LISTENING TO COLLEGE ALGEBRA SURVIVORS:

A NATURAL HISTORY ETHNOGRAPHY

by

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ABSTRACT

The purpose of this dissertation is to amplify the voices of college algebra students to inform researchers, administrators, and educators to make college algebra more equitable. Nearly 50% of college algebra students fail the course at least once, and many of these students are students of color. Yet, in studies investigating college algebra, student voices are rarely considered. Erickson's Natural History Approach and Gutierrez' dimensions of equity (access, achievement, power, and identity) frame this ethnographic case study. I present two cases of college algebra "survivors," students of color who have repeated college algebra due to a previous course failure. Each case is composed of a narrative of the student's experience, and my analysis of each student's voice(s) and (in)equitable experiences. I demonstrate that math learners' life experiences shape their experiences in college algebra. I use Gilligan's Listening Guide method, which centers students' voices and illuminates the multiple voices of participants, to analyze ethnographic data from interviews and participant observations.. Furthermore, I have developed the (In)Equitable Experience Analysis method to investigate ways that student achievement, access, identity, and power can be afforded or constrained in the classroom. I employ voice analysis and (in)equitable experience analysis together because students can articulate equitable and inequitable experiences through voice and listening to students' voices is a critical step toward more equitable college algebra experiences. Two key lessons emerge from this study: First, insisting that students "just work harder" is insufficient to remedy the problem with college algebra; second, promoting students' achievement and power is more nuanced than

just fostering their access and identity. I conclude with implications for promoting equitable learning opportunities for college algebra students.

Keywords: Voice, Experience, Equity, Ethnography, Case Study, College Algebra

Approved: Heather Johnson

DEDICATION

To Andre, Mary and all the survivors. Your voice matters.

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CHAPTER I

INTRODUCTION

Words mean more than what is set down on paper.

It takes the human voice to infuse them with deeper meaning. -Maya Angelou

Words have power. Voice has meaning. Words, through a voice, express the human experience. To understand the human experience requires listening to and feeling the deeper meaning of the words through the voice of the human speaking them. There are tens of thousands of words set down on the paper of this dissertation. I implore readers to do more than read the words; listen to the humans whose voices speak those words.

Survivor is a word set down on paper. The Merriam Webster Dictionary (2006) defines survivor as follows: "to remain alive or in existence; to continue to function or prosper." The dictionary can provide a definition for the word survivor, but it takes the human voice to infuse survivor with deeper meaning. To understand the experience of surviving requires listening to feel the human experiences of survival. If one has not experienced surviving firsthand, the closest they can get to understanding the human experience of surviving is in listening to voices of individuals who have survived. Surviving can be used in a physical sense as in fighting for one's life. I extend the metaphor of surviving to spaces such as college algebra classrooms, where one might not be fighting for their life, but they may need to endure, despite systems that may not be working for them.

Employing a natural history approach (Erickson, 1982) to an ethnographic case study, I report two cases of mathematical "survivors," Andre and Mary. They have survived a university math course, college algebra. I call them survivors because they failed college algebra at least once yet persisted to pass the course.

To situate this study, I begin with a request for readers to listen to the experience and voices of Andre and Mary. I share their voices via words written in poetry, *I-poems* (Gilligan, 2015), that I constructed from interview data via the Listening Guide Analysis method (Gilligan, 2015). Extended I-poems for Andre and Mary are shown in Figures 1 and 2, respectively. Read the I-poems with three questions in mind: What does it mean to listen in such a way to hear and understand students? What do you feel as you listen to their voice? What could be a deeper meaning of their human experience of surviving college algebra?

Andre's Voice: I am a hard worker, I know I can do it

I am a hard worker
I am a dedicated student, a dad
I am a scholar
I am somebody
I am African American
I am first generation
I will be the first medical doctor in my family

I come to this university
That's not my background
I've gotten here all by myself

I am capable
I am supposed to be here
I will
I know
I'm ok

I actually didn't complete
I didn't..
I have to take it again.
I didn't do well enough

I don't know.
I don't even care.
I'm just ready to take the class again.

I just have to
I have to be sharper
I have to prove that I am capable
I am not here by chance
I had to work really hard to get here.

I never really been exposed to it.
I don't remember even taking any higher maths after my sophomore year.

I come to this university
I can be proud
I've gotten here all by myself

I didn't come this far to for math to stop me.

I know I can do it.
I am excited
I am up for it.
I know this is what
I am meant to do

Figure 1 *Andre's I-Poem*

Mary's Voice: I worked so hard, It's probably a fluke

I'm a wife
I'm a student
I'm a woman
I'm many things
I feel like it's easy to judge people
by my skin color
I'm multiracial

I tend to give up
I don't want to fail.
I want to be better

I look down on myself
My disabilities
I don't want to them to hinder me from educating myself
I'm strong
I have this conflict
I have moments of strength
I'm always in class

I hardly ever miss
I'm still struggling
I feel stuck
I feel like maybe if I were smarter

I never got help at home
My mom, she couldn't help me
no resources that I remember
My teachers didn't
I was also absent quite a bit
I left again for a year
I left in the middle of the year

I tried to get help from her
I don't know if she saw me as a lost cause
I was absent so much

I kind of sat in the back
I wore a hoodie over my head and tried to be invisible

I didn't pass algebra
I failed math quite a bit
I had a lot of negative feelings and hate

I'm gonna pass this class
I'm gonna pass
I had resources
I've actually been getting a lot of help
I passed the class
I feel it's probably a fluke
I wish I could do math
I kept failing
I failed three times
I worked so hard
I worked so hard

Figure 2 *Mary's I-Poem*

With these I-poems, I intend to humanize Andre and Mary, beyond numbers or statistics. Here I provide a glimpse of what will come. In the chapters that follow, I explain the method and development of these I-poems. One way to explain the previous failure of Andre and Mary could be to blame them as individuals, and point to a lack of effort on their part. However, their I-poems counter such an explanation. They identify as "hard workers" and exhibit characteristics of "hard working" students. They are both proud scholars of color; Andre identifies as African

American and Mary identifies as a multiracial Mexican. Together, Andre and Mary's voices express experiences of college algebra survivors.

Problem Statement

Almost 50% of university students attending a four-year institution (i.e., BA, MA, and PhD granting institutions) fail college algebra (Holm & Saxe, 2016), a problem that has led university administrators and math instructors to explore ways to improve achievement rates in this course (Harrell-Williams et.al., 2020). In addition, there is an inequitable distribution of failure rates, as students of color from low-income backgrounds often fail this class more than their white counterparts (Chen, 2016; Blair et al., 2018). To increase achievement rates and make college algebra more equitable, I argue that researchers and educators must listen to students' experience and voice.

With this dissertation study, I address a pervasive and insidious problem: How university students of color experience retaking college algebra, after at least one failed attempt. By addressing this problem, I aim to inform and improve learning experiences for college students who may feel invisible, silenced, or otherwise left out in some way. I do this by centering students' experiences and voices.

I begin this chapter by presenting a brief historical overview of college algebra. Next I explain why college algebra functions as a gatekeeping course and address the myth that if students just worked harder, they would pass the class. I then identify theoretical and methodological elements I used to investigate experience and voice. I conclude with the research questions, and a situation of this dissertation study in a larger research project.

College Algebra: From Elite to "Entry Level"

Around the year 1750, Harvard and Yale introduced college algebra as an elite course for students as a means of preparing the nation's most privileged college students for upper-level courses in geometry and differential calculus (Tunstall, 2018). As college evolved into institutions for more than the elite few (i.e., wealthy white men), the status of college algebra shifted, and it became the option for students not yet ready for calculus. As a required general education course, college algebra is considered by many institutions to be the lowest level for which general post-secondary credit can be given (Tunstall, 2018).

While there are numerous studies focused on college algebra learning at the community college level (e.g., Nguyen, 2015; Cortés-Suárez & Sandiford, 2008; Van Sickle, 2015; Champion et al., 2011), there is a gap in the literature regarding college algebra students' experiences in university classroom settings. I offer three reasons to account for this gap. First, at four-year universities, more prestigious introductory level courses, such as calculus, take priority (e.g., Bressoud et. al., 2013; Ellis, 2016). Second, a disproportionate number of students in college algebra are students from historically marginalized groups (Chen, 2016; Blair et al., 2018). Third, even when research on college algebra exists, the focus is on something other than students' experience (e.g., Nguyen, 2015; Tunstall, 2018). This lack of scholarly research on and students' experiences and voices in college algebra at four-year institutions has consequences.

In 2015, the Mathematical Association of America reported a 50% annual failure rate for college algebra in the United States (Saxe et. al., 2015). Tunstall (2018) corroborated this finding, reporting a 45% annual failure rate for U.S. students taking college algebra at PhD granting institutions, in the year 2010. In human terms, this percentage means that of the 990,000

U.S. students who enroll in introductory college math courses, such as college algebra, in any given year at four-year institutions (Blair et al, 2018), approximately 495,000 students would not successfully complete the course. A 45%-50% failure rate is too high for any course, yet the percentage alone masks the half million humans affected each year. The statistics are staggering. Andre and Mary represent two of the hundreds of thousands of students who fail introductory university math courses, such as college algebra, each year.

College Algebra as a Gatekeeper

College algebra has the highest course failure rate in U.S. higher education at 45%, this disproportionately limits opportunities for people of color and low-income White and Asian students (Chen, 2016; Blair et al., 2018). When race is considered, only 40% of White students will fail college algebra the first time they take the course (Tunstall, 2018). However, 59% of African Americans and 51% of Hispanic/Lantix will fail college algebra the first time they take it (Tunstall, 2018). In Fall 2018, from demographic data obtained from the institution where I conducted this study, 44% of freshman undergraduates were students of color, while 63% of the students that were enrolled in college algebra that same semester were also students of color. It follows that the gatekeeping aspects of college algebra disproportionately impact students of color. This is not a failure of the students; this is a failure of the system.

Uri Treisman has called college algebra “a burial ground for students’ aspirations” (Meyer, 2013). College algebra too often becomes a primary barrier to preventing student success and contributes to students failing to meet their academic and economic goals (Ganga et al., 2018; Martin et al., 2010; Moses and Cobb, 2001). Yet college algebra has the highest enrollment rate of all post-secondary math courses in the U.S. In 2010, college algebra accounted

for approximately two-thirds of all post-secondary math course enrollment, 45% of four-year institutions and 80% of two-year institutions (Chen, 2016).

Herriott and Dunbar (2009) found that across most institutions, the students who take college algebra are typically those who have been unsuccessful in high school mathematics and report an aversion to the subject; 98% of students taking a college algebra course were doing so as a requirement, not as an elective course. It follows that students do not take a college algebra course for intellectual enrichment; rather, it is a compulsory course that students enroll in to meet a mathematics degree requirement or fulfill a prerequisite for another course.

Failing College Algebra? The "Just Work Harder" Myth

According to tutoring and university help sites, there are several common reasons students fail college algebra (Chen & Marina, 2016; Crisp & Delgado, 2014). Some of the difficulties they face, involve language, attention, visual spatial ordering, or organization which impacts students' ability to work through multi-step problems. Other reasons to explain students' lack of success in the mandatory course include behavioral deficits such as being absent, not seeking out help, not practicing enough, not caring about math enough, having a poor attitude, not asking questions, being distracted or talking too much in class when they are supposed to be listening.

These difficulties, or shortcomings, place blame on the individual for failing, and so the solution devolves into the prescription that one half million students should "just work harder." This is much like blaming people for being poor rather than examining social structures that result in economic inequities. To counter this, through the analysis of Andre and Mary's experience and voice, I aim to demonstrate why working harder does not guarantee success in

college algebra. Yet, the myth of working harder is necessary to uphold structures that create and sustain the gatekeeping function of college algebra.

Telling students to just work harder often comes at the expense of focusing on systemic reform. I argue that instructors should not tell students who are already working hard, who visit office hours, attend study sessions, and are present for every class, to work harder. Instead, I urge instructors to listen to students' voices and experiences. Lessons learned from listening can inform those in power (e.g., department chairpersons) about the specific ways to improve achievement for college algebra students. Understanding the experiences of math students, such as Andre and Mary, can inform improved systems of teaching and learning mathematics (e.g., Munter & Haines, 2019; Boaler, 2016), as well as studies specific to college algebra (e.g., Weinstein, 2004; Nguyen, 2015).

Listening to Students' Experience

To characterize experience, I draw on Erickson's (1982) natural history approach to ethnography. Experiences are ways of encountering and being in the world. Experience includes acting, being, feeling or engaging in a moment. Such experiences may be present, or exist in the past as memories, or markers of lived experience. Experiences also exist as different ways of being in the world, like cognitive, social, or sociopolitical. Put another way, experiences may be filtered through different lenses, and are thus highly subjective. Experience happens in a series of present moments, making it a complex phenomenon for researchers to study.

To analyze survivors' moment-to-moment experiences in the college algebra classroom, I developed an approach based on Gutiérrez's (2012) dimensions of equity: access, achievement, power, and identity. I call this approach (in)equitable experience analysis. I use the term (in)equitable experience to include equitable and/or inequitable experiences of access,

achievement, power, and identity. Gutiérrez (2012) argued that equity "means fairness, not sameness" (p. 19). In the learning environment, such a definition of equity recognizes not all learners are the same, and that they must receive fair, or equitable, learning opportunities. Equitable learning opportunities are not the same for all students; what is required for one student to learn in an equitable way may not be the same as another student. This also means that instructors must employ different methods of providing learning opportunities to different students to ensure equitability in the classroom.

Listening to Students' Voice

Voice is a form of communication and a way of learning about the self and the "verbal expressions" of the self and psyche (Sadowski, 2012, p. 80). Voice also communicates feelings and perceptions of experiences. Voice may provide insight into the different ways that participants feel and understand an experience. Each voice represents a different way that participants can describe their experiences. That is, an individual may describe a single event or experience in multiple ways and listening to voice can help researchers identify these voices, or experiences.

To analyze students' voice, I employ the Listening Guide (LG) method (Gilligan, 2015). The LG method has roots in research investigating trauma survivors and aims to amplify their voices. In my study participants are also survivors—of a math system that does not work for them. I wanted to be able to listen to participants to elevate their voice as loudly as possible because these voices are typically covered with layers of silence. As a person in a position of power working to improve math teaching and learning, I wanted to take the time to stop to listen and understand what these often-silenced voices are saying.

Research Questions

I conducted this dissertation study to amplify and understand the experience and voice of college algebra survivors, to inform and improve learning outcomes for college students who may feel invisible, silenced, or otherwise left out in some way. This ethnographic case study is situated within a larger study, *Implementing Techtivities to Promote Students' Covariational Reasoning in College Algebra* (ITSCoRe; NSF #1709903). A key component of the larger study was the design and implementation of Techtivities—free, web-based activities to promote college algebra students' understanding of how graphs work (Johnson et al., 2018). Through the Techtivities, the ITSCoRe team aimed to open opportunities for students to engage in reasoning and sense making, to promote their success in college algebra. I conducted this ethnographic case study as a complement to the larger study.

To examine the rich and complex nature of the voices and experiences of college algebra survivors, I focus the unit of analysis on individuals, acknowledging that the individual is part of an immediate learning environment in the classroom and that the classroom is also a part of a larger sociopolitical structure. I report a multiple case study (Stake, 2013) of the experiences of two students, Andre and Mary, who survived college algebra, after failing on at least one previous attempt.

In this study, I pose three research questions:

- RQ1. How do college algebra survivors describe their math experience?
- RQ2. What are the voices of college algebra survivors?
- RQ3. How are college algebra survivors' access, achievement, power and identity afforded or constrained?

I address each research question for each case study participant. For RQ1, I created participant narratives (Erickson, 1982) to describe math experience. For RQ2, I conducted voice analysis via the LG method (Gilligan, 2015). For RQ3, I examined how college algebra survivors' access, achievement, power and identity were afforded or via the (in)equitable experience analysis technique that I developed. In addition to addressing each research question individually, I include a case summary for each participant, as well as cross-case analysis. In the chapters that follow, I situate and discuss the experiences and voices of two college algebra survivors. I conclude with implications for math teaching and learning.

CHAPTER II

THEORETICAL FRAMEWORKS

In this chapter, I discuss the theoretical and conceptual tools that I used to examine the experience and voice of college algebra survivors. I organize this chapter into three overarching sections: experience, voice, and equity. I begin each section with an explanation of the construct and summarize relevant literature. In the first section, I explain how experience has been studied in college algebra. Then I discuss how Erickson's (1982) levels of organization to a natural history approach can frame an examination of the experience and voice of college algebra students. In the second section, I explain how voice has been studied in college algebra and discuss the Listening Guide (Gilligan et. al., 2006; Gilligan, 2015) as a method to amplify student voice. In the third section, I explain how Gutiérrez's dimensions of equity (2009, 2012a) can inform an investigation of students' equitable and inequitable experiences in the college algebra classroom.

Experience

When I use experience, I mean ways of encountering and being in the world, in a series of present moments, including cognitive, social, and/or sociopolitical encounters (Erickson, 1982). Experience encompasses acting, being, feeling, or engaging in a moment. Such experiences may be present or exist in the past as markers of lived experiences. In this section, I begin with a historical overview of theories that aim to explain learning experiences (Dewey, 1938; Piaget, 1953; Vygotsky, 1978). Next, I explain what I mean by experience in terms of present moments (Erickson, 1982) and markers of lived experience (Fielding, 2008; Larkin & Thompson, 2012). Then, I discuss what is known about college students' experiences as math learners.

Brief Overview of the Experience of Learning

In their theories, Dewey, Vygotsky, and Piaget explicated the psychological experience of learning. Deweys' theory of progressive education (1938), Vygotsky's sociocultural theory of cognitive development (1978) and Piaget's theory of cognitive development (1953) attended to the role of experience in learning. Both Dewey and Vygotsky emphasized the role of cultural forms and meanings in learning experiences, whereas Piaget focused on the cognitive role played by logic and reasoning in learning experiences. Both Piaget and Dewey emphasized the role of independent reasoning in learning experiences, while Vygotsky emphasized the social context of learning, including the zone of proximal development.

Dewey (1938) asserted genuine education comes about through experience, not through "passive and receptive" ways of being. He emphasized the importance of meaningful activity in learning rather than traditional education models that relied on rote memorization. In this, he criticized educators' attempts to pass down knowledge to the student, in which each student is expected to take external knowledge, internalize it, and form it into something useful for the future. Dewey argued that instead, curriculum should be relevant to the learner, by incorporating meaningful cognitive and social experiences whereby learners construct their own conceptual understandings.

Vygotsky (1978) asserted learning experiences are connected to the context in which they occur, first on the "social plane and then on the psychological plane" (p 57). Social life was seen by Vygotsky as prior to thought, or cognition. He viewed learners as active psychological organizers of their social experiences and rejected Dewey's and Piaget's notion of individual development. Instead, he made a distinction between the actual level of development of a learner

and the potential level of development, centering this Zone of Proximal Development to explain the experience of learning.

Piaget (1953) primarily focused on experiences of thinking, paying less attention to social experiences involved in learning than Dewey and Vygotsky. Instead, he asserted learning experiences are rooted in cognitive development. He described the process of learning as an adaptive process and continual cycle of cognitive disequilibration and reequilibration whereby learners create new knowledge by reflecting on their physical and mental actions.

Dewey, Vygotsky, and Piaget all described the experience of learning as some form of psychological process involving interactions with their environment, albeit, to varying degrees. In contrast, Gilligan (1982; 2011) asserted human development theories historically portrayed men and women as different. Gilligan argued that psychological theorists, relied on male norms of behavior in studies of human development, focused on the lives of White males and interpreted through the minds of White males. As a result, men were positioned as the dominant gender and women as the subordinate gender, or those who were less morally developed than men (Gilligan, 1982; 2011).

Gilligan's Listening Guide (LG) (Gilligan et. al., 2006; Gilligan, 2015) emerged based on her recognition that the voice of women was largely missing from development theories. Gilligan (1982; 2011) challenged the omission of the experience and development of women by centering women's voices. Gilligan privileged the experience of the individual, specifically women, as a way for researchers to gain an understanding and make sense of participant's "truth" as told through their stories (voice).

I take experience to be a complex construct that includes cognitive, emotional, social, and sociopolitical interactions where voice is a way to gain an understanding of how a person makes

sense of those experiences (Gilligan, 1982). Listening Guide amplifies Gilligan's (2006; 2015) students voice to make sense of their cognitive and emotional experiences. I also attend to dimensions of equity (Gutiérrez, 2009; 2012) to account for social and sociopolitical experiences, to build on the theoretical groundings of Piaget, Dewey, and Vygotsky.

Experience of Learning from a Natural History Ethnographic Perspective

With a natural history approach to ethnography (Erickson, 1982), a researcher examines the experience of learning, as an individual process occurring across times in the learner's environment. This approach accounts for the crucial sequence of events that transpire before, during, and after an individual's learning (i.e., a series of present moments). Rooted in educational anthropology, a natural history approach uses ethnographic methodologies, with two major changes: (a) a shift in focus from the social group to the individual as the unit of study, and (b) redirection from studying the exotic to studying the commonplace.

A natural history approach is grounded in Vygotsky's central notion that human cognitive functioning emerges out of the experience of participation in the reciprocity of social interactions in the classroom environment and everyday life. Erickson contends that cognitive psychologists (e.g., Piaget) attempted to study thinking apart from social and cultural circumstances, while educational anthropologists focused on social and structural aspects with a deliberate avoidance of cognitive functioning. In response, he has posited a theory of naturally occurring learning-task environments, or a natural history approach, to study cognitive teaching and learning, in a way that attends to social, political, and cultural factors in the learning environment, in addition to individual cognitive functioning.

Erickson's approach includes three levels of organization: (1) level I, which includes the general sociocultural system (i.e. sociopolitical experience); (2) level II, which includes the

immediate learning environment (i.e. college algebra classroom); and (3) level III, which includes individual functioning (i.e., cognitive and emotional experience). Erickson centers the pedagogical encounter, or the adaptive transaction between an individual (i.e., level III) and the immediate learning environment (i.e., level II), recognizing the embedded nature of the immediate learning environment within the wider sociocultural context (i.e., level I). He contends that the immediate learning environment should be at the center of the research interest, while considering the other two levels. The levels are not hierarchical. Instead, they are semipermeable, such that Level I and III can be inferred based on what is present in Level II. The relationship across the levels is shown in Figure 3; the dotted lines indicated the semipermeability between levels.

I created this diagram with circles to represent the individual functioning and general sociocultural system to represent the holistic components of those levels. The immediate learning environment is square, to represent the sometimes-boxed nature of a college algebra classroom. The dotted lines between the immediate learning environment and the other two levels indicate information observed in the immediate learning environment give evidence of what can be inferred at the other two levels. The levels are concentric, to represent an individual, within a classroom, within the general sociocultural system all at the same time when experiencing learning in the college algebra classroom.

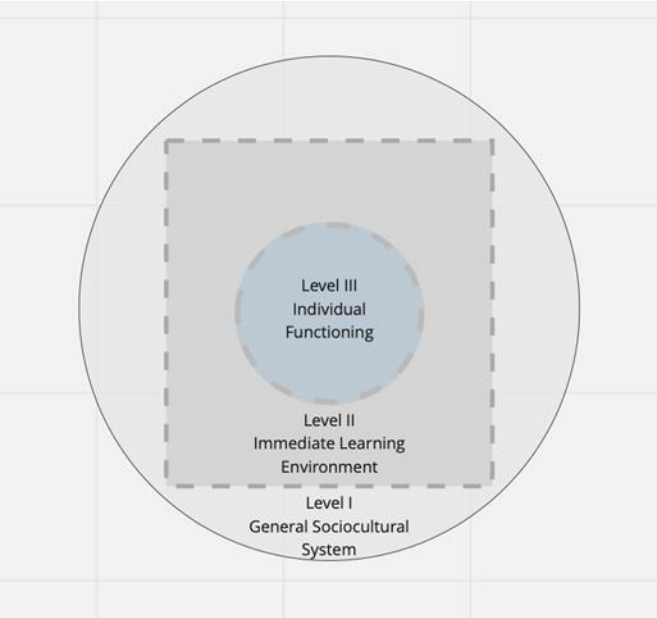

Figure 3 *Relationship Across Erickson's Levels of Organization*

Learning experiences can take place in a group setting, such as a university classroom, but it is the individual who acquires new knowledge and skills in the process, or action of learning. As such, a natural history approach shifts the focus of ethnographic observations from an entire group to center on one individual, while still recognizing the social interactions and social structures that the individual is a part of and also understanding the effect this has on their learning experience. I take the experience of learning to involve an individual who learns (i.e., individual functioning) and recognize this learning does not take place in isolation. Rather, the experience of learning is part of an immediate learning environment (i.e., classroom, home, etc.) which is embedded in a sociocultural system (i.e., school, community, country).

While some scholars posit that experience is best studied through the use of interviews (Clandinin & Connelly, 2000; Polkinghorn, 1998; Webster & Mertova, 2007), I take experience as something that can also be observed, via a human-centered method, such as a natural history approach to ethnography (Erickson, 1982). Interviews can provide a way to understand how the

participant made sense of the experience. Observations allow for the study of experience in real time, in a series of present moments. Equally important to survey, interview, and observational data is a member checking process to ensure all aspects and interpretations of the findings, presented as narratives, are reported accurately, from the perspective of the participants (Carlson, 2010).

College Algebra Students' Math Experiences

Experience is included, but rarely defined, in studies of early undergraduate students' math experience at four-year institutions and community college. Instead, other factors are often taken as a proxy for experience in math learning. These encompass student behaviors (Nguyen, 2015), high school course taking patterns and exposure to previous curriculum (Harwell et.al., 2013; Post et. al., 2010), outcomes, such as course grades after receiving an instructional (Lunsford & Pendergrass, 2016; Hauk et. al., 2015; Mirani & Ramon, 2016), curricular interventions (González-Muñiz, 2012; Boyce & O'Halloran, 2020), and beliefs about mathematics (Hekimoglu & Kittrell, 2010). In all nine of these empirical studies, researchers investigated experience via survey and interview methods, quantifying results in terms of course passing rates. Even if observation methods were used, the focus of the study was something other than moment-to-moment experiences of college algebra students in the immediate learning environment (i.e. classroom).

In two studies (e.g., Nguyen, 2015; Weinstein, 2004) observations were used to build rapport and to invite for an interview, rather than being conducted for the purpose of observing, documenting, and analyzing the in-class moment to moment interactions and occurrences of experiences. In another study, Weinstein (2004) studied the experience of remedial college students enrolled in basic algebra at a midwestern university with the "intent to give teachers of

introductory college mathematics insights into their students" (p 230). Observations were conducted and used as a way to invite students to interview where they described their experience. Nguyen (2015), also conducted observations, but centered surveys and interviews in a mixed methods study of 613 students enrolled in college algebra at a community college. When experience includes cognitive, emotional, social, and sociopolitical interactions, it is necessary to extend beyond survey and interview methods, to include observations of interactions in a series of present moments.

Despite the paucity of studies centering students' experience in college algebra, researchers have investigated the experience of math majors at both the undergraduate and graduate levels (e.g., Williams et. al, 2005; Borum & Walker, 2012; Jett, 2011; 2016; 2019; McGee & Martin, 2011). In such studies, researchers have centered the lived experiences of students, creating space to hear their "truth" as told through their stories. Yet, absent from these studies are observations of students in classroom learning spaces as experiences are occurring.

Focusing on race, power, identity, and intersectionality, researchers studied the experience of undergraduate math majors and graduate math students (e.g., Acosta et.al., 2015; Chavous & Cogburn, 2007; Jett, 2019). Jett (2019) analyzed the experiences of four mathematically persistent African American men enrolled in graduate coursework. Findings from Jett's case illuminated the racialized and gendered experiences of African American men, which mitigated their mathematical participation, persistence, and representation. Studies such as this could inform the teaching and learning of entry level math courses, such as college algebra, to understand complex aspects of early college math experiences that also may include racialized and gendered experiences.

Several researchers who centered the lived experience of college students (Jett, 2019; Mesa, 2012; Savitz and Savitz, 2010) employed survey and/or interview methods, forgoing field notes or observational data. Mesa (2012) surveyed 777 students enrolled in remedial and college-level mathematics courses at a community college and found students are interested in developing competence, expect and believe they can handle challenging work and generally exhibit positive mathematics self-concepts. Through action research, Savitz and Savitz (2010) developed and implemented what they described as multimodal activities and assessments with the goal of mitigating potential course failure. Survey results from 64 students enrolled in introductory level undergraduate math courses (college algebra and statistics) indicated they felt they learned more in a multimodal environment, as opposed to a traditional lecture environment. Important to survey, interview, and observational data is a member checking process such as Jett (2019) employed to ensure all aspects and interpretations of the findings were reported accurately.

In summary, researchers who have examined the human stories of math learning at four-year institutions, only hint at what might occur in introductory courses, such as college algebra, let alone study the human stories of retaking an entry level math course (i.e., experiences of college algebra survivors). Instead of field notes or observations, researchers have relied on survey and interview data is to study experience. With this dissertation, I aim to address this gap in the literature by employing a natural history approach to ethnography to study college algebra students' experiences, including moment-to-moment experiences in the university classroom and lived experiences expressed via their voice in an interview.

Voice

Using a natural history approach to ethnography (Erickson, 1982), I aimed to center students' voice, to analyze their accounts of their experiences as math learners. I sought to create space to learn about individuals in the systems of the college algebra classroom and the larger university, and with intentional listening to amplify their voices. I intended to make space for their story, their voice, and their experience to be heard, to inform improved mathematics teaching and learning practices. Listening for voices was a way for me to understand and make sense of participants' math learning experiences. Using this approach allowed me to position participants at the center of my research by privileging their voices using their own words.

Voices can serve as a way of learning about the self and the "verbal expressions" of the self and psyche (Sadowski, 2012, p. 80). Voices provide insight into the different ways that participants feel and understand an experience. Each voice represents a different way that participants describe their experiences. That is, an individual may describe a single event or experience in multiple ways and listening to voice can help researchers analyze those experiences.

Voice is a way through which individuals express themselves and their psyche, and their relationship with the world around them. Bakhtin (1981; 1986) focuses on voice as a way through which the living world is shaped, and the dialogic relationship between speaker and listener. Multiple voices exist and interplay within an individual. They come together as a hybrid composition, including voices of an individual's social and living world (Evans, 2008). In this hybrid there exists a lead voice, or the voice that asserts dominance and power over the other voices and is often related to the social voices that others have on the individual.

The voices humans use to speak are impacted by experiences. Voice can communicate those moment-by-moment experiences and memories, but voice may also be considered the absence of sound (i.e., not talking in a classroom). Voice is a way to make sense of power and identity (Gutiérrez, 2013), because humans use voice differently in different spaces and contexts.

College Algebra Students' Voice

There is very little research on student voice in college algebra. Research that does exist involves teaching students how to participate in and access dominant ways of being in math classrooms, including access to achieve without as much consideration for incorporating identity and power (e.g., Jensen-Vallin, 2017; Lerch, 2004). What is missing are investigations of voice that could provide insight into the different ways that students feel and understand the experience of being in a college algebra classroom.

Jensen-Vallin (2017) tacitly considered student voice by teaching students how to navigate resources such as textbooks and formulate questions as part of a flipped classroom that employed inquiry-based learning. Lerch (2004) centered student voice more in her action research study that used pictograms, reflective, writings, protocol transcripts, and interviews, to examine students' belief systems. She examined how four college students enrolled in an introductory college level math course (called elementary algebra, described as Alg 1 at the time) "do" mathematics. Building from Erickson and Shultz (1992), Lerch included voice with the stated purpose "to prepare students for success in mathematics we as educators need to understand the process students use to solve homework or examination questions. In other words, understand how they "do" mathematics" (p. 22). However, voice was not the unit of analysis; it was belief systems as expressed through voice. As suggested by Jensen-Vallin (2017) and Lerch (2004), writing and resource navigation are reasonable starting points, but they are not

enough to allow students' voice to be heard. Research informing K-12 education reform has started to account for student voice, although not specific to math reform or college level reform.

Students' voices should be at the center of discussions to improve math education and equity in learning experiences in K-12 (Daniels & Arapostathis, 2005; Pritchard et. al., 2005; Yonezawa & Jones, 2009). Yonezawa & Jones (2009) asserted educational reformers often partner with others to make change happen in their schools, but few reformers look to students as agents of change. They argued that students are an often under-utilized, and yet crucial, educational partner. Daniels and Arapostathis (2005) used voice to examine motivation in alternative high schoolers and found that students identified teachers as those who had the largest impact on their motivation, and that teachers have the power to foster a sense of engagement in students. Pritchard, Morrow, and Marshall (2005) examined student achievement through student voices of their experiences within school and district culture. Those participants who attended schools where students were afforded identity and power, or the ability to see themselves reflected in the school and learning environment and take ownership of their learning fared better than students at schools where these opportunities were constrained. While none of these studies centered math education or college level learning, they could inform attention to students' voices when considering how to improve the teaching learning experiences of college algebra students.

Student voice in the mathematics classroom can be interpreted in two distinct but interconnected ways: (1) through opportunities for students to be actively engaged in mathematical discussions and mathematical argumentation in group and whole class settings. (2) in terms of developing student agency that supports students to feel in control and empowered in their learning (Anthony & Hunter, 2017). An ethnographic approach to examining students' experience in the college algebra classroom attends to both, through observations of moment to

moment experiences involving discussion and agency, and through interviews to gain insight into how students make sense of their lived experiences. This requires intentional listening to students' voices on multiple levels via a targeted analytic technique.

Listening Guide Method

In this section, I discuss the historical roots of the Listening Guide (LG) method of analysis and explain how this dissertation study builds on previous math education studies that employed LG. A final step of the LG method is the creation of I-poems (See Figures 1 and 2) to center participants' voices. I argue that I-poems are a form of storytelling that can counter the dominant narrative and myth that students should just work harder.

Listening Guide Method in Mathematics

LG (Gilligan et al., 2006; Gilligan, 2015) is a method of analysis that enables the researcher to step outside his or her own framework and to understand how another human constructs reality from their experiences. It intentionally provides space to hear those who may have previously been silenced, amplifying the voices of historically marginalized populations (Woodcock, 2010; 2015). It is a voice-focused method for analyzing qualitative data that is applicable to any text or transcript that contains a first-person voice, including diaries, letters, speeches, and narratives.

The feminist and civil rights movements of the 1960s that birthed critical race theory also led to the emergence of the LG method. Gilligan (1982) studied women who were faced with the choice of terminating a pregnancy, just after the Roe vs. Wade Supreme Court decision that legalized abortion. Gilligan (1982) asserted that many women became aware of the strength of an “internal voice” which was previously interfering with their ability to speak. This internal voice told a woman that it would be “selfish” to bring her voice into relationships, that perhaps

she did not know what she really wanted, or that her experience was not a reliable guide in thinking about what to do. According to Gilligan (1982), women often sensed that it was dangerous to say or know what they wanted or thought, upsetting to others and therefore carrying with it the threat of abandonment or retaliation. The internal voice of the psyche and external expressed voice composed the "contrapuntal voice" (Gilligan, 1982; Gilligan et al., 2006). Contrapuntal voices may be opposing (i.e., in tension), complementary (i.e., in harmony) or a composition of voices (i.e. dissonance). In the relationship context of Gilligan's research, the contrapuntal voices of these women emerged, and the LG Method was born.

