ANTI-RACIST LEADERSHIP IN A HIGH-PERFORMING PUBLIC HIGH SCHOOL:
A DESIGN-BASED STUDY OF DETRACKING MATHEMATICS

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In

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by

Jack Ballard

San Francisco, California

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CERTIFICATION OF APPROVAL

I certify that I have read *Anti-Racist Leadership in a High-Performing Public High School: A Design-Based Study of Detracking Mathematics* by Jack Ballard, and that in my opinion this work meets the criteria for approving a dissertation submitted in partial fulfillment of the requirement for the degree Doctorate of Education in Educational Leadership at San Francisco State University.

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ANTI-RACIST LEADERSHIP IN A HIGH-PERFORMING PUBLIC HIGH SCHOOL:
A DESIGN-BASED STUDY OF DETRACKING MATHEMATICS

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San Francisco, California
2018

Creekside High School is a high-performing public high school where students who are not White or Asian face a racialized school environment. This dissertation examines the school's initiative to detrack its ninth grade Algebra class. Detracking is the process of placing students in heterogeneous classes instead of grouping students by ability. The framework of design-based research was adopted to perform this study. Design-based research places the researcher and practitioners in collaboration working to iteratively design interventions. Chapter Two is a qualitative study that examined the perceptions of tracking shared by teachers and the community. This study found that the community holds many misperceptions about detracking due to lack of communication from the school and the district. However, the study also found a small group who want to build more equitable solutions. Chapter Three is a quantitative study of student outcomes. There was a slight drop in student grades between the tracked course and the detracked course with no drop in exam scores. Furthermore, students in the detracked course were more successful in their subsequent Geometry courses. Chapter 4 is qualitative study of pedagogy and teacher perceptions. Pedagogy changed during the detracking process. The tracked course was very teacher-centered, and the rigor was not universal due to there being two levels of Algebra. During the first year of the detracked course, the course became much more student-centered, and the average level of rigor increased. However, for advanced students, rigor and challenge were missing, and this was an area of focus for the second year. Teacher perceptions also changed throughout the process. The teachers on the team have grown into viewing Mathematics as an interconnected, non-linear system of thought and have moved beyond questioning detracking to developing solutions. Chapter Five is a qualitative study synthesizing all of the data collected in Chapters Two through Four. These data were used to propose a leadership framework called Critical Design-Based School Leadership. Critical refers to the use of a critical lens focused on equity and Design-Based refers to the use of design-based research techniques as the mechanism for school leadership.

I certify that the abstract is a correct representation of the content of this dissertation.

Chair, Dissertation Committee

June 22, 2018
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Chapter One: Creating a Detracked Ninth Grade Algebra Course in a High-Performing Public High School

This dissertation explores an initiative to detrack two levels of ninth grade Algebra at a high-performing public school, Creekside High School, within the Golden Valley School District (pseudonyms) in Northern California. This first chapter will examine the racialized environment within Creekside High School, define how tracking of Mathematics educations contributes to the educational debt of minoritized students (Ladson-Billings, 2006, 2007, 2013), define the process of detracking, and, finally, explain how design-based research is being used to examine and develop the implementation of the detracked Algebra course.

Demographics play a major role within Creekside High School and the Golden Valley Unified School District. Black students, Latinx students, socioeconomically disadvantaged students, and students with disabilities are an extreme numerical minority within the school and the district. These student demographics for the school and the district are provided below in Figure 1.

Figure 1. Golden Valley Unified and Creekside High School Demographics for the 2016-17 School Year. White and Asian students are the predominant demographics within the school and district.

Black and Latinx students are actively *minoritized* within this predominantly White and Asian school environment. I use the term *minoritized* throughout this dissertation because it is a way to talk about the experiences of these students that places the blame for their lack of access on the institution. Harper (2012) provides an excellent definition for the term *minoritize*:

[Minoritize] signif[ies] the social construction of underrepresentation and subordination in U.S. social institutions. Persons are not born into a minority status nor are they minoritized in every social context (e.g., their families, racially homogeneous friendship groups, or places of worship). Instead, they are rendered

minorities in particular situations and institutional environments that sustain an overrepresentation of Whiteness (p. 9).

Using Harper's definition of *minoritize* helps to illustrate how White supremacy contributes to a racialized student experience, which leads to systemic racism, and therefore contributes to the educational debt (Ladson-Billings, 2006, 2007, 2013) of these *minoritized* students. Clary-Wheeler's (2017) qualitative study of 16 academically successful Black and Latinx students who attended Creekside High School demonstrates that these students face a highly racialized student experience including stereotypes, racial slurs, and oblivious teachers. Clary-Wheeler uncovered a perception that academic success in this high-performing school is considered the domain of White and Asian students. Despite their academic success, these students are *minoritized* due to their racial identity. These students do not have traditional social capital in this setting, and their community cultural wealth in the form of aspirational, familial, social, navigational, resistant, and linguistic capital (Yosso, 2005) is not recognized on the Creekside High Campus. Clary-Wheeler found students from middle-class Black and Latinx families with high levels of traditional social capital still faced this highly racialized environment.

