet her self-conception.

Summary. Within Reagan's narratives, she *embraces* the institutional designation of remediation as a pathway to college-level courses. However, her narratives about learning

experiences while in remedial courses suggest she struggled to make assertions as a math learner. As a result, she *troubles* what it means to be a learner in remediation. Second, Reagan's case presents insight into an adult learner's identity work around age in remediation. She discusses it in an experience when an instructor implies her age has a negative impact on her ability to learn math. She also discusses it in an experience when she suggests her age makes it easier for her to make assertions as a math learner. In other words, it is not possible to reduce her experiences to a qualitatively simple result, that being an adult learner in remediation is either good or bad. Rather, Reagan's account shows she does identity work around *Age* while in remediation and that the social identity *Age* complicates her mathematics experiences.

Sandra – I Can't Find the Math in Me

As shown in Table 8, Sandra does not evidence a single type of identity work, although she primarily *distances* in her narratives. Like Reagan, Sandra struggles to make assertions as a math learner in her remedial math courses. Following, I present Reagan's evidenced identity work, orienting on what it meant to her to be in remediation and on her learning experiences in remedial math courses. Sandra's case is unique in that she was the only participant to fail her Intermediate Algebra course during the first interview, and I include an analysis of its effects.

Identity Work Around Learning Experiences. Sandra's case is the most extreme case in this study in terms of her perceptions of remediation and her identity work with remediation. Recall, Sandra completed her high school diploma at a vocational high school, and she completed mathematics courses through Algebra 1. The following excerpt orients the reader to her experiences with Beginning Algebra and Intermediate Algebra in comparison to her math experiences in high school, her last school math experience.

JB: Do these [remedial] courses feel different than what you took in high school?

Sandra: Yeah.

JB: How so?

Sandra: Never had these before. I never saw some of this in my life.

JB: So what's it feel like? When you took your intro to algebra course, like in your sophomore, junior year [of high school], how did [Beginning Algebra] feel different? How does [Intermediate Algebra] feel different than that?

Sandra: It feels like I missed something. It feels like had I been taught this back then, that something would spring up, something would refresh my memory, 'cause I know I'm not illiterate, and I've already proved that with the ... with the English. I got As and Bs in that ... in that ... in that English.

I came back to school after all that time and even though I took that one, I did the [necessary components] and I moved on. I'm done with that, right in the very beginning. So that made me feel like, "Okay. Okay. You're thinking, you're good. Let's go for this math." But then I got into math and it was like I was trying to find it somewhere in me, like, "Okay, logically, let's read this chapter and see if that makes sense, since you like words. That don't make sense. Okay, let's look at these problems everybody gives on these websites." Go on Purplemath, go on this, go on that. "Oh, ah, what? What? Where is it?"

So if ... I don't know. By now it should be like, ah, it should be ... It's not in me. [*Remediation; Mathematics; Trouble; Age*]

Sandra speaks to a local narrative of remediation presented by her instructor, that remediation is a refresher course of content students learned in high school. The narrative seemed to serve as a means to minimizing some of the stigma of the course by presenting it as less difficult. However, the narrative carried very different implications for an adult learner like Sandra, as her *Age* as an adult learner was part of her identity work. Indeed, of the five participants, Sandra's narratives most reference this social identity, due in part to this local narrative. In response, she *troubles* experiences as a math learner because, for her, the course was not a refresher and so she struggled to make assertions.

Sandra attempts to seek out learning experiences with mathematics and opportunities to do identity work around it. However, her narratives suggest she had *embraced* a stigma carried

by narratives about remediation which shaped her experiences in other spaces. In this excerpt, Sandra discusses an experience going to tutoring:

Sandra: ... I think I thought I was gonna get that person sitting right there with me... my personal [tutor], [so] I can have someone's undivided attention for that whole hour, whatever we spend. But, it's like, "Oh, you work it till you get stuck." Okay, so if I work until I get stuck and Mr. X comes over, he helps me out because he's available. And then I work until I get stuck again, and Miss B comes over and she helps me out. They teach two different ways; they think two different ways. At some point, with my defensive guards up, I'm thinking, "They're gonna think that something's wrong with me, 'cause I'm not getting it with two different people." [*Remediation; Distance*]

She speaks of being afforded a learning experience and to make questions about her mathematical understanding, but Sandra *distances* from making assertions in the space because she now perceives that 'struggling to understand a mathematics concept' means 'something's wrong with her,' even in an institutional space that is not the mathematics classroom.

In the next narrative, Sandra seeks an out-of-classroom learning experience through collaboration with peers:

Sandra: I don't even care about my peers in the course. At this point I'm 54, and I'm not child anymore. I chose to come back to school and I'm probably older than some of my instructors... The ones who act like they got it all together... they see you going to tutoring and you're asking, "Want to... You know, want to get together? Want to do something...?" And no, they don't have time, but then at the end, when everybody's struggling, "What is your grade?" Y'all want to talk to me now, 'cause I don't wanna talk. Don't ask me my grade... now you're telling me you're struggling too, we could have been working together. But I figured that people have their pride, or that their self-esteem is so low, they don't want you to know.... [*Remediation; Distancing; Age*]

Again, she struggles to find such an experience. In her narrative, she suggests her *Age* influenced peers' responses to her, denying her a study group. As important, the narrative shows her peers in the course also *distanced* from learning experiences around their mathematics understanding. However, Sandra's case includes one narrative where she *is* afforded a learning experience, when I followed up to her response where she says the math is not inside her. In this excerpt, I

reference a set of experiences Sandra and I shared in remediation, where I was tutoring her for Intermediate Algebra.

JB: Do you feel like [the math is] in you when you come work with me?

Sandra: The reason I feel like ... Yes. The reason I feel like it is, is because you give it to me in everyday life, something that I know exists. Food exists, um, colors, things that I, that I, I can touch. I know these things, and you break it down to me like that, and it's like, "Oh, so it is in me. It's just not in me, the way the book says it. It's in me in another form. Oh, okay, so that's why I'll have math with me all the days of my life." Recipes, how we talked about recipes, that makes sense to me. [*Mathematics; Trouble*]

Sandra suggests that when mathematics was presented to her contextually, in real-life scenarios, a preference by adult learners recognized in research (Evans, 2000), she no longer associated the stigma she felt in other spaces with remediation. This is worth noting because she *embraced* making assertions as a math learner during her tutoring, which took place in the office of the director of developmental education. It was the only space at CC solely devoted to remediation.

On Being a Learner in Remediation. Her experiences with mathematics remediation were heavily shaped by the narrative of remediation as a refresher.

Sandra: When I hear the word remedial, I think about...people who have not met ... in grammar school there was a class called PZ. PZ was a class that you didn't quite make it to third grade. You were in between third and somewhere between fourth, but they called it PZ. And in my head that always sticks out, that means that when kids made fun of you, they saw you as [less], "Oh, he's in third grade, or she's in third grade." They're in between so it means something's wrong with you, you didn't quite make it. You didn't get something. Something ain't working right. So i- i- it's a negative. So remedial, it means it's a negative. [*Remediation*]

Sandra's response resonates with the medical model of remediation, where remediation was intended to 'remedy' an issue (Arendale, 2005), and she shows that her experiences in remediation changed how she made assertions as a math learner from "at least I remembered something" to "I feel like I missed something...that something would refresh my memory" to finally "something ain't working right".

On Failure. The final set of narratives are unique to Sandra because she was the only participant failing during the time of the first interview. In the excerpts, she also speaks to the number of times she took Beginning Algebra and Intermediate Algebra. At the time of the first interview, she needed only nine credit hours to complete her associates, of which four credit hours were her general education math requirement. Completing remediation weighed heavily on her.

JB: Students who take remedial courses in college are less likely to complete college. Were you aware of this? Why do you think that's the case?

Sandra: I was not aware of it, but I know, I thought about it, this year, when I didn't see those people that I started with, and then the ones that are still here, and I'm like, "Whoa, we're still here, we've been here since 2012. We're not talking about [Intermediate Algebra] no more." They said, "Forget that, I'm just getting me ... I'm just getting out of here, 'cause I'm tired of being here. I'm not taking anything with math." So they decided to dismiss their career, goals that they had when they started, because of math. And just take that degree where you can't transfer into a four-year institute. [*Success; Distance*]

Sandra speaks to the attrition of students in remediation and to a narrative not often discussed in extant research on remediation or in policy reports on remediation – the narrative of mitigated success. CC offers an Associate of General Studies (AGS). Unlike Associates of Arts degrees, an AGS does not align with four-year degree pathways. Indeed, it is of interest here because, at the time, there was no specific math requirement for completion. If students struggled to complete remediation, they were offered an AGS option to complete, requiring, as Sandra mentions, sacrificing the option to transfer to a four-year institute. So while an AGS might mean completing an Associate's degree, it also means foregoing a number of potential career and education options. As Sandra suggests, taking that option over years of siege by a program that offers almost no flexibility is *not* a success. When I say siege, the next excerpt presents insight:

Sandra: ...you already waited late to come back to school...age wise not late, cuz it's never too late. But now, when you get yourself all giddy-up to come back, you were saying, "Okay, I know what it is. I finally grew up. I'm gonna do this."

Now you're saying, "Ah, you know what, I'm gonna settle for this instead, because I can't get the math." That sucks! That's not good. That is not right... The average person in their right mind is gonna go ... only going to repeat it maybe two times. That third time, it takes too much energy to pump yourself up to save face. You'd rather just not show your face than to come around and say, "Yeah, I'm sitting in this class for the third time." [*Success; Distance; Age*]

Figure 4 shows there is a percentage of students who fail out of each step in the sequence of progression of remedial courses at CC. Sandra's excerpt provides insight into the realities students face during their progress through the sequence. For students who fail, the chances of failing a second time increases. Without support systems in place for students who do not find success the first time, the program offers only increasingly difficult gates on a path towards completion. Sandra shows in her identity work that the local narrative of remediation as a refresher not only resulted in *distancing* from math learning experiences, it also resulted in *distancing* from identity work around success.

In Sandra's last excerpt, she provides anecdotal insight on why so many institutions, as they reform remediation, are offering options in remediation that track towards specific, college-level math classes and pathways.

JB: So when you complete [Intermediate Algebra], how do you think you'll do in your next math class?

Sandra: I'll do fine.

JB: Why do you think that is?

Sandra: I already know. I've researched it.

There's none of this, even though [people are saying] you're gonna have to use some [of the content later in life]... stop, stop, don't lie to me. Quit, quit playing. Stop it! Don't do that, 'cause if that was true, every teacher I know would be able to help me through 99. And most the teachers in my life, in my family, they're like, "Girl!... Oh, I haven't did that since [did my schooling]." You know, they gotta think, they ain't even teaching their kids like this. Stop. [*Mathematics; Distance*]

Sandra speaks to the realities of a curriculum that covers learning objectives that support mathematics learning trajectories to three different college-level options. At CC, Intermediate Algebra is the final gatekeeping math class that students experience on their pathways. Indeed, her case shows it is difficult to do identity work toward identifying positively with mathematics if the learner does not see value in it.

Summary. Sandra's narratives include several moments of identity work worth addressing. Of the participants, Sandra struggles the most to *embrace* learning experiences in her remedial math courses. Throughout her first interview, she discusses only a single experience as a positive learning experience with math. In that experience, mathematics is presented contextually, aligning with researchers' broader understandings of adult math learners (cf. Evans, 2000). When contextualized, Sandra was able to draw on her out-of-school mathematics understandings to support her learning of algebraic concepts.

As addressed in her narratives, Sandra's experiences in remediation afforded few local and broad narratives about remediation as resources to do identity work. Her narratives discuss remediation as a refresher and remediation as a gatekeeper (Martin et al., 2010). While she may have been afforded mathematics learning experiences in her classes, Sandra *distanced* from those experiences in part due to the local narratives about remediation. Her identity work suggests the incongruence of the narratives in relation to her self-concept overwhelmed her, and her identity work oriented on that incongruence rather than on, for example, being a math learner. In addition, she discussed no experiences of academic achievement in her remedial math courses, discussing only negative experiences. Together, this shows Sandra was primarily afforded opportunities to do identity work around negative experiences, and if she was afforded opportunities to do identity work around positive experiences with mathematics, they were

sufficiently minimal that she did not address them in our interview. Indeed, Sandra's narratives show she views remediation as institutional requirement she must negotiate through or around; she does not view remediation as a program of access to either mathematics learning or to higher level mathematics content.

Finally, Sandra's narratives include several examples of identity work around *Age*. She speaks to motivation and resiliency that her identity as an adult learner affords, particularly in the face of failure. Such aspects align with research on successful learners of mathematics (Berry & Thunder, 2012), yet Sandra does not find many, if any, successes in her remedial math courses. She speaks to the hardship of attrition, watching those she calls peers, other adult learners, either leave the program completely or sacrifice their goals because of their struggles with mathematics. Again, Sandra's identity work orients on negative experiences in remediation as an adult learner, and the result is a view of remediation as an institutional mechanism that denies access to a postsecondary degree.

Terri – Past Trauma

As shown in Table 8, Terri does not evidence a single type of identity work, although she primarily *troubles* in her narratives. Terri struggles to make assertions as a math learner in her remedial math courses. Following, I present Reagan's evidenced identity work, orienting on what it meant to her to be in remediation and on her learning experiences in remedial math courses. Terri's case offers insight into an adult learners' identity work around past trauma associated with mathematics.

Identity Work Around Learning Experiences. Terri completed her GED program at a sister college to CC. She continued to take Foundational Studies, the first tier of remediation, at the same college. Both were considered adult education courses, different than the latter two tiers

as both counted as credit towards a degree. Afterwards, she transferred to CC to work on her Associate's degree and her credit-bearing courses. It took multiple iterations of each class for Terri to progress to the next course in the sequence. In the following excerpt, she speaks about her transition from Beginning Algebra to Intermediate Algebra.

Terri: This is the second time that I've taken [Intermediate Algebra], and the first [instructor], he actually retired in the spring of last year...At first when I got him I thought it was gonna be like, [Uh oh!], but... his presentation, it was real good.

I had him twice, I had him for [Beginning Algebra] and [Intermediate Algebra]. He was so good in [Beginning Algebra]. I saw how I was flowing with it, I was like, "okay, I'm gonna take him again because I'm learning", I'm getting something from him. [*Embrace*]

But he told me, he said, "you know", he said, "[Intermediate Algebra] is just a tad bit different. It's more...it's a lot more rules that you have to understand", you know, and by god, he was absolute right. (laughs)-

Terri's comment "I'm going to take him again because I'm learning" shows she experienced learning experiences in Beginning Algebra with her instructor and that she sought similar learning experiences in Intermediate Algebra. The last sentence of the excerpt, her instructor's advice on Intermediate Algebra, speaks to a relationship between the two, a mentor and mentee. In the next excerpt, Terri speaks to her experiences in the first Intermediate Algebra course.

Terri: ...I would go to his office...on the seventh floor [to get help] and then I would [sit] with the tutors in there, and sometimes I would go in there and sit with him. He said, "You know, I see you you're a hard worker, you do the work. But when you take the test, somethings not connecting..."The [semester] with him, I may have got two tests that I got really good scores, one was 80 something, and one was a 70 something.

So I think the last one was, like, 60 and the other one was, like, 50 something, or something like that. But...he told me, he said, "you know it's okay, if you drop the class. [Just] keep coming." So that's what I did, all the way up until it was time for it to stop. He was really, really proud of me. He was like, "you're doing good work," he said, "and it's okay," he said, "sometimes it just take people long than others...The next time you take it, maybe it'll really sink in and you can identify [with it]." [*Remediation; Success*]

Terri's account of her first Intermediate Algebra course, with her old professor, suggests she was afforded learning experiences that resulted in achievement, and she *embraced* those experiences, seeking more. However, in the same narrative, her professor designates her as a slow math learner. Indeed, the statement "the next time you take it, maybe it'll sink in" suggests he could see Terri taking Intermediate Algebra at least two times, maybe three or more. In other words, her professor suggests a single iteration of Intermediate Algebra would not afford sufficient learning experiences for Terri, even if she *embraced* them. The remedial math curriculum at CC was not designed for students to take each course multiple times. The intended curriculum moved students through course progression sequentially, semester by semester. There were no support systems in place for students who failed a course. As mentioned in Sandra's case, students who failed a remedial math course were shown to have higher failure rates when they took it again. The statement "next time you take it, maybe it'll really sink in" repositioned the systemic failures of remediation at CC on the learner, on Terri.

Terri continues her narrative about remediation at CC. In this excerpt, she is taking Intermediate Algebra for the second time with a different faculty member.

Terri: So, this time, the professor, he's really good; his style is different. I have to get used to, especially when it comes to math, that everybody doesn't teach the same way. And here's that little girl, sometimes, when you're shown one way to solve a math problem before] ... and I'm like, "okay", in my mind I'm like, "well that's not the way that it was shown to me" (laughs). So I get caught up with the aspect of [which] rule... And there's a perfectionist side of me, I know, (laughs), and I have to learn how to just accept that, in my mind that it's okay that I'm doing it this way and I'm getting it right. [As] long as I'm understanding the steps to get it right, I don't have to try to do it like everybody else, 'cause I get confused when ... [the answer will] come out the same, but I'm like, "but why did they do it that way?" My mind will play games with me like that sometimes. [*Distance*]

Terri discusses the difficulties she has negotiating the mathematical obligations of classroom with the new professor, most notably the procedures he emphasizes and the pedagogical style he

conveys them through. With limited formal school experience, Terri struggles to solve problems with “the steps to get it right” while also not doing it “like everybody else”. She attributed the lack of clarity and the difficulty of learning math in this new space predominantly to herself, but her account suggests she was not able to make assertions as a math learner by questioning her understanding. Again, Terri attributes the difficulties to herself, such as in the next excerpt.

Terri: The professor today said, “I think with you [Terri], you have to keep building your confidence.” I get frustrated sometimes when people say that because, in my mind, you don't know how hard I'm working at this, what do you mean I don't have confidence? He [said], “you know this, it's there,” But you second guess yourself.

... sometimes I'll just blank, while I'm taking [the test], and I'll have to tell myself, "no, no, no, I know this, I was just doing this problem, I know this...I'll start to [do] the steps of trying to figure it out, kinda relax a little bit, [let it] come, [let it] flow a little bit, [to work around] the tension...I know its anxiety. I know that it's that. So I'm learning, you know, I'm trying to continuously do things to help me get better with that. [*Trouble*]

Terri provides a nuanced account of the differences in her confidence with math, her anxiety with math, and her work ethic with math. Terri states that an ascription from her professor, lack of confidence, is not true; rather, she states her issues with performance in the course are due to test-taking anxiety. Between these two accounts of Intermediate Algebra with different professors, Terri evidences identity work as she works towards finding success in this course. Of interest, while Terri's account says she prefers the first faculty member, she ended up passing Intermediate Algebra with the second faculty member. As Terri suggests, perhaps she only needed more math classes to learn how to be a math learner, more learning experiences. From this perspective, Terri's account suggests a single Intermediate Algebra course at CC, as her first professor suggests, did not afford sufficient learning experiences.

On Being a Learner in Remediation. The following excerpts were in response to prompts about Terri's perceptions about math in relation to remediation. In the first excerpt Terri speaks to whether she considers herself 'good at math':

Terri: Um, (laughs), I'm not gonna say that [I'm good at math]. I feel better about it, I feel that I'm learning. I feel that my confidence may not be up here [gestures with her hand, above her head], but it may be here [lowers it down to her chin]. I'm standing. I'm facing the fear of this. I'm not running. Yeah. I'll say that. [*Trouble*]

"Facing her fear" is interwoven in Terri's experiences with mathematics. During our first interview, Terri spoke to a number of traumatic experiences that happened around learning math when she was young, before middle school. So much of Terri's experiences with mathematics at CC was facing past trauma associated with mathematics experiences. For Terri, becoming good at math and successful at math was linked to negotiating the scars from that trauma. For example, in the following excerpt, she speaks about what success in math means to her.