Researchers have employed the LG Method across a wide range of contexts and projects, primarily in psychology, sociology and political science, involving human experiences of trauma, abuse and survival. Researchers have studied individuals experiencing depression (Jack, 1991; Mauthner, 2002; Gilligan et al., 2003), survivors of domestic abuse (Belknap, 2015), survivors of sexual violence (Smith-Marek et al, 2018), resilient experiences of queer adolescents (Sadowski, 2013), survival processes of people affected by armed conflict (Lugo & Gilligan, 2019), and experiences of women in combat (Daphna-Tekoah and Harel-Shalev, 2014; Harel-Shalev & Daphna-Tekoah, 2019).

"Survivor" may seem like a strong term to use to describe a person who successfully completes a math course, such as college algebra. Yet, researchers have suggested that math classes can be something to survive, across K-12 and college settings. Boaler (2019) used "trauma" to describe the results of students' math learning experience in K-12 schooling, stating "In the United States people are more likely to have a fixed mindset about mathematics than any other subject or area of their lives, and the prevalence of fixed mindset thinking is one of the reasonings we have widespread failure and math trauma in this country" (p. 4). Chang & Beilock

(2016) found that in the US, an estimated 25% of four-year college students and up to 80% of community college students suffer from a moderate to high degree of mathematics anxiety. Through MRI brain scans, Lyons & Beilock (2012) found that even the anticipation of math activated neural regions involved in pain processing, indicating the mere anticipation of math can be experienced as a visceral threat and even pain. Even though students may not experience physical trauma in math, they may experience real psychological pain. LG is a method of psychological analysis that draws on voice and relationships as a way of coming to know the inner world of another person, hence, making it a strong method to use to study how students' experiences in math at the level of individual function (Erickson, 1982).

Listening Guide Method in Math Education

In the field of mathematics education, the LG method has rarely been used, with only two such studies (Hall, personal communication, March 18, 2019). Both Simpson & Che (2015) and Simpson (2015) report results from Simpson's dissertation study; in their study, Hall et al., (2018) used Listening Guide analysis, centering the construction of I-poems (See Figures 1 and 2), to examine students' mathematical identities.

In her dissertation study, Simpson (2015) conducted a narrative inquiry (Connelly & Clandinin, 1990) of 12 middle school students, six males and six females. Simpson examined how voice shapes the mathematical identities of male and female students and how their voices were embodied in different class compositions (i.e., all-female, all-male, and coeducational); they analyzed student interviews using I-poems. Results supported the notion that students' math identity is complex. Extending from Simpson (2015), Simpson and Che (2015) found students' voice, taken as a proxy for mathematical identity, is "an interplay between the local context (i.e.

teacher) and global context (i.e., gender)" (p. 4). They challenged researchers to study identity differently, particularly using I-poems.

Hall et al. (2018) also used I-poems as a methodological tool to examine complexities inherent in students' mathematical identities, one of which they referred to as students' sometimes "contested character." They conducted a study that included interviews with over 120 elementary aged students, to examine students' experiences learning mathematics in Canadian schools. Due to the involved nature of LG analysis, they only analyzed a small number of "interesting" cases, arguing that the method allows complexity in students' identity to be drawn out, but is not feasible for large-scale analysis. Hall et al. (2018) reported on one participant specifically, a 5th grade girl attending a public school, as a "test case" to illustrate the Listening Guide as a viable method with analytical value in the field of mathematics education research, particularly in studies involving students' voice, identity, and experience.

The LG method lends itself to a researcher serving as a participant observer (Kawulich, 2005) in ethnographic studies, because it creates space for discovery, centering the power of students' voice, while actively reflecting on researcher positionality (Cruz, 2013). LG analysis also lends itself to amplifying the individual functioning (i.e., Level III) level of the natural history approach (Erickson, 1982) to ethnography where a learner's cognitive and emotional experiences are centered. This is intended for use with text or script that contains first person voice, including interview data. As such, to examine students' social and sociopolitical experiences (i.e., Level I and Level II) documented via field notes and observations, requires a different type of analysis.

(In)Equitable Experience: Dimensions of Equity

Gutiérrez (2012), drawing from sociocultural theory (Vygotsky, 1978; Cobb, 2006) posited four dimensions of equity of mathematics teaching and learning: access, achievement, identity, and power. These dimensions comprise two axes, the dominant and the critical. Along the dominant axis sit access and achievement. The critical axis is composed of identity and power. All four of these dimensions are important for equitable learning experiences, yet as

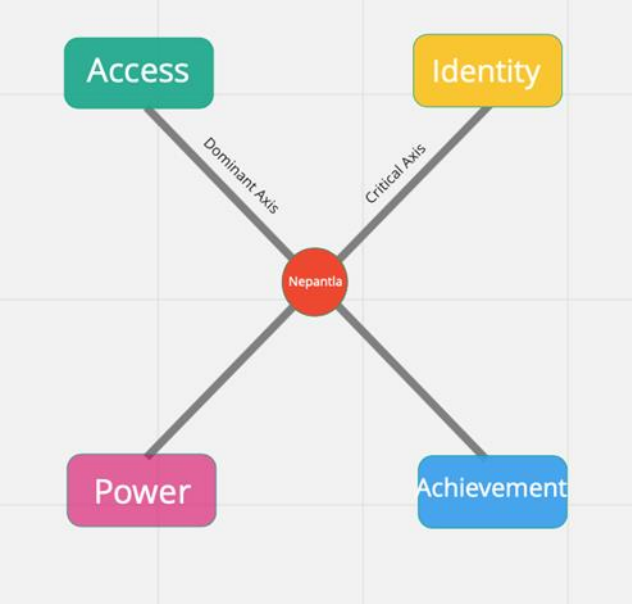

Figure 4 *Gutiérrez's Dimensions of Equity*

Gutiérrez (2013) has argued, often the dominant axis is privileged over the critical axis in mathematics education research and practice. The four dimensions are shown in Figure 4.

According to Gutiérrez (2012), access may be viewed as a precursor to achievement and identity as a precursor to power. In the context of the college algebra classroom, access can refer to the learning opportunities and resources available to students. Achievement, according to Gutiérrez, follows from access and may be viewed as the tangible and measurable outcomes for

students, such as test scores and class participation. The dominant axis reflects the status quo (Gutiérrez, 2009; 2012).

For students, a math identity includes the ability of students to connect mathematics in their lives and to see themselves represented in the mathematics (Dominguez, 2016; Gutiérrez, 2008). When students develop an identity where they are seen and heard in the math classroom, they may be better able to transform their own relationships with mathematics as a discipline, the mathematics classroom, and the world around them. Identity may lead to power and democratic participation (Dewey, 1938) in mathematics and as critical citizens of their world. In this section, I explain each of the four dimensions, beginning with access and achievement (i.e., dominant axis), then identity and power (i.e., critical axis).

Dominant Axis: Access and Achievement

The dominant axis includes opportunities to learn (i.e., access) that lead to measurable outcomes (i.e., achievements) (Gutiérrez, 2012). Experiences can afford access, such as readily available tutoring, and constrain access, such as not being exposed to rigorous mathematical content. Experiences that can afford achievement include successfully passing a quiz and not scoring high enough on a standardized exam to enroll in college algebra is an example of achievement constrained. Gutiérrez (2009) asserted that students learn to "play the game" of mathematics through the dimensions of access and achievement, which taken together, compose the dominant axis of the dimensions of equity.

There is a pervasive deficit framing when considering math achievement of students of color and other historically marginalized backgrounds, perpetuating the narrative that these students are somehow less capable as mathematicians (Adiredja, & Louie, 2020). Achievement gap framing, or "gap-gazing" (Gutiérrez, 2008), is a product of othering (Langer-Osuna & Nasir,

2016). When focusing on students' mathematical achievement with attention to gaps between racial groups, students of color are subordinated while White students are simultaneously advantaged. Markers of otherness can include culture, language, skin color, gender, socioeconomic status, etc. where such markers are measured against White, English speaking, male, middle class, heterosexual norms and experiences. Othering can extend to the math classroom in the form of structures such as tracking and ability grouping, or in differential ways teachers treat students of different races (e.g. Battey, 2013; Battey et al., 2018; Darling-Hammond, 2001).

Gap-gazing can lead to instructional strategies that presume that populations that have been historically marginalized are deficient and need saved to achieve in dominant mathematics (Martin & Herrera, 2007). Furthermore, achievement gap framing can perpetuate myths about students of color, such as the inferiority or deficits in their ability, as compared to their White peers. Gutiérrez (2008) urged researchers to move away from such practices, and to engage in studies that instead focus on the context of learning. Systems that perpetuate the gatekeeping aspects of courses such as college algebra are complex; studying the experiences of students navigating such systems in a university classroom are also complex. A sociopolitical examination of such experiences can illuminate why, an individual student, rather than a broken system, can be blamed for not working hard enough to pass the course.

To promote equitable learning experiences, researchers should attend to the critical as well as the dominant axis. Even if students achieve in mathematics, they might not feel they are mathematicians, or that they belong in mathematics. In a study of 2266 university calculus students, Ellis et al., (2016) found that women's self-confidence led them to leave the STEM

pipeline, even if they achieved. Flores (2007) asserted efforts to document and eliminate the achievement gap are appropriate and necessary, but insufficient because the achievement gap is more of a symptom than a root issue. Lubienski and Gutiérrez (2008) called for a broader focus to address equity that attends to identity and experience, which requires the inclusion of the critical axis. Opportunities to see themselves in mathematics, should come in conjunction with students' opportunities for access and achievement.

Critical Axis: Power and Identity

The critical axis of Gutiérrez's dimensions of equity (2009; 2012) includes power and identity, which are crucial for equitable, democratic (Dewey, 1938) math learning experiences. Power and identity may be afforded or constrained in math learning experiences, although not always in ways in which the student or instructor may be aware. The process of affording or constraining power and identity involves the educator, the students, and the relationship between them, in the context of the classroom (Battey, 2013; Martin, 2000). It is in the immediate learning environment (Erickson, 1982) where issues of identity and power can play out and where connections and conflicts can be navigated by students experiencing them in real time.

Identities are one aspect to consider in understanding how students make sense of their participation in the mathematics classroom. Identities allow individuals to determine which social groups they belong to (Tajfel & Turner, 1986) and whether behaviors are congruent with what it means to be a member of particular groups (Boaler et al., 2000; Oyserman & Lewis, 2017). Broadly, identities are traits and characteristics, social relationships, roles, and group memberships that people use to define who they are or might become (Oyserman et al., 2012). Erickson (1968) has argued that identity formation is one of the most critical aspects of human development.

Students can develop identities specific to math classrooms, which researchers have called math identity. Hodge (2006) described math identity as "a relation between students' ways of participation in the local community and those of the classroom" (p 383). In his discussion of math identity, Martin (2000) included students' perspectives of their own abilities in mathematics, as well as "opportunities and constraints" (p. vii) which could afford or mitigate their participation in mathematics. Building from Hodge and Martin, I take math identity to include relational interactions and how one makes sense of their abilities, including opportunities and constraints that exist to participate in mathematics. Relational interactions can be accounted for in social and sociopolitical (Gutiérrez, 2009; 2012) experiences in the immediate learning environment (i.e., Level II) and general sociocultural (i.e., Level I) system (Ericson, 1982) while how one makes sense of their abilities and participation in the mathematics can account for at the level of individual functioning (i.e., Level III), and can be expressed through voice.

Mathematics, as a subject domain, is not cultural, without context or purpose. Yet, many students perceive school mathematics to be a narrow set of rules and algorithms that have little or no meaning to their lives (Martin et al., 2010). When students' experiences include opportunities to see themselves in the mathematics, they are afforded opportunities to feel heard, seen, and valued without having to downplay or hide aspects of who they are or how they identify (Dominguez, 2016; Gutiérrez, 2008). Such experiences afford the equity dimension of identity. In contrast, forcing students to speak only English or not allowing them to use algorithms from other countries are examples of constraining identity. Identity can be thought of as a precursor to power, where power takes up issues of social transformation (Gutiérrez, 2012a). Gutiérrez (2009) asserted that educators could teach students to "change the game" by attending to the "critical axis" composed of the dimensions of identity and power. This means acknowledging

students' frames of reference and resources in ways that help build citizens who can critically analyze the world; it is in the critical axis where students can question whose game and for what purpose the game is being played.

Questioning the game is necessary because status and power reveals the political (Leonard, 2008) and non-neutral nature of mathematics teaching and learning (Nasir & Royston, 2013). In addition, to be a tool for achievement gap framing, othering also can be used to perpetuate power structures in math learning systems, including the college algebra classroom. For example, certain ways of talking can be deemed appropriate, acceptable or valued, such as raising your hand or waiting to be called on to be given permission to speak by a person in a position of power, rather than community-based call and answer communication patterns. These power structures guide instructional decisions, design decisions, and ongoing interactions between humans in the classroom. Students who are members of a dominant group possess the cultural capital (Bourdieu, 1977) of the classroom, which includes ways of speaking, writing, dressing, ways of reasoning with tools and symbols, and so forth. Students who do not possess the cultural capital of the classroom can be othered, and this othering may occur without the instructor's awareness.

Dimensions of Equity Addressed in College Algebra Literature

Overall, college algebra literature has focused on the dominant, rather than the critical axis. Researchers have investigated which textbooks to use (Mesa et. al., 2012), game-like ways to study for a test (González-Muñiz et al., 2012), computer-based resources such adaptive learning platforms (Boyce, 2020), virtual lecture videos (Marani & Ramon, 2016), online homework systems (Hauk et al., 2015; Lunsford & Pendergrass, 2016), and modified grading policies and systems (Zimmerman, 2020), all with a goal to increase student pass rates. In other

words, there are many scholars and math educators working to increase access to tangible resources to improve student achievement. Yet, the dimensions of achievement and access operate in conjunction with power and identity, and more researchers need to attend to the critical axis when investigating math learning experiences (Gutiérrez, 2013).

To make mathematics education more equitable, researchers, educators, and policymakers should focus on the critical axis (Gutiérrez, 2013). Some researchers addressed the critical axis by centering students' identity, voice and power, albeit in the context of thinking through how to increase student success. Savitz & Savitz (2010) recognized the first-year college experience to be anxiety-producing, especially for those representing traditionally underserved populations. With a goal of increasing achievement, Savitz & Savitz (2010) investigated students' identities and feelings as math learners in the construction of tangible resources. Researchers should go beyond investigations of student's identity in services of achievement-focused goals, to position the critical axis dimensions as worthy of study.

Writing could be used as a tool to promote students' conceptual understanding (Gay & Peterson, 2014) and provide non-verbal ways for students to participate in math classroom, to allow students opportunities to express emotion and feel in the classroom (Braun, 2014). Gay and Peterson (2014) integrated writing with concept focused quiz questions that focused on sense-making, rather than answer finding. They analyzed student responses from 10 classes and found students' writing provided valuable insight how they were making sense of linear and quadratic equations and systems of linear equations. They asserted that instructors could use this type of information, which may be undetected with other forms of assessment, to make instructional decisions that meet students' needs.

Braun (2014) provided a framework for creating and using writing assignments in college level math courses based on four types of writing: personal, expository, critical, and creative. Braun provided suggestions for instructors who are beginning to implement such student-centered practices such as writing in math, complete with illustrative sample assignments for each type of writing. To elicit student reasoning, thinking, and critiquing, Braun (2014) used "is it possible" type questions as a prompt. Writing and reflecting about mathematics in ways suggested by Braun (2014) and Gay and Peterson (2014), could invite more students into the learning, if instructors created a welcoming space for students to communicate via writing. Furthermore, writing could extend opportunities for students to reason and think, rather than answer-find and rule-follow.

In addition to reasoning and thinking, students also need to be critical questioners (Gutstein & Peterson, 2005; Johnson et al., 2020; Simic-Muller, 2019) of the world. Some college instructor training programs are taking steps to attend to both the dominant and critical access through professional development. The ITSCoRe project has worked to address issues of power within a reasoning-based intervention (Johnson et al., under review). ITSCoRe's face-to-face professional development includes how to implement computer-based activities (i.e., Techtivities) designed to help students learn how graphs work, while simultaneously challenging college algebra instructors to examine their own biases, acknowledging they hold power to amplify/silence students voices. When students have access to dominant mathematics, learned through equity-based pedagogies that attend to identity and power, students are afforded opportunities to question and challenge the status quo. Equitable learning requires attention to both axes in concert and the result is empowered mathematicians.

Nepantla: Towards Empowered Learning Experiences

Access and achievement dominate what most educators and policymakers pay attention to and think matters regarding math learning experiences (Gutiérrez, 2012a). It is the status quo. The critical axis serves to critique the status quo. Nepantla (Gutiérrez, 2012b) is a kind of space, a way of interacting, that recognizes, values and maintains those opposing forces rather than shutting down or resisting. Nepantla is about leaning into and embracing the tension because it is in this space new knowledge is constructed. I take this intersection to be the definition of empowered math learning experiences.

The dominant access is not a precursor to the critical axis. A lack of attention to all four dimensions of equity results in the dehumanization of mathematics learning (Skovsmose & Greer, 2012), or what I mean by inequitable experiences. Conversely, what I mean by equitable experiences is all four dimensions of equity are attended to over time, whereby students are empowered to *play* and *change* the game, or "read and write the world with mathematics" (Friere, 2018; Frankenstein, 2001; Gutstein, 2005). Equitable learning embraces the natural tension that exists between mastering the dominant axis to have the tools to *play the game* of mathematics, while also learning to vary or challenge the dominant axis by *changing the game* (Gutiérrez, 2002; 2009). This is Nepantla, what I take to be empowered learning.

Gutiérrez (2013) asserted mathematics education research must take a sociopolitical turn to include critical axis dimensions of power and identity in addition to dominant axis dimensions of access and achievement in mathematics. This shift in focus privileges voice, power, identity and politics to allow questions about what forms of power and authority are enacted in determining what students learn and from whose perspective they learn, in addition to how students learn math, including college algebra. Adopting a sociopolitical turn means uncovering

the taken-for-granted rules and ways of operating that privilege some individuals and excludes others (Gutiérrez, 2013).

I take students' social and sociopolitical experiences to include access, achievement, power, and identity, amplified with the Listening Guide and the construction of I-poems. It is from the views and voices of marginalized populations, such as Andre and Mary, that those in power can learn from and rethink math teaching and learning structures (Gutiérrez, 2013). Centering students' voice and mindfully listening to understand students' experiences is imperative for math teachers, educators and researchers who aim to improve learning opportunities that disrupt systems of oppression.

Researcher Positionality

The researcher is never neutral, or an "objective" observer (Gilligan et al., 2006). Scholars called for the mathematics education research community to acknowledge the power relations and political acts of mathematics education research (e.g., Aguirre et al., 2017; Gutiérrez, 2013; Lerman, 2000; Martin, 2015; Pais & Valero, 2012; Valero & Zevenbergen, 2004). This includes being transparent about how power, privilege, and oppression may tacitly and explicitly play a role in research of which addressing researcher positionality is important (Cruz, 2013; Milner, 2007).

I enter this study as a White middle-class woman with prior undergraduate experiences as a student in a college algebra course and as an instructor of college algebra at two other universities. Like some of the learners in the course, I am a first-generation high school graduate who grew up categorized as "low-income." I paid my own way through undergraduate school while working full-time to support my two young children. My lived experiences helped to build

rapport as a co-learner in the classroom space, while also working to empathetically observe, examine, analyze and report on their learning experience.

CHAPTER III

METHODOLOGY

I conducted an ethnographic case study (Erickson, 1982) to examine how university students of color experience retaking college algebra, after at least one failed attempt. In this chapter, I describe the research design and methodology. I begin this chapter by outlining the natural history approach to the ethnographic case study I conducted in this dissertation study. I describe the research design in detail before moving to a discussion of the research setting, participants, and cases. Then, I discuss the sources of data for this ethnographic case study and how I analyzed these data to understand students' voices and experience retaking college algebra.

Methodology: A Natural History Approach to Ethnographic Case Study

Ethnography is a qualitative methodology in which researchers observe and interact with a study's participants in their real-life environment (Creswell & Poth, 2016). A case study allows in-depth, multi-faceted exploration of complex issues in their real-life settings (Stake, 2013). An ethnographic case study allowed for in-depth exploration of the complexities of experiencing learning while observing and interacting with participants in their environment (i.e., the college algebra classroom).

A natural history approach to ethnography (Erickson, 1982) involves interactions between a "student" and "teacher" with deliberate teaching to promote learning, shifting from a historical description to short term historical descriptions, and following one student engaging in social interactions and cognitive information in a succession of present moments (Erickson, 1982). I employed a natural history approach to ethnographic case study, because it allowed me

to examine experience and voice in a way that was more complex, rather than compartmentalized.

Participant observation (Kawulich, 2005) is a method of data collection where, in addition to observing an activity or series of activities, a researcher participates in those as well. Participant observation is a key method of data collection for ethnographers, because it allows ethnographers to better understand an experience from the point of view of those involved. With a natural history approach, participant observations allow for information gathering and collection of artifacts of learning experience that become data to infer how students' cognitively, emotionally and socio-politically experience college algebra.

With the natural history approach, Erickson (1982) extended accounts of specificity (McDermott et al., 1978) and validity (Frake, 1981), to what he called a "descriptively adequate account." He contended that accounts must include attention to the individual functioning of the learner, the pedagogical encounter, and the wider sociocultural system. He posited four criteria of adequacy in data collection for a natural history study: (a) specific in detail; (b) accounts for specific, relevant actions of the individual learner; (c) accounts specific, relevant features of the environment including intentions of the teacher; and (d) accounts for changes across time. I used these four criteria as a guideline for data collection to capture moment-to-moment interactions in the series of present moments in which they occurred.

Case study research involves the study of a case within a real-life context or setting and can deal with either single or multiple cases (Stake, 2013). A case study is appropriate when researchers seek answers to 'how' and 'why' questions. Further, case studies require a case, or a bounded phenomenon through which to explore all angles. In this study, cases were bounded, or

limited to, students who were repeating and survived (passed) college algebra in one college algebra classroom on one university campus.

Researchers employ case studies to investigate existing problems to understand, explain, and raise public awareness (Yin, 2011). Instrumental cases (Stake, 2013) can promote a broader appreciation of an issue or phenomenon with the purpose of going beyond the case. This does not mean that instrumental cases are generalizable, rather, instrumental case studies generate findings that are potentially transferable. I report instrumental cases of students who repeated college algebra for the purpose of going beyond these two students.

Case studies may include single or multiple cases. When multiple cases are used, a typical format is to provide detailed descriptions of each case and then present the themes within the case, also known as within case analysis, followed by thematic analysis across cases, or cross-case analysis. In the final interpretative phase, the researcher reports the lessons learned from the analysis. I report the analysis of two cases of college algebra students' experience and voice, first within each case, then across cases.

Stake (2013) cautioned against dissertation research consisting of too many cases, because case frequency can mean that each individual case suffers due to a lack of time to dedicate to the project. Following Stake's (2013) caution, I selected two participants upon which to base this ethnographic case study so that I could focus my data collection and analysis time and effort on the depth required by a case study approach. This move is consistent with ethnographic approaches, such as a natural history approach, because sufficient depth is required to present a holistic view of a phenomenon. By focusing on two cases, I was able to examine the complexities and depth of students' experience and voice.

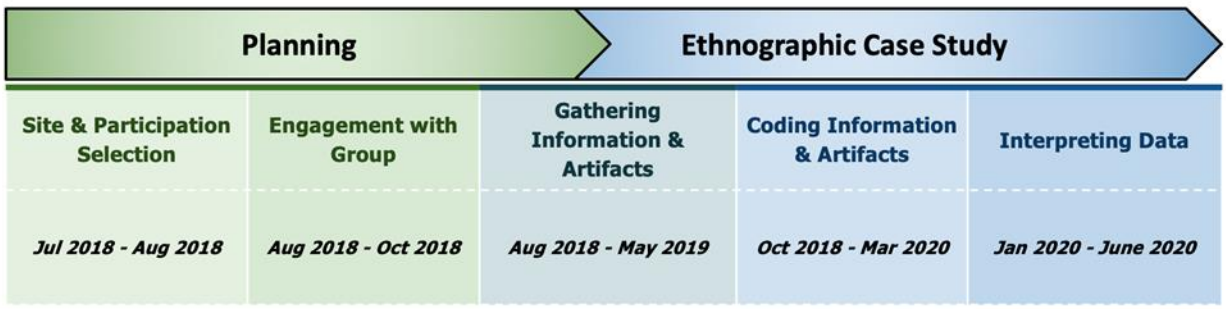

Figure 5 *Research Design and Timeline: An Ethnographic Case Study*

Research Design and Timeline

I followed the research design and timeline shown in Figure 5 to collect information, which became data through analysis, about individual college algebra students' cognitive, emotional, and sociopolitical experiences up to and including college algebra.

Setting, Participants, and Case Selection

Setting

The study was conducted at a U.S. public university, whose campus is in the downtown of a large city. Approximately 20,000 students attended the commuter campus at the time of the study, about half of whom self-identify as a member of a historically marginalized population (e.g., low income, first generation to college, student of color, etc.). During the Fall semester of 2018, the first semester I conducted observations, 44% of incoming freshmen identified as students of color and 51% identified as first-generation college students. Per institutional data provided by the University's Office of Institutional Research and Effectiveness, enrollment in college algebra had even higher percentages of students of color, with 63% self-identifying as such in Fall 2018 and 68% in Spring 2019.

To learn about students' experiences, I conducted participant observations (Kawulich, 2005) in one of several sections of college algebra offered at the university over the course of one academic year. As a participant observer, I observed as a qualitative researcher while also sitting with students and participating in the activities of the group. During the Fall 2018 semester, participant observations were conducted in one of the 11 sections of college algebra and one of the nine sections during the Spring 2019 semester.

The college algebra course met two times per week for fifteen weeks with approximately thirty students in each section and included a lecture and separate recitation component. A graduate teaching assistant, or GTA, was responsible for instruction during recitation, comprising the first 50 minutes of the observation, followed by a 75-minute lecture that was taught by a university faculty member or more senior-level graduate teaching assistant. I attended the class one to two times per week, participating in 20 observations during the Fall 2018 semester and 13 observations during the Spring 2019 semester. The first nine observations in the Fall 2018 semester were part of the ethnographic planning process, which served to orient the focus of the study and to allow research questions to emerge.

The sections I observed each semester took place in the same classroom, located in a newly constructed building. It was equipped with new furniture, wall to wall white boards on two opposing sides of the room, and a podium in one corner that housed a series of technological

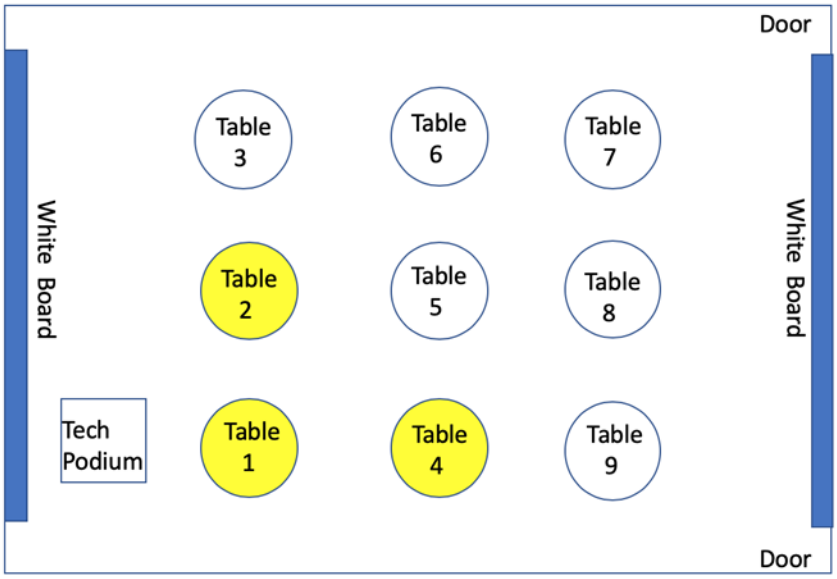

Figure 6 *Floorplan of the Observed University Classroom*

tools to aid in the delivery of lessons, including SMART Boards and audio-visual projecting equipment. Each of the nine round tables were circled by four black office style rolling chairs, making natural space for groups of four students to work together. A floor plan of the classroom is shown in Figure 6. Gaining a sense of the physical space, including table numbers, helps orient the reader in later sections, in which I refer to students' locations in the room, specifically table 1, table 2 and table 4.

Participant Selection

To explain the participant selection process, I mention ethnographic techniques, such as jottings and audio reflections, and return to explain such techniques in a later section. Identifying an instructor to help recruit participants was a vital first step. During the Fall 2018 and Spring

2019 semesters, I observed a section of college algebra taught by the faculty member who also served as the coordinator for all college algebra sections at the university.

To recruit student participants, I worked to build a trusting relationship and rapport as a participant observer in the classroom. I did not want my jotting sheet and constant writing that takes place in ethnographic field work to hinder this relationship building in the beginning. Therefore, I did not take jottings for the first week, instead, I only focused on getting to know the students in the classroom through informal interactions as a co-learner in the space during the first two to three class periods each semester. For example, during the Fall 2018 semester, the GTA and the instructor spent a week building the learning community with a series of icebreakers and "getting-to-know-you" activities. I participated in such activities as a student in the community with the other students and completed audio recordings immediately after each of the first two classes to capture my initial observations, feelings, hunches, and reflections.

During the second week of class each semester, I focused on identifying a table group of students to build rapport as a participant observer. Certain table groups emerged as being on the outskirts of the classrooms. I found myself drawn to a group of students for a primary reason; they seemed to be the least noticed and the least heard students in the room, by my approximation. These students rarely shared their voice in the class, if at all. For example, they did not raise their hand, did not voluntarily participate in class discussions, and would only speak when first spoken to by an instructor or GTA.

While the instructor was making rounds to check work, I noticed certain tables received less help from the teacher and GTA compared to other tables. I often noted these students

waiting in silence to get work checked or receive help while the GTA and teacher were busy assisting other students. As the Fall 2018 semester progressed, I intentionally tuned into a type of typical behavior I called “fly under the radar,” and these were the students whose experiences’ I eventually studied. This attention continued into Spring 2019. The goal of this study evolved to center the experiences of these college algebra students who appeared more hidden, to create space to amplify their voices, and learn from their experiences.

During the Fall 2018 semester, I was drawn to the students seated at tables 1 and 4, and in Spring 2019, at table 2 (Figure 4). I joined each of the respective table groups to observe the interactions of the students with one another at that table, with their peers, and with the instructor. The proximity to these students, three each semester, also allowed me to gain a sense of how the greater class environment was experienced from their physical vantage point.

Case Selection

From the six students who I observed, I chose cases for whom I had a complete data set of participant observations, interviews, and member checks. In Fall 2018, I observed Andre, Justina, and Luis. In Spring 2019, I observed Mary, Ty, and Brad. I was able to interview four students: Andre, Mary, Ty and Justina. My original intention was to interview all six students. However, neither Luis nor Brad participated in their scheduled interview, so I excluded all their other data from participant observation. When I interviewed Andre, Mary, Ty, and Justina, I learned that all except Ty had failed college algebra on a previous attempt. Hence, I decided to narrow my case selection to Andre, Mary, and Justina. Justina was unavailable to conduct member checking, so I was left with a full data set for Andre and Mary only. Because Andre and Mary represented both semesters of observation and were representative of experiences and

voices of the students whom I observed, their cases yielded enough data to address the research questions.

Andre and Mary each self-identified as a person of color. They were both first-generation, non-traditional college students who already held associate degrees and had careers in the health sciences. They worked full-time and attended class part-time and were enrolled in bachelor's degree programs at the time of the study. They were attempting college algebra for at least the second time; Andre had previously attempted the class once, while Mary had three previous course failures. Table 1 presents their self-reported characteristics, including demographics, course load, challenges, and family relationships.

Table 1

Case Study Participant Characteristics

Student	Andre	Mary
Semester	Fall 2018 Passed College Algebra on second attempt	Spring 2019 Passed College Algebra on fourth attempt
Self-reported Demographics	African American	Multiracial, Mexican
	Career goal: Physician's Assistant	Career goal: School Counselor
	First generation college student	First generation college student
	Non-traditional undergraduate age	Non-traditional undergraduate age
	Previously took and failed college algebra at this university	Previously took and failed college algebra (pre-calc) at the community college three times
	Earned AA from a community college, attending university part-time for BS	Earned AA from a community college, attending university part-time for BS
Course load	Part-time status	Part-time status
Admitted challenges as a student	Feeling ill-prepared for college algebra content; balancing being a father; self-funding	Physical disability, being in undergraduate courses in mid-thirties; self-funding; balancing needs of family
Family Relationships	1st medical doctor in family, make proud; father passed away	Takes care of mother, since brother passed away, divorced

Table 2

Sources of Data

Source of Data	Brief Description
Field Work	Audio reflections (three), jottings (27), field notes (23), and memos (three). Field notes, built from audio reflections, jottings and memos, totaled 127 single spaced typed pages.
Student Interview	Interviews followed a semi-structured protocol and lasted approximately 60 minutes each.

Sources of Data

To examine students' complex experiences and voice, I drew from two main sources of data: field work and student interviews, shown in Table 2. In the subsections that follow, I describe the tools and/or protocols involved each source of data.

Data from Field Work

My fieldwork tools included ethnographic audio, jottings, field notes, observer comments, memos, and audio-recorded student interviews. Each fieldwork tool was intended to contribute to the descriptive adequacy of the account of learning experiences.

Ethnographic Audio. Audio-recorded reflections served as a space to process and reflect as a participant observer as needed and were used more often in the beginning of the semester as I tuned into the learning spaces. This is consistent with Espinoza's (2011) description of ethnographic audio files, as an "ongoing social science diary." Audio recordings

were completed the same day as an observation and used to capture my thoughts, feelings, and hunches as a participant observer in a medium that could be revisited and transcribed as needed during ongoing and retrospective analysis. I completed three audio recordings, two in Fall 2018 after the first two observations of the semester, and one in Spring 2019 after the first observation of the semester. Each audio recording was approximately 20 minutes long.

Jottings. Instruments such as computers and clipboards for field work data collection are physical barriers between researcher and participant. During all field observations when audio reflections were not completed, I used jottings (See Figure 7) to capture live moment-to-moment interactions, occurring in a series of present moments. Jottings are four column notes, handwritten without looking at the paper, much like court stenography, intended to capture as much of the live action as possible while events occur without looking away from the action. They serve as a paper form of shorthand commentary. When the paper is folded, only a two-inch by five-inch rectangle of paper is visible to the participants, eliminating the barrier between the observed and the observer as much as possible. For more detail, Appendix A shows a representative example of a full set of jottings taken from an observation during the Fall 2018 semester.