Students are further minoritized by the school system itself. In 2015, a district committee called the Minority Achievement and Talent Development Committee collected data to identify issues for "Historically Underrepresented Minorities." Despite the good work that came out of the committee, the committee's name and the name the district gives to *minoritized* students continues to demonstrate White supremacy within the district. Rather than accepting these students for their own backgrounds, it labels them as a problem to be

solved by a predominantly White and Asian community. The committee's analysis was based on an examination of test scores, grades, course-taking patterns, college acceptance rates, and college attendance rates in combination with student focus groups. It concluded that there appears to be two versions of Golden Valley Unified: one for "a high achieving majority of students, with access to enrichment opportunities and high expectations," and one "in which access and expectations for students of color and students from low resourced backgrounds are limited" (p. 2).

The systemic racism of Creekside High School and Golden Valley Unified School District can be understood by examining the extensive tracking system in place within the Mathematics department at Creekside High School.

Figure 2. Creekside High School Mathematics course sequence. The students within Creekside High School are highly tracked within the Mathematics department.

Within the Golden Valley Unified School district, the various levels of Mathematics are referred to as lanes, rather than tracks. This is because it is possible for students to move

between these lanes from year-to-year, as represented by the dotted lines in the course sequence. The lowest lane is called the college prep lane, the middle lane is called the advanced lane, and the highest lane is called the honors lane. Even though the college prep lane has a name that denotes higher-level learning, it is a *de facto* remedial track of courses.

Relevant to the patterns of systemic racism evident in this school district, an examination of the demographics of each of the Math lanes makes evident that extensive demographic segregation occurs, despite students having the option of moving between lanes. The demographic breakdown of the Math lanes is included below in Figure 3.

Figure 3. Math Lane Demographics Across All Courses for the 2016-17 School Year at Creekside High School. It is important to note that the detracked Algebra course has been included within the demographics for both the college prep and the advanced lanes, since

the typical pathway for these students can involve placing into either lane as indicated by the solid lines in Figure 2.

Thus to summarize, *minoritized* students are overrepresented in the college prep lane (lowest track) and underrepresented in the honors math lane (highest track). The advanced lane (middle track) comes closest to demographics representative of the school as a whole. This dissertation specifically examines detracking ninth grade Algebra, so it is also necessary to examine the demographics of the Algebra 1 course specifically. These are the students whose Math course sequence was not accelerated in middle school. In this case acceleration refers to receiving three years of math during the seventh and eighth grade year rather than two. This specifically means the accelerate students are taking Algebra or higher in eighth grade. This acceleration grants students access to taking Calculus by their senior year. Below, Figure 4 represents the demographics for these non-accelerated students taking ninth grade Algebra.

Figure 4. Ninth grade Algebra course demographics for the 2016-17 school year. These students have been selected out of the ability to complete Calculus by the end of their 12th grade year.

The percentage of students with disabilities in this Algebra course (22%) is extremely high compared to the percentage of students with disabilities at Creekside High School (6.8%). This pattern of unequal representation is also especially evident with the Asian (44.2% of the school, 18.5% of the course), Latinx (8.70% of the school, 22.5% of the course), and Black students (1.3% of the school, 4.00% of the school). Examining the overall demographics for students with disabilities at the school also points to an overrepresentation of Latinx and Black students and an underrepresentation of Asian students within the group of students with special needs, which is pictured below in Figure 5.

Figure 5. Demographics of students with special needs for the 2016-17 school year. There is not proportional racial representation within this smaller group of students.

Consequently, students with special disabilities are another *minoritized* group that is also racialized. Overall, the demographics of the Math course sequence, ninth grade Algebra, and students with disabilities indicate not just a racialized culture, but a system that promotes White supremacy at an institutional level.

The racialized environment and systemic racism both contribute to the educational debt of *minoritized* students on campus, which can be quantified by examining standardized student achievement data. The Math scores on the California Assessment of Student

Performance and Progress, CAASPP for juniors during the 2015-16 school year are pictured below in figure 6.

Figure 6. CAASPP Math results for the 2015-16 school year. It is important to note that Black students are not included in this table since no Black students participated in this test during this school year. This represents only 40% of the students at the school due to low participation rates; however, this is the only standardized assessment data available across the site.

Overall, these data look impressive with 92% of students meeting or exceeding state standards, but the educational debt at Creekside High School is measurable by comparing the test scores of Latinx students (69% met or exceeded, 25% did not meet), socioeconomically disadvantaged students (44% met or exceeded, 44% did not meet) and students with disabilities (50% met or exceeded, 50% did not meet) with that of Asian (98%

met or exceeded, 0% did not meet) and White students (85% met or exceeded, 6% did not meet). Developing initiatives for addressing the racialized environment and resolving the educational debt of *minoritized* students is multi-faceted. A single intervention will not immediately address any of these areas of concern. However, there is an extensive body of research that examines how a highly tracked Mathematics course sequence, like the one that operates at Creekside High School, could exacerbate the *minoritizing* of students on the campus.