Terri: Do I feel successful? Absolutely. You don't know the shoes that I've had to walk in life, and [what it took], getting to this point from where I've come from. Trust me, it wasn't on my own. I had a lot of help, and I have a lot of people that help me deal with and be who I am today.

...I'm not afraid anymore, that's the biggest thing. I'm not afraid, and I feel like I can do it. I can conquer [math]. It's still taken time and I'm still working at it, [but] I'm not afraid of it anymore. It's almost like when you find out that somethings wrong...Some people can be in denial, and just [say], "f-it I'm, you know, I'm not even gonna deal with it", no, I'm not that kinda person.

There's a lot of perseverance, there's a lot of willingness, there's a lot of want. I wanna be in a place where it comes a little easy, when I see it, I can just be like, "15 plus 15", you know what I mean? [And I] can apply it to my every day [life]. Some people say math is applied in everything that you do today. I see that in some things, especially when it comes to budgeting and money and stuff like that, but, I haven't got to the point where I see it in other things (laughs). [*Mathematics; Success; Embrace*]

Terri's account suggests that affording opportunities for success in mathematics does not just mean offering students experiences to be successful in mathematics. It also means providing opportunities to negotiate the results of past math experiences, to do identity work.

In the last excerpt, Terri provides a potential framing for what it means to be a learner in remediation:

Terri: ..I mean, again, not just because of my own experience and I think about a lot of, even the population of people that I've worked with at the place that I worked with [social worker at state institutions], some of the brilliant aspect of people ended up in places like that, and it wasn't because [they lacked] brilliance, it was because of certain things that they lacked learning, that they had to learn how to relearn...[*Remediation; Trouble*]

Terri's perspective provides insight into the role of non-cognitive factors like anxiety, more common in research on remediation. But she also speaks to deeper reasons, past experiences that shape an identity with mathematics that are not always about the mathematics itself. Finally, she suggests that not all learners enter remediation with the same resources as learners.

Summary. Terri's case is unique in that she discusses no experiences with mathematics outside of remediation in relation to her experiences in remediation, except only to suggest her past experiences with mathematics carried severe trauma. While the trauma was not related to mathematics, Terri's narratives show that as she grew older, she was unable to separate the traumatic experiences from her math experiences. As such, the majority of Terri's identity work with mathematics was oriented on that past trauma. In large due to this, Terri's narratives suggest she does not perceive remediation as a negative experience. For example, while Terri drops her first attempt at Intermediate Algebra, her narratives around it present as a positive experience to do identity work as a math learner. Indeed, she remains in the course to take advantage of learning experiences with a faculty member she views as a mentor.

Within her second time in Intermediate Algebra, she struggles to make assertions as a math learner. Her narratives suggest she *distanced* from experiences where she could question her mathematics understanding. Her significant identity work around her past trauma, recognized by her prior instructor, was diminished by the new instructor. In spite of this, Terri still *embraced* learning experiences, pointing to values and experiences outside of mathematics that served as motivation for her persistence with the program.

Brad – A Supported Learner

As shown in Table 8, Brad does not evidence a single type of identity work as his narratives are almost uniform across types. As a case, Brad presents insight about remediation from the perspective of a student that is afforded mathematics learning experiences that predominantly align with his self-concept. His identity work suggests he differentiates himself from his peers, and through that, he finds successes with mathematics. Following, I present Brad's evidenced identity work, orienting on what it meant to him to be in remediation and on his learning experiences in remedial math courses.

Identity Work Around Learning Experiences. Brad's experiences with mathematics remediation at CC began in a summer bridge program. The program was designed to be a proactive intervention for students who placed into remedial mathematics or English classes. It was a six-week long, intensive program, and it was self-directed through an online learning management system, with an instructor who answered questions and taught small group breakout sessions. At the end of the program, students could retake the placement test with the intent that they would place into a higher course on the remedial sequence. Students could self-select into the program. Brad was one of the successes; after the program he placed into Intermediate Algebra. The narrative below speaks to his experiences with it.

Brad To be honest, and not to like help build up your little system here, but [I appreciated] just understanding some of those early formulas and stuff like that. Just having a little bit of a knowledge of them and like knowing what the teacher [in Intermediate Algebra] was talking about immediately. That was enjoyable, because that was, I mean, that's really how you can grasp something. Like you recognize it. You understand how it's applied. And then you go into a little bit more detail with it and it's just that much easier and that much, just clicks a little bit better. I mean, the [program], being that I understood it at that level, really helped. Because that was a bit enjoyable. And then, not only that, but then I can help others who weren't really grasping it. [*Remediation; Mathematics; Embrace*]

Brad's narrative shows he was afforded learning experiences in the intervention, and through his *embracement*, he shows the experience afforded opportunities that align with his self-concept.

On Being a Learner in Remediation. Brad's experiences with the summer bridge program seemed sufficiently positive that they shaped his perception of narratives about remediation, such as in the following excerpt:

Brad: Honestly, when I took the [placement test], when I got my scores back on the entry exam and they mentioned the [summer bridge program]...that was kind of your brain child, and it was just you saying you need to do this, this is why. [I understand], "Okay, foundation. Yes, I need to get that foundation." And then just going through it, understanding that it, it was necessary...

... Not that there was something wrong with me or that, you know, it's not a dumb thing. It's just that it's necessary. You need to get this foundation before you move on. [*Remediation; Success; Trouble*]

In this narrative, he *troubles* both local and broad narratives about remediation. He resists the local narrative that placing into remediation means one as dumb, and he embraces the local narrative that remediation is a necessary experience to support a student's success in college-level mathematics. However, Brad's perception of his peers in the program and course is not positive.

Brad: You know, and it's all adults here. And it's, everybody has the same understanding that you're adults. If you're going to text away the class, text away the class. You're paying for it. I don't care. If you want to learn math, here's math. I'll teach you math. And since I want to learn math, because I

know that there's something I want to do in my life... Yeah, it was different in that way. That it's not high school. It's college. [*Remediation; Distancing*]

Brad suggests while he feels his remedial math courses offered learning experiences, his peers were not taking advantage of the experiences. While he *embraced* the experiences in other narratives, he *distanced* from his peers in remediation. He expounds on his perspective more deeply in the following excerpt:

Brad: ...I'm doing this because I want to. You know, I'm doing this because I feel like it's something that I should do as a productive member of society, you know, get an education and, you know, convince others to do so as well. But there's a certain amount of motivation behind that. And not everybody has that motivation. And you can definitely tell the ones that didn't have that motivation or understanding were not going to succeed. There were some kids sitting behind me that just they talked the entire time to each other. And I'd turn around and be like, "Hey, you guys understand this stuff?" They'd be like, "No." He's like, "No, I don't get it at all." And then he was shocked when he went and got his, you know, there's like four weeks left in, in the course. And he was like, "How am I getting this?" He's like, "I do really well on the homework." It's like, "Yeah, but you bomb the exams and you bomb the, bomb the quizzes." He's like, "You don't?" ... Like he just didn't get it. [*Remediation; Distancing*]

Brad suggests his values are his motivation for returning to school and for his work ethic at school, for seeking learning experiences. Brad *distances* again from his peers, because he perceives that they do not share the same values and motivation. He also suggests that his peers in the course may not share the same degree of mathematical understanding he has. This is a subtle point that comes up later in the findings. Indeed, in the following excerpt, Brad suggests again his values and work ethic are the reason why he is able to find and *embrace* learning experiences.

JB: How do you feel about math now, as you are about to transition to your next math course?

Brad: ... it's been made clear that it's not a demon. It's not like, math is not impossible, you know? It's not something that ... And granted it, it is the case for some people, but it's not that difficult to grasp if you apply yourself, you know? And it, it, it does get very difficult, and like I'm not saying that math is

super easy. I'm not like some genius, but like it's not as hard as I thought it was going to be, basically. [*Mathematics; Embrace*]

Brad's narratives show that when a learner can *embrace* learning experiences, their math identity can be shaped. In the next excerpt, Brad directly attributes his confidence in his future success in college-level mathematics to his experiences in remediation.

Brad I have a lot more confidence going into college algebra. Having that foundation...I mean, maybe I'm selling myself short. But [I don't think I will get] high marks in college algebra had I not gone through this whole little system [remediation]. And that's what it's there for. [*Remediation; Success; Embrace*]

Again, Brad's narrative shows he *embraces* an institutional narrative of remediation, and he suggests his success in mathematics is due to his experiences in remediation. Notably, he specifically states the system was there to support *his* success in mathematics.

Summary. Brad's narratives include several instances of identity work worth addressing. First, out of the five participants, Brad stands out in his *embracement* of remediation and his positive mathematics experiences during remediation. He attributes his confidence in his future success in mathematics courses due to the 'system' of remediation and his motivation to *embrace* learning experiences that were offered. Brad suggests his values around education not only drive his motivation but also separate him from his peers. Brad's narratives are sufficiently direct that if one were to read only his narratives, one would assume that the majority of students would be successful in mathematics remediation at CC.

Finally, Brad does not speak directly to experiences as an adult learner. In fact, his only reference to being an adult is to differentiate all of the learners in college as adults when compared to younger versions of their selves in high school. In addition, Brad does not speak directly to experiences about race. In sum, his narratives suggest his experiences in remediation were relatively 'normal'.

DeAndre – Finding Successes

As shown in Table 8, DeAndre does not evidence a single type of identity work, although he primarily *embraces* in his narratives. DeAndre as a case provides insights into experiences with remediation because of his unique background. He was both accelerated in school, almost two full years, and a high school drop-out. He earned high marks in mathematics in school, but he did not experience formal school mathematics beyond a portion of high school geometry. His experiences outside of the classroom, particularly in the military, afforded a number of out-of-school mathematics experiences, but they did not involve complex mathematics. As a result, his narratives carry a critical perception of his experiences and his self. Following, I present DeAndre's evidenced identity work, orienting on what it meant to him to be in remediation and on his learning experiences in remedial math courses.

Identity Work Around Learning Experiences. I was fortunate to have DeAndre as a student for both Beginning Algebra and Intermediate Algebra. In the following excerpt, I ask about his experiences in our first course together.

JB: How was [Beginning] Algebra?

DeAndre: It was terrible. Just, figuring out, like, what am I supposed to do with a letter? Yeah, 'cause everything I've done, like, throughout the military and everything, I've never even seen, like, a letter formed with math, and if it was a letter with math, it was like, "okay, here's your grid, here's the number, go here"...[*Remediation; Distance*]

DeAndre suggests his instructor provided learning experiences in Beginning Algebra, and he suggests he *distanced* from those experiences because he could not draw on his experiences with out-of-school mathematics. He had no experience with abstract mathematical concepts like a variable. While he performed well on the first assessment, he failed the second test. In his interview he called it "a wake-up call because [he] had never failed a math test before." That experience shifted how much work he devoted to the course. After the failure, his test scores

were high for the remainder of Beginning Algebra and Intermediate Algebra. In other words, for DeAndre, a failed test meant changing how he approached learning mathematics.

DeAndre's narratives about remediation, like other adult learners, referenced a difficulty in finding balance between work, family, and school.

DeAndre: I was working at the same time, and my job at the time was extremely stressful, so trying to focus on that, leaving here to go into meetings and everything, and trying to get caught up on homework. I was taking five classes at the same time [with work]. It was just hectic. [*Remediation; Success; Embrace*]

This narrative suggested a motivating force for DeAndre to meet his obligations.

DeAndre: The biggest component of me being successful was every time I was studying, anytime I wanted to quit, I thought of my daughter.

Like many adult learners, DeAndre had obligations as a parent. These obligations meant that his successes in school were not solely for him; they also meant, through completion of a degree, access to higher paying positions and a career. His values, particularly through his family, informed his motivation and persistence in remediation.

Eventually, DeAndre found academic achievements, and his perceptions about mathematics shifted.

JB: How do you feel about math now [in Intermediate Algebra]?

DeAndre: It's still a struggle. There's still a lot of stuff I have to learn but, yeah, I'm actually finding it a lot easier now, and I think it has to do with teaching... The math class is actually me getting the math classes now, and in my business courses are really easy for me to understand. It's actually developing, making me think that should be what I'm doing [pursuing]. [*Remediation; Embrace*]

DeAndre's narrative suggests that affording learning experiences with achievement, including *not* achieving, can benefit a learner. Unfortunately, DeAndre's narrative does not capture the effects of failing beyond his 'working harder'. Given the large percentage of students who fail remedial mathematics, it is trivial to suggest that providing learning experiences that support

failure is all that is needed to be successful, or that such a large percentage simply do not ‘work harder’ to find achievement.

On Being a Learner in Remediation. The remaining excerpts present DeAndre’s overall perceptions of remediation. The following suggests insight into DeAndre’s failure and subsequent successes:

DeAndre: No, I wasn’t aware of that, but I think it is because getting placed into a developmental course, it pretty much gets into people’s minds that they’re not good enough to succeed. So I think it has ... It’s all about character. So, if you have to keep telling yourself, “I am good enough,” then you’ll pass, but if you sit there and you’re like, “Oh, well this is too hard for me,” this, that, and you keep making excuses for yourself, that’s probably why they fail.
[Remediation; Success]

DeAndre’s narrative speaks to the broader narrative of individually-oriented motivation and achievement (Zavala & Hand, 2017). Not present are other factors that afford or deny experiences with achievement. It could be argued that DeAndre ‘lucked’ into a course with an instructor that afforded learning experiences with achievement. Indeed, in his narrative he discusses interacting with a different faculty member when his instructor was absent for a week. In his characteristic manner, he describes his experience with the different faculty member as “terrible,” suggesting he would have dropped the course if she had been the instructor.

It can be argued that DeAndre did not feel he entered into remediation with an established mathematics understanding. In the following excerpt, he explains his shift in perception of his understanding of mathematics across his experiences in remediation:

DeAndre: [On being placed into remediation] Before, everybody was like, “Oh, then you’re just ... You’re pretty much dumb if you didn’t make it. If you didn’t hit college level yet, you’re dumb. You know... pretty much everybody that I talked to asking about 98 [Beginning Algebra], like even when I went into the classroom before you walked in, I was like, “So, what’s this class for?” People were like, “Oh, this is where the dumb people go.” And I was like, “Okay.”
(laughs)

JB: And now, how does that feel?

DeAndre: Uh, at the time I was pretty dumb! (laughs)

JB: Do you still feel that way?

DeAndre: No...It's just, like, a learning curve, you know? It's just to get me ready for [math] 118 or 121, whichever I go to. Yeah, and I think it's a step that I actually really need because... If I did go up to those courses, I think I'd do okay, but I want to get the grade that I expect myself to get. [*Remediation; Trouble*]

DeAndre *troubles* two narratives about remediation while presenting a nuanced analysis of what it means to be in remediation. DeAndre suggests that “remediation is for people dumb at math” was too reductive, that requiring additional learning experiences in math was not the same as being ‘bad at math’. His narrative suggests this *troubling* shaped how he experienced his failure and successes, that they were necessary steps on his path to college-level mathematics. Indeed, the following narrative confirms this analysis:

DeAndre: Um, I'd describe, describe it as, um, pretty much baby steps into college level math... ..I saw myself in that category because I'd been out of school for so long, so it's like everybody that's in school at the moment knows more than I do. So, it's like I have more experience in the real world, while they have more experience in school. So, it's like I can't really say, you know, that they were wrong; I can't really say that we right...[*Remediation; Trouble*]

DeAndre as a case also shows how a learner responds to experiences with success in remedial mathematics courses. In this excerpt, DeAndre discusses his change in trajectories for his career:

DeAndre: Well, I didn't think I was actually going to pursue a business degree. I wanted to, and I had a reason to because I was going to get paid to do it [from the GI Bill], but I didn't think I was going to actually go through with it...to a bachelor's degree. I thought I was going to get an Associate's [degree] and that's it.

JB: And now?

DeAndre: The math class is...actually me getting the math classes now, and my business courses are really easy for me to understand. It's actually developing ... Making me think that I should be doing that [transferring to a 4-year university]. [*Remediation; Success*]

This excerpt provides insight into DeAndre's path through remediation. As he states, his successes as a math learner and as a learner in his business courses prompt him to consider expanding his educational trajectory from a two-year degree to a four-year program. DeAndre as a case presents, arguably, the best-case scenario for a student's experiences in remediation when afforded the opportunities they require to be successful.

Summary. DeAndre's narratives offer a compelling account that aligns with traditional, achievement-motivation narratives around success with mathematics (Zavala & Hand, 2017). Like Brad, he suggests his motivation and work ethic are primary reasons for his successes in the courses. Unlike Brad, DeAndre suggests experiences in remediation, primarily during office hours, afforded opportunities to do identity work as a math learner. In this, he suggests these experiences with his instructor are also primary reasons for his successes in the courses.

Summary of Within-Case Analyses

The within case analysis offers insights into five adult learners' identity work evidenced in narratives about their experiences in remedial mathematics courses. Sandra primarily *distances*, suggesting that she found it difficult to make assertions as a math learner as she failed her Intermediate Algebra course. Reagan and Terri primarily *trouble*, suggesting that as they struggled to find academic achievements in their course, both earning a C, they also struggled in their identity work. Last, Brad and DeAndre offer insight into learners who seem to find success with remediation. Brad suggests he was able to make assertions because the system supported him so well, while DeAndre suggests he was able to make assertions as a math learner because of his intrinsic motivation and work ethic. In the following chapter, I present identity work in participants' narratives from their reflections.

Chapter 6 – The Story’s End – After Remediation

In this chapter, I present a cross-case and within-case analysis of participants’ identity work evidenced in reflection of their experiences in remediation, conducted several years after their completion of the program. As I have mentioned, the second interview with participants served as a reflection of their mathematics experiences, primarily focusing on their experiences approximately three years past in mathematics remediation at CC. As I mentioned in Chapter 3, meanings of stories can change over time (Singer & Salovey, 2010), and I sought to explore how participants’ stories of remediation had changed over the years. Due to the gap in time, I anticipated that participants would present a hazy, almost sanitized version of their experiences and resulting identity work I presented in Chapter 5. However, participants recalled their experiences in remediation with detail, potentially due to my role and association with the program and courses they had experienced.

Of note, I do not attempt to ‘control’ for participants’ experiences in their postsecondary general education (GE) mathematics courses after remediation. I assumed that participants’ variation in mathematics and institutional experiences would, similarly, result in variations in their identity work and mathematics identities. In addition, I orient on how participants’ experiences in remediation at CC informed their later experiences with mathematics. In this I sought to investigate how experiences in mathematics remediation, such as their identity work around narratives about remediation that I present in Chapter 5, influence their identity work in subsequent math experiences. Like Boaler and Selling (2017), I sought to capture the effects of a particular program in how it shaped participants’ identity work and mathematics identities.

Toward this endeavor, I first present a cross-case analysis of participants’ identity work after completion of their remedial mathematics program. This includes relevant academic

achievement indicators, showing that all five participants experience formal success with mathematics. Second, I present aggregate identity work across the participants. No patterns in participants' identity work emerged. However, differences in identity work across their stories emerged. For example, Sandra and Reagan's identity work changed markedly in comparison to the identity work evidenced during remediation. Next, I discuss patterns in participants' identity work as math learners, showing that *all* participants struggle to identify more positively with mathematics. After, I discuss participants' continued identity work around narratives of remediation. Three participants continue to *distance* and *trouble* these narratives. Finally, I discuss social identities emergent in participants' narratives, orienting on race and age.