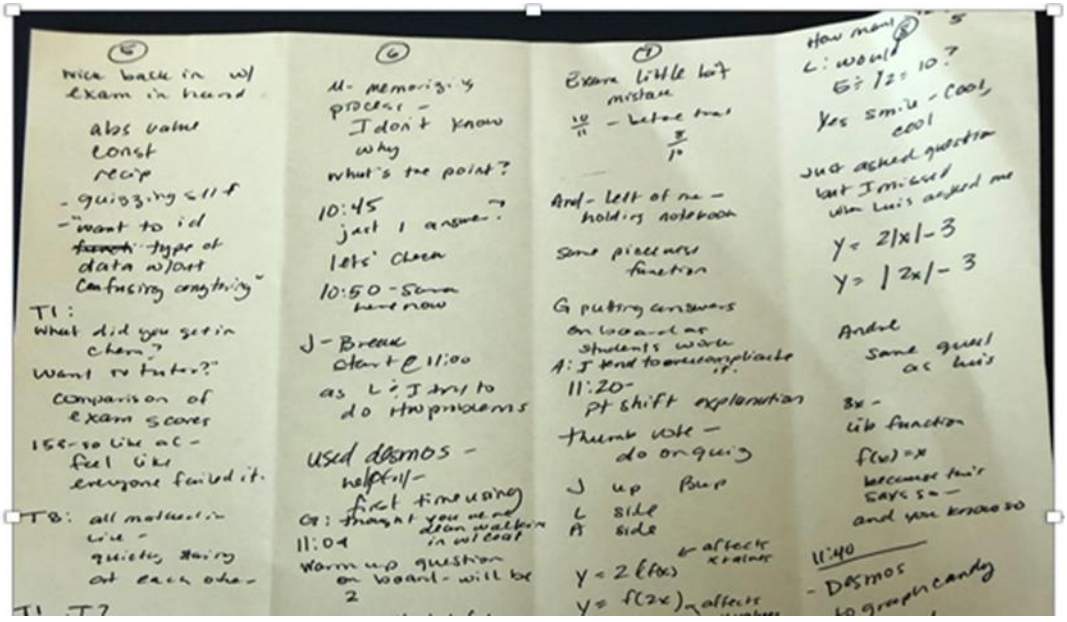

Figure 7 *Jottings: Four-Column Note*

Field Notes and Observer Comments (OCs). From jottings, I crafted field notes to narrate the play-by-play of the observation and included observer comments (i.e., OCs) as a space to wonder, to make hunches, and to begin to interpret and hypothesize about what was being observed. The main body of the field notes read much like commentary, reporting only what was noted in jottings to capture the moment-to-moment interactions and the non-linear live action witnessed in the observation. Field notes could be lengthy; a single two-and-a-half-hour classroom observation generally yielded seven to nine single spaced pages in the final form. I wrote the first draft of a field note the same day as the observation and completed a final version within 48 hours of the observation to allow a natural flow of immediate capture of moments noted in my jottings, while also allowing time to digest and reflect on each observation before finalizing. Over the course of the 33 observations, I completed 23 field notes, totaling 127 single-spaced typed pages.

The day after an observation, while editing and finalizing the second and final draft of a field note, I added and expanded on observer comments, or OCs. All field notes contained several OCs, but their frequency decreased in later observations as my ethnographic observations became more focused. For example, Andre first appeared in an OC several class periods into the semester:

> OC: During class, Andre usually has a laptop or a tablet in front of him at all times. I think about asking if I can take a pic of his notecards, but don't feel I've built the rapport to ask for that yet, given we have never spoken and I've never heard him speak in class, even though we sit just a few feet away from each other. How has he been so "invisible" in class? More importantly, why? I will tune into this more. (Field Note #9, October 02, 2018)

The OCs in the field notes from Fall 2018 helped me focus future observations for the remainder of my time collecting artifacts of experience. Early in Spring 2019, I was actively paying attention to students to whom the instructors paid less attention, and Mary's table group showed up in my field notes by the start of the third observation.

> T2 [Table 2] appears to be finished with the circles task but all are sitting quietly, not talking to each other….Ben from T6 calls Nate [GTA] over for help. T2 is still waiting for Nate to check their work – sitting in silence. Nate goes to T6, passing by T2, seemingly not noticing they are still waiting. It's been about 15 minutes of them waiting...Nate finally stops by, about 20 minutes since this group finished. 20 minutes sitting waiting for the worksheet to start the next step. Nate hurriedly asks, "you have any questions real quick before I go help other groups?" ...Nate quickly answers then walks away without giving time for additional questions or checking for understanding. He sits at another table. (Field Note #18, February 2019)

The 18th field note in the study, seen above, took place over two semesters. It is only the third field note from the Spring 2019 semester. I was tuning in to the invisible learners much sooner the second semester as the OCs in my earlier field notes provided space for me to interpret, make hunches, and ask questions that served as a form of ongoing analysis that focused following observations. Field note narratives and OCs worked together to not only capture the

moment-to-moment happenings of the classrooms, but also to step back from action exposition to pose ethnographic wonderings in the OCs. A completed field note with observer comments from a Fall 2018 observation is shown in Appendix B to gain a sense of how the two ethnographic tools work in a symbiotic relationship together.

Memos. Making meaning in an ethnographic study was a recursive process. OCs could be described as a form of ongoing analysis, whereas memos served to engage in retrospective analysis. This is consistent with Espinoza's (2011) description, "Memo writing is an artificial opportunity to revisit points of interest and write about them at any length that seems appropriate." Additionally, memos allowed a place to document future questions to ask, a way to consider phenomena of interest, and an opportunity to note where I wanted to focus attention in future observations.

I wrote three memos over the course of this dissertation study, all in Fall 2018. They primarily served as an ongoing space to narrow down the focus of the study, to evolve working hunches and later research questions, and to consider how best to study said questions. By October 2018, through the process of memo writing, I had a stronger sense of the research question and analytic techniques. For this reason, I did not complete additional memos during the Spring 2019 semester.

Individual Student Interviews

To go deeper than survey questions would allow, two days after students completed the final exam in the course, I conducted a semi-structured interview to collect participants' oral histories (Plummer, 1983). This allowed for students to describe their lived experiences as math learners up to and including college algebra. I created an interview protocol that was divided into

four categories of questions: (1) *demographics* to get a sense of how students self-identify and see themselves as individuals; (2) *memories* to get a sense of students' previous experiences; (3) *connections to classroom* to get a sense of students' formal school experiences; and (4) *connections to life and future* to get a sense of how students felt math connected to them, or how they connected with math. Each student interview lasted approximately 60 minutes and was audio recorded. Within 48 hours of the interview, I transcribed the audio recording.

Table 3 shows the overarching questions or each category. Consistent with semi-structured interviews, I explored new ideas in follow up questions, depending on what the interviewee said during the interview. The full interview protocol is included in Appendix C.

Table 3
Interviews

Category	Question
Demographics	How do you describe yourself? Who are you? This can include any characteristics or descriptors of who you are as a human actor in this world. How do you identify? This can include race, ethnicity, gender, social class, first generation student, etc. How do you think your teachers would describe you? How would your friends/family describe you?
Memories and Previous Experiences	How do you describe your relationship with math? Tell me a about your journey as a math learner, from as far back as you can remember until now (the completion of college algebra). Are there ways you learned math at home? How do you feel about yourself as a learner of mathematics? Has this changed or remained the same over time? What is your earliest math memory? What is your best math memory? What is your worst math memory?
Connections to the Classroom	How was learning math at home similar or different to learning math at school? Is this the first time you took college algebra? Describe your experiences in college algebra? How do you choose where to sit in a math class? Is that similar/different from other subjects? What is helpful to you as a math learner? What do you wish your math teachers knew? What do you think math teachers should do more of? What do you think math teachers should do less of?
Connection to Life and Future	What need for mathematics do you see in your life, family or work situations? What are your plans/hopes for the future? Anything else you think would be helpful for me or math teachers to know?

Data Analysis

In this section, I detail the data analysis process and procedures I used. In the first subsection, I explain how I analyzed and constructed the case narratives. In the second subsection, I explain how I used LG (Gilligan, 2016) to analyze participants' voice in interviews. In the third subsection, I discuss how I developed and employed the (in)equitable experience analysis method to analyze observational data (field notes). In the fourth subsection, I explain how I constructed a case summary to triangulate findings drawn from interview and observational data. In the fifth subsection, I explain how I conducted cross case analysis. I address member checking across the subsections, and in the sixth subsection, I describe the overall process I used.

Case Narratives: How Do College Algebra Survivors Describe Their Math Experience?

To examine how students described their math experiences, I developed a case narrative for Andre and Mary based on data from their semi-structured interviews. I followed a general guideline to develop Andre's and Mary's narratives. I began each with an identification of who Andre and Mary are; that is, how they identify themselves in the present day. Then, I transitioned to a narrative description of Andre's and Mary's memories of their experiences with math in their early lives. I did this to trace the ways that those experiences may impact their experiences with math today, while being careful to stay close to the data, presenting this narrative free from interpretation or claims of cause and effect. I then addressed how Andre and Mary experience math in the present day. Finally, I included those suggestions that Andre and Mary had for math instructors that they believed would benefit other students.

I used the member checking process to inform the final version of each case narrative. I sought Andre and Mary's input, requesting they amend or confirm anything that they felt I did

not get right in my own drafting. I worked from their suggestions to revise and finalize the case narratives.

Listening Guide Analysis: What Are the Voices of College Algebra Survivors?

To examine how students made sense of their lived experiences as college algebra survivors at the level of individual functioning (Erickson, 1982), I analyzed transcripts from their semi-structured interview using the LG (Gilligan, 2017) method. Listening for voices in interviews is akin to exploring and developing themes, or plot lines (Gilligan, 2017). Gilligan suggests that the LG method of data analysis dovetails with components of other qualitative data analysis methods like thematic and narrative analyses. Unique to this approach, though, is a specified number of listenings – those close readings of narrative data for the psychological processes at play in how participants describe their experiences. Attending to analysis in such a way centers participants' voices and, as Woodcock (2016) suggests, "Provides space to hear those who may have previously been silenced." (p. 1). This also provides a way to hear and understand not just what participants say, but how they say it, in a way that other qualitative data analysis approaches may not uncover.

Step 1: Listening for the Plot. The first listening requires researchers identify overarching themes, or plots, then write a listener's response. This overlaps with other qualitative methods, such as open coding in grounded theory (Strauss & Corbin, 1998) and Interpretative Phenomenological Analysis (IPA) (Larkin & Thompson, 2012). The primary goal of IPA is to investigate how individuals make sense of their experience. In listening for the plot, I listened to hear how the student made sense of their experiences as a math learner up to and including college algebra. The 'sense making' I listened for became the plot lines.

As I listened for the plot, I also worked to gain a sense of the larger social and cultural context in which the stories being told were experienced. In borrowing from Strauss and Corbin (1998) and Larkin and Thompson (2012), I focused on generating memos about the plot. These memos included those aspects of the interview germane to the research questions, any new ideas that emerged, or those statements that underscored the plot of the narrative.

Because the researcher is never neutral, or an "objective" observer (Gilligan et al., 2006) an important part of step one, that differs from open coding, requires the researcher to locate themselves in relation to the transcript; to create space for the listener to explore their own thoughts and feelings about the person they have listened to and the material gathered. I did this by noticing and reflecting on where I found myself feeling connected with students' stories, noting thoughts, emotions, why I think I was responding in such a way, and how all the above might affect my understanding of their experiences. This is like the need for a therapist to identify emotional reactions they may be having in response to a client so as not to interfere with her ability to listen to and ethically provide therapeutic services.

Step 2: Listening for the "I." The second step of Listening Guide analysis further amplifies the student's voice. It gives insight into the first-person voice as it speaks of acting and being in the world through the construction of an I-poem (Gilligan et al., 2006). This step serves two purposes—to press the researcher to listen to the participant's first-person voice and to hear how this person speaks about him or herself.

In the second listening, I read the transcript of students' interviews, underlining every first person "I", along with the verb and any seemingly important accompanying words, maintaining the sequence in which the phrases appear. For example, to construct an I-poem from the passage show in Table 4, I underlined "I", "me" or "my" statements, followed by key words or phrases, maintaining the order of the words as spoken by the student. I then lined up underlined phrases, in order, like lines in a poem.

Table 4

Construction of an I-Poem

So, ya know, I come to this university and the last class, math class was two years ago And so I come into this class, and ya know, this is a university so they have higher expectations and standards for their students to come in and have already been exposed to this knowledge. And, ya know, that's not my background right now. And there's still a lot of things I can be proud of, as far as my adapting to the material, my learning, my grades improving, but, it's a lot. It's a lot of a learning curve, especially, I've gotten here all by myself, really.

I come to this university
I come into this class
That's not my background right now
I can be proud
My adapting
My learning
My grades improving
I've gotten here all by myself

Step 3: Listening for Voices. Step three prescribes listening to the text again, but this listening is intended to listen for the counterpoint, or the multiple facets of the story being told with the interplay of voices. Each voice can be thought of as a different instrument in a piece of music where one listening may draw the ear to the lead guitar, another to the drums, another to the lyrics, and yet another to the combination of the instruments that when combined, produces an entirely different listening experience in the form of a song with meaning.

Listening steps one and two amplify the first-person voice of the speaker and provide context for the third listening, where the listener begins to identify, specify and sort out different strands in the interview (Gilligan et al., 2006). From listenings one and two, different voices in

the students' narration of their lived experiences begin to emerge. Listening step three allows listeners to further tune in to hear what voices were layered within students' experiences.

At the start of step three, I named and defined the voices I heard. To name and define these voices, I listened for keywords, ideas, and patterns that participants used to describe their experiences. Listening to these words and phrases was like exploring data for themes. I examined how participants used these words and phrases in context and to describe their math experiences. I used participants' words to name these voices when possible, but in other cases I used a word that described an overall sentiment expressed by a participant or participants. For example, both Andre and Mary explained the hard work they put in to succeeding in and passing college algebra in multiple places in each of their interviews. These statements, taken together, represented a larger concept of determination, so I titled this the "Voice of Determination."

After identifying categories of voices, the third step of the listening guide method attends to the contrapuntal voice. Contrapuntal voices may be opposing (i.e., in tension), complementary (i.e. in harmony) or a composition of voice (i.e. dissonance). This step allows the researcher to hear the relationship between the participant's first-person voice and the contrapuntal voices. To do this, I returned to students' transcripts and listened for each category of voice that emerged in the first part of this third step. I listened for each category separately, then together with its contrapuntal, to determine how the voices occurred together. In cases when I heard two voices together, I titled these voices co-occurrences with one voice, which later became a composition of voices. Mary, for example, spoke in a voice of hiding and a voice of being noticed. These two contrapuntal voices spoke in dissonance, and so I titled the composition of these voices as the voice of visibility.

Step 4: Bringing Listening Parts Together. The fourth step of the listening guide method involved bringing the three listening parts together to synthesize what has been learned about the participant in relation to the research question(s). Important to this step is an interpretation of the interview in such a way so as "not to reduce or lose the complexity of a person's expressed experience" (Gilligan et al., 2003, p. 169). Building from Gilligan's (2015) prescribed four step process, I added two sub steps as I brought the listening parts together: a voice map and an extended I-poem.

To illustrate the complexity and interplay of participants' voices, I constructed a voice map to show how I made sense of the relationship between participants' voices. I extended Simpson's (2015) voice maps to show the relationship between contrapuntal voices, including harmony and tension. I also included arrows to indicate the direction of influence one voice had on another and used relatively sized circles to indicate the volume in which I heard the voices where the loudest voice (i.e., lead voice) was shown with the largest and the quietest voice was indicated by the smallest circle. A hypothetical voice map is shown in Figure 8.

Figure 8 *Hypothetical Voice Map*

I also created an extended I-poem as I brought the listenings together. I did this by piecing together smaller I-poems I created during analysis, maintaining the order in which the passages appeared in the participant's interview. The extended I-poems were a representation of the interplay of all the participant's voices, like a song composed of multiple verses, with a chorus (i.e., lead voice), harmonies and tensions in the music. The voice maps could be thought of as an album cover and the extended I-poem as the lyrics of a song with deeper meaning.

The LG analysis described in this section centered Level III analysis (Erickson, 1982), because it focused on the individual's cognitive and emotional experience. To center Level I (general sociocultural system) and Level II (immediate learning environment) required analysis that focused on the social and sociopolitical experience in the classroom. This demanded a different analytic technique, which I explain in the next section.

(In)Equitable Experience Analysis: How are College Algebra Survivors' Access, Achievement, Power and Identity Afforded or Constrained?

Students sitting in the same college algebra classroom can have fundamentally different experiences of learning. To analyze those experiences, I developed a technique which I term (in)equitable experiences analysis—(I)EEA. I use (in)equitable to include equitable and/or inequitable experiences. Gutiérrez (2012) posited four dimensions of equity: achievement, access, power, and identity. I used those dimensions to guide this technique, providing me a way to describe the context of students' learning.

With my application of this technique, I chose to analyze field notes for instances in which I wrote specific observations about the study participants. I acknowledge that the source of data is a view of student experience through my lens as a participant observer, as documented in field notes. To maintain the integrity of the account, I build field notes from jottings, which I used to document moment-to-moment interactions in the classroom as they happened (See Descriptively Adequate Account). Additionally, participants were able to review my jottings, field notes, and analysis documents throughout the study, providing their voice in the analysis process as well (See Member Checking).

The (in)equitable experience analysis occurred in three rounds. In the first round, I identified the occurrence of the four dimension(s) in passage of participant observation field notes. In the second round, I reviewed each occurrence to determine whether the identified dimensions of achievement, access, identity, and power were afforded or constrained. In the third

round, I created an (in)equitable experience map of each participant to illustrate the overall set of data.

In all, there were 58 passages for Andre and 41 passages for Mary that served as sources of data. For each participant, the passages spanned the entire semester. While I described coding for individual dimensions, a single passage could have more than one code, as passages were often in the form of a paragraph in which multiple complex experiences were happening at the same time. Next, I explain each of the three rounds of the technique, using excerpts from field notes to illustrate.

First Round of (I)EEA. The first round involved identification of the occurrence of different dimension(s) in each passage of participant observation field notes. I read each passage and determined if it provided evidence of access, achievement, identity, and/or power. I assigned the access passages the code ACC, the achievement passages the code ACH, the identity passages ID, and the power passages POW.

For the dimension of access, I analyzed for participants' opportunities and tangible resources for math learning. Examples included field notes in which participants discussed attending office hours or working in class on Techtivities. For the dimension of achievement, I analyzed for participants' measurable results. Examples included field notes in which participants received a low grade on an assignment. For the dimension of identity, I analyzed for how participants viewed math in the context of their lives, such as their career goals. Examples included field notes in which participants connected mathematical modeling with medicine dosages. For the dimension of power, I analyzed for participants' voice, including whose voices are privileged or marginalized in the classroom and/or society. Examples included field notes in which participants asked questions in class and instructors either responded to their

questions or did not answer. At the end of this round, I had four lists of all data related to access, achievement, identity, and power, respectively.

Second Round of (I)EEA. The second round of (I)EEA data analysis served to determine if each passage was evidence of the dimension being afforded or constrained. In instances where those dimensions were afforded, I added a '+' by the code, and in instances where those dimensions were constrained, I added a '-' by the code. If an instance identified in data was an affordance of achievement, for example, that passage received an ACH+. When and where I identified instances of instructors supporting students, I coded for affordance. For example, if a student felt welcomed going to office hours, this presented a situation when that student was afforded access. I coded for constraint when participants' achievement, access, identity, and power were hindered. For example, if a student felt that the instructor paid more attention to other students that would be a constraint of both access and identity. I started with access and followed the same process for coding each of the remaining three dimensions, achievement, identity, and power.

Third Round of (I)EEA. In the third round, I analyzed the overall (in)equitable experiences of the participant as a unit by creating an ethnographic thesaurus and creating an inequitable experience map of each participant. I created an ethnographic index and thesaurus (See Appendix D) for side-by-side consideration of evidence of each dimension being afforded and constrained and an (in)equity map to visualize the coded passages from the field notes. A hypothetical (in)equity map is shown in figure 9. I placed a single dot on the axis based on my analysis of the overall amount of affordance or constraint for each dimension – the greater the affordances relative to the constraints, the closer to the Nepantla.

If affording and constraining experiences were about the same, I placed the dot on the border between the two concentric circles. I placed the dot further out if the constraints were greater. The closer the dot is placed to the origin indicates the closer to the Nepantla, which represents a constructive and empowering, or in other words, an equitable learning environment for students. The further the dot is placed, the more constraining the students' experiences as a math learner, or inequitable. The size of the dot used to represent each dimension is also significant. A larger dot indicates there was frequent evidence, a medium dot indicates there was occasional evidence and a smaller when there was rare evidence in my field notes of a given dimension.

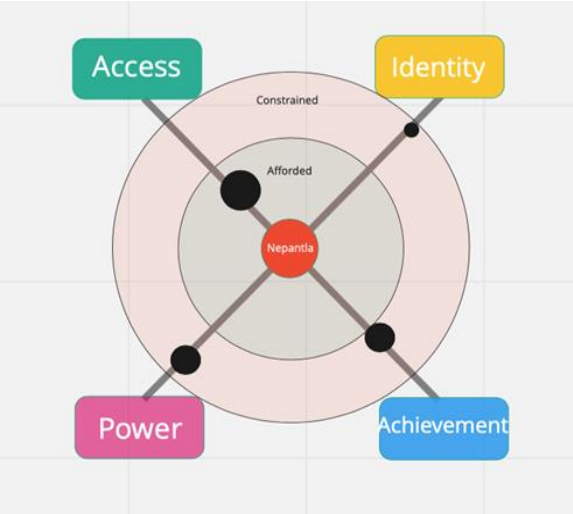

Figure 9 *Hypothetical (In)Equity Map*

(In)equity maps provide a way to visualize what empowered learning means. Figure 10 is an example of an (in)equity map I created to illustrate what an equitable learning experience would look like, where all four dimensions are afforded with ample evidence. This is also what I would refer to as empowered learning; where students are empowered with access to dominant mathematics to critically challenge the status quo.

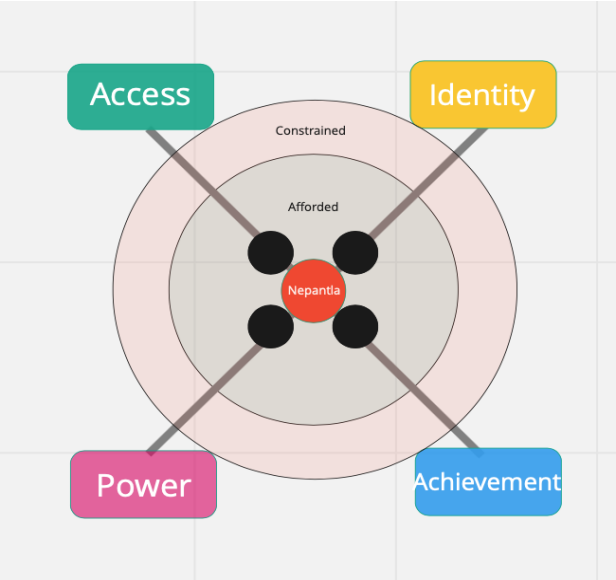

Figure 10 *Empowered Learning Illustrated in an Equity Map*

To vet these codes, I engaged in intercoder reliability. Another graduate student, who served on the larger ITSCoRe project, conducted a round of independent coding based on my directions for following the three round process above. We then met to discuss codes. Doing this served two purposes. First, this helped me to confirm the accuracy of my own coding, as reliability can be established when two independent coders arrive at similar conclusions when exploring and analyzing the same data set. Second, areas of discrepancy where the other coder and I did not agree on the coding provided more opportunity for analysis and reflection, and adjustment of the coding if necessary.

Case Summary: Triangulation

Through LG and (in)equitable experience analysis, I examined the individual, within a classroom, within a general sociocultural system. These data sources required triangulation to understand the experience of college algebra survivors, which will ideally mean that there is

some level of consensus, or convergence, reached across all data sources. However, one reason why participant observation as an ethnographic research method is so important is because it allows researchers to see discrepancies between what people say they do and what they do. That is, a participant observer may be able to see an experience in a way different from how people describe that experience. Triangulation is critical to uphold the trustworthiness of a study, but when data are divergent, these differences may present new opportunities for inquiry.

To triangulate students' experience and voice, I constructed a case summary that served as a synthesis of each participants' voice and (in)equitable experiences as a math learner. I reflected on the relationship between the narrative of students' experiences, the voices I heard in LG analysis and the (in)equitable experiences I observed in the immediate learning environment. This allowed me to return to the interview transcript to examine students' ways of making sense of their experience through their voice and to return to my field notes to examine interactions in the immediate learning environment. The case summaries, then, are a summary of what I understood of the human experience of surviving college algebra as I listened to the deeper meaning of the words and voices of Andre and Mary.

When creating the case summaries, I paid attention to those differences, or discrepancies, between data from field notes and data. I examined field notes and interviews for confirming or disconfirming evidence of results found from LG and (I)EEA analysis, respectively. When this occurred, I made a note in the table, because these discrepancies pointed to areas that required deeper consideration and analysis. An example of such a discrepancy would be if a student

performed poorly on a class assignment but described themselves as being very good at math in their interview. I weighed these discrepancies to account for complexity in experience and voice.

Using interview data, field notes from participant observation, and voice, I also created a brief vignette for each case, or participant during the triangulation process. These vignettes are a montage, or a mixtape of sorts, that combine what I heard through LG analysis and what I found through (in)equitable experiences analysis. This vignette provided a composite of the total math learning experiences for each Andre and Mary, including those equity affording and constraining experiences, centering the I to summarize their experience and thus amplifying their voice. In these, I considered the way that experiences in the classroom may have been similar to or different from participants' accounts of these experiences.

Cross-Case Analysis

After analysis of Andre and Mary's data separately, I analyzed these data together in the cross-case analysis. In the cross-case analysis, I examined their narratives, voices, and dimensions of equity. I began the cross-case analysis by reviewing Andre and Mary's narratives and noting the similarities. I paid attention to those experiences that they shared, such as an early love of math. I also examined the ways that their experiences were different. For example, Andre and Mary shared this early love of math, but different experiences in their lives impacted this love of math. For Mary, the experience of being told she was stupid by a high school math teacher made her dislike math, while for Andre, his struggle to perform well on exams despite putting in hard work and effort robbed him of the joy of math.

In the next step of the cross-case analysis, I weighed the voices I identified from LG analysis for similarities and differences. I noted where there were similarities, like in the voice of

determination that both Andre and Mary used to describe their math learning experiences. I also explored the different voices that Andre and Mary used, which indicated different experiences with math. Andre, for example, used a voice of struggle to describe how he experienced math as something he continued fighting to understand. In contrast, Mary used a voice of self-doubt to describe her own experiences and the fact that she had high expectations of and was hard on herself.

Finally, the last step of this analysis was to explore the similarities and differences in affording or constraining experiences of math learning. For each dimension of equity—achievement, access, identity, and power—I analyzed Andre and Mary's interview and observation data to determine if their affording and constraining experiences were similar or different, and in what ways. I looked, for example, at those experiences related to achievement to ascertain if those experiences that afforded achievement to Andre and Mary were similar, or if, for example, experiences that constrained their power differed in any way. This allowed for looking at the relationship between all four dimensions of equity, not just same axis relationships.

Member Checking: Including Student Voice in the Analysis

Member checking, also known as respondent validation, is the process of including participants in the review of data and results to check for accuracy of the account (Carlson, 2010). I completed member checking with Andre and Mary separately, following the same process with both. First, I met with each participant individually, via Zoom to briefly explain my research questions and purpose for my study. I reminded them of jottings, which they both remembered from field work, and explained how I turned those into field notes. I also explained

that I transcribed the interview and how I used the LG method to analyze their interview, including the construction of I-poems and naming voices. I shared a Google folder with a draft of their narrative including my interpretation of their (in)equitable experiences, their transcript and narrative, I-poems, and description and explanation of voices. I gave them one week to review and comment on the documents. I asked them to consider the following questions as they reviewed their documents: (1) What is your opinion regarding the accuracy of the account?; (2) Does my rendition jive with your memory of the events? If no, why not? And where, exactly, is the point of difference? What do you think of my characterization of you?; (3) What was left out that ought to be included?

One week later I met with each student separately, again via Zoom, but this time I recorded the meeting with their permission. They expanded on any comments or questions they had after reviewing their documents, then we went through each of the four questions above one by one. I incorporated their comments and any adjustments that needed to be into what became the section of analysis I present for each of them in Chapter 4.

Two Cases of College Algebra Survivors

The natural history approach to ethnographic case study outlined in this chapter serves as the overarching methodology to study college algebra students' experience and voice. I present two cases of college algebra survivors; each case is composed of my narrative of the student's experience, and my analysis of each of the student's voice(s), and the student's (in)equitable experiences.. I use Gilligan's Listening Guide method to analyze ethnographic data from interviews and participant observations and the (In)Equitable Experience Analysis method to investigate ways that student achievement, access, identity, and power can be afforded or

constrained in the classroom. Within case and cross case analysis is presented in the next chapter.

CHAPTER IV

FINDINGS

In this chapter, I present findings from this ethnographic multi-case study. Both Andre and Mary are cases of students who passed (survived) college algebra after at least one previous failure. Andre became a college algebra survivor during the Fall 2018 semester and Mary during the Spring 2019 semester. Andre and Mary share an ethos of hard work, despite experiences that constrained their ability to succeed in the college algebra class.

I provide a sense of the college algebra classroom space and energy, then I report each case— Andre's case first, then Mary's case. This is the order they were enrolled in college algebra, and thus the order they were observed in my study (i.e., Andre, Fall 2018 and Mary, Spring 2019). My report of each case contains five subsections. First, to answer RQ1, I include a narrative (Erickson, 1982) of that participant's previous and current experiences as a math learner, drawing on interview data. Second, I answer RQ2 by presenting findings of the participants' voices, which I developed using LG analysis (Gilligan, 2015), drawing primarily on interview data. Third, to answer RQ3, I report findings of participants' (in)equitable experience using dimensions of equity (Gutiérrez, 2002; 2012) analysis technique that I developed, drawing primarily on field note data. Fourth, I include a case summary that triangulates LG and (in)equitable experience analyses. Fifth, I conclude the presentation of each case with a brief vignette as a synthesis of what is learned by listening to each participant. Next, I describe the organization of each of the five subsections of each case.

In the first subsection, I began the narrative with an overview of who Andre and Mary are, or how they see themselves. This included how they view themselves in relation to math and

the college algebra classroom. Then, I described their previous life experiences as math learners, including in the United States K-12 education system, college, and university. I paid attention to those experiences that marked turning points; that is, those experiences that impacted their attitudes toward math and math learning.

In the second subsection, I reported findings from the LG analysis, drawn from interview data. I started by describing each person's collection of voices. Then, I explained what each voice means and how I interpreted it from interview data. I provided representative passages from the interview transcript, with accompanying I-poems, to support my interpretations. Finally, I shared a voice map (Simpson, 2015) and the extended I-Poem (see Chapter 1) to explain the interplay between each participant's voices.

In the third subsection, I presented the findings from my (in)equitable experience analysis. Drawing from observational data, I described those factors that either afford or constrain each participant's access and achievement in math (i.e., dominant axis), as well as their identity and power (i.e., critical axis). I did this to show how, despite Andre and Mary's hard work, their experiences as math learners and success in college algebra are impacted by social and sociocultural factors, resulting in (in)equitable experiences.

In the fourth subsection, I included a case summary, to triangulate findings drawn from interview and observational data. I reflected on the relationship between the voices I heard through LG analysis and the (in)equitable experiences I observed in the immediate learning environment. I concluded with a synthesis of each participant's voice and (in)equitable experiences as a math learner.

In the fifth subsection, I culminated each case with a vignette, to close my relationship with Andre and Mary formed through my observations, my interviews, and my analysis. The vignette is my synthesis of Andre and Mary as humans—my understanding and interpretation of their voices and their (in)equitable experiences. I chose to write the vignettes in first person to urge the reader to hear Andre and Mary's story in a way that humanizes them as living beings who experienced and survived college algebra.

I conclude this chapter with a cross case analysis, in which I synthesize the narratives, voices, and (in)equitable experiences of Andre and Mary. I note themes, similarities and differences across the cases.

College Algebra Classroom

The two sections I observed were co-taught by three white men—Greg and Jason (fall 2018) and Greg and Nick (spring 2019). All three names are pseudonyms; I refer to them by a first name pseudonym, because they asked students also refer to them by first name only. At the time of the study, Greg was a senior instructor entering his 15th year as an undergraduate mathematics instructor. He received several awards, including the university award for excellence in teaching and outstanding commitment to undergraduate services. Additionally, he served as the university coordinator for college algebra, overseeing instruction and training of GTAs (i.e. Graduate Teaching Assistant) for all sections of college algebra in addition to teaching his own sections. Jason, a fourth year Math PhD grad student, was the TA during the Fall 2018 semester and Nate, a third year Math PhD grad student, was the GTA during the Spring 2019 semester. Both Jason and Nate were the GTA coach in the semester observations were conducted, serving as lead GTA to the other GTA's at the university.

Each class had three parts: a recitation, break, and lecture. Recitations began with a brief, warm welcome, typically followed by a 50-minute group task that students completed at tables while instructors went from table to table to answer questions. Next, there was a 10-minute break that students often voluntarily worked through. This break separated recitation from the 75-minute lecture block. Once a week, there was a 15-minute quiz at the end of the lecture portion of class, and about once per month, there was an exam. Greg referred to quizzes as "mini festivals of learning" and exams as "festivals of learning," always with a jolly smile. Greg led the lecture portion of the class (i.e., the last 75 minutes), and Jason and Nate each led the recitation portion (i.e., the first 50 minutes). In each semester, I observed Greg to work in a collaborative, co-teaching model with the GTAs.

Most recitations consisted of tasks designed to promote work. Tasks were of two main types—Tachtivites and Techtivities. Tachtivities were hands on activities designed for students to complete collaboratively. Figure 11 shows a Tachtivity involving strips of colored paper, to promote groups of three to four students who shared a table to engage in solving mathematics problems together. Three times throughout the semester, students also engaged in Techtivities, computer activities that linked computer animation with dynamic graphs intended to help students learn how graphs work, shown in Figure 12 (Reprinted from Johnson et al., 2020). These tasks during recitation served to preview or review concepts covered during the lecture.