Relevant Literature

Understanding the literature on tracking first involves identifying a theoretical orientation. The research on tracking attempts to operationalize critical theory surrounding social reproduction in schools. Paolo Freire's (1972) *The Pedagogy of the Oppressed* expresses ideas about education being a tool of the oppressing class, although one that can, when used in different ways, liberate oppressed people. Further work builds on Freire and is dedicated to identifying how oppression is built into our capitalist schools and transmitted via hidden curriculum (Anyon, 1980; Apple, 1979; Bowles & Gintis, 1976; Giroux & Penna, 1979). This work looks at class structures and take a Marxist and Neo-Marxist critical theory stance. Oakes (2005) took these theories of social reproduction and operationalized them. In 1985, Oakes examined the experiences, perceptions, and achievement of students in different tracks across 25 different high schools. This work, *Keeping Track*, is the seminal work on tracking in modern high schools. Despite the age of her work, it exists as the foundation for

most subsequent research on tracking. Other articles by Oakes have further clarified her findings in *Keeping Track* and are also fundamental works for qualitative research on tracking.

The next related theoretical strand is critical race theory in education (Ladson-Billings & Tate, 1995). Critical race theory makes three propositions particularly relevant to this dissertation: “race continues to be a significant factor in determining inequity in the United States, U.S. society is based on property rights, and the intersection of race and property creates an analytic tool through which we can understand social (and, consequently, school) inequity” (p. 48). Critical race theory recognizes race as the major factor of inequity in schools, but it only provides a theoretical lens for examining inequity. Anti-racist education uses the lens of critical race theory to take action against racism (Au, 2009; Blackwell, 2010; Denevi & Pastan, 2006; Georgis & Kennedy, 2009; Gillborn, 2006; Lea & Sims, 2004; Mosley, 2010; Raby, 2004; Ringrose, 2007; St. Denis & Schick, 2003; Wagner, 2005; Yu, 2012; Zembylas, 2015). As will be illustrated by the literature on the effects of tracking, detracking ninth grade Algebra is an anti-racist initiative.

Effects of Tracking

Creekside High School’s highly tracked Mathematics course sequence is problematic in light of the research literature. Tracking, or the ability grouping of students, is an educational practice that contributes to inequitable access and outcomes within schools. The origins of tracking seem reasonable since “[t]racking is an organizational practice whose aim is to facilitate instruction and increase learning” (Hallinan, 1994, p. 79). In American high schools in the past, students were often placed into rigid general, vocational, or academic

tracks, but now, as is the case with Creekside High, students are tracked within specific subjects and courses (Lucas, 1999). Tracking seeks to place students in instructional contexts adjusted for their specific ability levels, which ostensibly makes instruction easier to plan and provides environments better tailored to students' needs. Educators presume that homogeneity of the students in tracked course allows teachers to meet students' individual needs rather than lowering standards within a heterogeneously grouped class when tracked courses even though research has shown that homogeneously grouped classes lower standards for students in the lower levels of courses, denying entire groups of students a rigorous education (Dreeben & Barr, 1983; Gamoran, 2004; Oakes, 1992; Rosenbaum, 1999). Homogenous group courses are also justified because educators have been found to assume that students need to learn at their own pace and may become disengaged in more challenging classes despite the evidence that challenging courses increase student engagement (Allensworth, Nomi, Montgomery, & Lee, 2009).

Tracking is based on two major assumptions (cf. Hallinan, 1994). The first assumption is that students are accurately placed into tracks based on their abilities. However, research has shown that students who have scored the same on standardized achievement tests are placed into different tracks within the same school (Garet & Delany, 1988; Kilgore, 1991; Oakes, 2005). Furthermore, it has been observed that race and family background play a major role in course placement (Gamoran, 1992; Kelly, 2009; Mickelson, 2001; Riegle-Crumb & Grodsky, 2010). Thus, these studies provide some of the evidence that tracking is a form of systemic racism.

The second assumption is that students in all tracks receive equally high quality instruction. However, this does not align with research conducted on this topic. High tracks are found to contain high levels of critical thinking and active learning while low tracks are found to have a focus on basic skills and memorization (Attewell & Domina, 2008; Boaler, 2002; cf. Hallinan, 1994; Lucas, 1999; Oakes, 2005; Oakes, Gamoran, & Page, 1992). This aligns with the theory of social reproduction within the classroom as proposed by Anyon (1980), who found these types of disparities existing between schools that serve different social classes.

Finally, students at Creekside High School generally stay within one track throughout their entire high school career despite having the opportunity to move up to a more rigorous course through an open enrollment process. Even though students have the ability to move between tracks, students who succeed in remedial courses find it difficult to move into higher level courses due to missing the content and learning experience necessary be successful beyond the remedial level (Hallinan, 1987; Oakes, 1987; Rosenbaum, 1976). Thus overall, the assumptions supporting tracking as an instructional benefit for all students have been shown to be false, and further, giving students the ability to move between tracks does not appear to fix these fundamental problems (Watanabe, 2007; Yonezawa, Wells, & Serna, 2002). Oakes (2005) proposed a solution to these problems associated with tracking by identifying the possibility of organizing schools around detracked, heterogeneously grouped classes to provide rigorous curriculum to all students.