In the within-case analysis, I present narratives of participants' experiences in reflection of remediation. In each case, I show how participants evidenced identity work in relation to their experiences in mathematics remediation at CC and in their GE mathematics courses. In addition, I analyze individuals' identity work towards identifying more positively with mathematics. When applicable, I discuss participants' narratives that evidence identity work around other social identities like race and age.

Analysis of Participants' Identity Work after Remediation

In this section, I present a cross-case analysis of participants' identity work after completion of their remediation program. First, I present academic indicators of participants' experiences. Second, I present several emergent patterns in participants' identity work in reflection of mathematics remediation after experiencing various general education mathematics courses. After, I discuss patterns of identity work towards identifying more positively with mathematics. Next, I discuss continued identity work, if present, around school-driven narratives

about remediation. Last, I discuss participants' identity work around other social identities like race and age.

Academic Achievement Indicators after Remediation

Participants were, at the time of the second interview, at various points of their academic career. Table 9 shows participants' academic trajectory, including the mathematics courses taken after remediation, as well as their current employment.

Table 9. Participants' Completed Math Courses After Remediation, Academic Trajectory, and Current Employment.

	Math Courses After Remediation	Academic Trajectory	Current Work
Reagan	Math for Liberal Arts	Earned Associate's degree at semester end (completed)	Part Time - Math Emporium at CC
Sandra	-	Earned Associate's degree	Paraprofessional in the fourth grade
Terri	Math for Liberal Arts; Introduction to Statistics	Earned Bachelor's degree, enrolled in Master's program	Internship for social work
Brad	College Algebra; Trigonometry	Final academic year of a Bachelor's degree (completed)	Bartending
DeAndre	College Algebra; Trigonometry; Business Calculus; Differential Equations; Linear Algebra	Final academic year of a Bachelor's degree (comted)	Full-Time Student

As shown, all five participants reached traditional, academic achievement milestones. All five completed remediation. All five either completed a degree or were in the process of completing a degree. In fact, by the time of my defense, all five had completed their degree. I include current work as a potential indicator of success, although it did not end up informing the findings. These indicators suggest that participants could draw on broader achievement-motivation narratives in their identity work (Zavala & Hand, 2017). Notably, from CC's institutional perspective, all

would be considered a success for metrics of program completion (remediation) and degree completion.

Identity Work in Reflection

I once again break down types of identity work by participants evidenced in their reflections, which I present in Table 10. It shows the aggregate instances of participants' identity work evidenced in narratives about mathematics experiences after completion of their remedial math program.

Table 10. Identity Work Evidenced in Participants' Narratives in Reflection of Remediation.

	Identity Work Evidenced in Reflection				
	Sandra	DeAndre	Terri	Brad	Reagan
Distancing	2	0	2	2	3
Embracing	7	5	1	2	2
Troubling	13	3	4	3	14

As shown, participants once again do not uniformly *Distance*, *Embrace*, or *Trouble* in their narratives.

In terms of emergent patterns across time periods, presented in Table 8 and Table 10, only minimal patterns emerge. Only Sandra and Brad continue to *distance* as they reflect on past experiences during remediation. Terri, Brad, and DeAndre *embrace* certain mathematics experiences from their time during remediation. Reagan, Sandra, and Brad *trouble* experiences in remediation. In their general education math experiences, Reagan, Sandra, and DeAndre *embrace* being a math learner. Reagan *troubles* her experiences. Again, this suggests that the identity work presented aggregately offers little insight. Similarly, identity work within case offers more nuanced differences and insights into participants' experiences with remediation.

Toward Identifying Positively with Mathematics. In their reflections of remediation, Terri, Brad, and DeAndre *embrace* certain math experiences in remediation. For example, Terri,

Brad, and DeAndre discuss experiences with tutors and teachers that they felt supported their mathematics success in college-level math courses. However, their identity work suggests participants struggle to identify more positively with mathematics, which suggests their experiences were not entirely positive. For example, Reagan *troubles* her experiences as a math learner. While she found formal success, she *distanced* from identifying as successful in math. Sandra, despite feeling a passion for math and working in a career where she teaches math, struggles to identify more positively with mathematics, stating that “at least she knows she can pass”. Terri, despite having transitioned to a graduate program, states “she’s not a numbers person”. Brad, despite academic achievement and a STEM trajectory while at CC, transitions out of a math-intensive pathway because he was tired of pushing himself in math. Finally, DeAndre, despite an Associates in Math and high academic achievement indicators, states he is not really “good at math”, rather he is only good at one type of problem solving. In other words, despite trajectories of academic achievement, participants did not consistently identify more positively with mathematics. Conceivably, their identity work suggests they were in a process of becoming. Participants’ reflections on remediation offer insight into this.

Narratives about Remediation Revisited. Three participants *trouble* narratives about remediation in their reflection. Reagan *troubles* remediation in narratives about experiences with newly placed students in remediation. Sandra and Brad *trouble* their prior experiences and the social identities of race and class that were salient. Their reflections carried a criticality that was not present in their narratives during remediation. Given that Sandra’s path to success in remediation was not to move through the program but to navigate institutionally around the program, one would, perhaps, expect her to be critical of it, particularly since her new path, a co-requisite course, offered her an experience quite different from her experiences in remediation at

CC. However, through this perspective, Brad's *troubling* would be unexpected, given his suggested ease through remediation. This suggests that their experiences in remediation, with narratives about remediation, required years of identity work.

Other Social Identities. Finally, all five participants' narratives include various social identities made salient in their experiences in and after remediation. Four of the five discuss experiences where their age as adult learners was salient. This included experiences with mathematics and success. Brad suggests his age changes how he does identity work around success. Sandra suggests her age means she has less chances to "mess up" on her path to success while Reagan suggests her age means there is less time to find success on her path toward her goal as an interpreter. In fact, across the participants, they suggest their identity as an adult learner implies constraints on their identity work towards success. Last, two participants discuss social identities of class and race. Sandra and Brad suggest their identity work around mathematics in remediation was compounded due to their differences in social identities. I unpack their differences in greater detail in the discussion. In the next section, I present a within-case analysis of participants' identity work evidenced in their second interviews, and I offer insight into the changes in participants' stories.

Narratives about Mathematics Remediation and Success by Case

In this section I present participants' narratives about their experiences three years after participants' experiences with remediation have ended. Recall that narratives in this section are bounded by their last day of class in remediation at CC and by the time of their second interview. For each case, I present narratives and offer a within-case analysis of their identity work, focusing on the effects of narratives about remediation that emerged during the first interview, the story's middle. Following, I discuss changes in participants' identity work towards

identifying more positively with mathematics. Last, I discuss narratives where social identities like race, class, and age are salient. Of note, participants are presented in the same order in each chapter of this study so the reader may, if they so choose, move through participants' narratives individually and chronologically.

Reagan – Troubling Remediation

As shown in Tables 8 and 10, Reagan's identity work changes markedly across the two interviews. The type of identity work most salient does not change, as she continues to *trouble* her experiences as a math learner. However, she evidences substantially more instances of *troubling* in her second interview. These instances oriented on her role in the mathematics emporium lab as a student worker, as she completed her degree pathway.

On Being a Learner in Remediation. Reagan as a case presents a unique perspective on remediation as she was employed in the math lab at CC where she worked as an assistant. This meant that she regularly interacted with students in remediation up until her completion of her Associate's degree. In the following excerpt, I took the opportunity to ask about current students' experiences with remediation at CC:

JB: Did [new] students talk about being placed in remedial classes or developmental classes?

Reagan: Yes, a few of them would come in and talk about it don't count. I'd tell some of the students that it don't, but it really do, because you can't even get to what counts if you don't do this. You can't really have the attitude that it don't count. Some of them come in... The young kids that come here, "It don't count, anyway. I'm finna go." I said, "It don't count on the book, but if you can't do this, you sure can't do the other stuff." They don't talk to me that much after that. [*Remediation; Trouble*]

Reagan attempts to *trouble* a local narrative of remediation for other students in remediation.

While her story is not unique among the participants, ones like this only emerged during their follow-up interviews. This suggests a combination of two possibilities: (1) in the intervening

time, Reagan had continued to do identity work around remediation and felt more comfortable making assertions about remediation; or (2) Reagan, now no longer in remediation, felt more comfortable making assertions about remediation because she no longer was positioned within the program.

This local narrative, that remediation does not count towards an Associate's degree, was not a narrative that emerged in participants' interviews during remediation. One potential reason is that the narrative is not completely true. Remedial courses at CC were credit bearing, and as such they 'counted' toward credit requirements for financial aid because they count towards credit load in a semester. However, they did not 'count' towards degree requirements. Their credits were treated like elective credits. I followed up, asking Reagan to reflect on her experiences in remediation:

JB: Did it feel like negative, or did it... How did it feel when you were taking all those classes? Looking back.

Reagan: No, it never felt negative. I never... Wow. Okay. I didn't understand the numbers, what they meant, and that might've worked good for me. I knew that I was far back, but I didn't pay attention because I had never been to college before. I didn't know about 98 [as a designation below 100, college-level courses]. Those was just numbers to me, and it didn't have a meaning to it. I saw young people in the class, so I figured, "Well, I'm all right because they been in high school, couple months ago." [*Remediation; Trouble*]

Reagan points to an implication about the numerical designation for remedial classes at CC. As they were not college-level, the institution assigned course numbers that were below the 100, college-level designation. Reagan suggests that she did not understand the implication of the course number while she was in those courses. However, her narratives in remediation suggest she was aware of and did identity work around other local narratives about remediation.

On Learning Experiences in Remediation. In the next narrative, Reagan discusses old perceptions of math learning in remediation:

Reagan: I was hurt, because I'm thinking, "Why is something going wrong with my brain?" I can't get this, and I always thought that... I never had this problem before in high school. Anything that I studied, back then we got... Okay, we got As and Bs. The only way I would get a C if I just half-assed it. For me to study and go to tutors, I'm like, "Aw, shit. Is this what old feel like? Am I getting dementia, too?" All this is running through my mind, and I'm like, "Aw, hell no." So every little thing that I can get, I'm wondering, "Aw shit. Is this the beginning of..." I think that has to do... Then, I ran into some people, and they said, "No, I get good grades too, and I don't get good grades in math." [*Mathematics; Age; Distance*]

In her interview during remediation, Reagan predominantly described her courses as "so fast," suggesting that she struggled to *embrace* learning experiences in remediation. She views her inability to keep pace with the curriculum as an individual fault, perhaps getting dementia like her aging mother. It was only through interactions with her peers that she realized most students struggle in the course. In the following excerpt, Reagan discusses what the experience of remediation means for her now:

Reagan: You know, this is probably the best thing that could ever happen to me. When I deal with the kids in my family, I won't say, "You got that C because you didn't apply yourself." I won't say that anymore, but before...if you got a C that mean because you didn't try. In my head, anything I ever tried, I did good. [*Mathematics; Distance*]

Up until this narrative, Reagan's discussion of mathematics had been from the perspective that she could learn and understand mathematics if given the opportunity. This excerpt suggests she experienced a shift in her identity with mathematics because of remediation, a shift in her view of a "C", and a shift with how she supported her family in math.

On Learning Experiences in GE Math. Entering Reagan's experience after remediation, the next excerpt discusses her experiences in college-level mathematics.

Reagan: You know what? After your class, the math class that stick out in my mind is... I took another class with [Professor]. I think it was [Math for Liberal Arts Majors]. It went fast, but it wasn't... I think I would start to get used to the pace. It always felt fast to me, but I really liked the class because I thought I could use it more in life. I learned things that I didn't know, and I'm thinking,

“Wow, I’ve been cheated.” I just wish that I would’ve known it earlier.
[*Mathematics; Embrace*]

Her experiences in college-level mathematics afforded her opportunities to draw on her out-of-school math experiences, contextualizing the curriculum in real-world scenarios. Reagan’s description suggests the course was the first in her math experiences at CC where her evidenced identity work was around a more positive identity with mathematics.

Toward a Positive Mathematics Identity. However, the next excerpt suggests Reagan is still in the process of developing a positive identity with mathematics, as successful.

Reagan: I’m way more comfortable with math, but I feel like I should be better. Just let me say that. I’m way comfortable with math, but I feel, in my heart, that I should be better than I am.

You know what? I think I’m okay at math. I just don’t know why I get Cs. All right, for a person who gets Cs, you would probably think I don’t like math. I swear, it ain’t that I don’t like math. It’s, kind of, fun, but I think if it’s slowed down, I’ll be better at it.

You know? I don’t not like math, but it sound crazy. How can I like math and I’m getting Cs? [*Mathematics; Trouble*]

Reagan as a case offers insight into an adult learner who seeks experiences to make assertions as a math learner but *distances* from doing so due to the pacing of the curriculum. Statements like “I like math” and “it’s kind of fun” suggest that she identifies more positively with mathematics, but she struggles to make assertions about her beliefs because she does not think an individual can maintain a C average while also identifying positively with mathematics. Indeed, the following excerpt supports this argument:

Reagan: I wish that could start from [Intermediate Algebra] and just do each class over. I would do it. If they would pay for it, I could do it because I want to be able to help the kids in my family. They struggling. My niece’s daughter was at my house. They don’t make her study where she lives. It was some math. I can’t even remember what it was, and I had to read the directions to learn how to do it.

JB: Do you think you could’ve done that five years ago?

Reagan: No, I couldn't have done that five years ago. [*Mathematics; Success; Trouble*]

Again, Reagan makes assertions that, if presented the opportunity, she would seek additional math courses. The narrative also points to driving values around family that resonate with extant research on successful African American learners. She seeks mathematics understanding to better support future generations of her family, suggesting that the core values and beliefs evidenced by successful African American learners of mathematics were not a product of their success with mathematics but rather that they served as motivation to seek and earn success, particularly when access to learning experiences were not afforded. In remediation, Reagan drops a math course for this reason, seeking a different instructor and space that affords her more learning experiences. Again, she evidences values and beliefs that align with successful learners. However, Reagan's beliefs around success are more problematic.

In the following excerpt, Reagan talks about her upcoming graduation at CC.

Reagan: I guess I supposed to be like, "Hurray." I don't feel like that. It feels good, but I'm trying to figure out what I'm going to do next. Am I going to be able to... I mean, I'm going to do something nice, like me and my nieces, we might go out to dinner, but I don't feel like it's a real celebration. Maybe when I do what I really want to do, that I'm scared may not happen, then that could be a real celebration. I think this... and I'm happy about it. Don't get me wrong, and I work hard, two classes, one class at a time, but I feel like the real celebration will come when I take my ASL class.

They were telling me that something is... At first, I'm like, "Graduation? No, I ain't going to no graduation." They was like, "No, go. We want to come to your graduation. You've been working hard." I was thinking, "Oh, okay. Yes, I guess I have. Okay, yes, I can go." At first, I'm thinking, "Graduation?" [*Success; Distance*]

She *distances* from a space where she would be afforded the opportunity to identify as successful by completing an Associate's degree, both for herself and for her family. The following excerpt offers insight into Reagan's conceptions of success that do not resonate with achievement-oriented measures.

Reagan: I want to learn sign language. I want to be an interpreter. I'm 56. I should be able to do... I do what I want now, and I just want to be able to talk to deaf people. If I could get a little money for it, too, that'll be sweet. You know?

Yes, that's what I... That's something I just really want to do, and that's for me. You know what I'm saying? My life, I've been doing...for my daughter, now my mother. This is just... The school thing, that's about me, and I know I should take something more concrete and I get all that from everybody, and I'm just going to do what I want to do, or nothing. That's what I want to do. I want to learn... I want to be on the street and be able to talk to somebody.
[*Success; Age; Trouble*]

Perhaps her unwillingness to conceptualize academic achievements as success is due to her perception of her C's in mathematics; that while C's get degrees, they do not mean you have mastered a concept. On the other hand, her conception of success *is* derived in a long-held goal of becoming an interpreter, one that her lived experiences, through support of her daughter and mother, meant she could not actively seek.

Summary. Reagan's identity work as a learner of mathematics provides insight into the experiences adult learners negotiate in and after their formal math experiences. Her narratives provide compelling statements that suggest she is attempting to identify positively as a math learner. Completing remediation, college level mathematics, and her Associate's degree suggests, as achievement-oriented indicators, that she found success in mathematics at CC. However, at the same time, Reagan struggles to make explicit assertions as an adult math learner. In sum, her experiences in remediation, doing identity work around the deficit-oriented narrative about remediation, had enduring, negative effects on her identity with mathematics, explicitly so due to her social identity as an adult learner of mathematics.

Sandra – Finding Mathematics Success and Troubling Remediation

As shown in Tables 8 and 10, Sandra's identity work changes markedly across the two interviews. She evidences substantial more instances where she *embraces* experiences as a math learner, and she evidences substantial more instances where she *troubles* her experiences with

remediation at CC. Finally, she presents a compelling reflection of remediation at CC as an intersectional experience.

On Learning Experiences in GE Math. Recall that at the time of the first interview, Sandra was failing her Intermediate Algebra course, and she went on to fail the course that semester, for the second time. She was on the verge of giving up. In one of our discussions after the interview, I told her about a pilot course at a sister college to CC. The pilot was based on an acceleration model where students enroll directly into a college-level mathematics course and in a co-requisite support course providing just-in-time review of the content for the main course. Her advisor informed me that the pilot was not listed in the course directory for the next semester, and so it required special administrative approval to enroll in the course. With my approval, Sandra agreed to try the course, and in the fall of the following academic year, she traveled to the north suburb, a college almost two hours away from her home, for a new type of math course.

Sandra's experiences in the course had a profound impact on her identity work with math. In the following excerpt, she compared the pilot to the traditional, Intermediate Algebra course.

Sandra: The math felt engaging, the math felt welcoming. The math did not do challenging, the math did not feel intimidating. That's how math 99 [Intermediate Algebra] made me feel because it was a book full of numbers, and concepts that I probably will never master. [*Remediation; Trouble*]

Sandra goes on to explain what she means. The follow excerpt is long, but necessary, as it was not just the curriculum about the course that was different.

Sandra: When the professor was explaining how the class is going to be structured, I felt like I was going to succeed, because what she told us was that, in this state-of-the-art classroom setting, she was going to do less talking and we were going to do more talking. She said, "Everything that you would normally do in a group setting outside of the classroom, when you come with your small groups to try to problem solve, and help each other." She said that's

what we were going to work together in the classroom...Because, sometimes you might learn from your peers, or someone sitting next to you may see it a different way than your professor.

... I wasn't intimidated, I didn't feel like I was being judged. I was getting to the point I was feeling like I was being judged because this is your second time, you're about to fail it again. "Everybody else...is doing this, why can't you?" The ones who are not just not applying themselves type of thing. It wasn't said, but that's what it felt like. [*Success; Mathematics; Embrace*]

Such an experience may not seem novel to a K12 educator. At least in my graduate program, we were expected to create the type of learning environment Sandra presents: collaborative, task oriented, and student centered. In other words, it was not the traditional, basic-skills refresher course she had experienced at CC (Ross & Roe, 1986). It was "the best math class [she] ever took to the point that it made [her] appreciate math." Comparatively, Sandra found a math course where she could make assertions as a math learner. As a result, she experienced formal success, passing the course with a 'B'.

On Remediation and Race. Her experience with a math classroom that afforded learning experiences she had long sought shaped her reflections on remediation at CC. They had become more critical, particularly of the narratives about remediation. In the following excerpt, she *troubles* available narratives at CC in comparison with the new program she experienced.