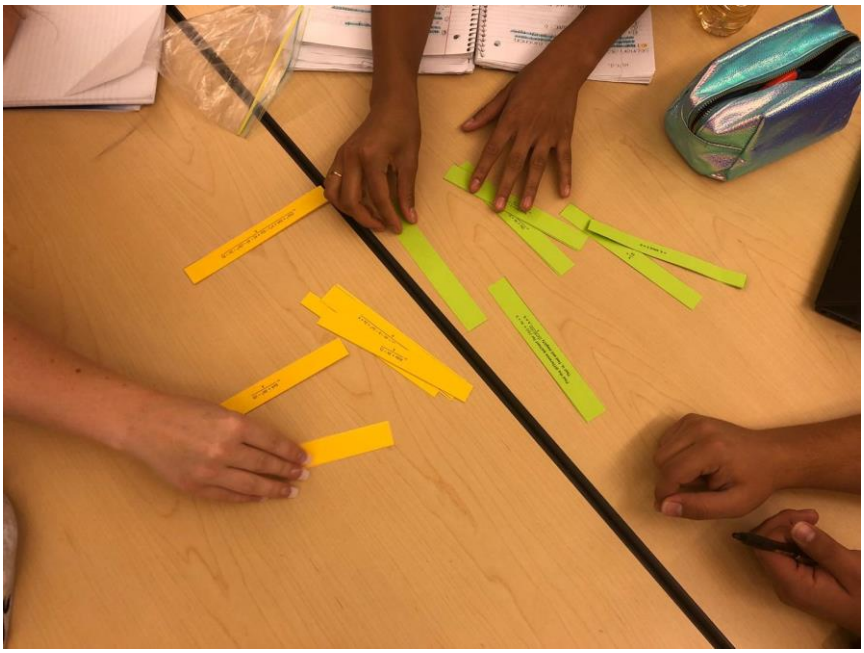

Figure 11 *Students Engage in Tachtivity in a Table Group*

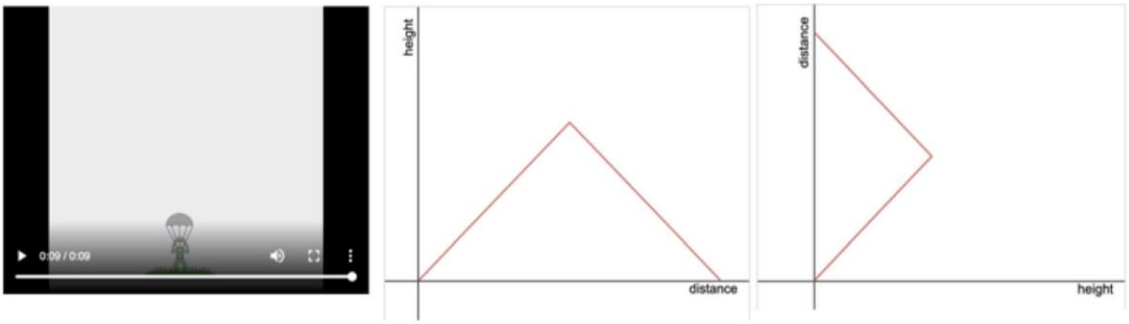

Figure 12 *Cannon Man: A Web-Based Techtivity*

Group work, student collaboration, and conversation also occurred most days in the lecture section of the course. Greg would do most of the talking and modeling of his thinking, while Jason circulated the room sitting with students at tables and assisting as needed. Greg's cheering persona matched his upbeat tone and friendly communication style in conversations and lecture. As the instructor, Greg was in a power relationship with his students that was not one of

equal power. However, he seemed to do things in his interactions that amplified the power of his students and decentered his institutional power. I am not sure if Greg did this intentionally, but I noticed it early in observations and was consistent over the course of each semester. For example, when explaining the cadence of homework, quizzes and exam cycles early in the Fall 2018 semester, I noted the following in my field notes and OCs:

> Greg refocuses the class after the break with "I hate to break you away from your studies. I hear a lot of good math conversations." then transitions into explaining the logistics of canvas and MyMathLab. Greg is in lecture mode now so there is a lot of direct instruction and him talking. "There is a quiz every week and you will always know where they came from. Can anyone remind me of the written homework questions?" (OC: Greg seems to take a one-down power place often with the students). "As long as you do the homework, you can use it on the quiz. Make time for the written homework, those problems show up again and again. The more problems you work, the better you'll get." (OC: This sounds like a behaviorist perspective to learning). "I always get a little math anxiety, especially with a quiz." (OC: Modeling, normalizing, one-down power position). While Greg delivers the lesson, talking and writing at the board, Jason circulates around the room. Greg goes on "you will get good at identifying good methods, the right tool at the right time (FN_1, 8/28/18).

Here, Greg did several things. He affirmed table conversations they students were having were mathematical and productive, he modeled it is ok to feel in math and that he too experiences emotions, he acknowledged math anxiety exists, and he took actions to distribute power with students. In this passage, there were two separate instances of this. When Greg asked, "Can anyone remind me of the written homework questions?" he created space for students to be the knowers of this important aspect of the class routine, rather than giving them orders on where to find these homework questions. When Greg stated, "I always get a little math anxiety, especially with a quiz." he normalized feeling in math while simultaneously decentering his power as an authority whom knows everything; instead, he used his power to give permission to his students to also feel anxious on things like quizzes because the person in a power position in the room also does this.

Greg physically and instructionally took the lead during lecture, standing and moving between wall to wall white boards on two opposing walls of the room while students were seated at tables copying or typing notes as fast as they could. His hand seemed to go as fast as possible with the black marker while his verbal explanations worked to explain what he was writing in real time. Sometimes it felt as if I was watching a tennis match as Greg would quickly move from one board to the other, filling the white board with notes, while including voice overs of what he was writing on the board pausing periodically to answer questions students interjected. Greg seemed to welcome these questions, messaging he wanted students to feel comfortable asking and it was ok to not know or have all the answers. Students could ask questions without having to raising hands to speak, as noted in this passage.

> As Greg is writing each step of a solution involving completing the square, a woman that appears to be Hispanic/Latina asks without raising a hand "is that important to show?" another black man calls "is it important to show those lines?" Greg answers "those are good questions." (OC: It seems this space is an environment where students feel allowed/empowered to ask questions without following compliance norms of raising hands and waiting to be called on). (FN_1, 8/28/18)

Greg created an environment where students had agency in when they could speak - they did not need to secure permission. Most of the time, the question and answers followed a teacher-student, student-teacher voice pattern, with occasional instances of prompting student-to-student discourse. On occasion, Greg re-voiced students' thinking and invited other students into the discussion, seemingly attempting to establish a classroom norm that all humans in the classroom listen to one another.

I provide this description of the lecture and recitation as a backdrop for the case study analysis. The processes, routines and energy of the college algebra classroom I presented in this section are intended to give the reader a sense of the moment to moment interactions that

occurred in the immediate learning environment from my perspective as a participant observer as captured in my field notes. Next, I report each case, Andre then Mary.

Andre

Case Narrative: "I am a Hard Worker; I am a Scholar, Even Though I'm not Supposed to be Here"

Andre identified himself as a hard worker, someone who is dedicated and throws himself into whatever he is involved in, whether as a student in school or as a father to his young daughter. He said he loves the pursuit of knowledge, and described himself as having, "a passion for learning." Andre identified as an African American man, and he is a first-generation college student, though his mother is concurrently working on her college degree.

Andre grew up enjoying math. When he was in elementary school, he enjoyed playing a math video game that helped him learn, but he says that middle school was the last time he remembered thinking that math was "cool." He enjoyed his teachers and their presentation of the material in engaging ways. He felt that his middle school math teachers were patient with students, ensuring that the class understood the material before moving on. Andre had a hard time recalling what math was like for him after middle school. Though he graduated from high school with good grades and some college credits in hand, he did not remember being exposed to math concepts past pre-algebra. He attributed this lack of exposure to the educational environment in which he grew up, where according to him, people were not expected to pursue higher education. He felt that high school helped his personal development but did not expose him to material he would face at the university level because of the low expectations during his high school experiences.

Andre previously completed an associate degree at another university, where he was required to take a math class for his health sciences degree. He earned a B in that class, which was focused on the application of math to health sciences, like drug dosage and half-life calculations. This application of mathematical principles helped Andre understand the importance of math and its applications. However, Andre felt that college algebra rarely connected to his aspirations of becoming a Physician's Assistant (PA) stating, “it’s hard to feel like, oh, since I forgot that formula, I’m going to be a bad PA.”

Andre reported feeling like his teachers noticed that he was a hard worker, when he spoke of “some of my better qualities show in class” during the interview. As a math learner, Andre described his ability to, “absorb as much content and knowledge and push myself to be the best in the class if I need to.” When he needs to be, Andre’s self-described adaptability allows him to be a “passionate math learner,” though he admitted that math was not something he would likely explore beyond his university-required classes. Rather, math served as the only barrier standing in his way to earning his college degree, to reaching his academic and financial goals; “I got big plans,” as he described it.

In the classrooms at the university, Andre sat at the front of all his classes, which is something he had learned to do through experience. “That is where I need to be,” Andre said. Andre reported that he is a visual learner and must see what the teacher is saying and “everything that is going on in the class.” He said that class is “not a game” so he made sure to remain attentive. Andre was also careful not to miss class or be tardy. He believed that turning weaknesses, like college algebra, into strength was ingrained in him from a young age because of societal expectations and his own drive to succeed.

Andre was proud of his performance progression in college algebra. However, he expressed frustration with, “little errors that I am making to get a better exam score,” because he understood where he went wrong when he reviewed his work later. Andre identified as a perfectionist and wondered why he could not avoid making those little errors, “like moving a decimal point,” during the exam.

Andre placed the responsibility for learning the material and passing college algebra on himself, he also accepted responsibility for and internalized failing college algebra for what he thought was a second time. Andre worked hard to pass college algebra on his second try and throughout the semester and on the final exam, which his class grade hinged on. In addition to coming to class every day, sitting in the front of the class, taking copious notes and generating flashcards, attending office hours, and obtaining a tutor, Andre participated in the two-day study group for the final exam and called off of work to give himself extra study time.

Despite his efforts, Andre failed the exam. At the time of his interview with me, he believed that failing the exam meant that he failed the course a second time. When final course grades were posted the following week, he found out he barely passed college algebra and would move onto trigonometry the next semester.

Andre wished that math teachers understood that students come from different backgrounds and levels of experience with math. Andre believed this could be as simple as a student profile sheet provided to teachers at the start of the semester. He wanted math teachers to understand their students as human beings and not just as college students and math learners. He believed if teachers knew their students as humans, they could help students from all backgrounds and previous math experiences connect with math in a way that allows students to see math in their lives.

In summary, Andre identified as a hard worker with a passion for learning, despite many experiences where he felt disconnected from the mathematics, he was expected to learn in college algebra. No matter how many barriers were put in his way, he persisted and took responsibility for his own learning because he was determined to succeed as a first generation, proud African American scholar.

Listening to Andre: Voices of Determination, Belonging, Struggle, and Pride

Through the LG analysis process, I heard four distinct voices in Andre's interview: determination, belonging, struggle, and pride. LG amplifies students' voice, but I use the phrase "I heard" throughout this analysis chapter, rather than amplify, because "I heard" emphasizes "I," as a researcher, am a part of the analysis while acting as a listener of students' voice. I begin with a brief overview of all four voices. In the subsections that follow, I present the voices in order from the loudest, most prominent voice, to the quietest, least prominent voice.

Andre's voice of determination seemed to be his lead voice, or the one that I heard him use most often during his interview, to describe his math experiences and is in direct relationship with all his other voices. I ascribed the voice of determination for passages from the transcript when Andre expressed putting forth effort with a firm purpose or intent to achieve. The voice of belonging was not just a single voice, but a composition of two contrapuntal voices, the voice of the insider and the voice of the outsider. I incorporated these two voices of dissonance in the voice of belonging because Andre expressed feelings associated with being accepted, or not, in the college classroom. Both the voice of determination and the voice of belonging influenced Andre's voice of struggle, which I ascribed to passages where Andre expressed feelings of rejection and experiences of being prevented from achieving. The final voice I heard, the voice of pride, was in harmony with the voice of determination, and in tension with his voice of

struggle. I ascribed the voice of pride to passages where Andre expressed a sense of confidence, self-respect and satisfaction derived from his own achievements.

Andre's Voice of Determination. Andre's voice of determination appeared in the first passage of his interview and continued throughout. When I asked him how he would describe himself, he said:

> Um, I guess I can answer that in two different ways. I am a hard worker. I am a dedicated student, dad, and beyond just that. But I am a scholar, I am somebody that loves knowledge, that likes to learn. I like to challenge myself. That's why I am here. Um, I like school. I like people and I truly just have a passion for learning. Truly (laughs).

This passage evinced Andre's expression of putting forth effort with intent to achieve. He privileged his identity as a hard worker and dedicated student, which I heard as a voice of determination. Later in this passage, he said, "I like to challenge myself." By challenging himself, he could enact his dedication as a student. Below is the I-poem that I created from the passage above:

> I am a hard worker.
> I am a dedicated student, dad.
> I am a scholar.
> I am somebody that loves knowledge, that likes to learn.
> I like to challenge myself.
> I am here.
> I like school.
> I like people.
> I truly just have a passion for learning.

In this I-poem, I hear Andre describe that he was putting forth effort (i.e., I am a hard worker) with a firm purpose (i.e., I like to challenge myself). Andre's effort and purpose drive him to achieve as a scholar and somebody who loves knowledge. His passion for learning continues even in times of adversity.

After this interaction, about three minutes into the interview, Andre talked about his test scores not demonstrating his understanding. He said:

> I understand the material, but, maybe my test scores haven't shown that, maybe, I don't know...a few times I have compared how many points they [instructor] will take off for an answer that I wrote, or a way I wrote it. You know, maybe somebody else got two points and I got, ya know, point 5. So I just want to compare, like, ya know, if I'm doing anything different. And most of the time, I've seen when the other student and I have made the same mistake but they got half credit more than I did.

Next, I asked Andre if he ever talked to the instructor about the fact that he felt his work was not graded the same way as his peers' work. His response is another instance where I heard a voice of determination:

> At this point, I just feel like, ya know, uh, just for me personally, I just have to, I have to be sharper, I have to be, I have to prove that I am capable, or that I understand the work even more so. Uh, ya know, I am not here by chance, I am not here just cuz I fell here. Ya know, I have to work really hard to get here. Ya know, a lot of people that go to this school just feel like 'I was expected to come here.' And that is not the case for me.

Andre placed the burden on himself to work hard and achieve. Instead of discussing his math challenges with his instructor, Andre identified what he needed to do to succeed in math. Using *I have to* phrases, Andre demonstrated that he knew what he needed to be successful. With his voice of determination, he expressed a feeling that if he did certain things that served an intentional purpose, such as working harder, he would pass the class. Below is the I-poem that I created from the second passage above:

> I just feel.
> I just have to be.
> I have to be sharper.
> I have to be.
> I have to prove that I am capable.
> I understand the work.
> I am not here by chance.
> I am not here cuz I just fell here.
> I have to work really hard to get here.

This I-poem highlights Andre's intent to achieve specific to his experiences in his college algebra class. In this I-poem, I hear Andre describe that he was putting forth effort (i.e., I have to work really hard) with a firm purpose (i.e., I have to prove that I am capable) and intent to achieve (i.e., understand the work). The *I have to* phrases, specific to being successful, are a part of Andre's voice of determination, and an example of how it overlaps with another voice: the voice of belonging. I explain this overlap, or harmony in the two voices in the next section.

Andre's Voice of Belonging. The voice of belonging was a composition of two contrapuntal voices: the voice of the insider and the voice of the outsider. Like music, with two melodic lines played at the same time, these voices, Andre oscillated between feeling like he belonged in an academic environment and feelings of being the "other" (Langer-Osuna and Nasir, 2016). I ascribed the voice of belonging to passages where Andre expressed feeling personally accepted/rejected, respected/disrespected, included/excluded, and supported/ignored in the college algebra classroom. When he talked about how he felt his teachers would describe him, I heard Andre's voice of belonging. He expressed a belief that his background experiences were lacking in preparing himself for university level math coursework. About six minutes into the interview he said:

> So, ya know, I come to this university and the last class, math class was two years ago And so I come into this class, and ya know, this is a university so they have higher expectations and standards for their students to come in and have already been exposed to this knowledge. And, ya know, that's not my background right now. And there's still a lot of things I can be proud of, as far as my adapting to the material, my learning, my grades improving, but, it's a lot. It's a lot of a learning curve, especially, since I've gotten here all by myself, really.

Andre did not talk in the first person when explaining that the university has higher standards and expectations for "their" students. Rather, he seemed to speak as an outsider. Although he was enrolled as a student at the university, he did not say the expectations are for

"us," which indicated that he did not see himself as a student for whom the university has high expectations. He saw himself as an "other" and not one of "their" students.

In the very next passage from the interview, I heard the counterpart in his voice of belonging: the voice of the insider. Instead of speaking in terms of being an "other," Andre asserted his will to belong:

> Um (laughs). I'm blessed. (laughs) I'm focused. Uh, and a big part of me just knows I am capable. Just knows I am supposed to be here, that I can do it. That, no matter what, my background, or my previous experiences to be here, I'm here, and I worked a lot harder than everybody else, so, I've been exposed to more experiences in life then they have.

Andre recognized that he belonged, but his belonging came with a caveat. He belonged because he worked hard and was determined to belong. While he heard external messages that said, "you are not supposed to be here" (i.e., voice of belonging as an outsider) a strong internal voice shouted, "I am supposed to be here" (i.e., voice of belonging as an insider). Together, this dissonance is expressed in Andre's voice of belonging. Below is the I poem that I created from the passage above:

> I am capable.
> I am supposed to be here.
> I can do it.
> I'm here.
> I worked a lot harder than everyone else.
> I've been exposed to more.

In this I-poem, I hear both parts of Andre's voice of belonging: the insider and the outsider. The first three lines of this I-poem demonstrate the voice of an insider; he believed he was a part of "here" [classroom]. The last two lines demonstrate a quieter, but still present voice of an outsider; he separated himself "from everyone else [his classmates]." Additionally, this I-poem illustrates how Andre's voice of belonging and his voice of determination worked in

harmony, so closely intertwined when he spoke, they almost sounded like one voice. Analysis of the lines of the I-poem illustrate the nuances in these harmonic voices and highlight how they get equal airtime as one speaks then the other. His voice of determination appears in the first line, third line, and part of the fifth line (i.e., I am capable; I can do it; I worked a lot harder...) and his voice of belonging in the second line, fourth line, and part of the fifth line (i.e., I am supposed to be here; I'm here; ..than everybody else). This provides evidence of how Andre's voice of determination influences, fueling, the voice of belonging as an insider.

Andre's Voice of Struggle. The voice of struggle began as the voice of defeat. For passages where Andre expressed feelings of rejection and experiences of being prevented from achieving, I ascribed a voice of defeat. However, during the member checking process, Andre said he preferred the voice of struggle, because he did not feel defeated. To center Andre's voice in the analysis, I renamed all passages previously described as voice of defeat to voice of struggle**.** Andre's voice of struggle first appeared almost 18 minutes into the interview. Just prior to the interview, Andre learned that he failed his college algebra exam, which meant he believed that he would repeat the class again, for a third time. Below, I asked Andre if he passed the algebra class and once he said now, I continued to ask how he felt about a need to repeat the class yet again:

Andre: I didn't.. I have to take it again.

Gardner: You have to take college algebra again?

Andre: Yes.

Gardner: How come?

Andre: I didn't do well enough on the final.

Gardner: You already know that?

> Andre: Ya, Ya. I got my grade back. But, I did so well. And Greg [instructor] and them [teaching assistant], I could tell, just how my grade shifted. Like, I've pushed so hard throughout the semester. To just, basically everything was based on my final. You know, if I got a very high grade on my final, I would be ok right now. And, test anxiety, pressure to perform, pressure to pass, whatever. I even took the two-day study group they offered. I called off of work and everything and I still didn't do well enough. I don't feel like it wasn't because I didn't understand. I don't feel it's, like, because my teachers didn't teach me well enough. I don't feel like it is either one of those things. I just feel like, maybe, I made little mistakes. I don't know. But at this point, I don't even care about seeing the final exam. I am just ready to take the class again and improve upon what I have done.

Andre was grappling to make sense of how and why he failed the class. Using the phrase, *I don't feel* twice, he had a hard time articulating his feelings about his failure. He said, "I don't feel like it wasn't because I didn't understand," using the negative to express his sentiment here, rather than stating something like he felt like he understood. Nor did Andre feel like his instructor was the problem: "I don't feel it's like because my teachers didn't teach me well enough." Andre finally settled on making little mistakes that cost him a passing exam grade.

In this passage, however, Andre shifted very quickly from the voice of struggle to the voice of determination. He said that he did not care, but the defeat in his voice made clear that he did care. Andre's use of the phrase "I don't even care [about the exam results]" implies a shift between the voice of struggle and the voice of determination – an attempt to regain control. "I am just ready to take the class again and improve upon what I have done," Andre said immediately following his statement that he did not care. Andre's voice of struggle frequently appeared with his voice of determination, indicating perhaps that he did not dwell on the barriers, but ultimately used them as learning experiences that provided him the motivation to work harder.

Below is the I poem that I created from the passage above:

I don't feel
I didn't understand
I don't feel
I just feel
I made little mistakes
I don't know
I don't even care
I am just ready

In this I-poem, I make palpable Andre's struggle as he described his feeling about failing the class. I hear a voice of struggle, then determination in the "I don't" statements in this I-poem. This I-poem highlights when Andre expressed feelings of rejection (i.e., I didn't understand) and experiences of being prevented from achieving (i.e., I made little mistakes). This was the only point in the transcript when Andre spoke in the negative "I", using *I don't* and *I didn't.* Hence, in the I-poem, five of the eight lines began in the negative. It was only after the member checking process when I really heard the last line of this I-poem, "I am just ready." This is a voice of struggle, not of defeat.

Andre's voice of struggle was strongly influenced by his voice of determination and his voice of belonging. Andre did not dwell on the barriers or obstacles working against his success. Rather, he used setbacks, such as failing college algebra, as learning experiences that provided for him the motivation to work harder to prove to himself that he belonged. During the member checking process, Andre wrote an email, which provided further evidence of the harmonic relationship between his voice of struggle and his voice of determination. He wrote an email, each sentence on its own line, as shown below:

Voice of Struggle>Voice of Defeat.
Struggle means to move or progress with difficulty.
We struggle, but we also keep progressing with difficulty.
We will not be defeated. (personal communication, 5/21/20)

Andre's four-line email was powerful; I heard and felt his voice. The way he crafted the email was reminiscent of the I-poem format. However, rather than speaking in the "I," he spoke in the "we," as a member of a group. Hence, I created the We-poem shown below:

We struggle
We also keep progressing
We will not be defeated.

The We-poem constructed from his email further amplifies the relationship in his voices of struggle, influenced by his voice of belonging and determination. He may have experienced what I perceived and described as defeat at times, but to Andre, such feelings of rejection or being prevented were better described as a voice of struggle. It is through his self confidence that he draws on as a source of strength in continuing to persist that I heard in a fourth voice: voice of pride.

Andre's Voice of Pride. Andre's voice of pride rarely stood alone. Rather, the voice of pride was in harmony with the voice of determination, and in tension with his voice of struggle. I ascribed the voice of pride to passages where Andre expressed a sense of confidence, self-respect, and satisfaction derived from his own achievements.

About 20 minutes into the interview, I first heard Andre's voice of pride. In the following exchange, Andre talked about his thoughts on the importance of attendance and punctuality as a student:

Gardner: And I believe you missed very few days of class.

Andre: I didn't miss any. Uh huh.

Gardner: So attendance is important to you?

> Andre: Of course, of course! Punctuality, all of that! Especially with this subject because I know math is like, I even intentionally took this class in my first semester at the university just because, it's like, oh, that is not a class that appeals to me so I want to take it first, challenge myself, see what I need to do to get through the class and get it over and done with now because that is just who I am. I took my least favorite class my first semester, and even right now, knowing I didn't pass the class, I feel like I have set myself up for failure because I'm like maybe I should have taken a slower route. But it has just been ingrained in me to turn my weaknesses into strength and that is what I have been doing my whole life.
>
> Gardner: How was that ingrained in you? Where did that come from?
>
> Andre: Experience. Life. Expectations of society of how somebody should be in the classroom setting. And just because I need teachers and everybody to know that I am here to exceed my own expectations. Above all. Above any test grade. Above pass-fail. I am here to prove to me.
>
> Gardner: Do you feel like you show up as you in a classroom?
>
> Andre: Yea (hesitantly). Uh, with some restrictions, (laughs) with some restrictions. But, all in all, I am comfortable with who I am. I know I am loud. I know I can be engaged and get other students engaged with me. I can be friendly. But I can be focused and I can motivate other students too. Cuz my peers thrived and did well. Ya know. Even amongst them. I know they know I know the material. They even looked at my test and be like, oh man! You just made this little mistake. Ya know, even from that, I'm like, ok. It's not that anybody is above or below me. It's like, you're here. Just got to do a little better, I guess.

In this extended passage, I heard several instances of Andre's voice of pride. He beamed as he spoke about his perfect attendance, about challenging himself to take the course he knew would be his biggest challenge first, about showing up for himself—to exceed his own expectations and to prove to himself. Andre also took pride in helping his classmates do well. He believed he acted as a motivating force for his classmates and took pride in his perceived ability to impact them. Below is the I-poem that I created from the extended passage above:

> I know math.
> I intentionally took this class my first semester.
> I want to take it first - to challenge myself.
> I took my least favorite class first.
> Turn my weaknesses into strength.
> My whole life.

I am here to exceed.
I am here to prove to me.

I am comfortable with who I am.
I know.
I am loud.
I know.
I can be engaged.
I can be friendly.
I can be focused.
I can motivate other students.
I know they know.
I know the material.

Through his voice of pride, Andre expresses self-confidence, self-respect, and satisfaction derived from his accomplishments. I heard Andre's self-confidence (i.e., I am comfortable with who I am; I know the material), self-respect (i.e., turn my weaknesses into strength; I am here to prove to me), and satisfaction derived from his accomplishments (i.e., I can motivate other students; I can be engaged).

Like the voice of struggle, Andre's voice of pride rarely stands alone. It is closely tied to his voice of determination, and often shows up in opposition to his voice of struggle or the "othering" aspect of his voice of belonging. With the analysis of the next set of passages, I illustrate this interplay. Andre spoke of his experience retaking college algebra with a voice of pride, specifically the word "proud" three times during the interview. The three passages below appear in the order they appeared within the interview, the first one came early in the interview and the second two near the end:

> I come into this class, and you know, this is a university, so they have higher expectations…There's still a lot of things that I can be proud of, as far as my adapting to the material, my learning, my grades improving.

> I am proud of myself. But it has been a tough last couple of days, to be honest, as far as me not passing, cuz for me, like I work in a career right now. I don't have to be here. I don't have to go further, per se. But, I am not gonna stop. I'm not gunna let this deter me from my goal. I didn't come this far to let math stop me.
>
> I am proud of myself but I know I am capable of doing better. I step back and just go, well, given your circumstance, you gotta do better.

Andre used the word *proud*, a literal signifier of a voice of pride. Interestingly, his statements of being proud were immediately preceded or followed by a "but" statement that seemingly contradicted or opposed the expression of pride in all three passages. This demonstrated how Andre's voice of pride did not exist in isolation, rather, it was closely connected to his voice of determination (i.e, in harmony) and his voice struggle (i.e., in tension). Below is the I-poem that I created from the three passages above:

> I come into this class
> they have higher expectations.
> I can be proud
> my adapting, my learning, my grades improving.
>
> I am proud of myself.
> I am not gonna stop.
> I'm not gunna let this deter me.
> I didn't come this far to let math stop me.
>
> I am proud of myself.
> I know.
> I am capable of doing better.
> I step back.

In this I-poem, there are three separate expressions of being proud. Each time, the voice of pride is preceded by the voice of struggle (i.e., I come into this class, they have higher expectations) or followed by a voice of struggle (i.e., I am capable of doing better). This illustrates how Andre's voice of pride was in tension, or working in opposition, with his voice of struggle. "I am proud" is also followed by "I am not gunna stop." This is an instance of Andre's voice of pride singing in harmony with his voice of determination. During member checking specific to this section, Andre's email comment typified how his voice of pride sang closely with his voice of struggle and voice of determination. He commented "Progression forward, even in failure, is still movement. Discouragement and stagnation will only weigh you now" (personal communication, 6/2/2020). Andre's voices of pride and determination, together, refused to let him be defeated by a voice of struggle or being an outside "other."

Andre is a determined, proud scholar struggling to persist. During the member checking process, Andre read, commented, and shared additional thoughts he had as he reflected on the passages I chose, the voices I ascribed, and the analysis I presented to him. I was nervous to share the drafts of my analysis with him; I wanted to honor him, his voice, and his experiences in a way he would be proud of. Andre, as he often did throughout our relationship as a participant and researcher, took a role of teaching me through his words. Regarding his voice of pride and my analysis of it, he stated "Education, in essence, is about different scholars coming together collectively to share and exchange knowledge." I do not know if I made him proud, but I do know, I am proud to have exchanged knowledge with Andre.

Andre's Voice Map

I created a voice map (Simpson, 2015) to express Andre's voices as an interplay of the voice of determination, voice of belonging, voice of struggle, and voice of pride (See Figure 13).

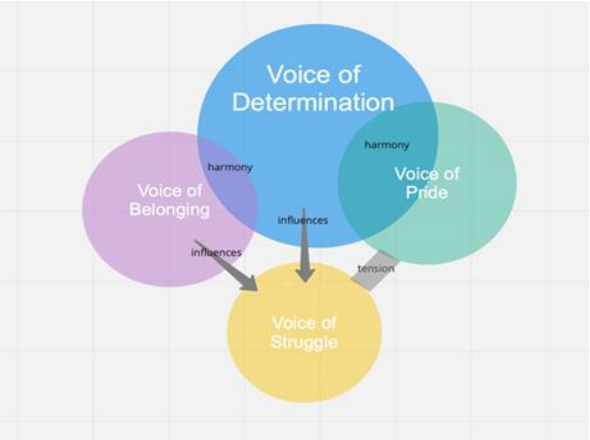

Figure 13 *Andre's Voice Map*

The voice of determination is shown in the largest circle because I consider it Andre's lead voice and in direct relationship with all other voices. This is indicated in the voice mapping, with overlapping circles to represent harmony in voices, arrows to represent directions of influence of one voice to another, and rectangles to represent tension or opposite in voices. In Andre's voices, the voice of determination is in harmony with the voice of belonging and pride and influences the voice of struggle. The overlapping section of the voice of determination and the voice of pride is larger than that of the voice of determination and the voice of belonging, because the voice of pride is more a part of his voice of determination. The voice of belonging also influences the voice of struggle while the voice of pride is in tension with the voice of struggle.

Andre's Extended I-poem

I close this section with Andre's extended I-poem, which I shared in Chapter 1. For ease of reading, I re-paste Figure 1 below.

The words of this I-poem express the human experience of Andre's story of survival as a college algebra student. I have created the extended I-poem by piecing together smaller I-poems I created during analysis, maintaining the order in which the passages appeared in his interview. This extended I-poem highlights the interplay between Andre's voice, where the words compose a song intended to evoke feeling to empathize with and understand his experience. In this song of survival, Andre's voice of determination is the chorus, "I am a hard worker; I didn't come this far to let math stop me." This chorus repeats throughout the song, sometimes sung in harmony with his voice of pride, "I can be proud; I've gotten here all by myself" and his voice of belonging "I am capable; I am supposed to be here." The voice of determination acting as the chorus of this song also influences his voice of struggle "I just have to be; I have to prove I am capable." There is also a small portion of the song, perhaps a single verse, when his voice of pride is in tensions with voice of struggle "I can be proud - I've gotten here all by myself." Together, Andre's voices of determination, belonging, struggle and pride are an upbeat musical composition of his experiences as a college algebra survivor.

Andre's Voice: I am a hard worker; I know I can do it

I am a hard worker
I am a dedicated student, a dad
I am a scholar
I am somebody
I am African American
I am first generation
I will be the first medical doctor in my family

I come to this university
That's not my background
I've gotten here all by myself

I am capable
I am supposed to be here
I will
I know
I'm ok

I actually didn't complete
I didn't..
I have to take it again.
I didn't do well enough

I don't know.
I don't even care.
I'm just ready to take the class again.

I just have to
I have to be sharper
I have to prove that I am capable
I am not here by chance
I had to work really hard to get here.

I never really been exposed to it.
I don't remember even taking any higher maths after my sophomore year.

I come to this university
I can be proud
I've gotten here all by myself

I didn't come this far to for math to stop me.

I know I can do it.
I am excited
I am up for it.
I know this is what
I am meant to do

Andre's (In)Equitable Experiences as a Mathematics Learner: "I Didn't Come This Far to Let Math Stop Me"

Andre's lived experiences include factors that constrained his ability to succeed in the college algebra class despite his hard work. Yet, there were factors that afforded his ability to succeed and eventually pass the course. I use the dominant and critical axes (Gutiérrez, 2012) to organize the presentation of this section. The dominant axis includes the dimensions of access and achievement, and the critical axis includes the dimensions of identity and power. For each dimension, I present evidence of both affordance (+)and constraint (-). The total number of coded passages in my field notes, organized by each dimension, is shown Table 5.

Table 5

Coded Passages of Andre's Experiences by Dimension

Dimension	Total Instances	Code	Instances for each Code
Access	23	ACC+	19
		ACC-	4
Achievement	8	ACHV+	1
		ACHV-	7
Identity	15	ID+	7
		ID-	8
Power	20	POW+	12
		POW-	8

I coded at least one instance of affordance and constraint in each dimension. In my observations, the dimensions of access and power had more instances of affordance than constraint; the dimension of achievement had more instances of constraint than affordance, and the dimension of identity had nearly equal instances of affordance and constraint. The observations took place during recitation, lecture and on the margins of the lesson, before class, after class, or during the 10-minute break that separated recitation from lecture.

Dominant Axis Experiences: Access and Achievement

Access. Andre's access was afforded in the college algebra classroom system, and he took steps to afford himself access as well. I coded multiple instances of Andre's access being afforded over the course of the semester. Andre attended the office hours offered twice per week

by the graduate teaching assistant (GTA), Jason. The following passage was taken from my field notes on October 2, 2018:

> Andre now finished his exam and hands it to Jason, and Jason reminds him of the office hour change too. “Cool, that still works.” I asked Greg who comes to see him during his office hours and he said usually it is people for a one time thing and it is often related to advising or in preparation for a test. Those that attend office hours regularly go to Jason. (OC: It appears Maria, Benjamin, Jacob, and Andre see Jason regularly. (FN_9, 10/2/18)

This passage demonstrated how Jason afforded Andre and other students’ access to math learning. Jason reminded Andre that he was holding office hours, and by doing so, made himself available outside of the classroom to help Andre. Andre had the opportunity to access learning through Jason, if he chose to do so. Beyond Jason reminding Andre of his office hours, Andre used these office hours. This was an invitation to learn, which Andre accepted. For Andre to feel comfortable attending Jason’s office hours, Jason had to have rapport with his students. That is, it was not enough for Jason to simply notify students of his office hours; if students did not trust Jason and the help he could provide, they might not attend office hours. This human connection amplified Andre’s access.

In my field notes, I documented several instances when Jason would remind students about his office hours and on at least two occasions, Greg, the course instructor, posted reminders about math tutoring hours that were provided by university math majors and was available to college algebra students at no cost. These occasions afforded students access to learning because the instructors provided greater opportunity for students to learn and obtain support for math, and enhanced equitability because there was no cost associated with these opportunities.

According to Andre, when he previously took college algebra, the instructor and GTA did not make him aware of office hours or tutoring as resources. In his interview, Andre explained that he felt that Greg and Jason "were more open to helping students like me" than his previous instructors. I observed this "openness," as Andre described it, in the way Greg and Jason communicate about their availability with the class. Rather than simply telling students about their office hours, they would invite students to office hours by saying things like, "Are you coming to office hours today?" These personal invitations happened in smaller group, or one-on-one settings with a seemingly personal touch. Inviting students to office hours in this way sent the message to students they were welcomed and encouraged to come but asking rather than telling honored their power to choose to come or not. Andre seemed to hear this welcome as well, hence evidence of his access being afforded.