Defining Detracking

Detracking is suggested by a body of research that shows that all students benefit from enrolling in high-level, rigorous courses (Gamoran, 1987; Gamoran & Mare, 1989; 2005). Student outcomes of this enrollment are quantified by Steenburgen-Hu et al. (2016) who performed a second-order meta-analysis of approximately one hundred years of research on ability grouping and found that courses with mixed ability grouping produced a positive, statistically significant impact on student achievement. Steenburgen et al. align themselves against detracking even though their evidence points towards the efficacy of heterogeneous courses. Steenburgen et al. did find that ability grouped courses do appear to have a small positive impact on student achievement for gifted students, and that within class ability grouping also produces a positive, statistically significant impact on student achievement. Thus, some forms of ability grouping are beneficial, but overall Steenburgen-Hu et al. provide evidence of the positive effects of detracking on students. In terms of the focus of this dissertation, Steenburgen-Hu et al. is problematic because they actively diminish the sociocultural impact of tracking found by qualitative researchers building on the work of Oakes. Steenburgen et al. do not disaggregate their data since they are not concerned about racial, gender, or social class differences in student achievement; their focus is on student ability, specifically students labelled as gifted.

In contrast, Burris, Wiley, Welner, and Murphy (2008) provide compelling evidence for the success of detracking reform in eliminating educational debt for Black and Latinx students. Burris, et al. performed a longitudinal, quasi-experimental study examining student

achievement data from a detracked school in a diverse suburban school district who were given accelerated mathematics in middle school and high track, heterogeneously grouped courses in ninth-grade. The heterogeneously grouped students experienced a roughly 70% increase in International Baccalaureate diploma attainment. Student attainment of a New York Regents' diploma also increased. There was a three-fold increase for White or Asian students, a five-fold increase for African American or Latino students who were eligible to receive free or reduced-price lunch, and a 26-fold increase for African American or Latino students not eligible for free or reduced-price lunch. Detracking shows much promise as a solution that can assist minoritized students in receiving a universally rigorous education.

Through the synthesis of the research surrounding detracking, I propose the construct of detracking as a process that involves changing structure, perceptions, and pedagogy. To drive these changes it takes the application of leadership at all levels. Detracking can produce social justice for *minoritized* students through the creation of a more universally rigorous student experience. Implementation can then be monitored through the use of measurable student outcomes. Below, Figure 7 illustrates this construct of detracking as a process.

Figure 7. Construct of Detracking. Detracking is a multi-faceted ongoing process.

Structure. There are two ways to examine a Mathematics course sequences. The “vertical” way to examine course sequences is to look at where students start and end in their careers as students of Mathematics. This is the big picture view of where students start and end within a course sequence. The “horizontal” way to examine course sequences is to look at what level of a specific course students enroll in. It may seem as though a study of detracking would only be concerned with the horizontal view, but even if students are participating in a detracked system, they could still have future educational options limited because of where they are placed vertically. I will examine literature about the implications of both vertical and horizontal decisions made around Mathematics course sequences and place Creekside High within this context.

Examining course sequences vertically, it becomes apparent that students who take Algebra or Geometry during their ninth grade year are much more successful than students completing Pre-Algebra or lower during their ninth grade year; these ninth grade students enrolled in Algebra or Geometry, are more successful completing high level Math course such as Precalculus, Calculus, or Statistics (Adelman, 1999; Adelman, Daniel, & Berkovits,

2003; Kelly, 2009; National Mathematics Advisory Panel, 2008; Pelavin & Kane, 1990; Riegle-Crumb, 2006; Schiller & Hunt, 2011), as well as being more successful in completing college (Adelman, 2006; Adelman et al., 2003), and obtaining higher incomes after college (National Mathematics Advisory Panel, 2008). From this measure, Creekside High School places all of its students at advantage because Algebra is the lowest level ninth grade Math course offered. However, from my personal experience, students enrolled in ninth grade Algebra are still viewed as being at a disadvantage because they have not had their Math course sequence accelerated in middle school. Even though all students are enrolled in Algebra at a minimum, students who want to pursue a STEM course of study in college are at a disadvantage because many of the competitive engineering programs throughout California make high school Calculus a prerequisite for admissions. Students who are in ninth grade Algebra are locked out of this course sequence unless they take summer bridge or community college courses. Thus, Creekside High is comparatively ahead of the curve, but it still *minoritizes* students who take ninth grade Algebra.

Not as much research has been conducted on examining math course sequences horizontally. Tyson and Roksa (2016, 2017) provide the most extensive examination of the implications of what level of Algebra 1 students are placed into by examining transcript data for the entire state of Florida for the for the years 1999-2004. Tyson and Roksa (2016) found that students had much higher mathematical attainment when their school offered either a detracked course sequence, or a course sequence with only two levels. Schools that offered a lower level remedial Algebra course were found to have students less successful in

mathematics (Tyson & Roksa, 2016). Based on their eighth-grade scores, students with the same score were found to have lower attainment if placed into remedial courses and higher attainment if placed into honors level course (Tyson & Roksa, 2016). Even students who are “misplaced” based on their test scores followed this pattern; students with high scores placed into remedial courses had lower attainment and students with low scores placed into honors course have higher attainment (Tyson & Roksa, 2016). Once students are placed into remedial level math courses, it is hard to escape this fate and progress further in mathematics (Tyson & Roksa, 2016). Tyson and Roksa (2017) also examined how grades in different levels of courses affected students’ math course attainment; they found that “[s]tudents who earned an A in remedial courses had lower attainment than students with a D in general Algebra 1 [, and s]tudents with an A in general Algebra 1 had lower attainment than students with median grades in honors Algebra 1” (p. 140). These results demonstrate that even if students who would be placed into the lowest level of ninth grade Algebra at Creekside High will benefit in the long-term by being placed into a single course sequence rather than being placed into a lower level course with the reputation of being a remedial course reserved for *minoritized* students. Examining how other detracked schools have organized themselves, a suggested structure for Creekside High could be a system with a single track of classes with acceleration available for all students. For this detracked structure, the San Francisco Unified Math pathway included in Appendix A provides a working model. However, an immediate shift to this type of course structure would be impossible, since this change also has to include a change in perceptions and a change in