Sandra: I felt like because we're now living in a time where we can speak out and it's okay, I felt like, yeah, I felt like the system, the math it was put in place for that man, that Caucasian, to go from that private school or some suburban school or something. He knew that, he probably had that in his high school. He goes there; he passes the test. And I will be sitting there, that inner city youth who's trying just to succeed, and I will be sitting there struggling. [*Remediation; Race*]

JB: So how was the co-requisite course different?

Sandra: That co-req, we were all treated equally. And in that co-req there was some people ... I got to know a couple of them personally and to listen to their stories like how they got there. And because this world we live in is so diverse, people, sometimes it's not about the learner, sometimes it's about the fitting in. Some of them did not fit in because of their gender, or because of

the gender that they chose to label themselves as. Because we're living in a time now where I can say to you "I am referred to as she, her." ...So I had a couple people in my class like that who expressed to me that sometimes in classroom settings like that, with that math being so intense, that they didn't fit in. Yeah, I was like me too.

And then some of them, perhaps, were here on a visa or something. There were different stereotypes. If you were Asian, you were supposed to know this math, you were supposed to come here knowing it, because that's what you do in your country. But, if you were from a different persuasion, okay, so you don't know it? And if you do know it, okay, you're one of the exceptions.

[*Mathematics, Gender, International, Race, Embrace*]

JB: You said different persuasion, do you mean...?

Sandra: I refer to skin color. Yeah, I'm sorry. I mean, I know we can't ... The recorder can't see what I'm doing here. I try to stay positive about life and not go there. But it's real. [*Race*]

Sandra: I didn't feel like I was less there. I felt like, you learn different, you're just a person in a classroom of people who learn different. And what we saw was that while we were all diverse, we weren't all the same. It wasn't a room of my peers, or people of my color, African American, because that's typical, right? Yeah, you all learn the same way, you all don't know. No, it was different throughout that course. So that made me feel like, oh, it's not just me, we all just learn different, it's not personal. [*Mathematics; Race; Embrace*]

In this narrative, Sandra touches on a number of points. She describes the pilot math class as both diverse and equitable. She suggests that because of the environment, she did not feel "less there", like she did in the remedial courses at CC. In turn, Sandra suggests remediation at CC was structured to serve a certain group of people but she was not a member of that group, that the program was a racialized experience. The narratives suggest her identity work around narratives about remediation at CC that affected her negatively was accompanied by identity work around social identities of race. In other words, Sandra suggests that she could not make assertions as a Black math learner in remediation at CC. Her account of the new pilot suggests it afforded a different experience and was the reason for her new stance about remediation at CC. Recall that

in her first interview, Sandra only pointed to general systemic issues with remediation; she did not point to remediation as a system of racial inequity.

On Being a Learner in Remediation. In her reflections on remediation, Sandra recounts experiences from that time period she did not share with me three years ago. As she was discussing what it felt like to take tests in the new course, she shifted to her experiences at CC:

Sandra: The test, because I felt more prepared, I didn't get the whole anxiety attacks, which I was struggling with at [CC]. Sometimes I would have to take my tests at a different setting because I would be overwhelmed. And a lot of that feeling was because I just couldn't grasp the material. I started thinking something was wrong with me. I started thinking in my head, that I couldn't differentiate numbers. I went to the Support Center, they gave me a math test...

JB: At the Support Center?

Sandra: They gave me a test to determine, to see if there was a blockage. I don't know why I'm saying math test but I mean, I'm not even ashamed to say this... They said no. Because I started feeling so inadequate, because I'm failing this class but yet I can comprehend words, what is it with me and numbers? Why am I not comprehending these numbers? So, I was having anxiety attacks and no, I didn't know what else to do. So I went to the Support Center and I told them, I said, something's wrong. [*Remediation; Mathematics; Distance*]

Sandra's narratives in remediation did not speak about this experience. The effects of Sandra's experiences in her remedial math courses drove her to seek testing for a mathematics-specific learning disability. This suggests Sandra was not just denied experiences where she could make assertions as math learner, but she was denied opportunities to do identity work around a positive mathematics identity. It was not until she was afforded experiences outside of remediation, tutoring with me and later the pilot co-requisite course, that Sandra began to change her perceptions of herself.

Sandra: But I was, at that time, I was...getting depressed about the whole math situation. Because here I brought my older-self back to school, and I was getting so close to graduation, but I couldn't pass that math class. So, yeah, I started feeling inadequate, I started feeling like, it's not in me, I don't know where it is when they say, "Well, pull it up and it'll come back to your

memory.” I felt like it wasn’t there. But then as we began to tutor, and even when I got into the co-req class, yeah, it was there but it was just there in a different format. It wasn’t there the way the book was telling me it should be there. [*Remediation; Mathematics; Distance*]

Such an experience had a profound impact on Sandra’s identity work and path after the co-requisite course.

Toward a Positive Mathematics Identity. In her second interview, Sandra discusses taking a break from formal education. She ended up working as a paraprofessional in a charter school, working with elementary school age children. She states, “in my mind I was thinking if I can...incorporate basic math and give them some extra help, then they wouldn’t be a struggling adult like me.” In the following excerpt, she speaks about the co-requisite course and the influence it has on her teaching as a paraprofessional.

Sandra: That class was the best math class I ever took to the point that it made me appreciate math. It made me appreciate math to the point that I’m so passionate now about the young people that I teach in the fourth-grade classroom. And when I see them struggling, because I realized that you have to get the foundation, when you’re young in order for it to be in you. I’m so passionate until I have been taking small groups. When I see them struggling, I take them out away from the large group so that they don’t just get lost in the crowd and just get pushed along. And then I work with them. [*Mathematics; Success; Embrace*]

Sandra’s experiences with mathematics in remediation inform who she interacts with new, elementary-aged students who are struggling with mathematics. She does not want her students to share the same experiences she did, and so she specifically seeks out students who are struggling with mathematics. Her narrative does not resonate with Brad’s account of remediation, where he received the “foundation” needed to do well in mathematics. Sandra was not afforded such an experience, and she attempts to shape her students’ mathematics experiences. She reinforces this analysis in the following narrative:

Sandra: But again, I kept seeing myself doing math, I couldn’t get away from it. It’s like all of a sudden, I found this new love for math, and the passion that I had

was that I don't want a child to ever struggle as an adult, because somebody didn't take the time to realize that they didn't get it. [*Mathematics; Age; Embrace*]

While this narrative suggests Sandra had shifted to a more positive mathematics identity because of a single course's intervention, the following narrative shows she still has much more identity work to do towards a positive mathematics identity.

Sandra: ...Just passing that class has given me the confidence that I need to know that I can pass. If I had not passed that math class, I don't know what I would be doing right now. Because I had to pass it in order to graduate. And I was so determined to graduate, I'm older, I don't get another chance to mess up, I've done all the goofing off. Everything now going forward has to go forward. So I was so determined to graduate, that I was like, whatever I need to do, I'll go upstairs and talk to the dean, somebody needs to change this class. They need to fix it. [*Success; Mathematics; Age; Trouble*]

Sandra suggests that her identity as an adult learner was the reason for her motivation and persistence, despite a number of failures in remediation at CC.

Summary. Sandra's case offers insight into a learner's experiences with mathematics success after failing an Intermediate Algebra course. Her identity work during remediation suggests she struggled to *embrace* mathematics learning experiences, instead doing identity work around the narrative about remediation as a deficit framing. Indeed, at CC, the traditional remedial sequence was the only option for students, and if they did not find success in the sequence, they were forced to accept a terminal degree or drop out of the sequence. The fact that Sandra's path to success required negotiating systemic pathways rather than opportunities in a classroom speaks to this reality. Indeed, when Sandra navigated systemic gatekeeping to an alternate pathway, she immediately experiences formal success in math. Her experiences in the course shape her view of her experiences in remediation, and in her reflections, she speaks to social identities of race that contributed to her identity work while in remedial math courses.

Sandra as a case also speaks to the harsh reality of a formal school experience for adult learners. She views her experiences at CC as her last chance to enact change on her career trajectory. In this, she suggests adult learners may be more motivated to endure negative experiences because they perceive no other options to move forward exist if they wish to continue toward their goals.

Terri – I’m not a Numbers Individual

As shown in Tables 8 and 10, Terri’s identity work changes little across the two interviews. In her second interview, she spoke only positively of her experiences in remediation and oriented predominantly on her recent experiences in a GE math course. Of interest, she chose to return to CC for a course required for entrance into a master’s program for social work. This suggests that, for her, CC was where she learned mathematics.

Toward a Positive Mathematics Identity. Recall that Terri’s experiences with remediation at CC were generally positive. After she completed her GED at CC’s sister school, she sought additional tutoring at CC before her math courses began. Terri states “...I was able to have access to that help there and they were able to get me through [remediation]”. After her completion of remediation, she completed Math for Liberal Arts Majors soon after, again earning a C. Recently after she transferred to four-year university for a degree in social work. While she suggests CC provided access to mathematics for her, the following excerpt suggests she has not yet identified positively with mathematics:

Terri: Once I was able to get done at CC, it was just something...I guess I had learned. How to face the fear, the anxiety of all of that comes to math because of numbers. I get it now, numbers are just not my thing. It’s just not. Some people might be able to deal with numbers, I am not a numbers kind of individual. [*Mathematics; Distance*]

Terri: I mean, it’s a whole lot better than what it was. I understand a little bit more. Am I fluent with it? No. Do I enjoy it? No. But I know it’s something that I have to do. I’m gonna take it and walk through it, moving through other stuff

so I know that I can get through it.

I'm not afraid of it. It's not as daunting as it once was. [*Mathematics; Success; Trouble*]

Considering Terri's past trauma linked with mathematics, no longer fearing mathematics is a success. In fact, while she does not positively identify with mathematics, she knows she can do it if necessary. The latter point is important.

On Learning Experiences in GE Math. Terri also completed her four-year degree, earning a BA in Social Work. Soon after, she enrolled in a Master's Degree program that required statistics. While she was offered a number of options for the course, she returned to CC to take it. She took the statistics course the summer before her graduate program, a few months before our second interview. She attributes the professor for her success in statistics. She describes her experience in this excerpt:

Terri: I enjoyed her for the few weeks that we had and being able to listen to her and how smart she is with numbers and how [gifted she is] with numbers...she made it [possible for me to learn statistics], and she wouldn't let me give up. [*Mathematics*]

Terri acknowledges a number of times in her second interview the importance and role the instructors and tutors of CC had on her learning. For Terri, CC was her opportunity to learn mathematics.

Summary. As a case, Terri presents a singular perspective of CC's mathematics and remedial mathematics program – supportive. She routinely states the tutors and instructors helped her work through her past issues with mathematics, and while she acknowledges her identity with mathematics is not positive, it is clear she no longer identifies as negatively with mathematics as she did when she entered CC. However, it is difficult to validate Terri's perspective of mathematics and remediation at CC because she experienced no other post-secondary mathematics program.

Brad – Troubling Remediation

As shown in Tables 8 and 10, Brad's identity work does not change markedly across the two interviews. He presents somewhat equivalent instances of *distancing*, *embracing*, and *troubling*. As a case, Brad's reflections about his experiences in remediation present a compelling description of remediation at CC as an intersectional experience, reflecting on his position of privilege in relation to his peers. Finally, he suggests his privileged social position influences how he views success.

On Being a Learner in Remediation. When I interviewed Brad the second time, he was in the final semester of his four-year degree. He had completed his general education math courses at CC, doing well in all of them. In the following excerpt, he speaks briefly about his understanding of mathematics, acknowledging the two-year span since his last formal course:

Brad: It's been three years so I don't know that the trigonometry would be there but the algebra would be there.

...and maybe the trig would be there, it's tough to say. I would definitely need a refresher course in that. I think I ended with a B. [*Mathematics; Embrace*]

Brad invokes a local narrative of remediation from CC, needing a "refresher". This suggests that his time in remediation served him well, at least as a math learner. In the following excerpt, Brad reflects on his time in remediation more deeply:

Brad: My perspective on it was that if you want to learn, you're going to find a way to learn, to do what you need to do to learn. There are a lot of people in those courses that, especially the [Bridge Program], that came from pretty rough backgrounds and it was pretty evident that the public-school system failed them in a few ways. That was the most striking thing to me. It was very easy to learn in those settings. I remember the [instructor] was an Indian guy, right? [*Remediation*]

JB: Yes.

Brad: I learned very, very easily from him. But people could not understand him at all, his dialect. That was the most striking thing to me. I was there to learn, I wanted to learn. I had a drive. And it was a very good thing for that. But beyond that, people still had struggles. The same struggles, I'm sure they had growing up. It wasn't just for lack of trying in a lot of instances.
[*Remediation; Embrace*]

Brad's narrative offers two perspectives on remediation at CC. In the first, he states mathematics in remediation was "very easy to learn." In the second, he suggests that his peers in the course, those from "pretty rough backgrounds" did not find learning mathematics in remediation at CC easy. As a matter of fact, he suggests their struggles in remediation were similar to their struggles outside of the classroom. In the following series of excerpts, he expands on his perspective.

Brad: Right, in regards to math it was really a cool experience to be in a remedial class with kids that came out of the public school system. And just the same way that I came out of my school system and the support system that I had and just see this, observe their struggles, especially going into, wanting to go into some stuff in the inner city, but just being their disdain for mathematics and they're just like...watching them learn was kind of cool. But I guess that doesn't have too much to do with math. [*Remediation; Mathematics; Class; Trouble*]

In this series of excerpts, Brad expands on his perception of remediation from his background in private high schools compared to his peers coming out of the public-school system and population CC served.

JB: When you say "cool," what do you mean?

Brad: Yeah, for some of them but just observe learning at, learning algebra but in such a remedial way of learning, if that makes any sense. Seeing the wheels turning and them trying to embrace something and just really seeing them try to learn something and go over and over it again. and sometimes they're working, you see the Eureka thing, and they're proud of themselves. It was neat. It was a very neat experience for me. And then it was also obviously very beneficial because you kind of got those wheels turning and, yes, you can do this sort of thing for math. And I wanted to push myself a little bit in math so once trig was done, I was done with the pushing. But that was also a neat thing to do. [*Remediation; Mathematics*]

JB: Do you feel like your perceptions of your peers pushed you to move further in math, or was it more you felt your successes with math came a little easier,

that you appreciated their struggles or their experiences simply as something new that you have never experienced because of your background in high school and schools?

Brad: Yeah, it was more of like an anthropological experience. [*Remediation; Class*]

Brad's narrative paints a different picture of remediation at CC than his narratives in remediation. He discusses his experiences with mathematics remediation at CC and the ease at which he was able to make assertions as a math learner. For him, the math part was "very easy," which allowed him to focus on his "anthropological" experience, observing how "inner-city" students learn math, something he was not afforded in his private schools. Indeed, it seems math remediation at CC offered, for Brad, an opportunity to do field work as a novice anthropologist. Subsequently, his experiences at CC inspired him to pursue a degree in Urban Studies when he transferred to a four-year university.

On Success. His difference in perspective, of remediation and of his peers, is echoed in his difference of what it means to be successful.

Brad: I don't think [I'm successful]. I haven't finished [my degree] yet. Again, that's kind of the double-edged sword, growing up enough in that private school environment and seeing all your friends move on to politics and move on to...different things. So, success is defined in different ways. I understand that I'm successful in that I actually went back at an older age and tried and I'm going to succeed as very successful and I'm probably at an end of a spectrum - a positive end of the spectrum in that regard. But I mean ultimately, I just don't think that it's a success when it seems like something I could have done a long time ago. [*Success; Age; Distance*]

In this excerpt, Brad suggests the privilege that afforded his anthropological experience at CC also intersected with his identity work towards being successful. He offers differing benchmarks for success, again class-based. While he feels he achieved some benchmarks, they were not the benchmarks for success set by the class of his peers from private school. Indeed, the privilege that informed Brad's *distancing* of peers in remediation also informs his *distancing* of his peers

in high school. This suggests Brad's identity work, even as a math learner, is around a more salient, social identity in class.

Summary. Brad's case offers insight into the experiences of a learner in remediation who is quite different from his peers. In his reflection of mathematics remediation at CC, he discusses mathematics learning experiences at CC only as a point of comparison to his peers in the course. Brad offers a unique insight into inequity of learning, both in the course and in his perception of his peers' educational and socioeconomic histories. His narrative presents a compelling account by an individual who is served by remediation. His discussion of success, or his lack of success, was rooted in a similar account, acknowledging a difference in meanings of success dependent on socioeconomic status and social identities like age. That he *distances* from identifying as successful suggests that his position of privilege also denies opportunities. In other words, Brad's identity work as a math learner included identity work around social identity of class and age, some of which is still ongoing.

DeAndre – Remediation and Access

As shown in Tables 8 and 10, DeAndre's identity work does not change markedly across the two interviews. In his reflection of his experiences in remediation, he *embraces* his experiences, suggesting they prepared him for multiple general education mathematics courses. Notably, of the five participants, only DeAndre speaks to access. However, he also *troubles* what it means to be good at math, suggesting he still struggles to identify positively with mathematics.

On Learning Experiences in Remediation. Recall that during remediation, DeAndre's successes with mathematics and business had inspired him to consider a four-year degree. After completing remediation at CC, DeAndre went to take several mathematics courses, eventually earning an Associate's of Arts degree in Mathematics. Along his mathematics trajectory, he

earned almost all A's, receiving only a single 'B', in my Beginning Algebra class, where he earned the 'F' he discussed in his first interview. In the follow excerpt, DeAndre reflects on his starting point of that path, remediation.

DeAndre: It was really crazy. Because I've had [many] other professors, and I still sit there, to this day and when people ask me, "How are you so good at math?" I'm like, when I came to college, multiplication, division, it's pretty much all I knew. I went to my sophomore year of high school. Before that I didn't know anything. I barely showed up to school, so I didn't know algebra. I came to that class [Beginning Algebra] as a fresh student. Like if I was a freshman in high school I came to that class. You made it really easy. And you made it interesting to learn. Most people, they'll just sit there and give you equations and expect you to know what it is because of the grade level that you're at. *[Mathematics; Success; Embrace]*

DeAndre suggests that not only did my courses afford opportunities for him to make assertions as a math learner, but I also lowered the barrier of entry to where learning was accessible. In fact, DeAndre suggests that professors make a fundamental mistake when they assume students possess prior mathematical knowledge. This was, indeed, a fundamental component of my teaching philosophy, although I seldom stated it in class. He also suggested I made the course interesting, which I followed up on:

JB: What did I do, that made it interesting for you?

DeAndre: The biggest thing that you did to make it interesting was used real-world scenarios. So you used things that people could relate to. It wasn't in class that you used them. It was when we went off to the office on the side [office hours]... okay, you taught me, X... You'd break it down. So it'd be like Harry has so-and-so amount of apples and Karina has this many. How do you determine the difference or what not? You'd break it down to the point where it was like you could just take a word problem and just take little pieces from it, and know exactly where to plug it without even having to think too hard on a problem.

I remember in [Beginning Algebra], I was really bad at word problems, and then when I went to [Intermediate Algebra], I was really good at word problems, really bad at everything else. So now it comes to the point where everything past college algebra is all word problems. So now I just break everything down. I could literally break a problem down to the smallest number and be like, oh, I'm good. I can just plug this here, plug this here, and

I don't have to put the equation because I already know where to plug everything. [*Remediation; Mathematics; Success; Embrace*]

DeAndre offers insight into *where* he was most able to make assertions as a math learner. As he states, it was not in class. Rather, it was in office hours that I could contextualize problems in scenarios “students could relate to.” DeAndre suggests I embedded mathematics in the understandings students bring to the classroom from their lived experiences, at least for him. Experiencing such an affordance in office hours makes sense, as contextualizing problems at such an individual level is difficult when class sizes are over 35. Second, DeAndre offers insight about his ability to do math. When he says he was “good at word problems, really bad at everything else”, DeAndre is suggesting that he had mastered an “ability to formulate, represent, and solve mathematical problems” (National Research Council, 2001, p. 116). As a strand of proficiency, DeAndre suggests, problematically or not, his success in mathematics was due to mastering it. There is more nuance to his statement, but such a simplification offers an interesting insight into *what* he learned in remediation.