During the semester, I noticed several instances in which Andre reviewed flash cards that he made and the copious notes that he took. He would flip through these resources he created during down times in class, such as the 10-minute break between recitation and lecture, to check his understanding and to review the material. I also documented in the field notes instances when Andre worked with his own computer and tablet, which he often used to access an online graphing platform (Desmos), Techtivites (see Figure 12), and to display his online textbook, all examples of access to tangible resources. These times when Andre afforded himself access were important, because he took initiative to do the hard work necessary. He knew what it took for him to learn best and gave himself permission to access learning by creating flash cards and using resources available to him.

Initiating the construction of notecards, then using them as a resource seemed to be a part of Andre's practices in other classes in addition to math. Early in October I made the following entry in my field notes:

> Greg moves to T3 [Table 3, see Figure 4 in Chapter 3 for a map of the classroom tables]. I glanced back at T7 [Table 7] and notice Justina and Natalie are comparing their work from the exam rewrite. Andre turns back to my table to shuffle through his notecards. As he picks a couple up, one at a time, and flips them over, I see that they are hand written/cards each with a library function on the front, and a description of and picture of each on the back. I ask him if he made these in class last week and he said no that he just did it for himself on his own. Andre turns around from his table to his notebook spread out next to me at T4 [Table 4]. I ask him if he makes notecards often. He explains that it is helpful for him whenever he has to remember things and when he wants to quiz him self. I ask if he only does that in math and he says he does it for all subjects. "I want to be able to identify the type of data in here without confusing anything," he tells me. He says "absolute value" to himself as he's looking at a card then flips to the back to confirm. He moves to the next card, "quadratic," checks the back and flips to another card. He is now whispering to himself as he continues flipping through the cards for another minute, then he turns back to T1 [Table 1]. (FN_9, 10/2/18)

As evidenced in this field note, Andre took initiative to provide himself with greater opportunities for math learning. For example, he increased his access to math learning by making notecards. He constructed these self-initiated and made resources to help himself remember algebraic functions and definitions. Further, simply making notecards was insufficient for learning if Andre did not use them. He reviewed the notecards regularly, not as part of an assignment, but because he was motivated to work hard to learn the material and to achieve in the course. This determination and work ethic of Andre as a dedicated student is further evinced by his assertion that he does this for all of his classes and is part of his self-initiated learning experience. The notecards are examples of tangible resources Andre had access to and used, thus access affording experiences.

On occasion, I noted evidence where Andre's access was constrained. On October 23, 2018, Andre arrived late to class and missed part of a class lecture and explanation, as the following passage highlights:

> 10:05 Jason hands out the practice packet for recitation. I notice it [focuses on the math of] complex and imaginary numbers. Jason goes through the first set of questions in his regular Mr Rogers type calm and soft voice. As he always does, he is smiling as he explains and writes on the board at the front of the room. He works through what i, i^2, i^3, i^4 and i^5 equals as well as the special properties of complex numbers. I appreciate the refresher.
>
> 10:20 Andre arrives as Jason releases the tables to complete the rest of the question. T1 is talking about Badblood, an animated movie. T2 and T5 seem to be working collaboratively on the worksheet. Greg is still sitting next to Illiana and seems to be helping her. All the students a T6, T7, T8, T9 have their heads down, working on the worksheet alone without talking. (FN_12' 10/23/18)

This excerpt illustrated the importance of on time class arrival was for the learning experience. Jason consistently began class precisely at 10:00 and Andre usually arrived an hour before class to work out problems with a classmate or prepare for quizzes and tests. However, this day, Andre's access was constrained because he did not make it to class on time (20 minutes late). Andre later explained during member checking he was late to class that morning, not by choice, but due to a personal and unavoidable situation. He did not communicate the reason for his tardiness to his instructors, nor seek their assistance in getting caught up on what he missed, further constraining Andre's access. In these important 20 minutes, Andre missed Jason's demonstration and explanation of the first set of questions in the practice packet. It is reasonable for instructors to expect students to be responsible for catching up when they are late. However, even a quick check in from the instructor could have afforded Andre's access in that moment. This passage was one of the few times I observed Andre's access as constrained in the college algebra classroom.

Achievement. Despite all of Andre's hard work to gain access to the math, I coded observed Andre's achievement being afforded on only one instance in the semester. One instance occurred when he told me about earning a previous degree in a conversation that took place during a class break:

> He talked about previous degrees he earned. Explained he was from [a neighboring state], went to college in [another state] and came out to [city where university in this study is located] because of [university medical school]. "I started as a CNA, got my EMT, I ran crews of nurses, the whole thing. I started at the bottom. But nobody back home doin' this."(FN_13, 10/30/18)

Conversations such as this between Andre and I were captured often in my field notes, occurring at the margins of the classroom before class and during breaks. In this instance, Andre spoke to me about achieving tangible and measurable outcomes in this passage, such as earning a CNA (i.e., Certified Nurse's Assistant) and EMT (i.e., Emergency Medical Technician). Both certifications were evidence of measurable outcomes of achieving degrees and certification and are evidence of achievement afforded. These instances were important for Andre in terms of professional and personal growth and demonstrated how far he came; that despite where he started, he still earned early college certificates and degrees. This passage highlighted Andre's agency in affording his achievement, by demonstrating how much he accomplished, and seems to connect to his desire to continue to achieve and go farther in college algebra, because "nobody back home doin' this." Notably, Andre's determination played a key role in his affordance of his own achievement.

I did not observe instances where Andre successfully achieved tangible or measurable outcomes, such as high marks on quizzes or tests, during the classroom interactions. In contrast, I observed several times when Andre's achievement was constrained. This passage from my field notes described a small group interaction:

> Andre begins talking to his tablemates at T1[Table 1] about how he is afraid to get his exam back, "I just need to know now – need to know if I need to leave or scrap the whole class." Greg is in the area of T1 so Andre takes the opportunity to press Greg for any information on his performance on the exam. Greg simply responds, "you did better" without elaborating. Andre, seemingly somewhat relieved says "ah, gonna get some breakfast on that note." He turns and walks towards the door, making eye contact with me, and says "this stressing me out." He walks out the door before I can respond. (FN_12, 10/23/18)

This passage demonstrated the constraint of achievement for Andre. Andre viewed the exam results as an indication of whether he should continue in the class. Greg did not elaborate on Andre's grade, on the exam, just that it was "better." The onus to learn more about what he did right or wrong on the exam now rested on Andre. Although Andre seemed somewhat relieved, there was tension, perhaps because Greg provided such a short answer to Andre's question. The continued lack of achievement related to math learning manifested in what Andre described as "test anxiety," in a conversation during class a week later.

During a class break, we discussed his anxiety surrounding exam performance; he asked me how best to handle this anxiety. Andre was a self-professed perfectionist who stressed when he made "stupid mistakes."

> Almost out of nowhere, he asks me about how to handle test anxiety. He starts to explain that he makes stupid errors and doesn't know why he does. He shakes his head yes vigorously and his eyes widened as he says, "yes, that is absolutely it! I am a perfectionist and get stressed out whenever I make what I see as stupid mistakes because I know the stuff I just go too fast or something. How do I help that?" (FN13, 10/30/18)

Andre pushed hard to achieve but lacked confidence that he would do well on quiz and exams in class. He attributed his lack of achievement to test anxiety, stupid errors, or going too fast. Although he consistently did not score well on tests, he wanted to continue to learn how to perform better. Although accuracy is important in mathematics, Andre experienced anxiety that arose from mistakes Andre viewed to be "stupid." In a sense, his desire to succeed on quizzes

and exams became a source of something that could help and simultaneously hurt. This is another instance in which Andre shared with me aspects of his personal experiences as a math learner during a non-instructional time.

In this section, I included excerpts from field notes to provide evidence of classroom experiences that afforded or constrained Andre's achievement and access. Importantly, Andre communicated feelings of being an '*other'* (Langer-Osuna & Nasir, 2016*)* or not belonging in the college algebra classroom (e.g., "were more open to helping students like me"). Feeling like an outsider, or other, goes beyond access and achievement. To explore this *otherness,* I look to critical dimensions of equity: identity and power.

Critical Axis Experiences: Identity and Power

Identity. There was occasional evidence of opportunities that afforded Andre's identity. These included the times he seemed to be enjoying himself in class, laughing and joking with others, and times when he spoke of his confidence in himself. On one occasion in class, he asserted he had "proven his ability to himself," confidently stating, "I know my shit and understand things." In the following field note, I noted how Andre was curious to know how the mathematical concept being covered in the lecture connected to his life***:***

> I begin tuning into Greg's lecture on complex and imaginary numbers. Andre slides his chair next to me so quickly it almost startles me. He says, "Question. When in real life we gonna need this?" I realize I don't have an answer to that off the top of my head, so I ask him to give me a few minutes to think about it. I do a quick google search and am reminded they are used in quantum physics, coding, engineering and other technological aspects. I tell him what I found in my google search and he says loud enough for much of the class, "We doin' quantum physics, y'all" Then soft enough for only me to hear, "Ok, ok, that works for me. We young minded, powerful scientist." (FN_12_10/23/2018)

Andre worked hard to understand how the math he was engaging with in college algebra connected to his life. As I analyzed this passage, I realized I had never questioned complex or

imaginary numbers myself; I never searched to see myself in the math the way Andre did, nor did I ask about how it connected to my life. By asking when he would need to know complex and imaginary numbers in real life, Andre sought out identity affording ways to see himself in the math and to see the math in himself. In this moment, he could connect to the idea that by paying attention to the complex and imaginary numbers lecture within the college algebra classroom, he was a young minded—or what I heard as a budding, powerful scientist, and he was okay with that.

There were also occasional instances during the semester when I observed Andre's identity being constrained. In the same conversation that took place during a class break, when he told me "I know my shit and understand things" he immediately followed it up by saying he felt judged by "you know, the way I look, the way I dress, the whole thing." He continued to express a sense of not belonging later in the same conversation as noted in the following passage of a field note:

> I ask him where this sense of urgency and pressure he puts on himself comes from. His response is powerful and surprises me. I am also humbled that he takes the risk to share with me. "I am not supposed to be here. Everybody else is supposed to be here" He says as he scans the room and motions with his left hand, palm up in a sweeping motion. He goes on to explain, "You don't understand. Everybody I grew up with is seriously dead or in jail. I am not supposed to be here and I work really hard to prove that I am supposed to be here." (FN_13_10/30/2018)

The framing of his experience in this way demonstrated Andre's awareness that he felt like an outsider in the classroom, or an "other" who was not supposed to be in this academic setting. I interpreted his sweeping hand to indicate the rest of his classmates' identities were affirmed in the classroom, but he had to "prove" that he was supposed to be "here." He was not automatically expected to continue his education, which led to him to feel like he was not

automatically welcomed as a part of this space. He had to work hard to fight and prove he belonged.

In my field notes, Andre's experiences in relation to the dimension of identity had the least amount of evidence. Much of the evidence I did have related to this dimension happened during side conversations at the margins of the algebra instruction during class breaks or before class started. It seemed learning about Andre as a human and his human experiences happened in more informal moments. Given the opportunity for more of these types of conversations, I suspect I could have learned more about his identity and how it was afforded or constrained.

Power. Along the power dimension of equity, I noted several opportunities that afforded Andre's power in the classroom during the semester, specifically in times when space was created for his voice to be heard while working with Bob, a classmate who self-identified as a white man and a veteran of the army. In my field notes, I documented an instance that occurred before the official start of the class period:

> I watched as Andre and Bob went over the homework problem. Andre stood at the board working it out with a dry erase marker as he talked it out loud to Bob, who was standing beside him nodding [yes]. Andre finished the problem, apparently pleased with his level of understanding, and said he was "cool to work on fractions now." (FN_14, 11/01/20)

Bob often took on the role of peer tutor to Andre during group and partner work, answering questions about the content, homework, or assignments when Andre was confused. When Andre would ask Bob for clarification or help, Bob would never directly tell. Instead, he would ask Andre questions and create space for Andre to think through the work. Andre's voice was privileged in a learning process which Bob, a classmate, often facilitated. In this small group interaction, Andre had space to be heard through shared ownership of the mathematics, affording his power.

Later in the same field note, I documented another instance when Andre's power was afforded, specific to his voice as a math learner and classmate. While completing a Techtivity, I heard Andre explain, "Wow, I wasn't expecting it [the graph] to look like that!" Then, I turned to see his tablemate, Bob, who was covering his ears with his hands saying, "la la la, wait, I want to build it." The two continued to interact together as tablemates while Greg and Jason moved around the room stopping to ask students if they needed help or had questions, but affording the power of the students, including Andre, to be thinkers and communicators of math learning. Such opportunities for students to engage in mathematical discussions during group work afforded opportunities for Andre's voice to be heard, thus affording his power.

I observed Andre's power as being constrained on occasion as well as noted in the following excerpt, which occurred during a lecture portion of class:

> Greg is set up at the front podium continuing his lecture on the candy data as an example for best fit regression in Desmos. In addition to Justina, Andre, and Luis, other students are having side conversations at their tables that Greg picks up on. He says, "I promise you will want to know this for the quiz" In an attempt to direct their attention back to the lecture. It quiets. (FN_9, 10/2/18)

The lecture about candy bars, did not seem to hold the attention of Andre and his tablemates, who continued with a conversation about a homework problem. Greg, to redirect their discussion, declared to the group, "I promise you will want to know this for the quiz." The attempt to direct Andre and his tablemates' attention back to the lecture worked. They listened. Yet, this was evidence of a power-constraining experience for Andre, because he lacked agency in the learning. This was not a typical interaction that pervaded the lecture portion of the class. It appeared to be a one-off experience that happened the same day I also noted "Greg seems in a different energy mood today. He was more low/negative than he normally is. I wonder if something is bothering him personally or professionally."

In this section, I included excerpts from field notes to provide evidence of classroom experiences that afforded or constrained Andre's identity and power. Due to the setup of the classroom instruction, Andre was afforded daily opportunities to work collaboratively and build supportive relationships with his tablemates, namely, Bob. This seemed to play a role in the opportunities for him engage in mathematical discussion and for his voice to be heard.

Andre's (In)Equitable Experiences Map

I created an (in)equitable experiences map to illustrate the relationship between Andre's affording and constraining experiences in the immediate learning environment of the college algebra classroom. This map includes all four dimensions of equity. The concentric circles indicate how each dimension was afforded or constrained. The black dots indicate where a participant's experiences fall on the spectrum of affording or constraining for each dimension. The closer the dots are to Nepantla (Gutiérrez, 2012), the more equitable those participants' experiences are and the more they experience empowered learning. All four dimensions must be afforded for a student to be empowered and for education to be equitable. Andre's map is shown in Figure 14.

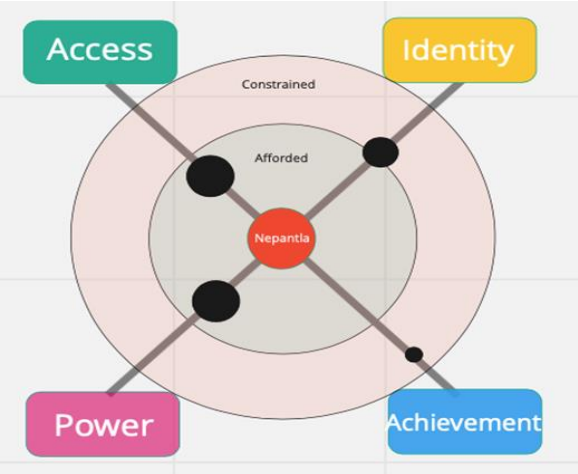

Figure 14 *Andre's (In)Equitable Experiences Map*

The two large circles indicate greater evidence of access (i.e., 23 instances) and power (i.e., 20 instances), while the small circle in the achievement dimension indicates rare evidence of achievement (i.e., 8 instances) in my field notes. The medium sized circle represents Andre's experiences in terms of his identity being afforded or constrained with occasional evidence (i.e., 15 instances). The dots representing his experiences in terms of access and power are closer to Nepantla, or can be described as more afforded, and therefore representative of being more equitable experiences. Conversely, the dot representing his experiences in terms of achievement was further from Nepantla, or can be described as more constrained, indicating less equitable experiences. The dot near the border of the two concentric circles on the dimension of the identity axis represents relative equal observations of his identity being afforded as it was constrained. Taken as a whole, Andre passed college algebra, but his experiences, in terms of the four dimensions of equity, were not all afforded (i.e., near Nepantla).

Case Summary: Andre's Voice and (In)Equitable Experiences

Andre's lead voice, which I heard in his interview, is related to his (in)equitable experiences, which I observed in ethnographic observations. Figure 15 illustrates a relationship

between his lead voice of determination, within the dimension of power, influencing the dimension of access. Voice is an aspect of the critical axis, as indicated by the grey circle transposed on the dimension of power. The pink arrow represents the directional influence of his lead voice of determination, within the critical axis, to the dominant axis where the dimension of access was afforded.

Andre's voice of determination refused to let him be defeated by a lack of access to higher level mathematics in his K-12 experiences. Andre's description of his lack of exposure to math and higher education — his access constraining experiences — is critical to understanding his voice of belonging. He identified as a scholar but described a learning gap that he believed put him at a disadvantage which lead to "a bit of a learning curve" in college algebra. This is evidenced by previous constraining experiences, in the form of lack of access to high quality mathematics instruction, high expectations, and resources in his high school math experiences resulted in him feeling like an 'other' in the college algebra math classroom. When Andre spoke in terms of "those" and "their" students, I interpreted that he felt like an outsider, attributed in part to his previous lack of access to mathematics.

Andre's voices of determination, struggle, and pride also acted to drive him to achieve by taking advantage of accessing affording opportunities. Data from Andre's interview and my participant observation field notes demonstrated that in college algebra,

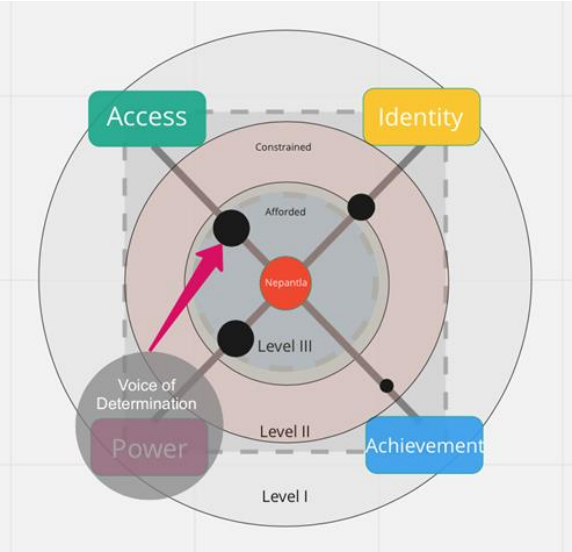

Figure 15 *Relationships Between Andre's Voice and (In)Equitable Experiences*

Andre's access was afforded on several instances during the semester, via welcoming office hours and his own persistence. In the interview, Andre recalled another example of access being afforded, "I even had a tutor here, too," explaining how he consistently sought help from the university-provided math tutors each week. I interpret his drive to seek help as part of his determination, his needing and utilizing a tutor as part of the struggle, and his pride in himself for working so hard to overcome the barrier (i.e. passing college algebra) that stood between him and his achieving his big plans to go to medical school and become a Physician's Assistant.

Andre's voice of determination and his voice of belonging influenced his identity as a scholar and mathematician. Through his voice of belonging, Andre expressed he did not understand how he was a part of the math in college algebra or how the math was a part of him, which is evidence of identity constraining experiences as a mathematician. This is like Gutierrez's (2012b) notion of windows and mirrors, "a mirror in the sense of offering students a chance to see oneself; a window in the sense of being able to see a different view onto the world" (2012, p. 44). Andre did not see himself reflected in the math (i.e., mirror), nor was he able to

view a world through the lens of math (i.e., window). Andre did have a strong identity as a scholar, which came through clearly in his voice of determination. He identified two parts of his academic self: the dedicated, hard worker, and the scholar with a passion for learning. Andre's voice of determination was a strong aspect of his identity as a student. For example, while Andre did not necessarily identify as someone who loved math, he described himself as somebody that would, "push myself to be the best in the class if I need to be." However, it is not clear he had many identity affording experiences as a math learner. When speaking about experiences prior to college algebra, Andre explained he was exposed to math more at school and not so much so at home; Andre likely made an early association that math is only linked to "have to" in school, not to his life or experience, something that constrained his identity as a mathematician.

Andre viewed power as being held by his instructors, which impacted his achievement. Andre explained his experience that instructors had the power to either award or deduct points for tiny mistakes like those he made on his exams. I interpret Andre's view about instructors holding the power to mean that instructors were also responsible for affording or constraining achievement. If instructors held the power to award or deduct points on assignments and exams, then Andre's self-described "stupid mistakes" could have a large impact on his achievement. This is an example of how the dominant axis and critical axis dimensions of Andre's experiences were connected. Even though Greg demonstrated many instances of actions in which he worked to share power with students, Andre still viewed a lot of power as being outside of his control, and I conjecture that reflected on his achievement.

Andre's view of math as a gatekeeper to his power in the world is closely tied to his voice of struggle and his achievement constraining experiences. Andre viewed math as a necessity in life, as evinced from field notes and his interview. To him, math was the only barrier he saw to

him obtaining a college degree, which meant that math could be either power affording or constraining, depending on a student's grade and ability to pass the class. This is because Andre viewed math as necessary to "everything in the world," to earning a degree and to accomplishing his "big plans that will require people to pay attention." However, Andre experienced math as power constraining with his achievement often constrained, even in the semester in which he passed the course. If Andre's power could be more afforded, his achievement may be as well.

Andre: A Determined and Proud College Algebra Survivor

I conclude with Andre's vignette. It is a montage, or a mixtape of sorts, to provide a composite of his case. Some of the statements are direct quotes from him. Others are my statements of what I heard him say, even if he did not say those words explicitly. Picture Andre saying these words, as a human who has lived and experienced surviving college algebra. Hear to his voice. Listen to his song below:

> I work hard and I keep persevering. I've come to believe the burden to succeed is on me. I'm not supposed to be here, yet I am, I have pride in that. I'm a fighter. Teachers have the power, not me, so I will work hard to try to figure out how to get the points they have the power to award or withhold as I know I must overcome the barrier of college algebra to achieve my goals. This math doesn't connect to my life; it is something I have to do. There are many obstacles to my success put in my way in and out of school, but I will succeed because I have to. I struggle and overcome and achieve for me, for my friends, for my family, for my community. I'm not just doing this for me, I'm doing it so WE all have a voice. Math is important, powerful, necessary and everywhere, but, I only understand it when it connects to my life - and I feel like that is hardly ever. I don't see myself in the math, nor the math in me. So, college algebra is another barrier, another system someone in a position of power has manufactured that I must overcome, and I will. Math classes are the biggest obstacles to my academic success and to ultimately earning by degree. I will take this challenge head on and I will not be defeated. I am proud. I am determined. I am a passionate learner. I am a scholar. I belong here. I am Andre and I've come too far to let math stop me.

Mary

Case Narrative: "I am Hard Working and Determined to Succeed, but I Feel Stupid"

Mary is someone who struggles to articulate who she is, before settling on "I'm many things." She is a wife, a student, a woman who is hardworking, determined and is someone who wishes to be seen for those characteristics, rather than superficial ones. She identifies as someone who is honest and with integrity, and she will, "always get back up," when she is knocked down.

Mary described math as a struggle for her, but this was not always the case. As an adolescent, Mary had, "a love for it." She was good at math and attained high marks on her report cards and standardized tests. The circumstances of her life changed, including frequent moves between the U.S. and Mexico and her mother's declining mental health. Mary began missing school for extended periods of time, which changed her relationship with math. She said that math, "wasn't easy anymore," and she quickly became, "below average." As she missed more and more school due to circumstances in her home life, her grades in math, and her love for the subject, declined. The periods of time Mary was in school were spent trying to catch up, and this catch up made math seem harder than it had been in previous years. In high school, she was at least a year behind her friends in the required math sequence, and Mary felt she struggled to grasp new concepts quickly. When a teacher called on her one day and Mary did not understand what the teacher was asking, her teacher called her stupid. Mary says, "I just went home crying that day." Mary reported the teacher was later fired, but not before creating a lasting negative impact on Mary's identity as a math learner.

Mary felt like her middle and high school teachers judged and disliked her because she missed so much school; Mary acknowledges she had no control over but for which she still ultimately carries the burden. Her teachers did not know what was happening in Mary's home

life that was causing her to miss school, nor did any of her teachers reach out to her and ask. Mary frequently sat in the back of the classroom with a hooded sweatshirt pulled over her head, trying to make herself small and invisible. While math was a source of trauma for Mary, she also felt it was, “a good escape,” because it allowed her to work through concrete problems without thinking of anything else. Math was a distraction from what she described as “my circumstances.” Mary believed there were no real resources available to her in high school to help her with math, and she “definitely wasn’t going to ask that teacher [who called me stupid]” for help.

Mary did not pass algebra or trigonometry in high school, so she had a lack of math exposure coming into college algebra. In addition to her high school experiences, Mary described having “a lot of negative feelings and hate for the subject [math],” associating “bad things” happening in her life after high school with math. Traumatic life experiences, such as the death of her brother, going through a divorce, and her mother’s cancer diagnosis each happened during previous semesters Mary attempted the course. Coming into her final attempt at college algebra, which she ultimately passed, Mary was determined to succeed. She said, “Regardless of what grade I’m gonna get, I’m gonna pass this class” despite fears she may fail again as her mother’s cancer started to worsen.

Mary attributes her successful passing of class to the hard work of others—the resources that were available to her. She says she received a lot of help but did not see her role and power in obtaining help, only that there were a lot of people to help and support her this time. Mary also has a hard time acknowledging the hard work that went into earning an ‘A,’ and she feels like her passing grade, “is probably a fluke,” perhaps a sign of imposter syndrome. She has a hard time saying she is proud of herself.

Mary wants teachers to be more engaging in their teaching approach. She acknowledges that teaching to a wide variety of learners is probably a challenge and burden to put on teachers, but says, “Some of us need to listen, some of us need to write, or some of us may need all of them.” She believes that teachers should not stop learning and trying new things in their attempt to reach all students. She likes when she can reflect on her exam and assignment answers to learn from her mistakes, and when instructors model thinking out loud for the class. Retaking and passing college algebra made Mary enjoy math again, and she wants to pursue a math minor, but stated that finances and her age have made following that dream impossible.

Listening to Mary: Voices of Self-Doubt, Visibility, Determination, and Hope

Through the LG analysis process, I heard four distinct voices in Mary’s interview: self-doubt, visibility, determination and hope. I begin with a brief overview of all four voices. In the subsections that follow, I present the voices in order from the loudest, most prominent voice, to the quietest, least prominent voice. Mary’s voice of self-doubt was her lead voice, or the one that she used most often during her interview to describe her math experiences. This voice had a direct relationship with all other voices. I ascribed a voice of self-doubt to passages from the transcript when Mary expressed lack of confidence in herself or her abilities, or when Mary spoke in such a way to belittle or criticize herself. For passages when Mary expressed strength and putting forth effort with a firm purpose or intent to achieve, I ascribed the voice of determination.

Both the voice of determination and the voice of self-doubt worked in opposition to each other. A third voice, the voice of visibility, was not just a single voice, but a composition of two contrapuntal voices: the voice of hiding and the voice of being noticed. I incorporated these two voices of dissonance in the voice of visibility because Mary expressed feelings associated with

being visible or not in tandem with each other. The voice of self-doubt was in harmony with the voice of hiding that existed within the voice of visibility. This final voice, the voice of hope, was much quieter and only got small amounts of airtime before being muted by the voice of self-doubt, a much louder voice. I ascribed a voice of hope to passages where Mary expressed a trust in, belief of or desire for something good to happen. The voice of hope quietly influenced her voice of determination and her voice of visibility.

Mary's Voice of Self-Doubt. Mary's voice of self-doubt appeared in the first passage of her interview and continued throughout. When I asked her how she would describe herself, she said:

> I don't know why I always struggle with this question. I used to kind of answer well, I'm a wife. I'm a student. I guess I can't think of any one answer. I'm a woman. I'm many things.

This passage evinced Mary's expression of lack of confidence in herself and engagement in self-critical talk. Immediately, she said didn't know why she always struggled with the question of describing herself, which I heard as self-doubt (i.e. I used to kind of). Below is the I-poem I created from the passage above:

> I don't know.
> I always struggle.
> I'm a wife.
> I'm a student.
> I guess.
> I can't think.
> I'm a woman.
> I'm many things.

In this I-poem, I hear Mary's voice of self-doubt expressed the very first time she spoke in the "I," stating "I don't know, I always struggle." I highlight her tentative, timid language in trying to describe herself (i.e., I guess, I can't think) before settling on "I'm a woman" to

describe herself. While Mary is “many things,” the strong presence of her voice of self-doubt makes it difficult for her to put in words what those many things are.

Mary’s voice of self-doubt extended beyond times she expressed a lack of confidence in herself or abilities. I also heard this voice of self-doubt when Mary spoke in such a way to belittle or criticize herself. For example, about ten minutes into the interview, I heard Mary’s voice of self-doubt when she spoke about her others describing her as smart. Our exchange follows:

> Mary: My brother kind of describes me as you're always such a sweetheart. Cheesy. My husband tends to say I'm really cheesy with my jokes and I'm kind of corny. Loyal. My brother says I'm smart. I'm not sure why or how he knows that.
>
> Gardner: You crinkled your face whenever you said that. Does it feel uncomfortable for him to think that you're smart?
>
> Mary: Yeah and I don't know if I believe him that he really sees me that way or if he is just trying to motivate me.
>
> Gardner: Do you see yourself as smart?
>
> Mary: No and I don't know why. I guess if I were to base it on an IQ test. I feel like I've missed out on a lot of education so I feel like I definitely wouldn't do very well in an IQ test because there is so much more that I need to learn. I feel like my knowledge is very limited. I feel like I'm so much slower that everyone. Like, in math we're sitting in a table doing group work in this current class that I had and people would get the concepts quicker than I and I'm still struggling with the first part of it or trying to figure it out and I feel stuck. I see other people getting it. I don't know. I feel like maybe if I were smarter maybe I would. I'm not sure what it is. I get tripped up over little steps. If I can't get past that little step, especially with math if you don't know the first step it's hard to move on because you have to go step by step. I feel like that's a struggle.

This passage provided evidence of the magnitude of Mary’s voice of self-doubt. Even though her brother, someone she admires and respects a great deal, said she was smart, she could not hear it. Her voice of self-doubt muted her ability to see herself as smart and capable as a

math learner. She felt she was “less than” her table group in some way, perceiving her classmates were quicker to complete and learn the concepts. Importantly, this is in contradiction to what I noted in field notes during Mary’s work in class. I observed Mary finishing worksheet problems before her tablemates without the use of her notes, then working with them as a peer tutor to help her tablemates with the math she had already finished and seemingly already understood while they were in a place of not knowing.

Below is the I-poem I created from the passage above:

I don't know why.
I guess if I were to base it on an IQ test.
I feel like.
I've missed out on a lot of education.
I feel like.
I definitely wouldn't do very well.
I feel like my knowledge is very limited.
I feel like.
I'm so much slower than everyone.
I'm still struggling.
I feel stuck.
I see other people getting it.
I don't know.
I feel like maybe if I were smarter.
maybe I would.
I'm not sure what it is.
I get tripped up.
I can't get past.
I feel like that's a struggle.

This I-poem highlights Mary’s voice of self-doubt and how it criticized and belittled Mary (i.e., I definitely wouldn’t do very well; my knowledge is limited). Here, her voice of self-doubt also works to compare her to others to ensure she continues to doubt (i.e., I’m so much slower than everyone; I see other people getting it). Mary’s brother viewed her as smart; I

observed her understanding math concepts before her peers, yet her voice of self-doubt was so loud, Mary could not embrace what her brother and I saw as part of her identity.

Mary's voice of self-doubt was her lead voice, characterized by her negative self-talk and her limiting beliefs about herself. Mary was aware of her voice of self-doubt. When I met with her during member checking and explained how LG analysis works, she immediately said, "I'm sure you heard my voice of self-doubt." Originally, I had named this the voice of the critic. I changed it to the voice of self-doubt because, Mary's named the voice herself, and it encompassed the self-critical aspect of this voice in addition to expressing the lack of confidence she had in herself and her abilities.

Mary's Voice of Visibility. The voice of visibility was a composition of two contrapuntal voices: the voice of hiding and the voice of being noticed. Much like in a piece of music, these contrapuntal voices had two independent melodic lines, but were played within the same song. With these voices, Mary oscillated between feeling like she was invisible and visible. I ascribed the voice of visibility to passages where Mary expressed feeling personally hidden/seen, not noticed/noticed, included/excluded, or supported/ignored in the college algebra classroom**.**

Mary's circumstances influenced her voice of visibility. During the member checking process, I heard the dissonance in Mary's voice as she explained "As much as I tried to be invisible, I still wanted to be seen" (personal communication, 5/27/20). To understand this dissonance required an understanding of what she meant by her "circumstances." Mary specifically mentioned "circumstances" in six separate passages over the course of the interview. Below I share one such passage:

> I kind of look down on myself for being this old and barely working on my bachelors but yet I know the *circumstances* of why I couldn't get an education sooner. I kind of have this battle within... I try not to but sometimes I do. I have moments of strength but then there's moments where I do feel like I do beat myself up for it. Beat myself up for not having a father or a mother essentially. Stuff like that. (About 5 minutes into the interview).

About 42 minutes into the interview, Mary elaborated on what her circumstances were. She explained:

> I was teased all the time. I had to wear my brothers hand-me-downs. So, I was called a tom boy. I had girls tease me because I developed a chest early on in life and so I would wear sports bras and really flatten them. I tried anything to just not get attention. My mother wouldn't let me shave my legs even to high school. So, I would never wear shorts and the PE uniform forced us to wear shorts so girls would tease me, threaten to beat me up for my hairy legs. Now I look back and it was so silly. Kids can be brutal. I was just always being threatened. I had bullies coming after me a lot. I had to hide in the bathroom in middle school because they told me if I would be in the lunch area, because we only had one lunch area, it wasn't a very big school, that I would be beaten up. In elementary school we were really poor so a lot of times I didn't have lunch money and I didn't get to bring lunch so what would happen is I would have to go to the office and say well I don't have lunch money and then they would give me a sack lunch but it was free, provided by the school but it was in this special brown bag that everyone knew was that free lunch and it was a peanut butter sandwich. They didn't even put jelly on it. So I would be made fun of for that. Just all sorts of things. And I am light skinned but we lived in an area that was really Hispanic and I'm also Mexican but there was this kind of struggle of fitting in. Like I couldn't really fit in with the white people, Caucasian or the Mexicans unless I spoke Spanish. Some of them would accept me because they're like okay you're fluent but I was constantly in the middle. Just not fitting in. Not only because of my race stuff but because of economics. We were poor and it showed in the way I dress, in the way I looked.

In this passage, I heard how Mary learned to hide because of her "circumstances." She expressed how her race and economics impacted her experiences as a student in a school. For her physical safety, she learned to be invisible in school, to "hide in the bathroom" to eat lunch in order to avoid being "beaten up."