pedagogy. Changing perceptions and changing pedagogy are both slow processes that require strong support and leadership. Changing the structure of ninth grade Algebra is the first step of a much longer detracking process.

Perceptions. Oakes (2005) identifies that a possible root cause for differences in pedagogy emerge from teacher expectations and perceptions of students. Thus, changing teacher perceptions can lead to the acceptance of new forms of pedagogy. Oakes shows how teacher perceptions affect pedagogy; furthermore, Watanabe (2006) provides insight into how to change teacher perceptions by examining how teacher inquiry groups can help start dialogue surrounding detracking and teachers' beliefs about student ability. By conducting focus groups throughout an entire school year with teachers, Watanabe examined how conflicting definitions of detracking have influenced teacher perspectives of reforms. Watanabe provides many examples from these focus groups that illustrate teacher voice in the dialogue surrounding tracking. Some teachers in the study thought that student choice in courses made the difference between a tracked school and a detracked school, even though research on tracking shows that student choice alone has no effect on implementing more equitable outcomes. Watanabe shows that the personal experience of many teachers is the contributing factor as to how they perceive the terms tracking and detracking. This leads to making teachers examine if "students can make genuine choices in course selection" (p. 27). Watanabe also provides examples of teachers who teach writing through a comprehensive, iterative process and teachers who place blame for lack of writing skills on the students. Teachers who blame students for lack of skills tend to have a fixed, rather than a growth

mindset with respect to students' skills and abilities (Dweck, 2006). A fixed conception of student skills also leads to teachers who more firmly believe in tracking, since they do not see how low-performing students can grow in a heterogeneous environment.

This examination of how teachers view student ability can be explored further by studying the way teachers discuss students. Horn (2007) breaks down how teachers perpetuate fixed beliefs of intelligence through their use of conversational category systems. Horn examines two schools, East High and South High. East High teachers challenged their beliefs that did not align with detracking reform within their Mathematics department while South High teachers reworked a reform mandate to align with their existing conceptions. Horn names this the "Mismatch Problem" referring to the mismatch between how teachers perceive students' abilities and the intentions of a school's curriculum. She pinpoints the teacher belief that low-performing students are unable to learn using an inquiry-based form of instruction (Horn, 2007). This belief is what exists at the center of the tracking debate.

Changing teacher perceptions is absolutely critical to changing practice. Horn (2006) stresses how a teacher's perception of mathematics curriculum will influence their pedagogy and their adherence to an open, detracked classroom. Horn found that if a teacher views math as a fixed body of knowledge made up of specific tasks, it is very difficult to practice more open instruction. She revealed that the teachers at schools with successful equity-focused reform have teachers and teacher-leaders who look at math as a messy, interconnected system of thought just like any other body of knowledge. These beliefs and

their expression in teacher interactions are what come in direct opposition to the goals of providing detracked mathematics instruction.

Just as important as teacher perceptions are student perceptions of detracking. Yonezawa and Jones (2006) provide an examination of the student perceptions of detracking using focus group data from 12 schools implementing detracking reforms from 2000-2002. Yonezawa and Jones found some very intriguing results: students are able to identify how structure and course placement are unfair, how important teacher perceptions of students are a school system, and how tracking leads to inferior instruction for students who are placed in lower courses. Student perspectives concur with the research about the issues concerning tracking, and these perspectives align with the conceptual definition of detracking as a multifaceted process. Students intuitively understand that changing teacher perceptions and pedagogy are necessary conditions for detracking initiatives to be successful.

Pedagogy. Pedagogy needs to shift to offer a rigorous Math experience for all students. Building on the work of Elmore (2004), who posits that any meaningful change within schools will come with reform of the technical core of instruction, the focus will now shift to the literature about the pedagogy necessary for successfully detracking in the subject of Mathematics. One detailed example of the results of detracked pedagogy is the book *Experiencing School Mathematics* (Boaler, 2002). Boaler conducted a mixed methods longitudinal study of two working-class schools in England, comparing a school with traditional homogeneously grouped, or tracked, mathematics instruction to a school with heterogeneously grouped, or detracked, mathematics instruction. Within the detracked

school, Boaler identified an open style of instruction. Boaler states that “the students at Phoenix Park were not given specified paths through their activities; they were merely introduced to starting questions or themes and expected to develop these into extended pieces of work” (p. 51). This open style of instruction is very different from the traditional, fixed-pace, algorithmic math instruction most common in England and America. Boaler found intriguing results when assessing these two different types of instruction. Students experiencing an open approach to mathematics performed the same on traditional, skills-based standardized math assessments, but when given applied, novel problems, including designing a house or apartment using math, the students exposed to the open approach scored significantly higher (Boaler, 2002). Changes in pedagogy appear to lead to more critical thinking without a loss of procedural, mathematical knowledge.