Toward a Positive Mathematics Identity. In the following excerpt DeAndre suggests it is difficult to say he is “good at math”.

DeAndre: I think as far as math, nobody's ever truly confident unless they know everything. As far as me, I don't ever sit there and I say that I'm really good at math. I have my Associates in Mathematics and I'm like, how? [*Mathematics; Trouble*]

This narrative suggests his identity work towards being a successful learner of mathematics is still ongoing and that DeAndre still struggles to make assertions that identify positively with mathematics.

Finally, DeAndre offers insight into his meaning of success in the last excerpt:

DeAndre: To me [successful] just means that I'm above everything that I thought I'd be at. I came to college thinking college is going to be the most difficult thing I've ever done. And I came here [CC and the four-year university], and

throughout the time I've come, I've met professors that helped me, and they molded me into the person that I am right now. [*Success; Embrace*]

Here DeAndre suggests success is moving *past* one's goal and self-conception, to being somewhere "above" it, attributing such achievement to his teachers and mentors.

Summary. DeAndre's case presents insight into a student who finds academic achievement in remediation, transitions to a STEM pathway, and continues to find academic achievement after remediation. His case points to explicit learning experiences in remediation, not in the classroom but in office hours, and his case points to a type of proficiency that DeAndre suggests enabled his achievement in later math courses. Furthermore, his case shows that mathematics presented contextually, in students' lived experiences, is a major cause for his pathway of academic achievements. However, his case also suggests that identity work around his achievements in and after remediation did not result in a salient positive mathematics identity. Rather, his case suggests more identity work is needed. I offer the following potential reasons: despite his achievements, remediation at CC did not afford sufficient opportunities to do identity work towards a positive mathematics identity, drawing on his statement that his understanding came not from class but from office hours; or DeAndre's identity work as a math learner was driven by his identity work around narratives about remediation, drawing on his narratives in remediation where he *embraced* being "dumb at math".

Summary of Within Case Analyses

The within case analysis offers insight into five adult learners' identity work evidenced in narratives that reflect on their experiences in remedial mathematics courses. Sandra and Brad offer reflections on their experiences in remediation, suggesting social identities of race and class shaped their experiences. Reagan, through her role in a mathematics learning space at CC, *troubles* local narratives of remediation for new students. Terri and DeAndre discuss the learning

experiences remediation afforded them. Last, each participant struggled to identify more positively with mathematics.

Chapter 7 – Discussion

In this chapter, I consider participants' stories from beginning to end, across their experiences with remediation. Two questions guided my exploration:

- How do adult learners negotiate school mathematics experiences in and after mathematics remediation towards identifying as successful learners of mathematics?
- How do experiences in mathematics remediation inform adult learners' identity development as math learners?

Across participants' stories, I discuss two findings that begin to answer these questions. I suggest that the common, school-level narratives about mathematics remediation at CC may limit how learners do identity work, orienting them on *distancing* from a deficit framing rather than, for example, *embracing* a framing of success. Second, participants' narratives suggest social identities of race and age are salient in their experiences in mathematics remediation at CC. However, before I discuss these findings, I discuss the affordances and constraints of how I operationalize identity, identity as narrative, and identity work.

Frameworks for Identity and Identity Work

To review, I theorize identity as narrative, specifically drawing on Martin's (2000) seminal work to define mathematics identity and his later work (Martin, 2006b) to further conceptualize it as narrative. In his framework, Martin theorizes that a learner's identity, as narrative, is a negotiated self. I was interested in the process of negotiation, and I drew upon two other frameworks to more concretely define negotiation in my methods and analysis. I drew on Sfard and Prusak's (2005) conceptualization of identity as narrative, a somewhat common decision in mathematics education research (Darragh, 2016), and with precedence in math education research in the context of remediation (Larnell, 2016a). Next, I drew on Snow and

Anderson's (1987) conceptualization of identity work to analytically define the process of identity negotiation, in this dissertation as *distancing*, *embracing*, and *troubling*. Such a combination meant, ostensibly, that I could analyze how participants did identity work in and after their experiences with mathematics remediation.

The orientation on narrative, in this dissertation as life stories (McAdams, 1985), meant I could capture changes in participants' stories and their meanings about stories. A primary example of this emerged in two participants' reflections about their experiences in remediation related to social identities about race and class, which I discuss later in this chapter. However, the definition of identity as narrative also meant I could not capture or analyze other types of identifying, such as performative. For example, during remediation, Reagan discussed dropping a math course because an instructor positions her negatively due to, in her perception, her age. In response, she drops her math course, withdrawing from the class to take it the following semester. While her narrative suggests *distancing*, her act of physically removing herself from the space and the instructor's presence was more performative. As such, I could only discuss her identity work on the periphery of the act, through her telling of it as a story. This shows that more work is needed in understanding how learners do identity work through other definitions of identity.

In terms of my analytic choice to orient on identity work, Snow and Anderson (1987) offered an empirically precise definition for identity work that meant I could capture participants' negotiations and characterize them in three, broad categories. Such a choice led my analysis to the two school-level narratives that emerged about mathematics remediation at CC, and it led to exploring how participants did identity work around these narratives as they served as resources for participants' identity formation and identity work (Gresalfi & Hand, 2019).

However, such an empirically precise definition meant losing nuances in the data. For example, I attempted to capture nuanced identity work with multiple narratives in my characterization of *troubling*; however, by the end of my study I found my definition muddled and at times unfit for capturing participants' identity work. This shows that more work is needed in understanding how learners evidence identity work, particularly around the availability of narratives as resources in and out of math classrooms.

Last, Sfard and Prusak's (2005) definition of identity as narrative makes certain methodological decisions more straight-forward, such as for coding identity. Their definition meant I could seek and code *reifying*, *endorsing*, and *significant* narratives to build towards participants' identities. However, I also found it difficult to make explicit statements about participants' mathematics identities. Their definition specifically states that identity is a collection of stories, but 'collection' is ambiguous and imprecise. How many stories makes an identity? Can a single story make an identity? Can one hundred small stories, even ones that are *reifying*, *endorsing*, or *significant* not make a story? While I entered this study assuming I had answers to these questions, I left the study only certain that making claims about someone else's identity is difficult.

As researchers, we make methodological choices to focus on a specific phenomenon of interest, and these decisions often result in 'missing' other phenomenon or aspects of the phenomenon we are investigating. This section highlights the implication for such choices. In the next two sections, I discuss the findings that emerged in this study.

Identity Work in Remediation

In this section I present local, school-level narratives about remediation that emerged across all participants' stories within remediation. I also present a synthesis of within case analyses within remediation and in reflection of remediation.

Narratives about Remediation

I presented in Chapter 5, several local, school-level narratives about remediation that emerged in participants' experiences. To review, participants discuss remediation as an institutionally driven pathway for access to college-level mathematics, a narrative that resonates with the broader sociohistoric narrative of remediation I present in chapter 2, rooted in remediation's history (Boylan, 1988; Maxwell, 1979). Participants also discuss remediation as a deficit framing of mathematics competence. This included narratives about remediation as a refresher course, driven by the assumption that students who place into remediation are either recent high school graduates or are the product of a traditional high school experience. This also included remediation as a low-level mathematics. This narrative, while local to remediation at CC, aligns broadly in consideration of remediation as a review of basic math skills (Ross & Roe, 1986). Last, participants discussed remediation as a program for those 'bad at math,' speaking to a local representation of the stigmatizing narrative of remediation (Arendale, 2005; Deil-Amen & Rosenbaum, 2002). These narratives are important because they serve as resources for students' identity work in remediation.

Gresalfi and Hand (2019) offer a framework for considering the role of narratives in learners' experiences in the mathematics classroom. Indeed, like others (cf. Martin, 2000; Zavala & Hand, 2017) they state that "narratives serve as fundamental resources for identity construction" (Gresalfi & Hand, 2019, p. 496). That is, individuals construct, negotiate, and maintain identities around and with such narratives. The narratives carry ascriptions because they

are situated socially. For example, narratives about remediation carry ascriptions for individuals who are placed in remediation, and these narratives are cued in their day-to-day mathematics experiences in remedial math classrooms. Considering the negative framing of the narratives about remediation offered by the participants, it follows that participants' identity work is done around negative ascriptions. In other words, I suggest that in remediation at CC, participants were not offered local narratives about remediation that oriented on being "good at math." Their identity work was oriented only on *not* identifying as "bad at math." I offer this as one possible reason why the majority of participants continued to struggle, even years later, at identifying positively with mathematics. Their path to a positive identity, from the perspective of these analytic stories, begun at a deficit. Given the preponderance of research and discourse on the effects of gap-gazing in education (see Gutierrez, 2008 as an entry point), such a deficit framing positions remediation as higher education's achievement gap. In the next section, I offer intersectionality as a lens on participants' experiences in remediation.

Remediation and Social identities

In this study of five adult learners' experiences in and after mathematics remediation, two relevant social identities emerge: race and age. Two participants offer reflections on their experiences in remediation, discussing the role of their social identities of race and class. All five participants' narratives both in remediation and in reflection of remediation discuss their identities as adult learners.

Race and Remediation. Both Sandra and Brad reflect on their experience with race while in remedial mathematics courses. Through contrasting positions, Sandra as a Black, inner-

city³ learner of mathematics in remediation and Brad as a white, outer-city⁴ learner of mathematics in remediation, suggest that the traditional remedial program at CC was enacted to serve learners like Brad. In her reflection, Sandra candidly describes the assault on her personal identity with mathematics by social identities imputed to her. At CC, she sought testing by the Support Center for a math-specific learning disability. Her discovery that she had no learning disability was ultimately what prompted her to *trouble* the social identities imputed around her experiences at CC. Eventually, rather than moving through remediation at CC, she sought a path around it, experiencing what I describe as a safe mathematics learning environment. In her reflection, she describes this experience and how it shapes her perception of remediation at CC, how the program was not in place to serve her. In her *troubling*, she suggests that the traditional remedial program at CC served as a system to prevent access to people like her, African American and from inner-city public schools. In his reflection, Brad's *troubling* suggests he perceives remediation not as an opportunity to learn mathematics and gain access to college-level mathematics but as an "anthropological experience" and as a "cool experience to be in a remedial class with kids that came out of the...inner-city...public school system." Brad's experiences promote several shifts in his development, which he discusses, including pursuing a

³ In Sandra's second interview, she describes herself as part of a group, "inner-city youths." I use the term here because she does, to describe the systemic limitations imposed on students at inner-city school systems, particularly k-12. For Sandra, this meant no access to math beyond pre-algebra.

⁴ Brad describes himself as having grown up in a privileged environment, attending private schools, with well-off parents, an identity that influences his identity of success. Here, I use 'outer-city' to characterize his perspective.

degree in Urban Studies directly, reflecting on the privileges he carries as a white person from an upper middle-class background.

Brad's identity work shows he feels positioned uniquely, from a point of privilege, among other 'urban, public school' learners. In *Learning to Divide the World: Education at Empire's End*, Willinsky (1998) describes this type of experience as exhibitionary pedagogy, where persons are taught the process of Othering through spaces like museums and circuses, where cultures and people are uprooted from their home, exoticized and Othered as an exhibit. Brad's discussion of remediation parallels this analysis: he positions remedial math at CC as a place filled with inner-city, public-school youth; he positions himself as the person of privilege; and he discusses the 'anthropological' benefits from his experiences. Brad's identity work resonates with Sandra's identity work, showing that CC, as a racialized space, imputed two polarizing ends of a social identity.

Remediation as a racialized space is not a new idea. Larnell (2016b) captures the effects of the racialized nature of remediation at a four-year university, and he shows that race, as an identity contingency (Steele, 2011; Steele, Spencer, & Aronson, 2002), invokes an identity threat for Black learners in remediation. Sandra's account suggests a similar experience. Her identity work within remediation shows she struggles to do identity work as a math learner. Her identity work in her reflection shows that, once in a space that did not invoke a threat, she shifts to *embracing* being a math learner finding opportunities to learn and to achieve.

Brad's account paints a unique perspective on Larnell's (2016b) analysis, less present in intersectional research. Brad also suggests his race serves as an identity contingency (Steele et al., 2002). He candidly discusses the difficulties peers in his remedial courses face as they struggle to navigate a racialized space that cued a threat to their identity. However, due to his

position of privilege (Willinsky, 1998), his experiences and resulting identity work differed markedly. For him, mathematics in remediation afforded a number of opportunities to learn and to achieve, and his identity work as a math learner resulted in a transformation from math as ‘a demon’ to being ‘very, very easy.’ His account suggests a corollary to identity threat research in remediation, maximizing (Larnell, 2016b) simply by being white, by being placed in a position of privilege (Willinsky, 1998).

Age, Success, and Math. Second, all participants evince identity work that suggests their identity as an adult learner plays a salient role in experiences in and after remediation. For example, being an adult learner shapes how they make assertions as a successful learner of mathematics. For Brad, it means *distancing* from identifying as successful. For Sandra and Reagan, it means *troubling* what it means to be a successful adult learner, suggesting that remediation at CC was their last chance to find success because they were getting older. For Reagan, her identity as an adult learner meant it was “easier” to make assertions because she felt less pressure from her peers.

Adult learners are increasing in representation in post-secondary institutions, arguably becoming the new traditional learner (Soares, 2009, 2013). While age as an identity is more prevalent in research outside of education (Marcus & Fritzsche, 2015), little to no research exists on age as an identity in the experiences of math learners. The present study suggests additional research is needed to better support adult learners’ experiences in higher education, particularly as many adult learners require developmental education (Soares, 2009, 2013).

Summary

Cumulatively, these findings suggest participants’ experiences in mathematics remediation at CC meant doing identity work around other social identities such as race and age.

In the case of Sandra, additional identity work was required to make assertions due to the social identities implied in her math learning experiences (Steele et al., 2002), and, in the case of Brad, less identity work was required due to the maximizing effect of his identity as white and privileged. This research aligns with past research on identity threat (Steele et al., 2002) and research on learners' racialized experiences in remediation (Larnell, 2016b). However, while identity threat research has extended to age-based identity cues (Hess, Auman, Colcombe, & Rahhal, 2003), the results of this study suggest more research is needed on the experiences of adult learners in mathematics courses. While there is insufficient evidence to conduct an intersectional analysis (Crenshaw, 1989, 1991), the presence of social identities of race and age suggest deeper intersectional research is warranted in terms of race, math, and age.

Chapter 8 – Conclusion

In this section, I present implications of this research for policy and practice. I then discuss limitations of the study. Last, I offer concluding remarks about this study around my roles as teachers and administrators.

Implications for Policy, Practice, and Research

Before I speak to implications, I contend that any implications I make are tempered by the small and local sample of this study. With that said, this research is also supported by ten years of experience with mathematics remediation as a researcher, teacher, and administrator.

For policy, the findings of this study suggest policy decisions that minimize or eliminate school-level, deficit-oriented narratives about remediation would benefit students who find academic achievement in remediation. Research suggests that mitigating the effects of these narratives is not sufficient (Deil-Amen & Rosenbaum, 2002). In other words, attempting to design a remediation program, such as under a different name like developmental education, does not mitigate the stigma that remediation carries (Arendale, 2005). The stigma from being positioned as ‘not college-ready,’ even for those decades removed from their past school math experience, such as three participants in this study, has a profoundly negative impact on learners’ identity work and identity development. Second, participants’ stories point to salient experiences in remediation that include social identities such as race, age, and class, suggesting remediation inequitably serves learners. Given the disproportionate placement of students into remediation, broadly (Attewell et al., 2006) and more locally at CC, while remediation may have once been in service of equity, it is now in service of inequity. Nuanced reform does not result in sufficient change (Deil-Amen & Ronsenbaum, 2002). As such, institutions who seek to eliminate such

inequities should consider outright abolishment of remediation (see California State University system's EO1110 and the resulting movement).

For practice, the findings of this study suggest that adult learners, as a large proportion of learners in mathematics remediation (Merisotis & Phipps, 2000), encounter both positive and negative experiences around the social identity of age. Like research has shown (Evans, 2000), adult learners bring a variety of lived experiences to the classroom that can be drawn upon to create supportive and nurturing classroom environments. Drawing on the abundance of research in K12 to create safe learning environments that approach mathematics through students lived experiences would benefit practitioners in remediation (see Gonzales et al., 2001 as an entry point). Indeed, Sandra's account of her experiences in a co-requisite reform course provides compelling insight into the effects of such a space.

In terms of the school-level narratives about remediation that informed participants' identity work, all were reified by the instructors of their remedial math courses, including me. These narratives serve as resources for students' identity formation and identity work (Gresalfi & Hand, 2019), and narratives that only afford learners the opportunity to do identity work around being 'bad at math' is not equitable. Learners in remediation, and in entry-level postsecondary general education math courses, should be afforded opportunities to do identity work around being 'good at math'. One aspect of such pedagogy includes making narratives of success available for students. Such consideration is present in mathematics standards (National Council of Teachers of Mathematics, 2000, 2014) and frameworks for mathematics competency (National Research Council, 2001) in K12 education. Students in postsecondary education, particularly those placed into remediation, would benefit from such consideration.

Finally, in terms of research, identity work is an elaboration of the process of negotiation in identity development. Drawing on Snow & Anderson (1987) afforded an empirically precise frame to code for identity work. However, the constraints of my study carried inherent limitations. Their framework grew out of a large sample, while I attempted to employ a similar frame in a small, exploratory study. As seen in the findings, my sample size meant it was difficult to differentiate types of identity work toward any real pattern or trend. However, I see this as a result of my design and not a limitation of the framework. For researchers interested not only in narratives as resources (Gresalfi & Hand, 2019) but how learners empirically negotiate available narratives, I offer this study as a starting point. In my transparency, I hope it offers insights into what worked well and what did not work well.

Second, while participants' stories include social identities such as race, class, and age, there was insufficient data to conduct an intersectional analysis (Crenshaw, 1989, 1991). This study, along with another in a four-year university context (Larnell, 2016a), suggests research about the intersectional experiences of learners in developmental education is warranted, and it suggests reforms for mathematics remediation, including abolition, should consider the intersectional experiences of students.

Limitations

While the present study met its aims, several limitations are worth noting as one considers the implications for research, policy, and practice. First, the study drew on a small, localized sample from a single community college in the center of a major, midwestern city. While the participants were adult learners, they were not the focal population in the original study. As such, adult learners as a participant population originated in their self-selection for the interviews. Finally, the remedial program they experienced was traditional and not reform

oriented. These factors suggest results may not apply to differing contexts, specifically to broader populations within remediation or to colleges of differing locales and demographics, or to remedial programs that have recently adopted any number of the emerging reforms.

On the other hand, the participants in this study align with broader definitions applied to adult learners (Evans, 2000; Soares, 2009, 2013), suggesting the present study can inform future research with adult learners of mathematics. Second, the social identities around remedial learner, math learner, and successful learner identified in participants' identity talk are similar to broader narratives identified in the discourse of remediation (Arendale, 2005; Bahr, 2008; Deil-Amen & Rosenbaum, 2002), suggesting experiences of students in remediation in other contexts may experience similar imputed social identities and similar resulting identity work. Finally, participants' experiences align with research in different post-secondary contexts (Larnell, 2016b), suggesting that adult learners' identity work around mathematics, remedial, and successful may inform the identity work of learners around other social identities. However, the present study serves as an exploratory investigation into how five learners come to identify with remedial learner, mathematics learner, and successful learner, and it should be viewed as such.