Below is an I-poem that I created from the passage above:

I was teased all the time
I had to wear hand-me-downs
I was called a tom boy
I tried anything to just not get attention
I look back and it was so silly
I was just always being threatened
I had bullies
I had to hide in the bathroom
I didn't have lunch money
I didn't get to bring lunch
I would be made fun of for that
I, light skinned
I couldn't really fit in
I spoke Spanish
I was constantly in the middle

In this I-poem I hear how Mary's circumstances influenced her voice of visibility. Her family does not have money for items such as clothes and food, which results in her voice of visibility taking over out of survival (i.e., "I tried anything to not get attention; I had to hide in the bathroom). I also hear the dissonance in her voice of visibility (i.e., "I was constantly in the middle; "I couldn't really fit in); she wants to be seen but needs to hide at the same time. This extended need to hide in order to survive extends into the classroom as well. Mary explained:

> I never got help at home growing up. My mom, she couldn't help me. There was no resources that I could remember in elementary, middle, or high school where you can get help after school or anything like that. My teachers didn't have office hours. I definitely wasn't going to ask that teacher in ninth grade [the one who called her stupid for asking a question]. I did have a geometry teacher in tenth grade. I would try to get help from her. She didn't seem to like me very well. I was also absent quite a bit [that year]. That was the year when I left again for a year. I left in the middle of the year, may have been a little sooner. I was actually getting some of the concepts. I seem to do better with geometry than algebra. I tried to get help from her because she did. She usually stayed after, like fifteen minutes or so and she would help people. She didn't seem to be willing to help me. I don't know if she saw me as a lost cause or didn't like that I was absent so much. I kind of sat in the back. I wore a hoodie over my head and I tried to be invisible. She made comments about me missing so much. I don't know if that's why she didn't help

> me but other than that, yeah I didn't have any, there was no resources for me to get help outside of school. I would try to read the textbook or get it on my own but it didn't work out. I failed math quite a bit... I couldn't do anything higher than that [sports math]. I didn't pass algebra or trig or anything like that.

When I asked her about her experiences learning math at home, Mary spoke about a lack of resources at home or outside of school hours. She then shifted to explaining learning experiences as a student in a classroom who had internalized the need to be invisible. Below is an I-poem that I created from the passage above:

> I never got help at home.
> I definitely wasn't going to ask.
> I would try to get help.
> I was also absent.
> I left again for a year.
> I left in the middle of the year.
> I tried to get help.
> I don't know if she saw me as a lost cause.
> I was absent so much.
> I kind of sat in the back.
> I wore a hoodie over my head.
> I tried to be invisible.
> I didn't have any, no resources.
> I would try to get it on my own.
> I failed math quite a bit.
> I felt so dumb.
> I couldn't do anything higher.
> I didn't pass algebra.

In this I-poem, I hear the contrapuntal voice of visibility, hiding and simultaneously being noticed, speaking at the same time. This dissonance includes a whisper voice of being noticed, in the form of trying, (i.e., I would try to get help, I tried to get help) but the voice of being noticed is so quiet it almost goes unnoticed. The other side of the voice of viability, the voice of hiding, is much louder (i.e. I would try to get it on my own; I wore a hoodie over my

head; I tried to be invisible) and works in harmony with Mary's voice of self-doubt (i.e., I failed math quite a bit; I felt so dumb, I couldn't do anything higher).

Mary gave additional examples of experiences learning math in the classroom. In speaking about how her teachers interacted with her, and what that felt like, she used her voice of visibility. She said:

> Well I had quite a bit of teachers that just talked. They weren't interacting with me at all or asking if people had questions. It was kind of just doing the problems. So, I kind of felt that was the same as going home and reading a textbook on my own and just working through it which is the part that I didn't like. I didn't like that similarity. I liked to be engaged more. My first teacher in community college for that the pre calc series, I did really well in his class. He was a really great teacher. He would engage students. He would ask questions. Like do any of you have questions or what don't you understand? And he would work it out on the over head. He would show us an example of us working it through and I loved being able to see him. He would talk out loud so we would know why he was doing what he was doing. I loved that. So, I did well in that class.

Mary explained how teachers interacted with her as a learner in the classroom. Specifically, she expressed not being noticed by them in instances when they were not interacting with her or asking if people had questions. By people, I interpreted her to be referring to herself, but her voice of self-doubt would not let her amplify the "I" in this statement. It seemed she felt the teachers that just talked but did not listen to her, reifying she is not seen or heard in the classroom. She confirmed "a really great teacher" was one that "would engage students" and do things such as ask, "Do any of you have questions or what don't you understand?" This indicated Mary felt these are actions a teacher would do that would make her feel seen.

Below is the I-poem I created from the passage above:

I had quite a bit of teachers
that just talked.
They weren't interacting with me.
I kind of felt that was the same
on my own.
I didn't like that similarity.
I liked to be engaged more.
I did really well in his class.
I loved being able to see him.
I loved that.
I did well.

In this poem I hear Mary's voice of visibility (i.e., I liked being engaged more). This is the desire to be seen within her voice of visibility, recognizing what it felt like to be noticed and included in the classroom as a learner. I hear how this feels good to Mary (i.e. I loved, I liked). Simultaneously, I hear her voice of self-doubt with "they weren't interacting with me" followed by "I kind of felt...on my own...I didn't like that" indicating a lack of confidence in her abilities. This is an example of how Mary's voice of visibility is in harmony with her voice of self-doubt. At the end of the interview, Mary alludes again, with her voice of visibility, that when she is seen and heard in a classroom, she experiences success and achieves. In speaking specifically about the semester, she finally passed college algebra on the fourth attempt, Mary recounts what was helpful:

> ...in this last class that I had, I think it was very beneficial to be able to look at our exams and actually write out what we were thinking while we're doing the problem, where it went wrong and then what the correct answer is. I feel like it's really important to learn from our mistakes and you know, we didn't get a lot of points back but that wasn't the point. For me, it was really good to learn and to figure out, why did I do that? What was I thinking? I feel like it's good to reflect and kind of go back to that. I think that's really beneficial.

Mary appreciated the process of looking at exams and writing out what she was thinking. In doing this, space was made for teachers to pay attention to her thinking like she experienced by thinking through test corrections, she felt seen and like someone cared about her and her thinking. She even mentioned it wasn't about the grade "we didn't get a lot of points back, but that wasn't the point." Rather, this act of correcting a test, reflecting, and sharing her thinking sent the message to her that she mattered. I created this I-poem below from the passage above:

> I think.
> I'm pretty sure.
> I think.
> Why did I do that?
> What was I thinking?
> I feel it's good to reflect.
> I think that's really beneficial.

In this I-poem, I hear her voice of visibility (i.e., I think). Mary is dying to be noticed, as evinced by most of the lines of the poem including an emphasis on thinking. However, her voice of self-doubt, ever so subtle, is also in harmony with her voice of visibility in this poem with a single line "I am pretty sure." I conclude this voice of visibility section by returning to a passage when Mary spoke about her circumstances. Near the end of the interview, she said:

> I feel like I could've maybe gone to med school or gone to Harvard or whatever I just feel like skies could've been the limit if I had that extra help. Someone to believe in me, someone to motivate me to help me not focus on the *circumstances.*

Mary expressed what might have been had she felt seen in the classroom during her K-12 experiences. I heard possibilities, if her voice of visibility, especially the voice of being noticed, had been nourished.

Below is the I poem I created from the passage above:

I feel like.
I could've
gone to med school.
gone to Harvard.
I feel like the skies could've been the limit.
If I had that extra help
someone to believe in me.
someone to motivate me.
to help me not focus on the circumstances.

In this I-poem, I hear Mary's voice of visibility (i.e., I could've gone to med school, gone to Harvard). I hear a young girl saying, if someone would have noticed me, I could have been and done anything. I also am cognizant of what I do not hear in this I-poem; a voice of self-doubt. This is surprising because often Mary's voice of self-doubt is in such close harmony with her voice of visibility, specifically the voice of hiding, it is difficult to separate them.

A voice that stands in contrast to, or in tension with, her voice of self-doubt is her voice of determination. It is a quieter voice, but I did hear it on occasion in her interview.

Mary's Voice of Determination. Mary's voice of determination is rooted in her purpose to achieve and her willingness to put forth the necessary effort to do so. For passages where Mary expressed putting forth effort with a firm purpose or intent to achieve, I ascribed a voice of determination. Ten minutes into the interview, Mary explained she considers herself a focused learner in the following exchange:

> Mary: More so in math. I feel like I really need to focus more so. I tend to not goof off much in class or joke around. I tend to be really serious and focused. More so in math than in other subjects.
>
> Gardner: Is that because you think that's what is expected of you in math?

> Mary: It's what I expect of myself. I know that it's a hard subject for me. I know that I really have to pay attention. I don't have time to play around.

Mary considered math a challenging subject that required additional focus than was required of her in other classes. Mary expressed she didn't have time to play around or goof off in math because it is a harder subject for her. As such, she held herself to a higher standard of expectations in math classrooms. Below is the I-poem I created from the previous exchange.

> I feel.
> I really need to focus.
> I tend to not goof off much in class.
> I tend to be really serious and focused.
>
> I expect of myself.
> I know that it's a hard subject for me.
> I know.
> I really have to pay attention.
> I don't have time to play around.

In this I-poem, I hear Mary's voice of determination in one of the rare times it stands alone. It is a lonely voice of determination (i.e., "I expect of myself; I know it's a hard subject for me) rather than a confident one. I usually hear the voice of determination in tension, fighting against her much louder voice of self-doubt as evidenced in the following passage.

> I don't want to fail. So, I have this determination and strength inside and from even my mom, seeing how she keeps fighting every day with her cancer, with her body failing. I think to myself, I want to be better. So, I look at her and other people in my life and I want to be more like them.I also want to be a good example to my family, to my younger nieces and nephews. I don't want them to see me as a failure or anything like that. I don't want to see myself that way either. I want to be better than that, be better than my circumstances. It keeps me going.

This passage gave evidence of a source of Mary's determination—her family. She drew strength from within, inspired by her mom's fight with cancer. She aspired to be stronger, like

her mother, and other people in her life. She wanted to be viewed and strong and not let her family down by failing. Below is the I-poem I created from the passage above:

> I don't want to fail.
> I have this determination and strength inside.
> I want to be better.
> I also want to be a good example to my family.
> I don't want them to see me as a failure.
> I don't want to see myself that way either.
> I want to be better.
> be better than my circumstances.
> It keeps me going.

In this I-poem I hear Mary's determination to achieve, motivated by making her family proud (i.e., I also want to be a good example to my family) and simultaneously out of fear of disappointing her family and herself (i.e., I don't want to fail). Perhaps this is a determination influenced by a desire to mute her voice of self-doubt (i.e., I don't want them to see me as a failure; I don't want to see myself that way either). This voice of determination expresses effort, motivated by fears spoken in her voice of self-doubt.

Mary's voice of determination is often present, but in tension or in a subordinate position, to her voice of self-doubt. For example, while still describing herself at the beginning of the interview, Mary explained:

> I feel like I'm a woman of integrity, honest. I mentioned hard working, determined to succeed. I tend to give up sometimes but I'll always get back up. Life circumstances or things knock me down for a bit but I always get back up. Strong, I guess.

Mary's use of integrity and strength were both indications of a voice of determination. She expressed a sense of experiencing adversity in the form of "life circumstances that knock me down." But Mary continued to persevere, or what she describes as "getting back up."

Below is the I-poem I created from this passage:

I feel like I'm a woman of integrity.
I mentioned hard working.
I tend to give up.
I'll always get back up.
I always get back up.
Strong, I guess.

In this I-poem, I hear Mary shifting between a voice of determination and a voice of self-doubt. The back and forth between the two voices illustrate the tension in the two voices. In the first two lines, I hear a muted voice of determination. The hedges "I feel" and "I mentioned" dampen the voice. Next I hear the voice of self-doubt (i.e., I tend to give up), with a quick shift back to the voice of determination (i.e., I'll always get back up. I always get back up). Here, getting up is presented as an action. Immediately following this, is the present and more concrete, *I always*—a signal of putting forth effort with a firm purpose. "Strong, I guess" is another example of the voice of determination, closely in tensions with the voice of self-doubt, the "I guess" indicating a lack of confidence.

Later, about seven minutes into the interview, Mary shared about not wanting to let her circumstances define her. Her much quieter voice of determination whispered in the tension with her voice of self-doubt. When talking about not letting her circumstances define her, Mary described:

> Yes, but it's a constant tug of war within myself. With society, being back in school right now at the age, I'm in my mid thirties. It's a constant struggle with myself. I kind of look down on myself for being this old and barely working on my bachelors but yet I know the circumstances of why I couldn't get an education sooner. I kind of have this battle within.

> It doesn't help to, last week in one of my math classes I got there early like I usually do and there was this girl two tables to the right of me who was talking with her group of friends and she was talking about how she hates this girl in her class [not the college algebra class].... They were talking loud so it wasn't like I was trying to listen but she said "I just can't stand her. She's so old too, she's 26. It's so sad for her to be in school this late" and I started to struggle again with my age or people see things with disabilities. I don't tend to have the money to buy clothes very often. Sometimes I feel like I have better days where I'm strong and I'm like those comments aren't going to get to me. Then, there's other days where they do. I have this conflict because I don't feel people should be defined by those things or looked down upon for them. Yet, I kind of hold myself to a different standard. It's a constant struggle.

This passage of Mary's interview illuminated her quiet voice of determination in tension with her much louder voice of self-doubt. Mary criticized herself for being an undergraduate student at her age and wonders why she did not go to college sooner. When she heard another student talking negatively about a fellow classmate, who is also an older, non-traditional aged student, Mary's voice of self-doubt was reified. Mary internalized this in a way that made her think that this student was making a blanket statement about non-traditional students in college, including her. While Mary articulated sympathy for other students who are in similar positions in life as her, her self-critical voice of self-doubt, told her that she could not find the same sympathy for herself. Mary knew this and recognized her struggle to reconcile her sympathetic stance toward others with her criticism of herself. Upon review of this during the member checking process, Mary noted the accuracy of the previous sentence. She said, "Yep! It makes me a hypocrite to not be able to give myself grace, too."

Below is an I-poem I created from the passage above:

> a constant tug of war within myself.
> I'm in my mid thirties.
> a constant struggle with myself.
> I kind of look down on myself.
> I know the circumstances.
> I couldn't get an education sooner.
> I kind of have this battle within.
>
> I started to struggle again.
> I don't tend to have the money.
> I feel like I have better days.
> I'm strong.
> I have this conflict.
> It's a constant struggle.

In this I-poem I hear Mary's voice of self-doubt loudly criticizing herself (i.e., I'm in my mid-thirties, I kind of look down on myself; I couldn't get an education sooner; I don't tend to have money). In between is her very quiet voice of determination fighting for air space, a single line, "I'm strong." It is the tension between these two voices, however, that is most evident in this I-poem. For instance, in Mary's own words, it is a "constant struggle." In the next passage, Mary's voice of determination and voice of self-doubt appeared in tension again when she talked about trying not to let her circumstances define her. She said:

> I try not to but sometimes I do. I have moments of strength but then there's moments where I do feel like I do beat myself up for it. Beat myself up for not having a father or a mother essentially. Stuff like that. Yet I know they were out of my control but for some reason I still feel responsible. I know I'm not but I don't know how to let it go and I guess...Just when I think I am healed because I've done counseling and I feel better, something will trigger it and these things will come back. Maybe not as strong but there's still that little voice.

Mary fluctuated between this voice of determination and her voice of self-doubt. Mary switched between these voices within the same sentence, demonstrating the tension in the two

voices (i.e., I have moments of strength but then there's moments where I do feel like I do beat myself up for it). The voice of determination, although often much quieter, worked to heal this ever present and much louder voice of self-doubt. Below is an I-poem I created from the passage above:

> I try not to but sometimes I do.
> I have moments of strength.
> I do feel.
> I do beat myself up for it.
> Beat myself up.
> I know they were out of my control.
> I still feel responsible.
> I know I'm not.
> I don't know how to let it go.
> I think I am healed.
> I've done counseling.
> I feel better.

In this I-poem I hear the moments of Mary's voice of determination (i.e., I have moments of strength) that works to mute Mary's voice of self-doubt (i.e., that little voice). But the voice of self-doubt is so loud, it dominates. Mary's voice of determination works to heal (i.e., I think I'm healed) and to feel better (i.e., I've done counseling), but the loud voice of self-doubt works against her determination to let it go (i.e. I don't know how to let it go). Perhaps it is the process of healing that exists in the tensions of these two voices.

During member checking, Mary confirmed the tension in her voice of determination and voice of self-doubt. I gained additional insight into how this tension was influenced by outside voices during the member checking process. Mary explained:

> There definitely is a voice of critic or self-doubt within me, but there has also been an audible voice from others. Teachers have even voiced my negativity out loud. I have struggled feeling stupid for example, and one math teacher asked if I was stupid...When I wanted to pursue computer science [at the university], an advisor told me it would be

> really difficult given that I had little math experience and was struggling with what I had taken. Sometimes, it is like I want to prove them and myself wrong. (personal communication, 5/18/20)

Mary's voice of determination grew from her experiences of overcoming adversity, but is often contrasted, muted and in tension with her voice of self-doubt. This voice of determination, however, is shaped by a quiet, but still present, voice of hope.

Mary's Voice of Hope. Mary's voice of hope did not stand alone, and I rarely heard it. This voice influenced her voice of determination and voice of visibility and was also in tensions with her voice of self-doubt. While this voice had a direct relationship with all other voices, like the voice of self-doubt, I do not consider it her lead voice because it is not as frequent, prominent, or as loud as her voice of self-doubt. I ascribed the voice of hope to passages where Mary expressed a trust in, belief of or desire for something good to happen.

At the end of the interview, I heard Mary's voice of hope in concert with her voice of determination, voice of visibility and voice of self-doubt when asked Mary what she thought teachers should do more and/or less of. She said:

> This is totally biased. It's just based on my experience and I understand not everyone has had the same experience as me. I didn't go to a lot of good schools growing up. I feel like I was judged a lot based on my attendance or other things and I think I was judged unfairly. I can't say I don't blame them though because what else are they supposed to think if I'm showing up and missing class once a week or whatever. I wish I would've had more of a chance. I wish, I, maybe, regardless of whether or not it would've helped or maybe I would've opened up, I wish I wasn't judged for that or my quietness. I was so quiet, I was so shy, I didn't want to talk. I really wanted to learn, I loved school. I just couldn't express it. I wish they could've looked past that. But again, I don't blame them. I get it. It looks bad.

With this question, Mary had the chance to be visible, to be heard and to voice what her teachers should and could do differently. In this passage, she did express desires for some things to be different in the form of wishes, but they are wishes based on what she wished her teachers

would have done differently in her own past experiences. Her voice of hope whispered, wishing to be seen and understood by her teachers, but was again washed out by the loud bass of self-doubt that continued to reverberate. Below is the I-poem I created from the passage above:

> I wish I would've had more of a chance.
> I wish.
> I maybe.
> I would've opened up.
> I wish I wasn't judged.
> I was so quiet.
> I was so shy.
> I didn't want to talk.
> I really wanted to learn.
> I loved school.
> I just couldn't express it.
> I wish they could've looked past that.
> I don't blame them.
> I get it
> it looks bad.

In this I-poem, I simultaneously hear Mary's voice of hope (i.e., I wish I wasn't judged; I really wanted to learn) and her voice of self-doubt in the form of lack of confidence in herself that resulted in her taking the blame again for what is out of her control (i.e., I don't blame them; I get it). Mary's voice of hope, evinced by her use of "wish" in this I-poem, explains things she wishes could be different (i.e., I wish I would've had more of a chance; I wish I wasn't judged), and influences her voice of determination (i.e., I really wanted to learn, I loved school). In essence, her voice of hope elevates her voice of visibility, expressing a desire to be seen (i.e., I was so quiet; I was so shy; I just couldn't express it), but her voice of self-doubt gets the final word (i.e., I don't blame them, I get it). As much as she wishes with her voice of hope that it could be different, the voice of hope is quickly interrupted by the voice of self-doubt reaffirming that it is her fault things are not different. This I-poem concludes with "it looks bad," where "it"

means I. Mary's voice of self-doubt is so loud, it does not sound like she thinks she deserves for things to be different. Her voice of self-doubt keeps her voice of hope muted.

Mary's Voice Map

I use a voice map to express Mary's voices as an interplay of the voice of self-doubt, voice of visibility, voice of determination, and voice of hope (see Figure 16). The voice of self-doubt is shown in the largest circle because it is her lead voice and in direct relationship with all other voices. This is indicated in the voice mapping by overlapping circles to represent harmony in voices, arrows to represent direction influence of one voice to another, and rectangles to represent tension or opposition in voices. In Mary's voices, the voice of self-doubt is in harmony with the voice of visibility, specifically, the part of her voice of visibility that actively seeks to blend into the background. The voice of hope is much smaller, and quieter, than the voice of self-doubt, where self-doubt acts to oppose the voice of hope on the rare occasions it surfaces. The voice of self-doubt also works to oppose her voice of determination and her voice of determination works to oppose her voice of self-doubt. Although quieter, the voice of hope influences Mary's voice of determination and the part of her voice of visibility that has a desire to be seen/heard.

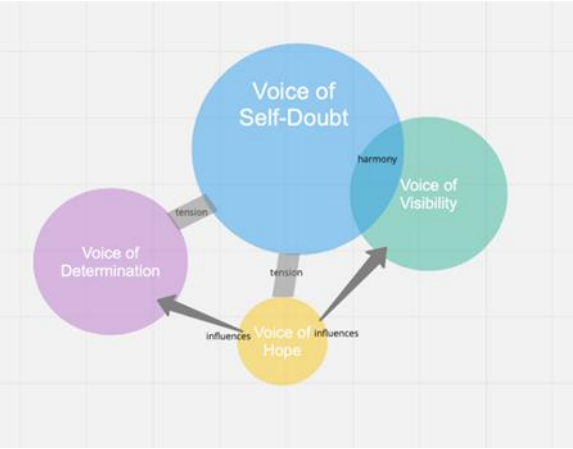

Figure 16 *Mary's Voice Map*

Mary's Extended I-Poem

I close this section with Mary's extended I poem, which I shared in Chapter 1. For ease of reading, I re-paste Figure 2 below. The words of this I-poem express the human experience of Mary's story of survival as a college algebra student. I have created the extended I-poem by piecing together smaller I-poems I created during analysis, maintaining the order in which the passages appeared in her interview. This extended I-poem highlights the interplay between Mary's voice, where the words compose a song intended to evoke feeling to empathize with and understand and her experience. In this song of survival, Mary's voice of self-doubt is the chorus, "I tend to give up; I look down on myself" This chorus repeats throughout the song, sometimes sung in harmony with her voice of visibility in the form of hiding, "I kind of sat in the back" and in tension with her voice of determination "I don't want to fail - I have this conflict - I am gonna pass" and voice of hope "I tend to give up - I want to be better ." Mary's voice of hope is a background singer; quietly influencing her voice of determination "I have moments of strength" and her voice of visibility that wants to be seen "I feel like maybe if I were smarter - maybe I

would. Together, Mary's voices of self-doubt, visibility, determination and hope are a melancholy musical composition of her experiences as a college algebra survivor.

Mary's Voice: I worked so hard, It's probably a fluke

I'm a wife
I'm a student
I'm a woman
I'm many things
I feel like it's easy to judge people
by my skin color
I'm multiracial

I tend to give up
I don't want to fail.
I want to be better

I look down on myself
My disabilities
I don't want to them to hinder me from educating myself
I'm strong
I have this conflict
I have moments of strength
I'm always in class

I hardly ever miss
I'm still struggling
I feel stuck
I feel like maybe if I were smarter
Maybe I would

I never got help at home
My mom, she couldn't help me
no resources that I remember
My teachers didn't
I was also absent quite a bit
I left again for a year
I left in the middle of the year

I tried to get help from her
I don't know if she saw me as a lost cause

I was absent so much
I kind of sat in the back
I wore a hoodie over my head and tried to be invisible

I didn't pass algebra
I failed math quite a bit
I had a lot of negative feelings and hate

I'm gonna pass this class
I'm gonna pass
I had resources
I've actually been getting a lot of help
I passed the class
I feel it's probably a fluke
I wish I could do math
I kept failing
I failed three times
I worked so hard

Mary's (In)Equitable Experiences: "As Much as I was Trying to be Invisible, I Still Wanted to be Seen"

As a survivor, Mary's lived experiences included factors that constrained her ability to succeed in the college algebra class despite his hard work. Yet, there were factors that afforded her ability to succeed and eventually pass the course. I use the dominant and critical axes (Gutiérrez, 2012) to organize the presentation of this section. The dominant axis includes the

dimensions of access and achievement, and the critical axis includes the dimensions of identity and power. For each dimension, I present evidence of both affordance and constraint when such evidence was a part of field note documentation. The total number of coded passages in my field notes, organized by each dimension, is shown Table 6.

Table 6

Coded Passages of Mary's Experiences by Dimension

Dimension	**Total Instances**	**Code**	**Instances for each Code**
Access	13	ACC+	5
		ACC-	8
Achievement	11	ACHV+	11
		ACHV-	0
Identity	8	ID+	1
		ID-	7
Power	13	POW+	7
		POW-	6

I coded at least one instance of affordance and constraint in each dimension, apart from achievement constrained. In my observations, the dimension of achievement had more instances of affordance than constraint; the dimensions of access and identity had more instances of constraint than affordance, and the dimension of power had nearly equal instances of affordance and constraint. The observations took place during recitation, lecture and on the margins of the lesson, before, during, and after class, or during the 10-minute break that separated recitation from lecture.

Dominant Access Experiences: Access and Achievement

Access. There were occasions that afforded Mary access. These included instances of Mary using tangible resources she created such as notes to assist her and her group with completing questions together. She also had access to extended time to complete a take home quiz on one occasion. In my field notes on March 13, 2019, I noted:

> Nate started class with good news. "Today is a take home quiz" Mary smiled, breathed a sigh of relief, and said "Ah!!" in a joyous and relieved way. (FN_21, 3/13/19).

Making the quiz take home allowed Mary to breathe a sigh of relief, as she was a student who self-described as someone who worked slower than her peers and needed more time to think. By allowing students as much time as needed to complete the quiz at home, Nate afforded access for Mary.

I found Mary's access to be constrained more often than afforded. Early in the semester, and continuing throughout, I noted multiple instances of Mary's access being constrained. Beyond notes, she did not have access to tangible resources, such as a computer or calculator, which her tablemates brought to class. During a conversation with her tablemates, she mentioned she did not attend office hours or visit the university offered tutoring center because the times they were offered did not work with her schedule. She also explained she prefers to ask her brother for help rather than seek out the assistance of an instructor. Additionally, Mary sat at a table in the room that the instructors seemed to visit less often when monitoring students' work in small groups.

In this field note on February 5, 2019, I documented a conversation between Greg and the students at Mary's table:

> Greg is at what I call T2 [Table 2]. What we know about positioning is sometimes tables located at this point in the room get less help. Please email Nate (GTA) and or I and let us know if you have questions. We just want you to know we aren't ignoring you.(FN_17, 2/5/19)

Greg recognized the physical location of the table in the room meant he did not visit it as much during students' small group work. Mary's presence at this table was access constraining, because it meant there were fewer informal opportunities to interact with the instructor. It was helpful to Greg to reach out to the students, to acknowledge the situation. Yet, Mary did not feel comfortable reaching out to an instructor to communicate, even in the welcoming environment that Greg worked to create. Hence, this was evidence of an access constraining experience for Mary, with the onus on her to initiate communication.

In college algebra, Mary had opportunities to engage in tasks intended to promote active learning. Yet, knowledge required to access those tasks constrained her learning opportunities. In a field note on March 20, 2019, I described Mary's work with a domino match task.

> Nate announced the take home portion of the exam would be due Thursday, and that the exam now only included up to 5.1.
> Nate: Today we will review 5.1 with a domino match then review for the exam. The Domino tiles have 12 different equations.
> Nate begins handing out the baggies with pink slips in them.
> Mary: I've never played dominoes.
> Tyson explains the concept of one end of a domino matching with the other end of another card. (FN_22, 3/20/19)

Nate intended the domino math to be an engaging way for his students to review for an exam. Yet, Mary was not familiar with dominoes. Nate handed out the domino match cards without directions on how to use the match cards, assuming everyone had played dominoes before. This was evidence of an access constraining experience as Mary did not have the background knowledge assumed by an instructor. Interestingly, the background knowledge needed had nothing to do with the actual mathematics of the lesson. If it had not been for a peer

at her table who could explain to her how to engage in the domino match, Mary could not have accessed the learning. The organization of recitations, with daily inclusion of table group tasks in the form of Tachtivities and Techtivities, allowed for Mary to work with peers in this manner, which helped to mitigate constraints of access.

Achievement. I observed several instances that afforded Mary's achievement. She was able to work homework problems from memory and explain concepts to her classmates if they are struggling because she did so well on homework, quizzes and exams. The day the first exams of the semester were returned, I documented Mary's results in my field notes:

> Mary and Taisa are chatting about the first exam they took last class period. Mary commented that it took forever. Taisa says that she told her mom she either got a 56 or 97, no in between. Mary, to Taisa says, "you kicked butt, I know it." ...Greg begins handing back quizzes. When Mary receives hers, I see a 91% written in blue ink at the top.(FN19_2/26/19)

This is one of several times Mary passed an exam or quiz with an 'A' throughout the semester, including on the final exam. All these instances of passing assignments with high scores are evidence of measurable outcomes as determined by dominant axis system. Passing quizzes and exams with percentage scores over 90%, can describe Mary's achievement in terms of affordance.

My analysis of field notes indicated that Mary's access was constrained more often that it was afforded, yet her achievement was afforded. There was no evidence of Mary's achievement being constrained in my field notes. This is important to note, as one might assume if a student's achievement is afforded, they would think of themselves as confident mathematicians as indicated in terms of power and identity. However, that was not the case with Mary, as I will show in the next section.

Critical Access Experiences: Identity and Power

Identity. During the semester, I did not observe instances in which Mary's identity was afforded in interactions with her classmates or instructors. The one instance I coded of Mary's identity being afforded occurred in a sidebar conversation with me that took place near the end of the semester during a class break.

> She excitedly tells me she is going to do a 4-week study abroad this summer in Spain – and that she is minoring in Spanish. "I'm excited to go, but worried about leaving my mom for that long."(FN23_4/9/19)

Mary grew up in a Spanish speaking home. She often spoke about her family, including her brother who would help her with her math homework up to and including college. While she was not able to use her home language in the college algebra classroom, she was excited about studying abroad where her home language and education would be connected, creating an identity affording experience.

Beyond being able to speak her home language in the math classroom, I observed other instances of identity constraining experiences such as this one near the middle of the semester:

> Mary begins working on it [the worksheet] and fills out #1-3 from memory while the rest of her tablemates reference notes, look things up online, or plug information into Desmos. After a few minutes Greg comes by the table and asks the table about x intercept and what Desmos shows. It seems Greg is doing a quick check for understanding. Mary does not say anything while Greg is at the table and Greg does not specifically say anything to her. (FN21_3/12/19)

Mary was able to complete the worksheet without using Desmos (a free online graphing calculator) like her classmates. Yet, Mary did not view this an opportunity to share work from memory or her reasoning about the worksheet; Greg came and went without he or Mary saying anything. Hence, she remained on the fringes of belonging, constraining her identity as a doer of mathematics.

Power. Mary's power was often afforded at her table but constrained in relation to the instructors or the rest of her class. While working on a worksheet during lecture about how functions behave—what Greg referred to as "bounce, wiggles and crosses," Mary took the initiative with her table group, acting as the more knowledgeable peer leading the learning for her group. I did not hear her speak in whole group or ask questions of the teacher, but she talked a lot when working in partners or as a table, as evidenced in the passage below:

> Taisa to table group: Did you guys use equations for vertex?
> Mary looks through her notes, writes the equation on the top of her worksheet. She turns notes to Taisa for Taisa to copy down too.
> Taisa: What is f?
> Mary: This is h, k
> Mary goes onto to explain the formula. Taisa and Mary solve the first vertex problem together, with Mary leading the conversation. (FN_21, 3/12/19)

At different points in the semester, I heard Mary lead conversations, like this one with Taisa, with everybody at her table. However, I did not observe Mary speak in the whole group once during the semester, nor did I observe her speak directly to the instructor or GTA. At her table, when Mary answered classmates' questions or prompted their learning, her voice was just above a whisper. Her whisper could be heard in small groups, but her audible voice did not reverberate to the whole room, as a louder voice may have done. Given the work in table groups every recitation, there were many opportunities for Mary's voice to be heard in her group. Thus, Mary experienced many power affording experiences in the immediate learning environment in the form of peer to peer interactions.

On occasion, I observed evidence of how Mary's power was constrained. My observations were addressed the student teacher relationship, as in the passage below:

> Ben from T6 [Table 6] calls Nate over for help. T2 [Table 2] is still waiting for Nate to check their work – sitting in silence. Nate goes to T6, passing by T2, seemingly not noticing they are still waiting. It's been about 15 minutes of them waiting, so I decided

> to go over to T2 to ask them how things are going. Tyson explains that "sometimes the rotation is longer, so we call him over." I ask if they feel comfortable with that. Brad, Tyson and Taisa all nod yes. Mary, sitting to my right, says "I don't" quietly under her breath, as she is looking down at her paper not making eye contact with anyone. (FN_19, 2/12/19)

Mary's three tablemates expressed they were comfortable asking the teacher for help if they felt like they were not being noticed. However, Mary expressed not feeling comfortable asking the instructor for help. She spoke just above a whisper and without making eye contact with anyone while she said it. This was evidence of a power constraining experience, as Mary did not feel her voice was or could be a part of the interaction with her instructors, whether that was in the form of asking questions, or participating in whole group lecture.

In this section, I included excerpts from field notes to provide evidence of classroom experiences that afforded or constrained Mary's identity and power. Due to the setup of the classroom instruction, Mary was afforded daily opportunities to work collaboratively, where her voice was amplified within interactions between her peers, including Taisa. However, her identity remained constrained as she had less opportunities to see herself as a confident mathematician, despite acting as the more knowledgeable other in table group learning activities and interactions.

Mary's (In)Equitable Experiences Map

Working from the ethnographic index and thesaurus I created to catalog instances and frequency of each category of codes, I created an (in)equitable experiences map to illustrate the relationship between Mary's affording and constraining experiences in the immediate learning environment of the college algebra classroom. Mary's map is shown in Figure 17.