Boaler (2006) later provides examples of instructional practices that made detracked mathematics instruction successful inside urban, American schools. Boaler first identifies Complex Instruction as a strategy that promotes equitable instruction. Complex Instruction involves students working cooperatively on open tasks with multiple solutions (Cohen, 1998; Cohen & Lotan, 1997; Cohen, Lotan, Scarloss, & Arellano, 1999; R. A. Lotan, 2003; Watanabe, 2012). Boaler concurs with the main strategies of Complex Instruction including grouping students using roles, assigning competence to students who might not usually be recognized, making students feel responsible for each other's learning, setting high expectations, emphasizing effort over ability, and communicating the learning practices that

lead to success in mathematics (Cohen, 1998; Cohen & Lotan, 1997; Cohen et al., 1999; R. A. Lotan, 2003; Watanabe, 2012).

A more open approach to Mathematics like Complex Instruction is also reinforced by Hsu, Kysh, Ramage, and Resek (2009) who describe their efforts in training teachers on how to destructure their classrooms. Hsu et. al provide very concrete guidance related to the amount of time and work involved in shifting mathematics teaching practices towards a more destructured approach. The authors admit that they do not have all the answers and best practices for more open mathematics instruction, but they see it as a path forward that improves access and outcomes for poor students and students of color; they demonstrate that concerted effort towards destructuring mathematics instruction leads to measurable gains for African American students. It becomes evident that an instructional vision needs to include a focus on a more open approach to mathematics instruction if a detracked system is going to be successful. Hsu et. al provided guidance on the strategies and content for professional development for Math teachers but admit that systematizing these techniques across a whole school or system is beyond the scope of their research.

Overall, the existing literature on pedagogy in detracked classrooms suggests an open style of instruction works best for heterogeneously grouped classrooms and that this open style of instruction benefits students of color and students of low-socioeconomic status. The literature also points to teacher perceptions of student ability and curriculum directly influencing whether teachers implement this type of instruction for all students. Teacher

perceptions can be changed through interacting with other educators, specifically instructional leaders.

Leadership. Instructional leaders play a major part in implementing any type of reform within a school; they provide guidance and support to help others understand and come to consensus about specific initiatives. Burris and Garrity (2008) wrote the book *Detracking for Excellence and Equity* to provide examples of best practices that could be used when detracking a school system. Burris and Garrity provide many suggestions for starting a detracking initiative. Their first suggestion is to start with thoughtful study and to work with teachers who are most open to detracking first. This process of thoughtful schoolwide study did not occur at Creekside High School, and all but one of the teachers of the ninth grade Algebra course during year one were new to the site or the profession. Burris and Garrity also suggest start with eliminating the lowest track first; Creekside High has followed this suggestion by starting with ninth grade Algebra. If more students move on the higher tracks after ninth grade Algebra, the lower tracks may disappear because of declining enrollment. Concurrent with eliminating low tracks, Burris and Garrity suggest moving to an open enrollment model where students and families decide their course placements rather than the school and teachers. This did occur at Creekside High School, but because there was not a study done on the shift, no input from teachers or the community, or no official district support, the change was misunderstood by teachers, community members, district administration, and the school board. Burris and Garrity (2008) also describe the process of changing curriculum and instruction for detracked courses. First, Burris and Garrity make it

known how important it is for leaders to provide ongoing, job-embedded professional development related to detracking. They then recommend a curriculum development process for ensuring high levels of rigor for all students. They make it clear that teachers need to be involved in the initial curriculum design, so they feel ownership. However, once the detracking process was put in place, Burris and Garrity suggest that this teacher developed curriculum becomes a district level curriculum implemented by teachers and maintained by the school district. The teachers who initially developed the district curriculum may have ownership, but as things move forward this move towards a district curriculum it seems as though it could lead to unintended consequences. Burris and Garrity make the critical point that maintaining consistent standards for rigor is essential but as soon as something becomes mandated, teachers can start feel resentment if their voice is not heard in the curriculum develop process. Maintaining a bottom up curriculum development and data analysis process seems to be a way to ensure continued teacher ownership of detracked courses especially in a district like the Golden Valley Unified School District that has a long history of site-based decision-making with teacher leadership. This can be problematic when traditional practices create systemic racism; however, mandating changes without acknowledging the culture of the school leads to conflict and mistrust.

Burris and Garrity (2008) acknowledge the politics involved with detracking. Within the district in which Burris was a principal, detracking was supported by the school board and district administration. This support helped them create a consistent message and communicate the reasons for detracking and the results of detracking to their community.

This type of communication is not what occurred at Creekside High School. Detracking came as a surprise to the school board and the community and still does not have full support of district administrators since it was instituted quickly and without deliberation by the former principal of Creekside High School. The reasons for this type of implementation will be further discussed in chapter 5. This is when my role in this project becomes most relevant. As the assistant principal tasked with supporting this course and as someone who personally believes in this course, I have been forced to learn how to navigate the type of politics identified by Burris and Garrity.