Second, as I acknowledge at multiple points throughout this study, my position in relation to the participants is complex. While I used the second interview to confirm my interpretation of events and experiences during the first interview, and while I reach out to participants to ensure my understanding of their experiences is accurate, this study is still my interpretation of their experiences and stories. I bring to this research biases, understandings, and experiences that influence my interpretation. Toward this, I have been transparent in my background as an educator and administrator, in my relationship with the participants, and in the research that

informs my personal identities so that readers may add criticality and skepticism as they deem necessary.

Third, the study extends across six years. As a novice research in a doctoral program, this presented significant implications. My understanding of the research process and the phenomenon of interest shifted and evolved in the intervening years. This meant that I struggled to hold a single methodology toward my goal. While Grounded Theory (Charmaz, 2006) initially informed my exploration, ultimately it fell to the wayside as I shifted to explore learners' identity work across several years, subsequently shifting to a life-story methodology (McAdams, 2008). The result was a study that did not hold fidelity to either methodology, existing somewhere in the in-between. The result was, unfortunately, a study less rigorous than if the methodology had been held constant over the years.

Fourth, the interview protocol carried affordances and limitations. Its breadth meant I *could* shift how I explored learners' experiences in remediation, but its breadth also meant I could not capture learners' experiences in remediation as deeply as a protocol more focused on students' experiences in and after remediation. Undeniably, a protocol designed around a dual-time case study (Yin, 2009) would have suited the analysis more appropriately, and a protocol informed by life-story research (McAdams, 1985), particularly narrative development (McAdams, 2018; McAdams & McLean, 2013), would have suited the methodology more appropriately. Closer alignment between methodology, methods, and analysis would have meant a less cumbersome study and less cumbersome manuscript.

Last, identity as a lens on success offers a number of limitations. Proponents of identity argue that it presents an analytic lens that broadens researchers' gaze to extend beyond mathematical thinking and reasoning to include how students come to think about themselves as

learners and doers of mathematics (cf. Cobb et al., 2009; Martin, 2000). In this, researchers seek to understand how learners identify with mathematics in relation to the forces of socialization that influence their participation in communities inside and outside of the classroom (Martin, 2000; Nasir, 2012; Wenger, 1998), privileging the sociocultural experiences of the learner. However, as a tool for empirical analysis its definition is often ill defined (Sfard & Prusak, 2005) and its relevance to the teaching and learning of mathematical concepts often is vague (Cobb et al., 2009). Undoubtedly, such weaknesses exist even in this study. Despite my attempt to empirically define narrative as identity, I found it difficult to “pin-down” identity in narrative form, even with a method appropriate in scale (Lemke, 2000).

Concluding Remarks

When I began this study in 2014, I was serving as a director over developmental education. I had romanticized the history of remediation that I presented in Chapter 2, and I had convinced myself that remediation was a program of access, perhaps only usurped by those made decisions based on pass rates and completion rates. This study started as a personal endeavor to reframe research about mathematics remediation as a program of access, where stories of success unfolded. This endeavor was rooted in my experiences as an instructor because I was privileged to witness success after success of my students. Simply put, I wanted to make remediation great again.

As I analyzed participants’ stories, I faced a harsh outcome. The stigma about remediation was pervasive, and it shaped how participants identified with mathematics. Even in my courses, where I actively labored against such narratives, the participants struggled to identify positively with mathematics. They were simply not afforded opportunities to do so. At times I had to take a break from writing because the findings and supporting evidence

undermined my perceptions about the classroom experiences I strove to create for students. My teaching philosophy speaks to the barriers some students face in their mathematics journey, and my teaching philosophy speaks to the endeavor we, student and I, undertake to work past those barriers. Except my findings show I had failed some of my students.

The implications section was similarly difficult. How do I write implications for practice when I struggle to make sense of the implications of this study for my own pedagogy? I was forced to reflect on my own assumptions as a practitioner. In a way, this study ended more as action research than as exploratory investigation of identity work. In the same way that we math teachers carefully consider which math problems we expose our students to, to support their journey as emerging mathematicians, so too must we consider the narratives we offer them as they do identity work around their experiences. For me it is the realization that “you’re better at math than you think you are” does not afford the same opportunities as “you are *good* at this.”

References

- Acevedo-Gil, N., Santos, R. E., Alonso, L., & Solorzano, D. G. (2015). Latinas/os in community college developmental education: Increasing moments of academic and interpersonal validation. *Journal of Hispanic Higher Education, 14*(2), 101-127.
doi:10.1177/1538192715572893
- Adelman, C. (2004). *Principal indicators of student academic histories in postsecondary education, 1972-2000*. Washington, D.C.: Institution of Education Sciences.
- Alvesson, M., & Willmott, H. (2002). Identity regulation as organizational control: Producing the appropriate individual. *Journal of Managerial Studies, 39*(5), 619-644.
- Amos, J. (2011). *Saving now and saving later: How high school reform can reduce the nation's wasted remediation dollars*. Washington, D.C.: Alliance for Excellent Education.
- Arendale, D. (2002). History of supplemental instruction (SI): Mainstreaming developmental education. In D. B. Lundell & J. L. Higbee (Eds.), *Histories of Developmental Education* (pp. 15-28). Minneapolis, MN: Center for Research on Developmental Education and Urban Literacy.
- Arendale, D. (2005). Terms of endearment: Words that define and guide developmental education. *Journal of College Reading and Learning, 35*(2), 66-82.
- Attewell, P., Lavin, D., Domina, T., & Levey, T. (2006). New evidence on college remediation. *Journal of Higher Education, 88*6-924.
- Aud, S., Hussar, W., Kena, G., Bianco, K., Frolich, L., Kemp, J., & Tahan, K. (2011). *The condition of education 2011*. (NCES 2011-033). Washington D.C.: Government Printing Office Retrieved from <http://nces.ed.gov/pubs2011/2011033.pdf>

- Bahr, P. R. (2008). Does mathematics remediation work?: A comparative analysis of academic attainment among community college students. *Research in Higher Education*, 49(5), 420-450. doi:10.1007/s11162-008-9089-4
- Bahr, P. R. (2010a). Preparing the underprepared: An analysis of racial disparities in postsecondary mathematics remediation. *The Journal of Higher Education*, 81(2), 209-237.
- Bahr, P. R. (2010b). Revisiting the efficacy of postsecondary remediation: The moderating effects of depth/breadth of deficiency. *The Review of Higher Education*, 33(2), 177-205. doi:10.1353/rhe.0.0128
- Bailey, T. (2008). *Challenge and opportunity: Rethinking the role and function of developmental education in community college*. Community College Research Center: Teachers College, Columbia University.
- Bandura, A. (1977). *Social Learning Theory*. Upper Saddle River, New Jersey: Prentice Hall.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Worth Publishers.
- Barton, A. C., & Tan, E. (2010). We be burnin'! Agency, identity, and science learning. *Journal of the Learning Sciences*, 19(2), 187-229. doi:10.1080/10508400903530044
- Berry, R. Q. (2008). Access to upper-level mathematics: The stories of successful African American middle school boys. *Journal for Research in Mathematics Education*, 39, 464-488.
- Berry, R. Q., & Thunder, K. (2015). Black learners' perseverance with mathematics: A qualitative metasynthesis.
- Bettinger, E. P., & Long, B. T. (2005). Remediation at the community college: Student participation and outcomes. *New Directions for Community Colleges* (129), 17-26.

- Boaler, J., & Greeno, J. G. (2000). Identity, agency, and knowing in mathematics worlds. In J. Boaler (Ed.), *Multiple perspectives on mathematics teaching and learning* (pp. 171-200). Westport, CT: Ablex Publishing.
- Boaler, J., & Selling, S. K. (2017). Psychological imprisonment or intellectual freedom? A longitudinal study of contrasting school mathematics approaches and their impact on adult lives'. *Journal for Research in Mathematics Education*, 48(1), 78-105.
- Bogdan, R., & Biklen, S. (2007). *Qualitative research for education: An introduction to theories and methods*. Boston, MA: Allyn & Bacon.
- Bowleg, L. (2008). When Black + Lesbian + Woman \neq Black Lesbian Woman: The methodological challenges of qualitative and quantitative intersectionality research. *Sex Roles*, 59(5-6), 312-325. doi:10.1007/s11199-008-9400-z
- Boylan, H. R. (1988). The historical roots of developmental education. *Research in Developmental Education*, 5(3), 3-14.
- Bragelman, J. (2015). Praxis as dialogue: Teacher and administrator. *Journal of Urban Mathematics Education*, 8(2).
- Bragelman, J. (2016). *What about me? Exploring the impact of remedial coursework on post-traditional learners' self beliefs*. Paper presented at the 38th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education, Tucson, AZ.
- Bullock, E. C. (2018). Intersectional analysis in critical mathematics education research: A response to figure hiding. *Review of Research in Education*, 42, 122-145.

- Calcagno, J. C., & Long, B. T. (2008). *The impact of postsecondary remediation using a regression discontinuity approach: Addressing endogenous sorting and noncompliance*. Teachers College, Columbia University. National Center for Postsecondary Research.
- Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis*. Thousand Oaks, CA: SAGE Publications, Ltd.
- Chronaki, A. (2013). *Identity work as a political space for change: The case of mathematics teaching through technology use*. Paper presented at the Seventh International Mathematics Education and Society Conference, Cape Town.
- Clutts, D. (2010). *Mathematics self-efficacy of community college students in developmental mathematics courses*. (Dissertation). Liberty University, KY.
- Cobb, P., Gresalfi, M. S., & Hodges, L. H. (2009). An interpretive scheme for analyzing the Identities that students develop in mathematics classrooms. *Journal for Research in Mathematics Education*, 40(1), 40-68.
- Community College. (2014). Math 99 Syllabus.
- Complete College America. (2012). *Remediation: Higher education's bridge to nowhere*. Indianapolis, IN: Complete College America.
- Conley, D. (2007). *Redefining college readiness*. Eugene, OR: Educational Policy Improvement Center.
- Connelly, F. M., & Clandinin, D. J. (1990). Stories of experience and narrative inquiry. *Educational Researcher*, 19, 2-14.
- Cote, J. E. (2009). Identity Formation and Self-Development in Adolescence. *Handbook of adolescent psychology, Vol 1: Individual bases of adolescent development (3rd ed.)*, 266-304.

- Crenshaw, K. (1989). Demarginalizing the intersection of race and sex: A black feminist critique of antidiscrimination doctrine, feminist theory and antiracist politics. *University of Chicago Legal Forum*, 139.
- Crenshaw, K. (1991). Mapping the margins: Intersectionality, identity politics, and violence against women of color. *Stanford Law Review*, 43(6), 1241-1299.
- Darragh, L. (2016). Identity research in mathematics education. *Educational Studies in Mathematics*, 1-15. doi:10.1007/s10649-016-9696-5
- Davis, R. J., & Palmer, R. T. (2010). The role of postsecondary remediation for African American students: A review of research. *Journal of Negro Education*, 79(4), 503-520.
- Deil-Amen, R., & Rosenbaum, J. E. (2002). The unintended consequences of stigma-free remediation. *Sociology of Education*, 75, 249-268.
- Denzin, N. K., & Lincoln, Y. S. (2005). Introduction: The discipline and practice of qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), *The sage handbook of qualitative research* (3rd ed.). Thousand Oaks: Sage Publications.
- Devi, S. (2019). *Identity and self-efficacy among mathematically successful African American single mothers in urban community college contexts*. Illinois Institute of Technology,
- Dougherty, K. (1994). *The contradictory college*. Albany, NY: State University of New York Press.
- Dowd, A., Bensimon, E. M., Gabbard, G., Singleton, S., Macias, E., Dee, J. R., . . . Giles, D. (2006). *Transfer access to elite colleges and universities in the United States: Threading the needle of the American dream*. Lansdowne, VA: Jack Kent Cook Foundation.
- Dweck, C. S. (2006). *Mindset: The new psychology of success*. New York: Random House, Inc.

- Dweck, C. S., Walton, G. M., & Cohen, G. L. (2011). *Academic tenacity: Mindsets and skills that promote long-term learning*. Seattle, WA: Bill & Melinda Gates Foundation.
- Erikson, E. (1963a). 8 Stages of Man. In *Childhood and Society* (pp. 247-274). New York: Norton.
- Erikson, E. (1963b). *Childhood and society*. New York: Norton.
- Erikson, E. (1968). *Identity: Youth and crisis*. New York: Norton.
- Evans, J. (2000). *Adults' mathematical thinking and emotions: A study of numerate practices*. New York, NY: RoutledgeFalmer.
- Fain, P. (2013, June 5). Remediation if you want it. *Inside Higher Ed*.
- Fain, P. (2014, April 7). Low expectations, high stakes. *Inside Higher Ed*.
- Fong, C. J., Zientek, L. R., Yetkiner Ozel, Z. E., & Phelps, J. M. (2014). Between and within ethnic differences in strategic learning: a study of developmental mathematics students. *Social Psychology of Education, 18*(1), 55-74. doi:10.1007/s11218-014-9275-5
- Fournillier, J. (2011). Working within and in-between frames: An academic tourist/midnight robber and the academy. *Qualitative Inquiry, 17*(6), 558-567.
- Gholson, M. L., & Martin, D. B. (2014). Black girls, mean girls, and bullies: At the intersection of identities and the mediating role of young girls' social network in mathematical communities of practice. *Journal of Education, 194*(1), 19-33.
- Gholson, M. L., & Martin, D. B. (2019). Blackgirl face: racialized and gendered performativity in mathematical contexts. *Zdm, 51*(3), 391-404. doi:10.1007/s11858-019-01051-x
- Goffman, E. (1963). *Stigma: Notes on the management of spoiled identity*. New York, NY: Prentice-Hall, Inc.

- Grant, M. R., Crompton, H., & Ford, D. J. (2015). Black male students and the algebra project: Mathematics identity as participation. *Journal of Urban Mathematics Education*, 8(2), 87-118.
- Gresalfi, M., & Hand, V. M. (2019). Coordinating situated identities in mathematics classrooms with sociohistorical narratives: a consideration for design. *Zdm*, 51(3), 493-504. doi:10.1007/s11858-019-01034-y
- Gutierrez, R. (2007). (Re)defining equity: The importance of a critical perspective. In N. i. S. Nasir & P. Cobb (Eds.), *Improving Access to Mathematics: Diversity and Equity in the Classroom* (pp. 27-50). New York: Teachers College Press.
- Gutierrez, R. (2008). A 'gap-gazing' fetish in mathematics education? Problematizing research on the achievement gap. *Journal for Research in Mathematics Education*, 39(4), 357-364.
- Gutierrez, R. (2013). The sociopolitical turn in mathematics education. *Journal for Research in Mathematics Education*, 44(1), 37-68.
- Hall, J. M., & Ponton, M. K. (2005). Mathematics self-efficacy of college freshman. *Journal of Developmental Education*, 28(3), 26-33.
- Hawkins, M. (2005). Becoming a student: Identity work and academic literacies in early schooling. *TESOL Quarterly*, 39(1), 59-82.
- Herbel-Eisenmann, B. A., Wagner, D., Johnson, K. R., Suh, H., & Figueras, H. (2015). Positioning in mathematics education: revelations on an imported theory. *Educational Studies in Mathematics*, 89(2), 185-204. doi:10.1007/s10649-014-9588-5
- Hess, T., Auman, C., Colcombe, S. J., & Rahhal, T. A. (2003). Impact of stereotype threat on age differences in memory performance. *Journal of Gerontology: Psychological Sciences*, 58B(1), 3-11.

- Higbee, J. L., Lundell, D. B., & Arendale, D. (Eds.). (2005). *The general college vision: Integrating intellectual growth, multicultural perspectives, and student development*. Minneapolis, MN: General College and the Center for Research on Developmental Education and Urban Literacy.
- Holland, D., Lachicotte, W., Skinner, D., & Cain, C. (1998). *Identity and agency in cultural worlds*. Boston, MA: Harvard University Press.
- Hossain, S., Mendick, H., & Adler, J. (2013). Troubling “understanding mathematics in-depth”: Its role in the identity work of student-teachers in England. *Educational Studies in Mathematics*, 84(1), 35-48. doi:10.1007/s10649-013-9474-6
- Howington, H., Hartfield, T., & Hillyard, C. (2015). Faculty Viewpoints on Teaching Quantway. *Numeracy*, 8(1), 1-12. doi:10.5038/1936-4660.8.1.10
- Jaggars, S. S., & Stacey, G. W. (2014). *What we know about developmental education outcomes*. Teachers College, Columbia University: Community College Research Center.
- Jett, C. C. (2019). Mathematical persistence among four African American male graduate students: A critical race analysis of their experience. *Journal for Research in Mathematics Education*, 50(3). doi:10.5951/jresmetheduc.50.3.0311
- Jones, H., & Richards-Smith, H. (1987). Historically black colleges and universities: A force in developmental education, part II. *Research in Developmental Education*, 4(5), 5-9.
- Kaasila, R., Hannula, M. S., & Laine, A. (2012). “My personal relationship towards mathematics has necessity not changed but...” Analyzing pre-service teachers’ mathematical identity talk. *International Journal of Science and Mathematics Education*, 10(4), 975-995.

- Kasworm, C. (2016). Adult student identity in an intergenerational community college classroom. *Adult Education Quarterly*, 56(1), 3-20. doi:10.1177/0741713605280148
- King, L. A. (2001). The hard road to the good life: The happy, mature person. *Journal of Humanistic Psychology*, 41(1), 51-72.
- Kulik, C.-L. C., Kulik, J. A., & Shwalb, B. J. (1983). College programs for high-risk and disadvantaged students: A meta-analysis of findings. *Review of Educational Research*, 53(3), 397-414.
- Langer-Osuna, J. M. (2011). How Brianna became bossy and Kofi came out smart: Understanding the trajectories of identity and engagement for two group leaders in a project-based mathematics classroom. *Canadian Journal of Science, Mathematics and Technology Education*, 11(3), 207-225. doi:10.1080/14926156.2011.595881
- Larnell, G. (2016a). More than just skill: Examining mathematics identities, racialized narratives, and remediation among Black undergraduates. *Journal for Research in Mathematics Education*, 47(3), 233-269.
- Larnell, G. (2016b). On 'new waves' in mathematics education research: Identity, power, and the mathematics learning experiences of all children. *New Waves—Educational Research and Development*, 16(1), 146-156.
- Larnell, G., Boston, D., & Bragelman, J. (2015). The stuff of stereotypes: Toward unpacking identity threats amid African-American students' learning experiences. *Journal of Education*, 194(1), 49-57.
- Lather, P. A., & Smithies, C. (1997). *Troubling the angels: Women living with HIV/AIDS*. Boulder, CO: Westview Press.

- Lemke, J. L. (2000). Across the scales of time: Artifacts, activities, and meanings in ecosocial systems. *Mind, Culture, and Activity*, 7(4), 273-290.
- Lieblich, A., Tuval-Mashiach, R., & Zilber, T. (1998). *Narrative research: Reading, analysis, and interpretation*. London: SAGE Publications.
- Marcus, J., & Fritzsche, B. A. (2015). One size doesn't fit all: Toward a theory on the intersectional salience of ageism at work. *Organizational Psychology Review*, 5(2), 168-188.
- Martin, D. B. (2000). *Mathematics success and failure among African American youth: The roles of sociohistorical context, community forces, school influence, and individual agency*. Mahwah, NJ: Lawrence Erlbaum.
- Martin, D. B. (2006a). Beyond missionaries or cannibals: Who should teach mathematics to African American children? *The High School Journal*, October/November, 6-28.
- Martin, D. B. (2006b). Mathematics learning and participation as racialized forms of experience: African American parents speak on the struggle for mathematics literacy. *Mathematical Thinking and Learning*, 8(3), 197-229. doi:10.1207/s15327833mtl0803_2
- Martin, D. B. (2007). Mathematics learning and participation in the African American context: The co-construction of identity in two intersecting realms of experience. In N. i. S. Nasir & P. Cobb (Eds.), *Improving Access to Mathematics: Diversity and Equity in the Classroom* (pp. 146-158). New York, NY: Teachers College Press, Columbia University.
- Martin, D. B. (2009a). Liberating the production of knowledge about African American children and mathematics. In D. B. Martin (Ed.), *Mathematics Teaching, Learning, and Liberation in the Lives of Black Children* (pp. 3-38). New York: Routledge.