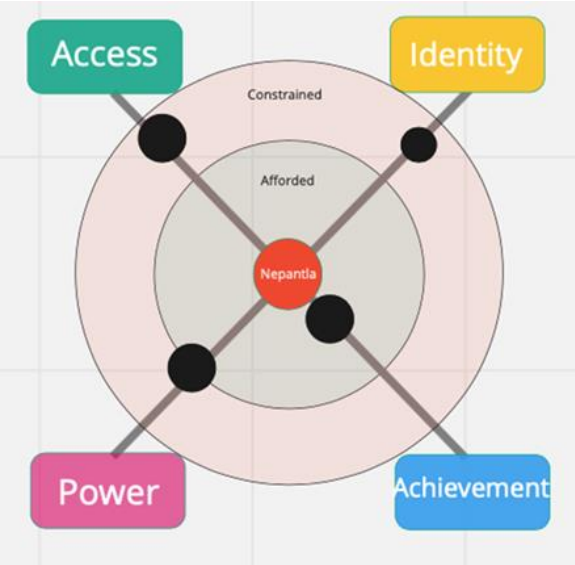

Figure 17 *Mary's (In)Equitable Experiences Map*

The three large circles indicate greater evidence of access (i.e. 13 instances), achievement (i.e. 11 instances) and power (i.e., 13 instances), while the medium dot in the identity dimension indicates occasional evidence (i.e., 8 instances) of identity in my field notes. The dots representing her experiences in terms of access is farther from Nepantla, or can be described as constrained, or less equitable, in that dimension. The dot representing her experience in terms of the dimension of achievement is closer to Nepantla, indicating that dimension was afforded. The dot representing her experiences in terms of identity illustrates her identity was constrained more than it was afforded. The dot on the afforded circle indicates how Mary experienced power on the border between affordance and constraint, because her power in the classroom was afforded during group work but constrained during whole group lecture and interactions with the instructor and GTA. Taken as a whole, Mary passed college algebra and achieved at high levels, but her experiences in terms of the other three dimension of equity were

more constrained. Mary worked hard and survived college algebra with a grade of an A. However, achievement alone does not mean that students see themselves as capable mathematicians or powerful mathematical thinkers whose voices matter in spaces such as college algebra classrooms.

Case Summary: Mary's Voice and (In)Equitable Experience

Mary's lead voice of self-doubt, which I heard in her interview, relates to her (in)equitable experiences, which I observed in ethnographic observations. Figure 18 illustrates a relationship between her lead voice of self-doubt within the dimension of identity. Voice is an aspect of the critical axis, as indicated by the grey circle transposed on the dimension of identity. The yellow arrow represents the directional influence of her lead voice of self-doubt to the constraining of her identity.

Despite being the more knowledgeable other (Vygotsky, 1978) at her table, Mary did not feel confident or identify as a mathematician. I attributed her voice of self-doubt and previous access, identity, and power constraining experiences to this. She was often the first one completed with a group task, answering problems from memorization when her peers would need to refer to notes. In a soft, but knowledgeable (and always mathematically correct) voice, she led table group conversations and helped her peers learn when the GTA and instructor were not near.

Despite Mary's leadership at her table, when the instructor or GTA would come around to check in with groups, she would avoid eye contact and remain silent. In my field notes observed her as a student who had a strong grasp on mathematics, yet this is not how Mary

viewed herself. In her interview, she reported feeling like her knowledge was limited and she was slower than her peers. This disconnect between what I witnessed in the classroom and how

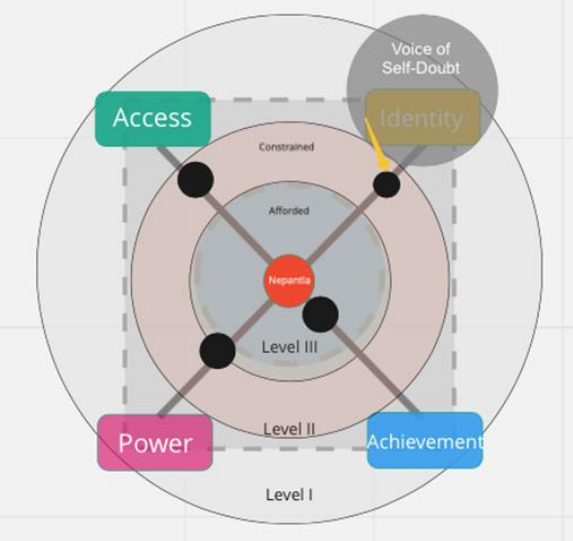

Figure 18 *Relationships Between Mary's Voice and (In)Equitable Experiences*

she identified as a math learner was likely because of the high volume of her voice of self-doubt, telling her she was less than, even though her achievement indicated otherwise.

Mary lacked access in her middle school and high school education, as evidenced by her descriptions of those experiences in her interview. This lack of access earlier on likely played a role in her constrained identity and power as a math learner in the college algebra classroom. Mary's voice of self-doubt was present even in her early years. Mary grew up loving math and, though she believed she did not have a natural aptitude for math, she attained high test scores in elementary school. Despite her self-doubt, in middle and high school she thought math was cool and referred to it as "a good escape" from her struggles. However, around that time, her achievement in the form of grades, started being constrained as well. Mary reported teachers seemed not to notice her absences or her grades with any real concern, which I heard as her voice

of visibility, desiring to be seen. She described feeling that her teachers were annoyed when she would use her voice to seek to catch up in class. One teacher asked, “Why? You’ll miss more school anyway.” Which Mary took to mean her teachers viewed her as lazy, dumb, or not a capable learner. Mary said, “I can’t remember their words exactly, just the sentiments.” Mary’s experience illustrates how teachers' actions can have long lasting impacts on student’s identity as math learners. Mary went from a deep love of, and excitement for math, to feeling that she was always behind, struggling to catch up, and ultimately, failing. These interactions and others constrained her identity as a mathematician. She seemed to base her worth and ability (i.e., identity) on these access and power constraining experiences in her past. Even though she achieved at high levels in college algebra, those voices remained. She still doubted and hid, which also constrained her identity as a math learner.

Access played a role in Mary’s experiences in college algebra, specifically in the relationship between her voices of self-doubt and her constrained identity and power as a math learner. Mary believed that math ability was something inherent in people and not something she could have, or a “fixed mindset” toward math (Boaler, 2019). Her identity as “the dumb one” (Bishop, 2012) was reaffirmed by her table’s lack of attention from the instructor and GTA. Mary was also aware of the lack of attention her tables received but took that to mean something was wrong with her. During member checking, Mary wrote: “With our table getting ignored in class, I had this impression that Greg thought I was dumb. I don't like to admit that. I know now it isn't true, but it weighed on me heavily” (personal communication, 5/18/20). Opportunities for Mary to grow her mathematical mindset (Boaler, 2019) and to see herself in mathematics (Dominguez, 2016) may help afford her dimension of identity.

Mary's voice of self-doubt was interwoven with her quieter voice of determination in relation to her achievement. Mary's determination led her to seek access through help from her brother twice a month. Mary received high marks on exams throughout the semester and passed the course with a letter grade of an 'A,' after taking this course, or its equivalent, a total four times. However, her voice of self-doubt dampened her ability to celebrate her accomplishments, making it difficult for her to admit she was proud herself. She was finally able to say, "Yes! I'm proud of myself. I worked so hard, oh my gosh" near the end of her interview. Once she did articulate that she was proud of herself, her voice of determination quietly proclaimed, "I worked so hard." Here, I heard Mary connect her hard work (i.e., voice of determination), with her success (i.e., achievement). If her voice of determination were louder, she may have quieted her voice of self-doubt, and felt like success in mathematics was something that could be more a part of her identity and experience.

Mary: A Hidden but Hopeful College Algebra Survivor

I conclude with Mary's vignette. This is her montage in the form of a mixtape intended to provide a composite of her case. Like Andre's vignette, some of the statements are direct quotes from her; others are my statements of what I heard her say. Picture Mary saying these words, as a human who has lived and experienced surviving college algebra. Hear her voice. Listen to her song below:

> I love school, I want to learn, I just can't express it. I'm self-aware of my limiting beliefs. I work hard and am harder on myself than you will ever be. I take responsibility for things out of my control and have internalized a negative belief about myself because of external messages - from teachers and at home. I try to be invisible at the back of the room, covering my head with a hoodie. I will never ask a question because I'm not sure I belong here. I've never felt like I belong anywhere, including in this classroom. I don't want to draw attention to myself. I like to be able to explain my thought processes in writing so teachers will see what I'm thinking. But I won't participate verbally - that is far

> too scary. I often feel like I don't have someone to listen to me or someone I can explain myself to - nobody understands me. I have a constant need to justify myself and my actions, a need to feel heard, but I don't have the confidence to speak up and participate. I am the one who knows the math the best at my table, but my teacher doesn't know that. My teacher doesn't see me. I wish they knew how smart I was. I wish I knew how smart I was. I am Mary and as hard as I try to be invisible, I really want to be seen.

Cross Case Analysis of Two Survivors: "I passed!"

Andre and Mary both passed college algebra. Cross case analysis of their experiences and voice, however, created space to listen to the similarities and difference in their human experience. Their voice maps and (in)equitable experiences maps, shown in Figure 19, also served to illustrate their experiences surviving college algebra.

Specifically, the composition of analysis maps suggests a reciprocal, rather than predictive, relationship between the dimensions of equity. Furthermore, their voices related to their experiences of those dimensions. For example, Andre's lead voice of determination was connected in the dimension of access being afforded. He took advantage of every tangible resources available, determined to succeed even though he felt like an outsider. Conversely, Mary's lead voice was that of self-doubt. What I observed in the classroom supported this; Mary's identity was constrained. She did not see herself as a mathematician even though she achieved at high levels. This suggests promoting students' equitable experiences is more nuanced than just fostering their access and identity, to promote achievement and power, respectively. In describing their experiences surviving college algebra after a previous failure, Andre and Mary used multiple voices, and those voices articulated with one another in complex ways. Both used a voice of determination which underscored their persistence and hard work as college algebra survivors. In addition to Andre's voice of determination, he also used a voice of belonging, of defeat, and of pride.

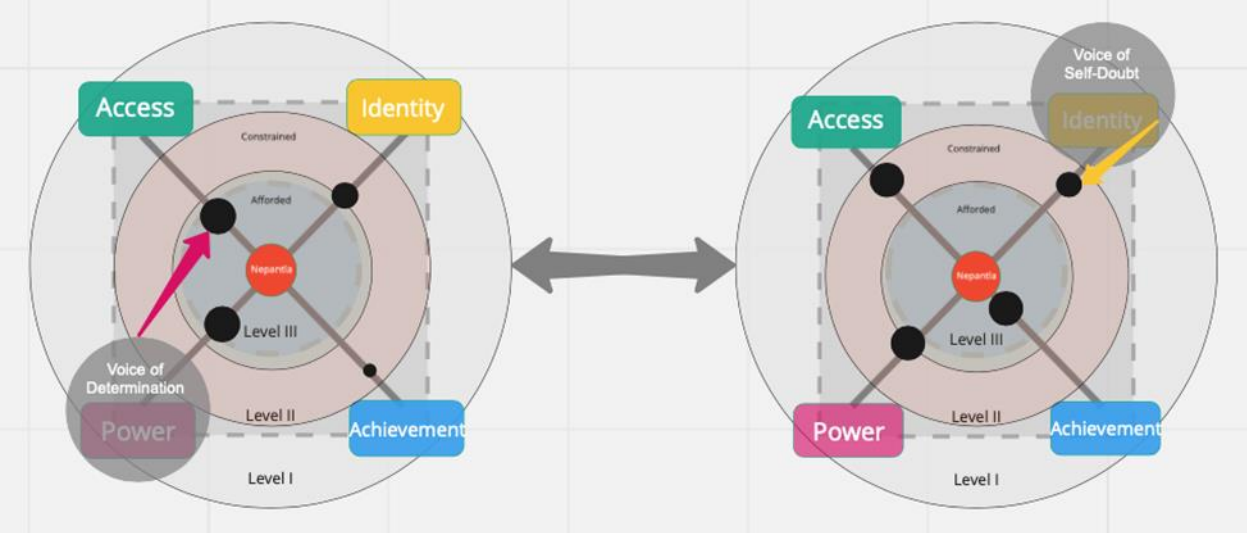

Figure 19 *(In)Equity Map and Voice Overlaid on Erickson's Levels of Organization*

Mary also used three voices in addition to that of determination, the voices of self-doubt, visibility and hope. Though these participants shared a voice of determination, their determination sang in different ways. Listening for the contrapuntal voices in the third step of LG analysis highlighted those aspects of their experiences and identities that drove their determination, indicating that for each participant, the origin of this voice was different. Andre believed that, through hard work, he could overcome what he referred to as the burden of college algebra. Mary dug deep for the strength and determination she described as being buried deep within. Andre and Mary both put a lot of pressure on themselves to do well, to achieve. For Andre, this appeared to come from a place where he felt that he needed to prove himself. For Mary, being hard on herself and never feeling like she was good enough was part of her identity. Both were motivated, persisted, and were driven to continually learn and to do better.

Important, both students seemed to believe that the burden to pass the class was on them—not their instructors. Andre and Mary compared their experiences of math in high school

with college. In high school, they were more apt to recognize the role of a "good" teacher as central to their doing well in the class. In college, Andre and Mary wished that their instructors could take the time to get to know them more, as students, as humans. Andre believed that if his instructors were to connect with students, this "would have to be something that was within a teacher's personal agenda," because he believed this was not a university expectation for instructors and professors. He thought that perhaps if the university issued a description of each student's background for instructors to review before the term, this would help instructors know who to focus on and maybe help a little more. Mary wanted to see instructors use a wider variety of techniques to engage students, because "we all learn differently." She appreciated times she was able to feel heard through writing about her math thinking for assignment and quizzes.

While Andre and Mary wished their instructors knew them more as people, they both acknowledged this would be challenging for instructors. Andre expressed, "it may be unfair to burden them in addition to teaching responsibilities." Mary also recognized that this could be a challenge to place additional responsibilities on teachers. She acknowledged that "it must not be easy to come up with a certain teaching style that fits everyone, because we are all so different." This could be solved if instructors were open to accepting feedback and continual improvement, Mary suggested, so that instructors could reach more students from a wider variety of backgrounds. Like Andre, though, Mary thought that teaching responsibilities were already so great that, "Maybe I'm being unfair in expecting that." What Andre and Mary are asking for is not unfair; it is necessary for more equitable math teaching and learning experiences. It may not be common, or part of the status quo, for college algebra instructors to center and know the humans who are experiencing the learning of undergraduate math. However, the findings I presented in this chapter suggest Andre and Mary are asking for just that.

CHAPTER V

DISCUSSION

Not everything that is faced can be changed, but nothing can be changed until it is faced. -James Baldwin

We need in every community a group of angelic troublemakers. - Bayard Rustin

Educators need to face a problem before it can be changed, and to change it requires a group of "angelic" troublemakers (Hodes, 2014). When 50% of students who take college-algebra fail (Holm & Saxe, 2016), this signals a problem. Such a failure rate cannot be blamed solely on students (Chen & Marina, 2016; Crisp & Delgado, 2014). Rather, it seems to be a symptom of a system that is failing to meet the needs of students (Ladson-Billings, 1997). To change the system requires facing the problem of this high college algebra failure rate and considering how educators may contribute to and perpetuate this problem, instead of simply blaming students for not working hard enough (Carmody, et al., 2012).

Andre and Mary provide two cases through which one can understand the experiences of college algebra students who were retaking the class. These two cases are important because they represent two students from historically marginalized populations who make up a large proportion of the 50% of students who fail college algebra the first time they take the class. Further, my empirical ethnographic research illuminates the hard work that Andre and Mary have demonstrated, not only in the semester they passed the course, but also in their descriptions of their previous math experiences. As such, their experiences challenge the dominant narrative that if students just worked harder at math, then they would pass.

Gutiérrez (2013) has argued that it is from "the views of subordinate individuals that we will learn how to rethink mathematics teaching and learning" (p. 39). Specific to this study, it is

from the experience and voices of students like Andre and Mary that the rethinking of college algebra teaching and learning in a university classroom may be possible. Centering students' voice and mindfully listening to understand students' experiences is imperative for math teachers, educators, and researchers who aim to improve learning opportunities that disrupt systems of othering. Doing so can remind instructors of their students' humanity and create learning systems that account for the unique backgrounds and perspectives of all students.

Two key lessons emerged from this study: One, insisting that students "just work harder" is insufficient to remedy the problem with college algebra, and two, promoting students' achievement and power is more nuanced than just fostering their access and identity. To organize this chapter, first I discuss each lesson learned. Second, I explain how my analytical techniques contribute to the field, including the extension of Simpson's (2015) voice mapping and the new (in)equitable experience analysis method that I developed. Third, I provide insight on what researchers, administrators, and educators can learn by listening to the voices, or perspectives, students use to describe their experiences retaking college algebra. Finally, I address how educators may work to increase equitable learning opportunities for students in the college algebra classroom to foster students' learning and growth.

Countering the "Just Work Harder" Myth

To pass college algebra, the dominant narrative is students should work harder to improve individual deficits (e.g. Chen & Marina, 2016; Crisp & Delgado, 2014), or institutions should implement an intervention (i.e., afford access) to improve (i.e., afford achievement) the reported 50% pass rates (Holm & Saxe, 2016; Blair et al. 2018). Both Andre and Mary worked hard and were determined, yet they felt like outsiders, even in the semester they passed the course, and did not see themselves as connected to the mathematics. Improving pass rates

statistics requires change beyond an individual student level. When the system is working harder, humans enrolled in college algebra can go beyond surviving, to thriving as powerful mathematicians and critical thinkers empowered to make a difference in their world.

When students feel they can (and do) contribute to classroom instruction in constructive ways, they have agency in their engagement (Reeve & Tseng, 2011). Students can have agency when learning through activities that are meaningful and relevant to them, driven by their interests, and initiated with appropriate guidance from instructors. Student agency, then, is a mechanism for students to embrace their voice and identity in the classroom. Yet, the instructor is in a position of power and thereby integral to experiences that afford or constrain student's recognition of their agency. Instructors' understanding of their power in affording or constraining students' agency is necessary to provide equitable learning opportunities because inequities in social hierarchies and positioning can be reproduced in math classrooms (Ball, 2018). For example, classrooms that employ group work and inquiry-based learning and teaching practices can use problems that rely on outside knowledge and experience or discourse rich environments can reproduce societal biases (i.e., voices of white males have more airtime in group discussions or lectures). Providing time for students to work in groups or engage in discussion, is a start, yet is not enough to address issues of power and agency.

Researchers investigating students' experiences at the college level have found that group work and inquiry-based learning settings are not neutral (E. Johnson et al., 2020; Enright, 2016). E. Johnson et al. (2020) analyzed 522 content assessments of students enrolled in a Linear Algebra course described an "an unfortunate finding" (p. 969); a gender achievement gap where students identifying as female performed worse in inquiry oriented instruction, which includes student voice through classroom discourse and group work, than the students whom

identified as the male students. This is supported by other studies that found women in predominantly male groups speak less and are interrupted more than men (Karpowitz, Mendelberg, and Shaker, 2012) and students' opportunities to participate in whole-class math discussions follow patterns of gender, race, and class (Black, 2004; Walshaw & Anthony, 2008) in the general sociocultural system. In a study involving calculus courses at the university level instructed by GTAs, Enright (2016) found GTAs who were members of overrepresented groups (i.e., majoritized students identifying as men and Asian or White) acted on their ideas about intelligence through their teaching practices, creating differentiated access to learning opportunities and marginalizing minoritized students. Hence, students may be working hard in inquiring based learning settings, but experiences may reify general sociocultural systems within the immediate learning environment and dampen potential of students' hard work. Instructors must also work hard and takes steps to disrupt and support more equitable learning experiences that include attention to all four dimensions of equity (Gutiérrez, 2013), particularly the critical axis dimensions of power and identity.

The myth of meritocracy and hard work is pervasive in mathematics education (Rubel, 2017). The dominant narrative of college algebra is that with hard work, students can pass the class. Yet, Andre's case illustrates that hard work may not be enough. Through ethnographic data collection, voice analysis, and (in)equitable experience mapping, I discovered other factors that can contribute to a student's success or failure. One such factor is student's math identity. Students who have access to the resources necessary to achieve in college algebra and use those resources may still fail, or barely pass—not for lack of effort, but for lack of connection. If the college algebra classroom represents windows and mirrors for students' math identity (Dominguez, 2016; Gutiérrez, 2008), this means that students should see themselves reflected in

the classroom environment, and that this environment could also open a view to a larger world for students. Andre's voice of belonging, through which he described finally understanding his own identity in relation to math during the semester he passed college algebra, speaks to the importance of affording this dimension of equity.

To make the college algebra classroom more equitable, instructors can provide students with opportunities to express themselves and their voices in ways beyond real time audible participation to facilitate connection with students who may be less likely to participate in whole group settings. These connections can happen in real time, or via assignments. In real time situations, instructors can be aware of when they are putting the onus on the student to initiate communication, recognizing some students like Mary will not if the onus is on them to do so. Through assignments, one-way instructors can initiate connections with students is to incorporate math autobiographies (Reisch, 2000) as a course assignment. This can help instructors to get to know their students and their students' experiences with math. However, such an assignment only scratches the surface. Instructors must care what their students write and demonstrate this care in ways that students feel safe expressing themselves and sharing these experiences.

Fostering Access and Identity may not Promote Achievement and Power

Gutiérrez (2009; 2012a) asserted that opportunities to learn (i.e., access) lead to outcomes (i.e., achievement) and that identity could be thought of as a precursor to power. For example, access to resources, in theory, would lead to good grades. Yet, results from this dissertation suggested such a relationship may not necessarily hold. Through (in)equitable experience mapping, I was able to draw out nuances in the relationship between the four dimensions in terms of the affordances and constraints. I found more of a reciprocal, rather than temporal, relationship between the dimensions on each axis, where dimensions can be afforded and

constrained together, rather than one leading to the other. Overall, Andre's access was afforded in the college algebra classroom, but his achievement was not. Conversely, Mary's identity was constrained, but her power was not. Hence, Andre and Mary's (in)equitable experiences in college algebra do not seem to follow the predictive pattern that Gutiérrez (2009; 2012a) posited. Combining voice and (in)equitable experience analysis can help to explain this finding.

Gutierrez (2012) acknowledged a role of voice in dimensions of equity along the critical axis, asserting "This dimension [power] could be measured in terms of voice in the classroom" (p. 20). Simpson (2015) and Hall et al. (2018) centered student voice as a way of making sense of student's complex identities. My observations and analysis indicate that voice can allow for relationships not only along the critical axis, but also across the critical and dominant axes. I found students' voice to influence affordance and constraint in different dimensions of equity. For example, voice within the dimension of power, can impact access as in Andre's case. In Mary's case, her voice was constrained along the critical access, but only in whole group settings, not in small group settings. (In)equity maps composed with voice maps served to tease apart a relationship between students' experience and voice and allow for deeper examination between all four dimensions of equity. Students' experience and voice were interconnected in complex ways, which mapping served to help illustrate and examine.

Future research could also help scholars to better understand relationships between voice and (in)equitable experiences. Questions could include: How does one's experience in the classroom relate to the voices they use to describe their experience? How does one's voice impact their experience in the classroom? Perhaps voice, which is a central component of the critical axes, is a greater predictor of students' achievement than Gutierrez predicted. Additionally, studies such as ITSCoRe (Johnson et al., 2019), which investigated students'

reasoning could help to shed light on these relationships, to examine interactions between cognitive processes of math reasoning and the dimensions of equity.

Analytic Techniques for Voice and Experience

Voice Mapping Extension

In her research, Simpson (2015) used voice mapping to demonstrate how voices can co-exist in the same spaces instead of solely in opposition, or tension, with one another. I borrowed from Simpson's voice mapping approach in this dissertation study, and extended its scope to connect explanations between voices, including harmony, tension and directional influence. Doing this was critical for understanding the different ways that students voiced their experiences, as an individual may perceive and understand an experience in different ways. That is, individuals make meaning of the same experience in different ways and from different angles, and they use voice to describe the different meanings. To understand the full scope of the experience of retaking college algebra, I had to understand the various ways participants perceived, understood, and made meaning of this experience.

Figure 20 illustrates the relationship between voice mapping and the dimension of equitable experience within the framework of Erickson's three levels. This helps situate the voice maps in context with the levels of experience and in relation to dimension of equity. Specifically, voice is expressed within the level of individual functioning (i.e., Level III) , to make sense of the concentric relationship of the immediate learning environment (i.e., Level II and general sociocultural system (i.e., Level I). Together, voice maps in tandem with the critical axis of dimensions of equity overlaid on Erickson's levels can provide a visual representation of the lenses through which students make sense of their experiences in college algebra.

Figure 20 *Voice Map and Dimensions of Equity Overlaid onto Erickson's Levels of Organization*

Contribution to Equity Analysis

I developed the (in)equitable experience analysis method, based on Gutiérrez's four dimensions of equity (2009; 2012). To do this, I used ethnographic data from participant observation and field notes to explore how participants' achievement, access, identity, and power were afforded or constrained. This method allowed me to combine equity analysis with ethnographic methods. This method could be useful for researchers who employ ethnographic methodologies and aim to study students' experience in the classroom as they are happening in real time. Focusing on experiences of achievement, access, identity, and power, and the ways in which they are afforded or constrained provides a way for researchers to narrow their gaze in the classroom, but also to explore how those specific experiences occur in the larger classroom setting. Applied to different college subjects, this may help researchers identify which students

are privileged or marginalized in other classes and understand why and how this happens. Understanding this is critical to rethinking teaching practices working toward equitability.

Inspired by voice mapping, I created an (in)equitable experiences map to illustrate and visualize students' experience in terms of four dimensions of equity (Gutiérrez, 2012). Specifically, (in)equitable experiences maps provide a way to visualize how participants' dimensions of equity were afforded or constrained. Figure 21 presents the (in)equitable experiences maps for Andre and Mary overlaid with Erickson's three levels of experiences. This composition illustrates how the college algebra classroom, or immediate learning environment (i.e., Level II), can be observed with participant observations through the lens of the dimension of access. While observations are conducted in the social interactions of the classroom, each of the four dimensions are impacted by participants sociopolitical experiences that occur in both Levels I and II, hence the label of each dimension on the boarder of the two outermost levels. Learning happens within the mental structures of the individual functioning level but is impacted by each of the other two levels simultaneously. The closer the black dots are to the origin, or what Gutiérrez (2013) called Nepantla, the more empowered and equitable the learning experience. This may be of use to future researchers of classroom and education inequality as a gauge to understand the degree of equitability of the learning experience and what steps can be taken to increase equitability and empower students in the classroom.

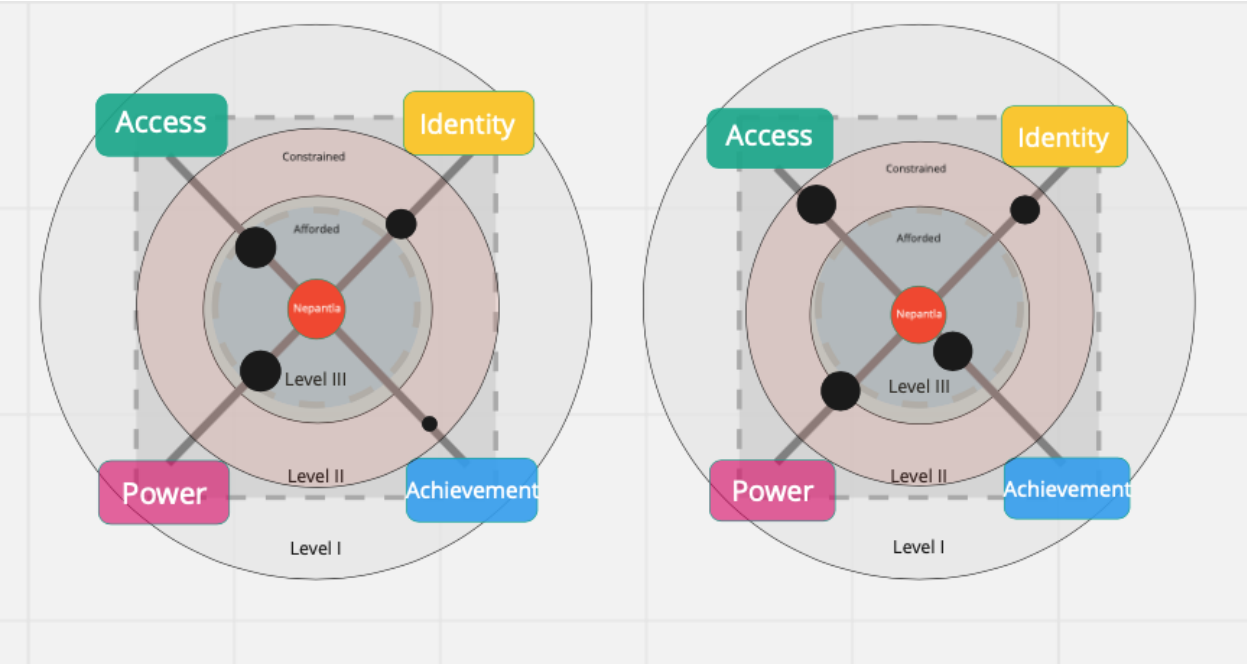

Figure 21 *(In)Equity Map Overlaid on Erickson's Levels of Organization*

Such a use of (in)equitable experiences mapping may have implications for predicting how well a student might do, or what they need to succeed in the college algebra classroom in terms of each dimension. More research on this may illustrate these relationships more fully and in ways that researchers might be able to generalize to larger groups of students in the future.

Limitations

Despite the strengths of this study, there were limitations. I selected two participants, or cases, to research for this dissertation. This small sample might not reflect a larger sample of students, like students in other algebra classes with different instructors or at different schools. Additionally, these students' voices might not fully reflect those of students in other contexts. Aspects of these experiences could be unique to Andre and Mary in the context of this college algebra class with these instructors and teaching assistants.

Another possible limitation of this study was the population itself. I selected participants who passed the course after at least one failed attempt. This means that I did not include students in college algebra who did not complete the course. Tasia and Gia were two such students. Listening to their voices could have further illuminated the ways in which access, achievement, identity, and power were afforded or constrained in the classroom. Conducting this study was my own introduction to learning to be an ethnographer, which meant that I was developing my skills in writing field notes while collecting data. In this dissertation study, I have made every attempt to use and center the voices of participants. With greater skill I could hone my ability to notice more in the classroom, as well as focus on other aspects of the college algebra experience that may have been important, thereby yielding more data to work with.

"Thank you for Listening to Me": A Call for Action

There were tens of thousands of words set down on the paper of this dissertation and I implored readers to do more than read the words, to listen to the humans whose voices speak those words. To understand the experience of surviving college algebra required listening to feel the human experiences of survival. If one has not experienced surviving firsthand, the closest they can get to understanding the human experience of surviving is in listening to voices of individuals who have survived. As I listened to the voices and worked to understand Andre and Mary's experience of survival, I heard ways math teaching and learning could be improved. After this dissertation research concluded, Andre reached out to me and said, "Thank you for listening to me."

The section that follows is somewhat unorthodox. I first pose questions I wondered about as I listened to Andre and Mary's stories of survival. I also speak in the "we/you." When I use "we/you" I speak to readers who are in a position of power to impact the stories and experiences

of math learners. The "we/you" includes researchers, instructors, administrators, advocates or any other person charged with the power and responsibility to make decisions about teaching and learning. I say "we/you" because I too am in a position of power and my identity includes each of those categories, working to hear Andre and Mary in ways that inform more equitable learning experiences.

What Does Equity in the Math Classroom Mean?

A lot of professional organizations are making the call for math to be more equitable. The inequity map that I created based on Gutiérrez's dimensions of equity (2009; 2012) can serve to guide professional development, planning, and instruction that is equitable. That means in each of those phases we ask ourselves, "how is this affording or constraining my students' access, and how is this affording or constraining my student's achievement, identity, power?" Only when we can identify, articulate, and live affordance in each of those four dimensions can we claim an equitable teaching and learning experience or describe ourselves as empowering students.

How do we Coach Teachers to be Promoters of Empowered Learning?

Currently, many K-12 schools and districts employ coaching models, where instructional coaches work to promote the professional development and learning of classroom teachers in a coaching model. The (in)equity map I created based on Gutiérrez (2009, 2012a) dimensions of equity can serve as a guide for coaching models. For example, coaches can train teachers about each of the four dimensions, what those look like in the classroom, and help teachers work towards dimension affording pedagogies. This becomes an asset-based guide for communicating coaching expectations, driving the work between coach and teachers as coaches help teachers progress and develop towards Nepantla (Gutiérrez, 2013).

What Can Early College Instructors Learn from Andre and Mary?

College algebra instructors have likely experienced "thriving" rather than "surviving" in math courses. Empathizing with experiences we have not lived ourselves is challenging. Yet this is often the case for early college instructors because we have not had a similar experience to their students. Rather than reflecting on our own teaching methods, it may be easier to blame the student for the bad grade. We can (and should) ask ourselves what more we can do.

Doing more means prioritizing knowing and connecting with all our students in equitable ways. Students want to be seen, heard, and understood, which Andre and Mary both expressed. We can develop a mindset of "I teach humans," which builds this connection. Knowing more about our students as humans helps us use our power to invite them into the math learning environment. This helps us see them, hear them, and understand them, which impacts their identities as math learners. When we truly know our students and their lives, careers, and passions, we can help them connect with math, and connect math to their lives.

Connecting with our students means considering who gets airtime in the classroom and ensuring everyone is heard. When students are talking, be aware of who is talking, who answers questions, and whose voices are we re-voicing as opposed to silencing or ignoring. We can create novel ways for students to share their work in safe ways that include the quieter students, such as different genres of writing or through anonymous chat boards.

Incorporating writing into our classes provides us information about how students are thinking about key concepts that we can then use to guide our instruction, which may build our connection with students and help them connect with math. Techtivities (Johnson et al., 2018; Johnson et al., 2020), freely available computer-based activities, are an example of tasks

designed to promote conceptual mathematics while also employing opportunities for students to explain in reasoning, communicating their thinking with peers, in non-verbal ways.

Connecting with our students allows us to understand and provide students with the tools they need to learn, which may make them feel empowered. We need to invite students to our office hours repeatedly. We can make the classroom feel like an inviting place where students feel welcome and like they belong. We can hold office hours at nontraditional or different times throughout the week, or online, to accommodate working students so they feel seen and heard. We can help students learn about university resources, so students know we hear what they need to succeed.

Connecting with students toward equitability means we communicate our high expectations because we know students can meet them, and we are alongside them to coach and support them. We can encourage a community of learning by asking table groups to share email addresses, if they feel comfortable, or to be "study buddies" and to support one another's learning throughout the semester. We can establish a culture of "together, we all rise."

Finally, by seeing, hearing, and connecting with our students, we look for the knowledge they bring to class on which we can build. We might do this by considering scoring exams in a way where students earn, instead of losing, points and by training ourselves to get in the habit of looking for evidence of what students know, rather than deducting for mistakes (Boaler, 2015).

At a minimum, we must share the burden of blame for our students' failures with our students. I urge us to do more. All people are capable of learning math, reasoning, thinking, and questioning. It is the systems and structures and people in positions of power, and how that power is used, that hinder or constrain what learners naturally do. If we do not believe this, we

must consider deeper questions and devote to working on ourselves and our biases, so we do not misuse our power as instructors.

The above suggestions may sound difficult, unreasonable, or improbable. Changing the game is not an easy feat, and maintaining the status quo is much easier. However, maintaining status quo practices means 59% of African American students and 51% of Hispanic/Latinx students will fail college algebra the first time they take it. Students like Andre and Mary are working hard, to struggle, to persevere and to overcome the barriers they experience; those in power should work harder to change the status quo.