Research Design

As a leader within an educational setting that I am studying, I have adopted design-based research as defined by McKenney and Reeves (2012) as my methodology for studying the detracked Algebra course. Design-based research is unique in how it seeks to develop theoretical insights and practical solutions simultaneously by working collaboratively and iteratively with stakeholders to develop interventions within a real-world context (McKenney & Reeves, 2012, p. 7). As a scholar and a practitioner design-based research allows me to pursue theory as a scholar while still assisting the team implementing the detracking Algebra course at a Creekside High School on a day-to-day basis. McKenney and Reeves delineate the difference between conducting research *on* an intervention and conducting research *through* an intervention. Research conducted *on* an intervention can help to determine the soundness and feasibility of an educational intervention while research conducted *through* an intervention can help to develop theoretical insights and design principles. I sought to

conduct research both *on* and *through* the intervention of implementing a detracked Algebra course. I investigated the perceptions of teachers and the community to develop insights about the community through research. I then conducted research on the intervention by examining student outcomes. When evaluating any educational intervention, it is absolutely critical to measure the student outcomes. As educators, we need to set goals and outcomes, so we can judge how successful we are in creating meaningful educational experiences (Dewey, 1997, Chapter 11). However, if we move our focus entirely to the outcomes, we destroy the meaning in the present experience (Dewey, 1926). This is because goals and outcomes exist in the future, and the future is only an idea (Dewey, 1926). Thus, if we focus exclusively on the quantitative student outcomes of an educational intervention, we erase all other meaning from our work. This is why it is also important to conduct research on how teacher perceptions and pedagogy have changed. Finally, I examined my own leadership in the context of this project to generate a larger leadership framework based on research through the intervention of detracking. This leads to four research questions:

1. How do teachers and the community view tracking and student ability in a high-performing public school district?
2. What are the student outcomes of the first year of a detracked ninth grade Algebra course within a high-performing, public high school?
3. How does detracking affect teacher perceptions and pedagogy in a high-performing public high school?

4. How can critical theory and design-based research be applied to the practice of leadership?

Design-Based Research

The iterative nature of design-based research makes it much more responsive than traditional forms of educational research. Design-based research breaks down research into three distinct phases: analysis and exploration, design and construction, and evaluation and reflection. The overall relationship between these phases is illustrated below in Figure 8.

Figure 8. Design-Based Research Process (McKenney & Reeves, 2012, p. 77). The design-based research process is responsive and iterative.

Design-based research is ongoing, so it also provides a framework for continual revision and improvement beyond the lifespan of this dissertation. An intervention can be scaled and adapted through this process and new theoretical insights can continue to be discovered.

The analysis and exploration phase of design-based research includes problem identification and diagnosis (McKenney & Reeves, 2012, p. 78). This includes reviewing available research and practitioner literature to clearly understand the problem (p. 79). This

phase also includes setting long range goals and deciding on the contextual constraints of any solution designed for the problem. The design and construction phase “resembles that of creating (not testing) a conceptual model” (p. 79). The core ideas for a project are articulated and allow for the underlying design framework to be developed collaboratively (p. 79). Prototypes of an intervention are then built and implemented. In the evaluation and reflection stage empirical testing is conducted on prototypes and critical self-reflection occurs. This allows for further development of practical and theoretical understanding based on the implementation of the prototype.

These stages are then repeated within larger cycles. Each stage can be considered a micro-cycle. Combinations of two or more stages are considered meso-cycles, and the development of a full intervention generally takes the implementation of repeated meso-cycles within a macro-cycle.

Dissertation Structure

Next, it is necessary to define the design-based research process for this dissertation and then to map the structure of the dissertation onto this process. The detracked Algebra course was originally prototyped during the 2015-16 school year. During this prototype year, year 0, two levels of Algebra were offered, but they used the same curriculum and assessments. This was my first year at Creekside High School and as a school administrator. I was not involved in the initial conception and design of this prototype. During the 2016-17 school year, year 1, the course was offered as a detracked Algebra course. The implementation during the 2016-17 school year gained the attention of the school board

during the spring of 2016. This led to the development of an extensive district program evaluation for the newly detracked course. Work from and related to this program evaluation is critical for my study of the intervention and my own leadership. Implementation is currently ongoing during the 2017-18 school year, year 2. This dissertation focuses on a single macro cycle of design-based research consisting of years 0 and 1. Year 1 is further split into two meso cycles, one for each semester of implementation. Below, Figure 9, represents the entire design-based research process for this dissertation.

Figure 9. Design-Based Research Process. This dissertation focuses on the first macro-cycle of the implementation of a detracked Algebra course; the project is currently in its second macro-cycle.

This dissertation does not seek to document each and every cycle within this larger design-based research process. The entire dissertation is focused on developing evaluation and reflection of the entire macro-cycle. Each chapter has a different focus and perspective on the detracked Algebra course. Chapter 2 is a synthesis of two qualitative studies and seeks to answer the research question: how do teachers and the community view tracking and student ability in a high-performing public school district? Chapter 3 is quantitative study answering the second research question: what are the student outcomes of the first year of a detracked ninth grade Algebra course within a high-performing, public high school? This is focused on the outcomes of the third meso-cycle and how they compare with the outcomes of the first meso-cycle. This chapter is focused at the level of developing practical insights for the team of teachers implementing the course. Chapter 4 is a qualitative study seeking to answer the question: how does detracking affect teacher perceptions and pedagogy in a high-performing public high school? Finally, Chapter 5 takes a larger perspective of the entire meta-cycle and answers the final research question: how can critical theory and design-based research be applied to the practice of leadership? Chapter 5 synthesizes the prior chapters to develop a local theory of leadership and articulate the implications of this theory for practice and policy at a school and district level and for my own personal practice and development as a critical, anti-racist educator. This structure allows me to address all aspects of the construct of detracking: structure, perceptions, pedagogy, student outcomes, and leadership.