- Martin, D. B. (2009b). Researching race in mathematics education. *Teachers College Record*, 11(2), 295-338.
- Martin, D. B. (2012). Learning mathematics while Black. *Educational Foundations*, 26(1/2), 47-66.
- Martin, D. B. (Ed.) (2009c). *Mathematics teaching, learning, and liberation in the lives of black children*. New York: Routledge.
- Martin, D. B., Gholson, M. L., & Leonard, J. (2010). Mathematics as gatekeeper: Power and privilege in the production of knowledge. *Journal of Urban Mathematics Education*, 3(2), 12-24.
- Martin, D. B., & McGee, E. O. (2009). Mathematics literacy and liberation: Reframing mathematics education for African American children. In B. Greer, S. Mukhopadhyay, & S. Nelson-Barber (Eds.), *Culturally responsive mathematics education* (pp. 207-238). New York: Routledge.
- Maxwell, M. (1979). *Improving student learning skills: A comprehensive guide to successful practices and programs for increasing the performance of underprepared students*. San Francisco, CA: Jossey-Bass Inc.
- McAdams, D. P. (1985). *Power, intimacy, and the life story: Personalogical inquiries into identity*. New York, NY: Guildford press.
- McAdams, D. P. (2008). Personal narratives and the life story. In *Handbook of personality: Theory and research 3* (pp. 242-262).
- McAdams, D. P. (2013). *The redemptive self: Stories Americans live by - revised and expanded edition*. Oxford, U.K.: Oxford University Press.

- McAdams, D. P. (2018). Narrative identity: What Is it? What does it do? How do you measure it? *Imagination, Cognition and Personality*, 37(3), 359-372.
doi:10.1177/0276236618756704
- McAdams, D. P., & McLean, K. C. (2013). Narrative identity. *Current Directions in Psychological Science*, 22(3), 233-238. doi:10.1177/0963721413475622
- McGee, E. O. (2009). *Race, identity, and resilience: Black college students negotiating success in mathematics and engineering*. University of Illinois at Chicago, Proquest - Ann Arbor, MI.
- McGee, E. O. (2015). Robust and fragile mathematical identities: A framework for exploring racialized experiences and high achievement among Black college students. *Journal for Research in Mathematics Education*, 46(5), 599-625.
- McGee, E. O., & Martin, D. B. (2011a). From the hood to being hooded: A case study of a Black male PhD. *Journal of African-American Males in Education*, 2(1), 46-65.
- McGee, E. O., & Martin, D. B. (2011b). "You would not believe what I have to go through to prove my intellectual value!" Stereotype management among academically successful Black mathematics and engineering students. *American Educational Research Journal*, 48(6), 1347-1389. doi:10.3102/0002831211423972
- McLean, K. C., Lilgendahl, J. P., Fordham, C., Alpert, E., Marsden, E., Szymanowski, K., & McAdams, D. P. (2018). Identity development in cultural context: The role of deviating from master narratives. *J Pers*, 86(4), 631-651. doi:10.1111/jopy.12341
- Mendick, H. (2005). A beautiful myth? The gendering of being:doing 'good at maths'. *Gender and Education*, 17(2), 203-219.

- Merisotis, J., & Phipps, R. (1998). *College remediation: What is it, what it costs, what's at stake?* Washington, D.C.: Institute for Higher Education Policy.
- Merisotis, J., & Phipps, R. (2000). Remedial education in colleges and universities: What's really going on? *The Review of Higher Education*, 24, 67-85. doi:10.1353/rhe.2000.0023
- Merseth, K. K. (2011). Report on innovations in developmental mathematics - Moving mathematical graveyards. *Journal of Developmental Education*, 34(3), 32-38.
- Mesa, V. (2012). Achievement goal orientations of community college mathematics students and the misalignment of instructor perceptions. *Community College Review*, 40(1), 46-74.
- Miller, R. S., & Wang, M. T. (2019). Cultivating adolescents' academic identity: Ascertaining the mediating effects of motivational beliefs between classroom practices and mathematics identity. *Journal of Youth and Adolescence*, 48(10), 2038-2050. doi:10.1007/s10964-019-01115-x
- Nasir, N. i. S. (2012). *Racialized identities: Race and achievement among African American youth*. Stanford, California: Stanford University Press.
- National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: NCTM.
- National Research Council. (2001). *Adding it up: Helping children learn mathematics*. Washington D. C.: National Research Council.
- Nelson, H. L. (2001). *Damaged identities, narrative repair*. Ithaca, NY: Cornell University Press.
- Noble, R. (2011). Mathematics self-efficacy and African-American male students: An examination of models of success. *Journal of African-American Males in Education*, 2(2), 188-213.

- Oppland-Cordell, S. (2013). Mathematics and racial identity co-construction in multiple sociopolitical contexts: A case study of a Latina undergraduate student from an urban community.
- Pasupathi, M. (2001). The social construction of the personal past and its implications for adult development. *Psychological Bulletin*, 127(5), 651-672.
- Radovic, D., Black, L., Williams, J., & Salas, C. E. (2018). Towards conceptual coherence in the research on mathematics learner identity: a systematic review of the literature. *Educational Studies in Mathematics*, 99(1), 21-42. doi:10.1007/s10649-018-9819-2
- Roberts, M. T. (2019). Racism in remediation: How Black students navigate stereotypes to achieve success in developmental mathematics. *Community College Journal of Research and Practice*, 1-21. doi:10.1080/10668926.2019.1640143
- Ross, E. P., & Roe, B. D. (1986). *The case for basic skills programs in higher education*. Bloomington, IN: Phi Delta Kappa.
- Scott-Clayton, J., & Rodriguez, O. (2012). *Development, discouragement, or diversion? New evidence of the effects of college remediation*. Cambridge, MA: National Bureau of Economic Research.
- Sfard, A., & Prusak, A. (2005). Telling identities: In search of an analytic tool for investigating learning as a culturally shaped activity. *Educational Researcher*, 34(4), 14-22.
- Simons, H. (2012). *Case study research in practice*. London: SAGE Publications.
- Singer, J. A., & Salovey, P. (2010). *Remembered self: Emotion and memory in personality*: Simon and Schuster.
- Soares, L. (2009). *Working learners: Educating our entire workforce for success in the 21st century*. Washington, D.C.: Center for American Progress.

- Soares, L. (2013). *Post-traditional learners and the transformation of postsecondary education: A manifesto for college* Washington, D.C.: American Council on Education.
- Solomon, Y. (2007). Not belonging? What makes a functional learner identity in undergraduate mathematics? *Studies in Higher Education*, 32(1), 79-96.
doi:10.1080/03075070601099473
- Solomon, Y. (2012). Finding a voice? Narrating the female self in mathematics. *Educational Studies in Mathematics*, 80, 171-183.
- Spence, D., & Usher, E. (2007). Engagement with mathematics courseware in traditional and online remedial learning environments: Relationship to self-efficacy and achievement. *Journal of Educational Computing Research*, 37(3), 267-288.
- Steele, C. M. (2011). *Whistling Vivaldi: How stereotypes affect us and what we can do*. New York: W. W. Norton & Company.
- Steele, C. M., Spencer, S. J., & Aronson, J. (2002). Contending with group image: The psychology of stereotype and social identity threat. *Advances in Experimental Social Psychology*, 34, 379-440.
- Stinson, D. W. (2013). Negotiating the "white male myth": African American male students and success in school mathematics. *Journal for Research in Mathematics Education*, 44(1), 69-99.
- Usher, E. L., & Pajares, F. (2008). Sources of Self-Efficacy in School: Critical Review of the Literature and Future Directions. *Review of Educational Research*, 78(4), 751-796.
- Usher, E. L., & Pajares, F. (2009). Sources of self-efficacy in mathematics: A validation study. *Contemporary Educational Psychology*, 34, 89-101.

- Varelas, M., Martin, D. B., & Kane, J. M. (2012). Content learning and identity: A framework to strengthen African American students' mathematics and science learning in urban elementary schools. *Human Development*, 55(5-6), 319 - 339.
- Watson, T. J. (2008). Managing identity: Identity work, personal predicaments and structural circumstances. *Organization*, 15(1), 121-143. doi:10.1177/1350508407084488
- Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. Cambridge: Cambridge University Press.
- Willinsky, J. (1998). *Learning to divide the world: Education at empire's end*. Minneapolis: Univesity of Minnesota Press.
- Wood, M. B. (2013). Mathematical micro-identities: Moment-to-moment positioning and learning in a fourth-grade classroom. *Journal for Research in Mathematics Education*, 44(5), 775-808.
- Wortham, S. (2006). *Learning identity: The joint emergence of social identification and academic learning*. Cambridge, UK: Cambridge University Press.
- Yamada, H. (2014). *Community college pathways' program success: Assessing the first two years' effectiveness of Statway*. Stanford, CA: Carnegie Foundation for the Advancement of Teaching.
- Yin, R. K. (2009). *Case study research: Design and methods fourth edition*. Thousand Oaks, CA: SAGE Publications.
- Zavala, M. d. R., & Hand, V. (2017). Conflicting narratives of success in mathematics and science education: challenging the achievement-motivation master narrative. *Race Ethnicity and Education*, 22(6), 802-820. doi:10.1080/13613324.2017.1417251

Zientek, L. R., Yetkiner Ozel, Z. E., Fong, C. J., & Griffin, M. (2013). Student success in developmental mathematics courses. *Community College Journal of Research and Practice*, 37(12), 990-1010. doi:10.1080/10668926.2010.491993

Appendix A – Student Interview Protocol

Personal Background

1. Demographics: Age, married or single, number of kids, where you grew up, other places lived, current or most recent occupation, prior occupations, primary source of income, spouse's age, spouse's occupation, income, describe your overall living standard.
2. Parent and family information: Where parents born, parents' education level, parents' occupation, number of siblings, education levels and occupations of siblings.
3. How would you describe yourself as a person? Why do you say those things? How do others describe you? Why do you believe they describe you in these ways?
4. General experiences and perceptions of life: How have you been treated in society up to this point in your life? Has life been fair or tough so far? Why? What is your outlook for the future? What are your personal and family goals? Why? What are you doing to achieve these goals? Describe any stumbling blocks toward your goals.
5. College experiences: Current major? Why this major? Which courses taking? How long enrolled? How doing in school overall? Particular experiences in mathematics or science. Future plans for schooling? Future occupational plans? Why?

School Experiences

1. Where did you go to (elementary, middle, high) school? What type of school (public, private; size, ethnic/racial mix)? Would you describe the school as a “good” school? Why or why not?
2. Highest grade you completed? (Person may have dropped out. If so, ask why)
3. What was school like when you think back about it? What was your interest level?
4. Was school challenging or easy? What kinds of grades did you receive?
5. Favorite and best subjects? Disliked subjects?
6. What was the quality of courses you took (middle school, high school)? Were they useful? At the time, did they seem relevant? Did they prepare you for adult life and the future? Did you enroll in any advanced courses? Remedial courses? How did you end up in those courses? Participation in special programs? Accomplishments?
7. What is your opinion of some of the teachers you had? Any memorable teachers or encounters or experiences with teachers? Racial distribution of your teachers and teachers at the schools you attended?
8. Any particularly positive influences on your school experiences? Role models? Recall the most Positive experiences? Recall the most negative experiences?
9. What kind of aspirations did you have back then? What were your plans for the future? Did you think those things were truly possible? Why or why not? How did you plan to make them come true? What were the aspirations of those around you? What did they wish for in life? Did they take school seriously?
10. Are you satisfied with the overall education you received? What did you get out of it? How could it have been better?
11. What was highest math course you completed? What math courses did you take in middle school and high school? What kinds of grades did you receive?
12. How confident were you in your math ability? Why?
13. Where would you say that you were: in the high, middle, low group of students?

14. Who did you identify as the good math students? Who did you identify as the less talented math students?
15. Was it important for you to do well in math during your middle school and high school years? Why or why not? Did doing well in math seem to be important to the other students around you? Why or why not? Did other students have an effect on you when it came to math?
16. What were some of the most difficult things about learning math? What were some of the most enjoyable aspects? Describe some of the classrooms experiences that you can remember in mathematics? Why are those instances most memorable? Did those experiences leave any lasting on impressions on you, positively or negatively?
17. Could you have gone further in math than you did? Was there a desire to go further? Did anybody stress math to you? Do you think your teachers believed you were capable of doing well in math? Did you know anyone in your family or neighborhood who did mathematics on a regular basis or whom you would say benefited from mathematics?
18. Did you try to avoid math? Why? Did you have any negative influences or discouraging experiences? Were higher math courses made available to you? Did your counselors or teachers encourage you to take advanced math classes? Why or why not?
19. [As a female student and African American, do you think you were expected to achieve and do as well in math as other students? Compared to black males?] or [As a Black male student, do you think you were expected to achieve and do as well in math as other students?]
20. Are you satisfied with math education you received? Did it prepare you for life as you now live it? Why or why not? What did you miss?
21. [If enrolled in college] What about now, how important is it to do well in math? Is math important to your goals in life? Has there been a change in your attitude toward math as you have gotten older or enrolled in college? Why and what caused the change?
22. How confident are you in your math ability now? Why?
23. If you didn't have to take math for your college studies would you take it?

Perception of Remediation

1. What does it mean to be in a developmental course?
2. What do you think it means to your peers to be in a developmental course? What do they think about the people in them?
3. How did you find out you were in a developmental course?
4. When you found out you were placed in developmental courses, how did you respond? Did it change how you felt about doing math? How so?
5. Do developmental courses feel different than your past math courses? How so?
6. Do you feel you will succeed in your college level math courses now that you've been through a developmental course? How so?
7. Do you feel you would have been as successful in a college level course if you had been immediately placed there? How so?
8. Students who place into developmental courses are less likely to complete college. Were you aware of this and why do you think this is so?

Perceptions of Underrepresentation

1. African American students participate in mathematics to a lesser degree than other groups. Were you aware of this and why do you think this is so?
2. On the other hand, a much larger percentage of Asian American students participate in math and do well. Why do you think this is so?
3. Do you think there are factors that prevent or discourage African Americans from going into mathematics, doing well, and sticking with it? What are those factors? Are those same factors present in other areas of life? Did any of those factors affect you? How?
4. Do you think society sends a different message to African Americans than other groups about their ability to participate in mathematics? If so, how is this message different for other groups?
5. Do you think there are factors in the African American community that affect whether African American students go into mathematics?
6. Do you think there are factors in schools that affect whether African American students go into mathematics? Are African American students treated any differently than other students? In what ways? What do you think schools and teachers should do to encourage students?
7. Do you think students themselves play a role in whether or not they continue to take mathematics courses? What do you think students themselves should do?

Appendix B – Sources of Self-Efficacy Instrument

Use the following scale to rate how much the statement describes you, where 1 is definitely a false description of you to 6 is definitely a true description of you.

Definitely False	Mostly False	Somewhat False	Somewhat True	Mostly True	Definitely True
1	2	3	4	5	6

Rating Question

- | | | |
|-------|-----|--|
| _____ | 1. | I get excellent grades in math. |
| _____ | 2. | I have always been successful with math. |
| _____ | 3. | Even when I study very hard, I do poorly in math. |
| _____ | 4. | I get excellent grades in math. |
| _____ | 5. | I have always been successful with math. |
| _____ | 6. | Even when I study very hard, I do poorly in math. |
| _____ | 7. | I got good grades the last semester I took math. |
| _____ | 8. | I do well on math assignments. |
| _____ | 9. | I do well on even the most difficult math assignments. |
| _____ | 10. | Seeing others do well in math pushes me to do better. |
| _____ | 11. | When I see how my math teacher/professor solves a problem, I can picture myself solving the problem in the same way. |
| _____ | 12. | Seeing other students do better than me in math pushes me to do better. |
| _____ | 13. | When I see how another student solves a math problem, I can see myself solving the problem in the same way. |
| _____ | 14. | I imagine myself working through challenging math problems successfully. |
| _____ | 15. | I compete with myself in math. |
| _____ | 16. | My math teachers/professors have told me that I am good at learning math. |
| _____ | 17. | People have told me that I have a talent for math. |
| _____ | 18. | Others in my family have told me what a good math student I am. |
| _____ | 19. | I have been praised for my ability in math. |
| _____ | 20. | Other students have told me that I'm good at learning math. |
| _____ | 21. | My classmates like to work with me in math because they think I'm good at it. |
| _____ | 22. | Just being in math class makes me feel stressed and nervous. |
| _____ | 23. | Doing math work takes all of my energy. |
| _____ | 24. | I start to feel stressed-out as soon as I begin my math work. |
| _____ | 25. | My mind goes blank and I am unable to think clearly when doing math work. |
| _____ | 26. | I get depressed when I think about learning math. |
| _____ | 27. | My whole body becomes tense when I have to do math. |

Appendix C – PMENA 2016 Poster

What About Me:

Exploring the Impact of Remedial Coursework on Post-traditional Learners' Self Beliefs

John Bragelman, University of Illinois at Chicago

Department of Curriculum & Instruction ■ UIC College of Education

Community College

- Open access mission and opportunity to rectify inequity
- Represent ¼ of higher education institutions and serve nearly half of all undergraduates
- Urban community college (UCC) is in the downtown area of a large, Midwestern city

Remediation

- Over 50% of students at 2-year colleges place into remediation
- 84% place into remedial math at UCC

Master Narratives

- Remediation does not work
- African Americans and Latin@s are disproportionately represented

Reform Movement

- After decades of relatively little change, reforms propagate
- Focus on sequence and structure – the numbers, not the experience

Counter Narratives

- Remediation works, for some
- Successful students in remediation

Adult Learners

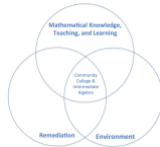
- Post-traditional learners, working age adults, ages 25 to 64, comprise almost 30% of students in the U.S.
- Adult learners are frequently absent from research on mathematics teaching and learning

Mathematics Self-Efficacy and Identity as an Analytic Lens

Self-Efficacy

Influences on Self-Efficacy

- Mastery Experiences
- Vicarious Experiences
- Social Persuasion
- Physiological State



Coding Scheme

Self-Efficacy → Identity & Socialization → Narrative Themes

Themes present among levels of math socialization

- Importance of Mathematics
- Motivation
- Perseverance
- Access
- Strategies for Learning Mathematics

Research Questions

- How does remediation effect learners' mathematics self-efficacy and identity?
- Traditional versus post-traditional learners?
- What themes emerge that suggest why some sources of influence are more important than others?