Concluding Remarks

As I reflect on what I learned by listening to Andre and Mary, I think about what it means to pass a college algebra course. Is this an act of achievement, does it give one access to things in the world they might not otherwise have? Is it an act of perseverance to overcome a systemic gatekeeper designed to "other" some and advance others? What could it take for each student to not just survive, but thrive? In equitable learning experiences, students can embrace their agency, and show up as themselves, and feel like they belong. Students are working hard to navigate mathematical systems and gatekeepers to achieve, but how are their voices, identity, and power impacted along the way? With my dissertation, I amplify the voices of Andre and Mary, so that students may thrive, and not just survive.

I began this dissertation with two I-poems and three questions for the reader to consider. I ask those three questions again here for your reflection, and leave you with one additional question to ponder as you encounter Andre and Mary in your spaces: What does it mean to listen in such a way to hear and understand students? What do you feel as you listen to their voice?

What could be a deeper meaning of their human experience? How will you be an “angelic” troublemaker to improve systems of math teaching and learning?

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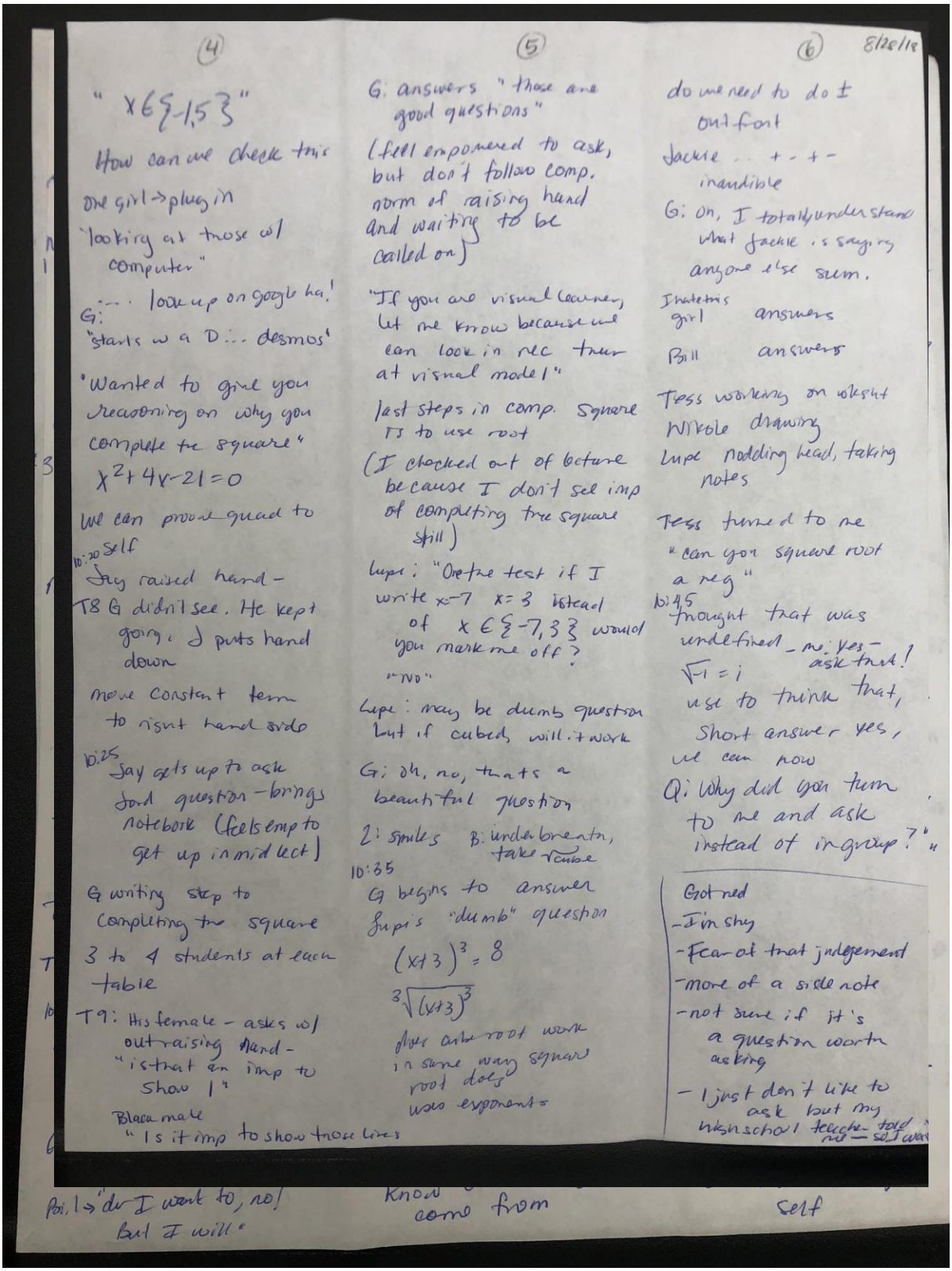
APPENDIX A

JOTTINGS



(7)

Nikole on access

...imag roots, but we will save for chpt 5 ... save for later, thank you for asking

Reason I'm willing to answer these because very pertinent to section 1

G: wong ± w/ √

B: "cause you told me to.." laughs

G: Where did quad formula come from?"

T9: BM "A smart person"

10:48 Derive the quadratic formula

"Have a friend w/ quad formula tat; pyth on other side"

Eyebrows raised

$ax^2+bx+c=0$

B "take the c to other side"

$\frac{a^2+b^2}{a}=\frac{c}{a}$ a≠0

T8: if a is 0, wouldn't be a x^2 term so would be liner

G → T8 ←

lots of confused faces

T6 falling asleep girl w/ short curly hair

(8)

G keeps going

(I think about 3 people knew what he meant

10:50

arms crossed

rest of T6 notices sleepers smiling at each other

Science guy looks concerned - makes eye contact w/me, notices me noticing him

G still deriving formula

She's awake now

G "some of these terms may be looking familiar

T2: shakes head no

Munna - arms crossed

Nikole - still on access on phone

T6: eyes open, trying to take notes. Head still bobbing, eyes heavy (nare or drugs?)

T2: head shaking no

guy know it's the descriminant

N- hasn't taken a single note - back to lecture - drawing

G: next step

B: calls out √

guy nods; goes on

G ⇄ B

(9) 8-28-1

Jayden head down - texting

G: "we're close"

about 1/2 still taking notes

headphones - didn't want to see posters on last Thur, haven't heard speak yet

Will want to watch rest week

G: imp. to see how these form work - think it's a little bit cool?

Lived 100 years ago, could have been famous

B packing up

12:00 finishes 1.3

talk like need quad.

don't like: need to have sharpened prereq skills boom - need everything

If feel like it's been a crash course ... it is

factoring

reducing radical

fractions

imp. to front load

(normalizing)

Any questions on 1.3 (wait 3 sec) OK - move on

12:01

1.5 ok, some of these Q have already come up

(10)

$ pulls notebook back out

Squared: square root are undoing each other

my advise, do not "square right away"

** when I square both sides

N still doodling

Service guy: nodding head "easy"

T8: Male sleeping now - Same one as who called out correct answer in a → ← before.

T6: girls sleeping again

12:05
most still facing lecture board. taking notes

N flower page almost fully filled in

writes down board note/ equation for first time

Braxton face flush

plug one in for t

[illegible] we get 9=1 ≠

"something on the tracks, it derails"

extraneous solution

#7. "So the answer is 1?"

G - t=1 is an extraneous solutions

so no real solution

(11)

Find out I hate this girl's name and ask what she hated about being asked to move

10:10

Tess- gets up to ask dad a question while carrying her computer noticed mml was pulled up

G is giving a cubed example

Think for 30 seconds - I'll have you vote

BM: Always ✓ your solution

thumbs - ~~[illegible]~~ first to vote

about 1/2 of class voted

12:12

3min left. don't like to end early

leave you w/ a thinker question

$$\sqrt{x-3} + 2\sqrt{3x-4} = 9$$

Solve for x

How would you attempt to solve this?

See how this is dif. than the other ones?

something due at midnight

(12) 8

APPENDIX B

FIELD NOTES AND OBSERVER COMMENTS

Field Note #1 College Algebra

Amber Gardner
College Algebra
Observation dates 8-28-18
First draft of field note was written on 8-30-18
Revised draft completed 8-31-18

(OC: I originally thought I would do two observations and 1 field note to include both observations per week, but after trying that this week, I think I need a field note after each observation. As such, field note for observation 8-28 was written after observation for 8-30. But, in the future, I will write a field note immediately after observation and before the next observation)

Abstract:

Students hear about project from Heather and take attitude survey.

Why do we have to learn how to complete the square? "That's a stupid way to solve the problem emerges."

Tiffany and Lupe seem hesitant to ask questions but do and Greg answers with patience.

Narrative of Observation:

I open the door at 9:59, one minute before class was to start. A few faces turned to see me enter the clean, bright classroom. College Algebra, a 1000 level course, meets in one of the newer buildings on campus, much more modern and updated than the rooms my 7000 level graduate classes are held in. (OC: I've often felt math has power in society. The buildings certainly seem to send the message that the department of math and science deserves a better space than the school of education and development. I wonder how funds are allocated at a University and who decides what departments will be housed where).

The room is filled with 9 tables, in three rows of three, each composed of two trapezoid shape tables pushed together to create hexagonal tables with 4-5 black rolling office chairs around each table. The front of the room has two large screens that project whatever the instructor chooses to share from their computer, flanking each side of a wall-to-wall whiteboard, the slick white board I can tell easily erases. The back of the room also has a wall to wall white board. Everything in the room looks quite new. (OC: I think back to the old, dimly lit, crowded room I taught in last semester, again in the school of ed, with one small drop down projector screen and two white boards composing about ¼ the total board space in this luxurious classroom.)

This observation is the third class meeting. I observed last week, but did not take jottings or field notes. I wanted to join is as a participant in the beginning to best take in and experience the first week of class in an undergraduate course to work to build rapport without a paper and pen separating me as an outsider (OC: It's been 20 years since I took my Freshman undergraduate courses.) The room is almost full, with only 5 or 6 empty seats. Many heads turned to see me as the click of the opening door alerted them of my arrival. (OC: I hate being late and feel a bit anxious in arriving just as class is starting). I rushed to find a seat as close to the back of the room as possible, landing at T7. (OC: I refer to locations in my jottings by table number, as Jason, one of the co-teachers of the course, often numbers off students and shuffles them to the associated table number. When I learn names, and students settle into their desired location in the room, I will create and attach a seating chart and map of the classroom) I sat down, pulled my folded papers and pen out to start my jottings and seconds later heard Jason ask the class to count off. The white girl with dark brown hair and glasses sitting across from me knew this meant we would be moving from our choice seats to a forced shuffled group. Just loud enough for our table group to hear, she whispers "I hate this," as she picks up her things with force to move to the next table over. (OC: I do too. I like to sit at the back of the room. I often have my student move/partner up/etc. I haven't thought about how this can actually be a source of frustration for them until I'm reminded of how much I don't like it at this moment.) I was a #1, so I joined the frustrated girl in packing up my things to move to my newly assigned seat for the day, T1.

At my table, I find two other females and a male. I was grouped with all three of these people at different times last week during the community building rituals. I remember the males name, Bob, as he was the veteran that caught my attention in a reflection of my visit on 8-23. Bob told me last week that he has two other degrees, and the timeline matches with the age I estimate him to be, about 30. He is white, wears a black baseball cap with a long pony tail hanging out the back that is almost as long as his beard which extends about 4 inches past his chin. He has a black t-shirt on that reminds me of a heavy metal concert shirt. I also remember the one of the female's name's, the one with darker skin wearing a hijab and long flowing dress, Nyah. She is quiet, often leans in such a way her hand is over her mouth. She is a freshman with aspirations of becoming a nurse. She described herself as a 'math person' last week in introductions. I have one other memory of her from last week – after watching a Jo Boaler video on the brain and learning math, our table discussed our thoughts. I shared what happens when one's heartbeat gets over 140 beats per minute, the cortisol dump, and resulting block to the prefrontal cortex which literally makes recalling information impossible. She smiled and said 'I love how you pshycologize math.' (OC: I'm not sure what psuchologizing math means. Perhaps she was talking about the learning process and brain stuff related to math.) I didn't remember the name of the other female at first, but did remember she was a bio major, almost finished with classes, but had waited as long as possible to take algebra because she "hated" it. She is white, has long brown hair braided to one side and always wears a headband to match her yoga pants and running jacket. She is in excellent physical condition and I assume she is an athlete of some sort.

Jason handed a baggy with several orange slips of papers in it to each table. There are four quadratics with the steps to solve the problem cut up in each baggy. Our directions are introduce ourselves (OC: Learning names seems to be a priority to Jason and Greg, the co-instructors of the course) then begin to put the solutions steps in order for each quadratic. Natalie is the athletic white girl's name.

Bob takes the strips out of the bag and starts sorting as the rest of us watch. All strips are facing him. Natalie turns the completing the square solution set towards her (x^2+4x -21), looks at in then says "This is a stupid way to solve it."

10:20

We now move to working on the worksheet (See Scaffolded Tactivity for Solving Quadratic Equations Part 2) where we are asked to identify the correct and incorrect step. Natalie asks, kind of to herself, kind of to the table group, "Why can't we just factor it?" Bob asks his own question, "How do we choose what number goes here?" pointing to the blank line. Both questions go unanswered.

Bob continues to ponder questions out loud, Nyah works alone, quietly, Natalie is staring out into space. (OC: The comfort it takes to be vulnerable learners and cooperatively work together hasn't been established with this group yet.)

10:35

Jason checks on our table. Natalie asks her question about why we have to complete the square when we can get (x-7)(x+3) by just factoring. Jason agrees it's not necessary for this one, but that it will be in order to prove the quadratic equation next class. (OC: I'm not convinced of the explanation because I don't remember the trick for completing the square either, knowing I can factor any quadratic with the equation or factoring – I've never made space in my brain for this trick and Natalie doesn't seem convinced by Jason's justification either.)

From T3 I hear "Hey, remember what happens with mistakes?" In a happy, lighthearted tone. I look up to see Greg working with the T3 table group. He goes on to say, "two neurons firing!" referring back to the Jo Boaler we watched last week.

At T5, I see a white guy with short brown hair turned to help a girl sitting at T6. I don't know his name yet, but like Bob, I think he's been in the service as he talked about prepping for ops and trainings last week while sharing out with the whole class. He also appears to be in his late 20s or early 30s. He participates a lot in whole group discussions.

10:45

Heather arrives to explain the IRB opt out and to answer questions about the study. She then asks all students to take out their phone to take the attitude survey. Bob, sitting arms crossed, says loud enough for only our table to hear, "She's assuming we all have phones" (OC: I think this is a powerful observation by Bob about assumed privileges those in power make) Greg notices Bob is the only one not taking the survey and comes near him to ask "want to

borrow a computer?" to which Bob replies, "do I want to? No, but I will" He takes Greg's computer and begins typing, although I don't know if he is actually completing the survey or not.

10:55
Greg writes agenda on the board as students take survey. See jottings for agenda.

11:00
Break

About 80% of students stay in class during the 10 minute break to continue working on the recitation worksheet. Bob, returns from the hall after a short break, pulls out his phone (OC: Ha! He has a phone – now I'm even more intrigued by his phone assumption comment), and shows me a news story that has something about Universal Basic Income in the title. He asks what I think about UBI. I am honest and tell him I've never heard of it. He shares what he knows and speaks passionately about his interpretation of it, a combination of socialism and capitalism to combat loss of jobs though automazation. He goes on to explain that one of his degrees is in political science, but he is now working on engineering because so much of the political science work went towards activism after the Trump election and that he doesn't like talking to people. (OC: I find this interesting because Bob continually talks in whole group in class and initiates conversations with me.) He thinks he wants to now combine those two fields if possible in society engineering and/or renewable energies.

11:10
Greg refocuses the class after the break with "I hate to break you away from your studies. I hear a lot of good math conversations." then transitions into explaining the logistics of canvas and MyMathLab. Greg is in lecture mode now so there is a lot of direct instruction and him talking. "There is a quiz every week and you will always know where they came from. Can anyone remind me of the written homework questions?" (OC: Greg seems to take a one-down power place often with the students). "As long as you do the homework, you can use it on the quiz. Make time for the written homework, those problems show up again and again. The more problems you work, the better you'll get." (OC: This sounds like a behaviorist perspective to learning).

"I always get a little math anxiety, especially with a quiz." (OC: Modeling, normalizing, one down power position). While Greg delivers the lesson, talking and writing at the board, Jason circulates around the room. Greg goes on "you will get good at identifying good methods, the fight tool at the right time. I realize now that Jason is logging names and code names from the survey as Greg lectures.

I scan the room, at T5 there are two young guys, appear to be of Asian decent, whispering and looking at a computer screen. T9, a black male is also looking at his computer intently. Bob, sitting next to me, is still working on a problem on the worksheet he's been stuck on for awhile. He can't seem to let it go until he completes it. The rest of the class, which includes about 35 students total, appears to be taking notes.

Greg works a problem out and writes x€{-1,5} on the board. "How can we check this?" A female voice calls out "plug it in." Greg goes on without responding "I'm looking at those of you with computers." Another female voice calls out, "look it up on google" Laughter. Greg prompts more, "it starts with a d……Des….Desmos" (OC: Nobody seems to know what desmos is, or at least, they didn't know what Greg was looking for them to say).

"I wanted to give you reasoning on why you complete the square." He writes the same problem Natalie and I wondered about on the board. X^2+4x-21=0. I stop jotting because I want to tune in for my own math learning. He goes through the steps to completing the square, the how to, then ends with "and now we can prove the quadratic equation to ourselves." (OC: I'm still not convinced, and the look on Natalie's face seems to say she's not either).

11:20

Jaycob raised his hand (OC: This is the young man I talked about in an earlier audio reflection that shared the story of their teacher walking out on them in high school and how that affected his feelings about math). Greg didn't see his raised hand, kept going. After a few seconds, Jaycob put his hand down

11:25

Jaycob gets out of his seat to walk to Jason to ask him something (OC: While Greg missed Jaycob's cue, it seems he still felt empowered enough as a learner to leave his seat to get help from the other teacher not currently in front of the class). As Greg is writing each step of a solution involving completing the square, a female student that appears to be Hispanic asks without raising a hand "is that important to show?" another black male call "is it important to show those lines?" Greg answers "those are good questions." (OC: It seems this space is an environment where students feel allowed/empowered to ask questions without following compliance norms of raising hands and waiting to be called on).

Luis, a freshman who described himself as Mexican when he sat next to me the first day, is now sitting at T4. He calls out "on the test, if I write x=-7 and x=3 instead of the x{-7,3} think would you mark me off?" Greg responds, "no." Lupe continues, "ok, may be a dumb question, but if it's cubed, will it still work." Greg smiles and replies, "oh no, that's a beautiful question." I look back at Lupe and notice a smile on his face too. As Greg begins to answer Luis's question, Bob mutters under his breath next to me "take the cube root."

11:35

Greg carefully answers Luis's question, taking almost 10 minutes of class time to do so. During the explanation, Greg asks class if we need a $\pm$ sign out front. Josie is near Greg and mutter something about + and -, but it's too quite for me, and most of the class to hear. Greg listens to Josie intently, with constant eye contact. When she finishes he says, "oh, I totally understand what Josie is saying. Anyone else want to summarize what she said?" (OC: Decentering his power/voice again and empowering Josie).

11:45

My attention is drawn back to my table. Bob is answering all of Greg's questions, but only loud enough for our table to hear. Natalie is doodling. Tiffany is sitting at T4 next to Luis. She also sat by me the first day and shared this was her first college class ever. She is a blond haired, white girl that appears to be traditional freshman level age. She leaned back to me, where I was still sitting at T1, and whispered "Can you square root a negative? I thought that was undefined" I smiled and said "ask that!" (OC: I made a note to ask Tiffany after class why she turned to ask me instead of the whole group if to see if she could explain what she was thinking/feeling with this experience). Tiffany raised her hand just above her head and waited to be called on. When Greg called on her, she asked her question in a quiet voice, to which Greg said, "thank you for asking" and spent 5 minutes with an introductory explanation of imaginary roots then closed by saying "we will save the rest of that for chapter 5. The reason I'm willing to answer these questions is because they are very pertinent to section 1."

Natalie has taken a break from doodling and is now on her phone. It looks like UCD Access is pulled up. Greg asks the group, "where did the quadratic formula come from?" A male voice, "a smart person." Laughter

11:48

Greg explains they will derive the quadratic formula. "I have a friend with a tattoo of the quadratic formula on one arm and Pythagorean theorem on the other." (OC: I tune out of the lesson because I personally don't see a need to derive this. I wonder why he is taking class time to do this. I take the opportunity to observe the students instead of listening to the lecture.)

A girl is dozing. Her head bobbing up and down. The rest of her table notices her sleeping and are smiling at each other. Lots of confused faces attempting to follow lecture. T8 seems to be tracking what he is saying, but the lecture has drifted and seems to be a conversation just between Greg and T8 mostly. "Some of these terms may be looking familiar" I hear Greg say. T2 shakes their head no. Natalie is still on access. She closes her phone and goes back to her paper. For a brief moment, I think she may be starting to take notes, but she doesn't even look at the board or Greg and goes back to doodling. Jaycob's head is down, appears to be texting under the table. Greg "we're close" about ½ of the class appears to be taking notes.

I notice the student with headphones on. I spoke about s/he on the audio reflection. I still haven't heard that student speak nor do I know their name.

12:00 – Derivation complete

"If you feel like it's been a crash course, it has. It's important to frontload and sharpen our pre-requisite skills. Any questions on 1.3." Greg waits about 3 seconds, then moves on. "1.5, some of these questions have already come up." Natalie is still doodling. She has an almost complete flower garden on her page now. A male is sleeping at T8 now and the girl at T6 is also still sleeping. Greg pushes on with a lecture about extraneous solutions.

12:10

Tiffany gets up to ask Jason a questions while carrying her computer. She has MML pulled up. Greg is giving a cubed root example.

12:12

"There is 3 min left but I don't like finishing early so I want to leave you with a thinker question." He writes $\sqrt{(x-3)} + 2\sqrt{(3x-4)} = 9$ Solve for x. on the board. "How would you attempt to solve this? See how this is different than the other ones?" The students see it's 12:15 and start packing up as he is talking over the sound of their rustling and reminding them about a pre-test they have due at midnight.

I catch Tiffany and ask why she turned to me to ask instead of in group. Her face got red and she explained that she was shy, there is fear of judgement from the class and that she felt her question was more of a side note conversation and she wasn't sure if it was worth asking in whole group. "I just don't like to ask questions, but my high school teacher told me that so I wasn't sure." (OC: She was referring to the ability or not to take a root of a negative number. I am intrigued by Tiffany and she seems willing to share her thoughts/feelings with me. I want to observe her more closely next class and possibly interview her about her math story at some point.)

For the future:

I want to find out "I hate this" girls name and ask what she hated about being asked to move"

Continue watching Tiffany to learn more about her experiences.

Continue to learn more about the student who wears headphones.

Haven't talked to Jaycob yet, but want to build a rapport with him as I'm interested in learning more about his experiences.

APPENDIX C

INTERVIEW PROTOCOL

Research Question: How do college algebra students describe their experiences as math learners?

Semi-Structured Interview Protocol:

Thank you for your willingness to share your story with me. This interview will be audio recorded to help me remember your story and how you told it. You are welcome to say "pass" if you prefer not to answer any question. There are no right or wrong answers and there are not any response I'm "hoping to hear." This is a space for you to share your story and describe your experiences with math as honestly as you can. I know your story is powerful and important; I feel honored to hear it in your words. I will be asking you questions from four categories: 1) Who you are and how you identify/describe yourself, (2) about your memories and previous experiences learning math, (3) Suggestions you have for teachers, (4) and how you feel math connects to your life/future.

Do you have any questions for me before we start?

Demographics: *First I am going to ask you some questions about how you identify or describe yourself. I do this to get a sense of who people are as individuals, because I think that matters when it comes to people's math experiences.*

1. How do you describe yourself? Who are you? *This can include any characteristics or descriptors of who you are as a human actor in this world.*
2. How do you identify? *This can include race, ethnicity, gender, social class, first generation student, etc.*
3. How do you think your teachers would describe you?
4. How would your friends/family describe you?

Memories/Previous experiences *Now I am going to ask you some questions about your memories and previous experiences you have had in math learning. These memories may be positive, negative, mixed, ambiguous or detached. All memories are important to help me get a sense of how you experienced math. I ask you to share various memories because I think it is important to understand all your experiences with math, the best I can.*

1. How do you describe your relationship with math?
2. Tell me a about your journey as a math learner, from as far back as you can remember until now (the completion of college algebra).
3. Are there ways you learned math at home?
4. How do you feel about yourself as a learner of mathematics? Has this changed or remained the same over time?
    a. What is your earliest math memory?
    b. What is your best math memory?
    c. What is your worst math memory?

Connections to classroom *Now I am going to ask you some questions about experiences learning math in a classroom setting. I do this to get a sense of your formal learning experiences.*

1. How was learning math at home similar or different to learning math at school?

2. Is this the first time you took college algebra? Describe your experiences in college algebra?
3. How do you choose where to sit in a math class? Is that similar/different from other subjects?
4. What is helpful to you as a math learner?
5. What do you wish your math teachers knew?
6. What do you think math teachers should do more of?
7. What do you think math teachers should do less of?

Connections to life/future *This is the last section. I am going to ask a few final questions about how you see math connecting to you personally now and in the future.*

1. What need for mathematics do you see in your life, family or work situations?
2. What are your plans/hopes for the future?
3. Anything else you think would be helpful for me or math teachers to know?

Thank you for sharing.

Appendix D

Ethnographic Index & Thesaurus

CODES: Gutierrez' Dimensions of Equity

Access is a precursor to achievement and identity is a precursor to power.

Dominant Axis
Access emphasizes students' opportunities to learn and includes tangible resources available to students such as scaffolds, prompts, extensions, technology, curriculum, instructors, tutors, and physical spaces like class sizes and learning environment (Gutierrez, 2012). For example, experiences that afforded access include readily available tutoring, and not being exposed to rigorous mathematical content is an example of constrained access.
Achievements are tangible results that can be measured, such as standardized test scores, grades, and course-taking patterns. Experiences that afforded achievement included successfully passing a math course and not scoring high enough on a standardized test to take college algebra was an example of achievement constrained.
Critical Axis
Identity includes attending to students past, such mathematical contributions of their ancestors, seeing oneself as a mathematician, as well as attending to the balance between self and society (i.e., mirrors and windows, Gutierrez, 2012). Students' experiences of drawing on their cultural and linguistic resources are opportunities that afford the equity dimension of identity and not allowing students to use algorithms from other countries may be an example of constraining identity.
Power includes voice in the classroom, whose voice is privileged when answering questions, solving tasks, and sharing mathematical strategies. Power also includes analyzing and critiquing society through a social justice lessons. Centering students' voice in the classroom through debate afforded power but being sent to the principal's office for questioning a rule is an example of a power constraining experience.
Nepantla
Nepantla is a latinx term Gutierrez (2012) used to describe tensions in the axis, or the in-betweenness in the experience. Explain more about examples of this code here….

+ Access (affordance, promotion of or positive indicator of)

+ Acc Instances when I observed experiences that afforded access or were evidence of a positive indicator of the dimension of access, such as in: "*I even took the two-day study group they offered.*"			
Interview	**Cell**	**Field Notes**	**Cell**
Int #1 12_11_18	ACT_A51	FN_2	AFN_CC_C5

Int #1 12_11_18	ACT_A93	FN_2	AFN_CC_C6
Int #1 12_11_18	ACT_A135	FN_3	AFN_CC_C7
Int #1 12_11_18	ACT_A137	FN_9	AFN_CC_C15
Int #1 12_11_18	ACT_A139	FN_9	AFN_CC_C16
Int #1 12_11_18	ACT_A197	FN_9	AFN_CC_C17
Int #1 12_11_18	ACT_A199	FN_9	AFN_CC_C18
Int #1 12_11_18	ACT_A203	FN_9	AFN_CC_C21
Int #1 12_11_18	ACT_A209	FN_9	AFN_CC_C25
		FN_9	AFN_CC_C27
		FN_9	AFN_CC_C32
		FN_9	AFN_CC_C33
		FN_10	AFN_CC_C34
		FN_13	AFN_CC_C43
		FN_13	AFN_CC_C57
		FN_13	AFN_CC_C60
		FN_13	AFN_CC_C62
		FN_13	AFN_CC_C63
		FN_13	AFN_CC_C65
	9/73		19/58
	12%		33%

- Access (violation of, constrained, or negative indicator of)

--Acc Instances when I observed experiences that constrained access or were evidence of a negative indicator of the dimension of access, such as in: "*But as far as, like, the curriculum too, I don't remember even taking any higher maths after my sophomore year.*"

Interview	Cell	Field Notes	Cell
Int #1 12_11_18	ACT_A33	FN_9	AFN_CC_C33
Int #1 12_11_18	ACT_A34	FN_10	AFN_CC_C35
Int #1 12_11_18	ACT_A40	FN_12	AFN_CC_C38
Int #1 12_11_18	ACT_A42	FN_12	AFN_CC_C39
Int #1 12_11_18	ACT_A78		
Int #1 12_11_18	ACT_A95		
Int #1 12_11_18	ACT_A97		
Int #1 12_11_18	ACT_A99		
Int #1 12_11_18	ACT_A166		
Int #1 12_11_18	ACT_A227		
	10/73		4/58
	14%		7%

+ Achievement (affordance, promotion of or a positive indicator of)

+Achv Instances when I observed experiences that afforded achievement or were evidence of a positive indicator of the dimension of achievement, such as in: "*I had very great grades in all of my classes. I actually had college credits before I graduated high school."*

Interview	Cell	Field Notes	Cell
Int #1 12_11_18	ACT_A77	FN_13	AFN_CC_C54
Int #1 12_11_18	ACT_A84		
Int #1 12_11_18	ACT_A114		
	3/73		1/58
	4%		2%

-Achievement (violation of, constrained or negative indicator of)

-Achv Instances when I observed experiences that constrained achievement or were evidence of a negative indicator of the dimension of achievement, such as in: "*I didn't…I have to take it [college algebra] again.*"

Interview	Cell	Field Notes	Cell
Int #1 12_11_18	ACT_A13	FN_9	AFN_CC_C19
Int #1 12_11_18	ACT_A16	FN_9	AFN_CC_C22
Int #1 12_11_18	ACT_A20	FN_9	AFN_CC_C24
Int #1 12_11_18	ACT_A24	FN_9	AFN_CC_C29
Int #1 12_11_18	ACT_A116	FN_9	AFN_CC_C30
Int #1 12_11_18	ACT_A118	FN_12	AFN_CC_C40
Int #1 12_11_18	ACT_A120	FN_13	AFN_CC_C44
Int #1 12_11_18	ACT_A124	FN_13	AFN_CC_C45
Int #1 12_11_18	ACT_A128		
Int #1 12_11_18	ACT_A130		
Int #1 12_11_18	ACT_A141		
Int #1 12_11_18	ACT_A160		
Int #1 12_11_18	ACT_A189		
Int #1 12_11_18	ACT_A214		
Int #1 12_11_18	ACT_A235		
Int #1 12_11_18	ACT_A237		
Int #1 12_11_18	ACT_A247		
	17/73		8/58
	23%		14%

+ Identity (affordance, promotion of, or positive indicator of)

+Id Instances when I observed experiences that afforded identity or were evidence of a positive indicator of the dimension of identity, such as in: *"I'm not sure what it's called in English, or even in Spanish. I can't remember now. She tried to teach me math with that thing. It was something I had never seen before. In school we never had a thing like that before. We would count with maybe beans or stuff like that."*

Interview	Cell	Field Notes	Cell

Int #1 12_11_18	ACT_A7	FN_8	AFN_CC_C14
Int #1 12_11_18	ACT_A56	FN_12	AFN_CC_C42
Int #1 12_11_18	ACT_A85	FN_13	AFN_CC_C48
Int #1 12_11_18	ACT_A88	FN_13	AFN_CC_C53
Int #1 12_11_18	ACT_A90	FN_13	AFN_CC_C56
Int #1 12_11_18	ACT_A161	FN_13	AFN_CC_C67
Int #1 12_11_18	ACT_A186		
Int #1 12_11_18	ACT_A249		
	8/73		6/58
	11%		10%

-Identity (violation of, constrained, or negative indicator of)

-Id Instances when I observed experiences that constrained identity or were evidence of a negative indicator of the dimension of identity, such as in: "*I just don't feel like college algebra is going to be a true reflection of something I am passionate about.*"

Interview	Cell	Field Notes	Cell
Int #1 12_11_18	ACT_A29	FN_9	AFN_CC_C20
Int #1 12_11_18	ACT_A32	FN_9	AFN_CC_C23
Int #1 12_11_18	ACT_A45	FN_12	AFN_CC_C41
Int #1 12_11_18	ACT_A47	FN_13	AFN_CC_C46
Int #1 12_11_18	ACT_A50	FN_13	AFN_CC_C47
Int #1 12_11_18	ACT_A63	FN_13	AFN_CC_C50
Int #1 12_11_18	ACT_A68	FN_13	AFN_CC_C51
Int #1 12_11_18	ACT_A112	FN_13	AFN_CC_C55
Int #1 12_11_18	ACT_A153		
Int #1 12_11_18	ACT_A156		
Int #1 12_11_18	ACT_A165		
Int #1 12_11_18	ACT_A171		
Int #1 12_11_18	ACT_A173		
Int #1 12_11_18	ACT_A180		
Int #1 12_11_18	ACT_A195		
Int #1 12_11_18	ACT_A229		
	16/73		10/58
	22%		17%

+Power (affordance, promotion of, or positive indicator of)

+Pow Instances when I observed experiences that afforded power or were evidence of a positive indicator of the dimension of power, such as in: "*He would engage students and ask "what do you understand, what don't you understand*"

Interview	Cell	Field Notes	Cell
Int #1 12_11_18	ACT_A53	FN_9	AFN_CC_C28
Int #1 12_11_18	ACT_A144	FN_10	AFN_CC_C36
Int #1 12_11_18	ACT_A251	FN_13	AFN_CC_C52
Int #1 12_11_18	ACT_A253	FN_13	AFN_CC_C58

		FN_13	AFN_CC_C59
		FN_13	AFN_CC_C61
		FN_14	AFN_CC_C64
		FN_14	AFN_CC_C66
	4/73		8/58
	5%		14%

-Power (violation of, constrained, or negative indicator of)

-Pow Instances when I observed experiences that constrained power or were evidence of a negative indicator of the dimension of power, such as in: "*It is truly up to them, who passes and who fails. They dictate, ya know, who they can say yes, this student gets it and can go onto the next level.*"

Interview	**Cell**	**Field Notes**	**Cell**
Int #1 12_11_18	ACT_A12	FN_9	AFN_CC_C26
Int #1 12_11_18	ACT_A27	FN_13	AFN_CC_C49
Int #1 12_11_18	ACT_A121		
Int #1 12_11_18	ACT_A175		
Int #1 12_11_18	ACT_A231		
Int #1 12_11_18	ACT_A233		
	6/73		2/58
	8%		3%