Emerging Directions

- Remediation through the lens of adult learners
- Curriculum and pedagogy that privileges the new traditional learner
- Self-beliefs as vehicles for assessment of remediation
- Success in mathematics that is not derived from academic performance

References & Acknowledgement

- Bahr, P. R. (2008). Does Mathematics Remediation Work? A Comparative Analysis of Academic Attainment among Community College Students. *Research in Higher Education*, 49(5), 420-450.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Worth Publishers.
- Larnell, G. (2016). More than just skill: Examining mathematics identities, racialized narratives, and remediation among Black undergraduates. *Journal for Research in Mathematics Education*, 47(3), 233-269.
- Martin, D. B. (2000). *Mathematics Success and Failure among African American Youth: The Roles of Sociocultural Context, Community Forces, School Influences, and Individual Agency*. Mahwah, NJ: Erlbaum Associates.
- Messa, V. (2012). Achievement goal orientations of community college mathematics students and the misalignment of instructor perceptions. *Community College Review*, 40(1), 46-74.
- Noble, R. (2011). Mathematics self-efficacy and African-American male students: An examination of models of success. *Journal of African-American Males in Education*, 2(2), 189-213.
- Stinson, D. & Bullock, E. (2012) Critical postmodern theory in mathematics education research: A praxis of uncertainty. *Educational Studies in Mathematics*, 80(1-2), 41-55.

Preliminary Findings

Traditional vs. Post-Traditional

	n	mean	sd	mean	sd	t	p-value
Self-Efficacy	45	2.41	0.86	2.70	0.88	-0.98	.330**
Identity & Socialization	45	2.41	0.86	2.70	0.88	-0.98	.330**

*Significant difference between groups

- Adult learners show significant increase in self-efficacy over a remedial course

- Vicarious Experiences are significant

Sources of Influence

	n	mean	sd	mean	sd	t	p-value
Importance of Mathematics	45	2.41	0.86	2.70	0.88	-0.98	.330**
Motivation	45	2.41	0.86	2.70	0.88	-0.98	.330**
Perseverance	45	2.41	0.86	2.70	0.88	-0.98	.330**
Access	45	2.41	0.86	2.70	0.88	-0.98	.330**
Strategies for Learning Mathematics	45	2.41	0.86	2.70	0.88	-0.98	.330**

*Significant difference between groups

Vignettes

Influence of Others

Oscar on the largest factor of his success:

"The biggest component? Every time I was studying, any time I wanted to quit, I thought of my daughter. That was, that was the hardest thing. At points, I didn't have time to even, uh, like, I didn't have time to think for myself. I had to put myself on a schedule... I'm going to do my homework for an hour. Then I'm going to play with my daughter... Then I gotta go to work. It was like, it was just hectic."

Sandra on behavior and peers:

"I don't even care about my peers in the course. At this point, I'm over fifty. And, I'm not a child anymore. I chose to come back to school. And, I'm probably older than some of my instructors. So, I don't care. If they know how to teach it, I'm on board."

Algebra and Mastery

Oscar on his first encounter with algebra:

"It was terrible. Just figurin' out what I what supposed to do with a letter...clausure. Everything that I've done throughout the military, I've never seen a letter formed with math. And if there was a letter formed with math, it was like -okay, here's your grid. Here's the letter. Go here."

Sandra on her experiences in remedial math:

"You're thinking, 'You're good... Let's go for this math. But then I got into math, and I was like, I was trying to find it somewhere in me. Like...okay, logically, let's read this chapter and see if that makes sense, since you like words. That don't make sense. Okay, let's look at these problems, everybody's givin' me websites. Go on purlepath. Go on this. Go on that. Oh. Oh. What. What? Where is it? By now, it should be like, ah, it should be. It's not in me...I can't find this stuff in me."



Appendix D – Memo : Supplemental Support Course Analysis

The effects of supplemental instruction on sources of mathematics self-efficacy

Supplemental instruction (discuss intervention)

Understanding non-cognitive benefits from supplemental instruction, how students' beliefs are affected.

Results

Repeated Measures ANOVA for 4 sources as within subject factors, no between subject factor.

Time was not significant (no change overall – less meaningful)

ME was significant ($F[1,59] = 3.980, p = .05$)

Pre mean, s.d. = 21.00, 5.424

Post mean, s.d. = 22.18, 5.664

Social Persuasion was significant ($F[1,59] = 6.897, p = .011$)

Pre mean, s.d. = 16.63, 9.052

Post mean, s.d. = 18.68, 8.294

Vicarious Experiences was significant ($F[1,59] = 5.759, p = .020$)

Pre mean, s.d. = 25.02, 5.360

Post mean, s.d. = 26.72, 5.279

Repeated Measures ANOVA for 4 sources, with 'successfully transitioning out of remediation' as a between subject factor

Success and time were not significant, no significant interaction

No significant interaction effect.

Same with univariate tests

However, between subject effects were significant.

ME ($F[1,58] = 7.368, p = .009$)

Students who did not successfully transition out of remediation reported significantly lower mastery experiences than those who did transition out of remediation.

P ($F[1,58] = 4.211, p = .045$)

Students who did not successfully transition out of remediation reported significantly lower social experiences that impacted their self-efficacy beliefs about mathematics than those who did transition out of remediation.

PH ($F[1,58] = 5.879, p = .018$)

Students who did not successfully transition out of remediation reported significantly lower physiological effects that impacted their self-efficacy beliefs about mathematics than those who did transition out of remediation.

Repeated Measures ANOVA for 4 sources with participating in supplemental instruction as a between subject factor

SI was a significant between subject factor ($F[4,55] = 3.695, p = .010$).

No significant interaction effect between pre/post and SI

Between subject factors

ME was significant ($F[1,58] = 6.526, p = .013$)

Students in supplemental instruction courses had significantly higher sources of mastery experiences. **(this is a big deal)**

Repeated Measures ANOVA with 4 sources and SI & Success in Math as between subject factors

Only teacher & math success between interaction significant.

Within subject Univariate tests

Time & teacher – Vicarious

Time & math success – ME

Time & teacher & math success – ME and P (within subject contrast)

Students who self-selected into SI reported higher mastery experiences overall than those who did not select into SI. After a semester long intervention, students in SI who did not find success in mathematics reported significantly fewer master experiences than those who did (like, a huge difference – their entering reports dropped dramatically) –

- **so if a student didn't transition out of remediation and took SI, they reported significantly fewer mastery experiences, at the level of those who failed and didn't take SI**
- **So if students find sources of mastery experience in SI, it seems to work very, very well. If they don't, it may as well not occur?**

Really interesting interactions with P

- Students who don't pass remediation and don't select into SI have very, very few sources of social persuasion
- Students who self-selected into SI and failed remediation may have more sources of social persuasion entering the semester but leave with fewer, contrasting those who self select and pass, who find the exact opposite – fewer at start and significantly more at end.
-

Between subject tests

Math Success – ME

Math Success – Ph

No significant differences when controlling for SI and Success

Appendix E – Who-I-Am Worksheet

WHO I AM

Self-Portrait	Full Name	My ethnicity/race/culture	
	My hobbies/extra-curricular activities	Graduating Class	
		Birthday	
		My Family	

An accomplishment I am proud of	Person I look up to	Places I Have Lived
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I have never:	Where I spend my free time	Most memorable recent event
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Qualities of a good math teacher	Favorite childhood memory	<div style="text-align: center; font-weight: bold; margin-bottom: 5px;">FAVORITE</div> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> Food Music/Radio Station TV Show Book/Magazine Sport/Team Color </div> <div style="text-align: center;"> Class/Subject Movie </div> </div>
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Education

2020	Ph.D	University of Illinois at Chicago Major: Curriculum Studies – emphasis Mathematics Education
2007	M.Ed.	Georgia State University Major: Mathematics Education
2004	B.S.	Georgia Institute of Technology Major: Applied Psychology

Academic and Teaching Appointments

2020-	Assistant Professor, Department of Mathematics, University of North Georgia
2018 -	Research Specialist, Department of Undergraduate Education, San Jose State University
2015 - 2019	Professor, Department of Mathematics and Computer Science, Harold Washington College, Chicago, IL
2014 – 2015	Director, Developmental Education, Harold Washington College, Chicago, IL
2012 - 2018	Graduate Research Assistant, Elementary Teacher Preparation Program, Department of Mathematics, Statistics, and Computer Science, University of Illinois at Chicago
2011	Graduate Research Assistant, Department of Middle and Secondary Education, Georgia State University, Atlanta
2010 – 2013	Visiting Professor, Department of Mathematics, DeVry University, Chicago, IL & Atlanta, GA

Teaching Appointments - Secondary

2008 – 2010	High School Teacher, Tech High School, Atlanta, GA
2007 - 2008	High School Teacher, Early College at Carver, Atlanta, GA

Awards

2019	Internal funding award for the development of a digital learning environment for the support of teaching assistants of general education mathematics courses, San Jose State University
2014-2017	Department of Curriculum and Instruction Travel Award, University of Illinois at Chicago
2011	Excellence in Teaching Award, DeVry University
2007	TEEMS Mathematics Initial Teacher Preparation Award, Georgia State University, Atlanta
2006	Robert Noyce Scholar, Georgia State University, Atlanta

Research Foci

Exploration of mathematics identity of first year mathematics students in community college and university settings, particularly trajectories of development in relation to students' mathematical experiences during and after course completion

Understanding the role and impact of videocases as authentic representations of practice in prospective teacher development of noticing of students' mathematical thinking

Design, implement, and study the role of online platforms as a tool for prospective and inservice teacher development

Publications: Refereed Journal Articles

Bragelman, J., Amador, J., & Castro Superfine, A. (*accepted*). Micro-noticing: A lens on prospective teachers' trajectories of learning to notice. *ZDM Mathematics Education*.

Maciejewski, W., Bragelman, J., Campisi, M., Hsu, T., Gottlieb, A., Schettler, J., . . . Cayco, B. (2020). Change comes from without: Lessons learned in a chaotic year. *PRIMUS*. doi:10.1080/10511970.2020.1793854

Castro Superfine, A., Amador, J., & Bragelman, J. (2019). Facilitating video-based discussions to support prospective teacher noticing. *Journal of Mathematical Behavior*, 54(100681).

Castro Superfine, A. & Bragelman, J. (2018). Analyzing the impact of video representation complexity on preservice teacher noticing of children's thinking. *Eurasia Journal of Mathematics, Science and Technology Education*, 11(4), 1-18.

Castro Superfine, A., Fisher, A., Bragelman, J., & Amador, J. (2017). Shifting perspectives on preservice teachers' noticing of children's thinking. *Teacher Noticing Monograph*. Springer.

- Larnell, G., Blackmond Larnell, T., & Bragelman, J. (2016). Toward reframing the open door: Policy, pedagogy, and developmental education in the urban community college. White paper for University of Illinois at Chicago's Urban Forum, 2016.
- Martinez, M., Bragelman, J., & Stoelinga, T. (2016). Underprepared students' performance on algebra in a double-period high School mathematics program. *The Mathematics Educator*, 25(1), 3-31.
- Bragelman, J. (2015). Praxis as dialogue: Teacher and administrator. *Journal of Urban Mathematics Education*, 8(2), 1-17.
- Castro Superfine, A., Li, W., Fisher, A., & Bragelman, J. (2015). Reflecting on the use of video to support preservice elementary teachers' noticing of children's thinking. *Journal of Technology and Teacher Education*, 23(2), 137-157.
- Larnell, G., Boston, D., & Bragelman, J. (2014). The stuff of stereotypes: Toward unpacking identity threats amid African American students' learning experiences. *Journal of Education*, 194(1), 49-57.

Published Conference Proceedings (Refereed)

- Bragelman J. & Maciejewski, W. (accepted). *A culture of change: Student stories in undergraduate reform math. Proceeds of the 42nd annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*. St. Mazatlán, Sinaloa, Mexico.
- Bragelman, J., Stoelinga, T., & Castro Superfine, A. (2017). *Iterative (re)visioning: An improvement science approach to online professional development design and implementation. Proceedings of the 38th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (p. 1379). Indianapolis, IN.
- Bragelman, J. (2016). What about me? Exploring the impact of remedial coursework on post-traditional learners' beliefs. In M. B. Wood, E. E. Turner, M. Civil, & J. A. Eli (Eds.), *Proceedings of the 38th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (p. 1127). Tucson, AZ: The University of Arizona.

Refereed Conference Papers, Posters, and Presentations

- Bragelman, J. (2018). *Micro-Noticing: A Lens on Novice Teachers' Trajectories of Learning to Notice*. Research presented at the SJSU Mathematics Department Colloquium Series, San Jose, CA.
- Castro Superfine, A. & Bragelman, J. (2018). *Videocase Complexity and Preservice Teacher Noticing: Examining the Effects of Cognitive Load*. Research to be presented at the International Conference of the Learning Sciences, London, UK.

- Castro Superfine, A. & Bragelman, J. (2018). *Analyzing the Impact of Video Representation Complexity on PST Noticing*. Report to be presented at the National Council of Teachers of Mathematics Research Conference, Washington D. C.
- Bragelman, J. (2017). *It's not in me: Remediation's impact on post-traditional learner's efficacy and identity*. Research presented at the National Council of Teachers of Mathematics Research Conference, San Antonio, TX.
- Bragelman, J. & Stoelinga, T. (2017). *Design of an online learning environment for mathematics teachers*. Research presented at the Learning Sciences Research Institute Speaker Series, Chicago, IL.
- Bragelman, J. (2016). *What about me? Exploring the impact of remedial coursework on post-traditional learners' beliefs*. Research presented at the Psychology of Mathematics Education – North American annual conference, Tucson, AZ.
- Fisher, A., Amador, J., Castro Superfine, A., & Bragelman, J. (2016, January). Analyzing noticing across levels of expertise: The need for analytic frameworks to transcend ability and contexts. Invited presentation for the annual meeting of the Association of Mathematics Teacher Educators, Irvine, CA.
- Castro-Superfine, A., Fisher, A., & Bragelman, J. (2015). *The Videocases for Preservice Elementary Mathematics Platform: Supporting Preservice Teachers' Noticing of Children's Mathematical Thinking with Viewing Scaffolds*. Research presented at the American Educational Research Association annual conference, Chicago, IL.
- Andrews, A., Bragelman, J., Carlton, M., & Ortiz, M. (2015). *Restorative Justice Circles: A Proactive Tool for Engagement, Classroom Management, & Learning*. Research presented at Innovations 2015, Boston, MA.
- Carlton, T., Andrews, A., Bragelman, J., & Ortiz, M. (2015). *Restorative Justice Circles: A Proactive Tool for Engagement, Classroom Management, & Learning*. Research presented at NADE 2015, Greenville, SC.
- Bowens, K., Cerrentano, C., Bragelman, J., & Thomas, L. (2015). *M2 APS: Math Movement for Academic and Professional Success*. Grant program presented at the STEM CCR and Bridging the Gap Joint Winter Meeting, Bloomington, IL.
- Larnell, G., Boston, D., Yisra'el, Q., Omitoyin, J., & Bragelman, J. (2014). *Remath: New Explorations of the Math-Learning Experiences of Black Students in Non-credit-bearing University Courses*. Research presented at the Focus on Illinois Education Research Symposium, Bloomington, IL.
- Castro-Superfine, A., Fisher, A., & Bragelman, J. (2014). *Supporting Preservice Teachers' Ability to Notice: An Online Platform for Understanding Children's Mathematical Thinking*. Research presented at the Association of Mathematics Teacher Educators annual conference, Irvine, CA.

- Lynn, J., Stoelinga, T., Martinez, M., Fisher, A., & Bragelman, J. (2014). *An Architecture of Intensification*. Research presented at the LSRI Brown Bag Series, Chicago, IL.
- Castro-Superfine, A., Lynn, J., Stoelinga, T. M., & Bragelman, J. (2013). *Supporting Underprepared Algebra Students: Results from a Design-Based Research Program*. Research presented at the National Council of Teachers for Mathematics Research Presession, Denver, CO.
- Bragelman, J. (2011). *An Analysis of Time Management of a Pre-Service Teacher: Action research in practice*. Paper and its development presented to the Networking to Enhance Teacher Quality (NET-Q) Scholars of the Master of Arts of Teaching program, Georgia State University, Atlanta, GA.
- Bragelman, J. (2009). *Time Management Analysis of a Preservice Teacher*. Paper presented at the Association of Mathematics Teacher Educators Annual Conference, Orlando, FL.
- Bragelman, J. (2007). *Time Management Analysis of a Preservice Teacher*. Paper presented at the Robert Noyce Scholarship Conference, Washington D. C.
- Bragelman, J. (2006). *Time Management Analysis of a Preservice Teacher*. Paper presented at the Georgia Council of Teachers for Mathematics Annual Conference, Rock Eagle, GA.

Service

2017 -	K12 mathematics and test preparation advisor
2016	CCC Launch committee member – remedial math curricular redesign project
2014-2015	Developmental Education Committee Chair – interdisciplinary professional development committee
2014-2015	Student Success Committee – multi-departmental committee dedicated to building student support structures across the college
2013 - present	Reviewer – JUME, JTME, JRME, ICLS, MTL, ZDM
2013	Publicity Committee and lead web designer, PME-NA Annual Conference. Chicago, IL
2012	Volunteered at the annual Teachers for Social Justice Curriculum Fair, Chicago, IL
2007	Volunteered at the Georgia Council of Teachers for Mathematics Annual Conference in Rock Eagle, 2007

2006-2009 Urban Mathematics Educator Program – Professional Learning Community, an online community dedicated to the continued development of urban educators

Professional Memberships

National Council for Teachers of Mathematics (NCTM)
American Educational Research Association (AERA)
Association of Mathematics Teacher Educators (AMTE)
Psychology of Mathematics Education – North American Chapter (PMENA)
National Association for Developmental Education (NADE)
Teachers for Social Justice (TSJ)

Teaching Experience

Professional Development Seminar. Graduate course supporting teacher assistants for general education mathematics courses, targeting development of active learning, making student thinking visible, and noticing of students' mathematical thinking.

General Education Mathematics (MATH 118, HWC). Community college course taught as dual credit at Air Force Academic High School in Chicago Public Schools focused on general mathematics concepts for liberal arts majors.

Intermediate Algebra with Geometry (MATH 099, HWC). Third level remedial mathematics course focused on algebraic operations, expressions, and solving algebraic equations as a prerequisite for college algebra.

Beginning Algebra with Geometry (MATH 098, HWC). Second level remedial mathematics course focused on algebra of real numbers, polynomial operations, factoring, and systems of equations as a prerequisite for intermediate algebra.

College Success (INTDSP 101, HWC). Introductory course offered to incoming freshman covering best practices for success at college, taught within the English as Second Language department.

Applied Managerial Statistics (GM533, KGS). Graduate course on applied statistics for students in MBA programs, focused on concepts in descriptive statistics and inferential statistics through hypothesis testing and multiple regressions.

Statistics for Decision Making (MATH 221, DU). Undergraduate course on applied statistics for students in nursing and STEM tracks, focused on concepts in descriptive statistics and inferential statistics through hypothesis testing.

Pre-Calculus (MATH 190, DU). Undergraduate course for students in STEM tracks, focused on pre-calculus concepts such as analyzing and graphing quadratic, polynomial, rational, exponential, logarithmic and trigonometric functions; and developing complex solutions to problems in rectangular, trigonometric and Euler form.

Algebra for College Students (MATH 114, DU). Undergraduate course focused on concepts such as algebraic expressions, solving linear equations and inequalities, graphing linear equations and inequalities, polynomial operations, positive and negative integral exponents, factoring, systems of linear equations, radical and rational expressions, quadratic equations and various application problems.

Basic Algebra (MATH 092, DU). Remedial mathematics course focused on algebraic operations, expressions, and solving algebraic equations.

Introduction to Algebra (MATH 032, DU). Remedial mathematics course focused on algebra of real numbers, polynomial operations, factoring, and systems of equations.

Foundations of Mathematics (MATH 017, DU). Remedial mathematics course focused on foundations of mathematics including number sense, order of operations, and introductory algebraic concepts.