Chapter Two: Identifying Teacher and Community Perceptions of Tracking in a High Performing Public School District

To understand the local context, this chapter begins by describing material beyond the details of course structures and demographics. Specifically, the perceptions of teachers and the broader community are a major factor in the success of detracking, as indicated by the construct of detracking included in the prior chapter and in Figure 5 and Appendix B. To address this interaction between structural elements and attitudes towards students placed in different tracks, this chapter provides a synthesis of two practitioner research studies: one conducted on the perceptions of teachers towards tracking and one conducted on the perceptions of the local community towards tracking. The chapter provides a narrative of how the insights gained about the perceptions of teachers and the community led to decisions for the implementation of detracked Algebra course. Understanding these decisions and their context makes the descriptions of student outcomes and changes in teacher perceptions and pedagogy more salient for other school leaders and for my own self-study.

Teacher Perceptions

To understand how teachers perceive tracking at Creekside High, during Year 0, I conducted a study of the Geometry course sequence within the school. To understand how to begin to implement detracking reform within the school, it was necessary to conduct formalized research into teacher perceptions within the school. This research sought to answer a specific research question about the three Geometry courses within the Creekside

High School Mathematics course sequence detailed in Figure 2 and Appendix C: how do teachers perceive the three levels of Geometry at a high-performing public high school?

Research Design

In order to examine my research context, I used a grounded theory method based on the recommendations of Charmaz (2014). Charmaz advocates the use of grounded theory methods to systematically and flexibly collect qualitative data to construct theories based on the data itself. Grounded theory is dependent on the iterative strategy of going back and forth between data collection and analysis (Charmaz, 2014). Charmaz encourages researchers to collect multiple forms of data that might include interviews, field notes, and documents. The researcher then works to identify connections between these multiple forms of data. These connections help a researcher to triangulate categories and themes across multiple data sources.

Data collection. Using grounded theory methods means that I sought to collect qualitative data from a variety of data sources that could provide information about the perception of the courses within the Geometry sequence. I conducted interviews with teachers, analyzed documents, and performed observations of classrooms in order to identify themes about the perceptions of teachers within these courses.

Interviews. Three participant teachers were interviewed. I approached them for the interviews from a purely informational perspective because I wanted to learn more about the different levels of Geometry at the school. I asked each of them the same kinds of questions about their perceptions of the differences between the classes. I focused primarily on their

perceptions of the types of students who were successful in each of the levels of Geometry. I did not ask standardized interview questions, as I wanted to guide the interviews as necessary. I recorded full interviews, but I only transcribed relevant excerpts for further analysis. These interviews ranged in length between forty-five and ninety minutes.

Documents. I also collected documents for analysis. I collected all of the syllabi from the Geometry courses at the school. These syllabi are required to be accessible by parents, students, and administrators, so I was able to download them from the school's learning management system. I also used a Math course placement document developed by the school district. This was a document required by a new California state law requiring school districts to document their Math placement procedures to ensure equitable access to Mathematics education. I examined the seventeenth draft of this document, which was about to go to the district school board for approval.

Formal observations. I also used formal observations of teachers. All of the observations at the school are stored in a centralized observation database. I chose the observations strategically by using the monthly pacing guide for each course so that I could conduct observations about the same topic of "similar triangles" within each track of Geometry. My formal observations are taken as low-inference notes, so they are just a running transcript of the class period.

Field notes. I started writing journal entries and data memos whenever I would have an interaction related to the topic of tracking. I wrote journal entries immediately after

each interview. Since I am an active participant as well as an observer, my journals containing my initial thoughts were also used as further documents for analysis.

Data analysis approach. All the data were converted into written documents and were then coded for analysis via process and in vivo coding. Following Charmaz (2014) I only used process and *in vivo* coding because these coding approaches place emphasis on actions and preserves the voice of the participants. However, these actions and voices also allow myself to identify possibly beliefs, biases, and assumptions that help me to better understand and work within my local context.

Specifically, process coding involves coding raw data with phrases that describe actions and start with a gerund (Charmaz, 2014). Identifying the processes behind words and actions helps to identify relationships and participants' beliefs (Charmaz, 2014). *In vivo* coding involves coding data using the words of the study participants, and in that way, preserves the voices of the participants. Using these techniques together helps to examine root causes, while still keeping the research grounded in the voice of the participants.

I then sorted these codes into categories that coalesced into an initial conceptual framework. Using graphical techniques, I then developed themes based on these categories and more analysis of the codes and the data itself. These identified themes were single sentences revealed by underlying patterns in the data.

Findings

This study allowed me to discover two major themes surrounding teacher perceptions of tracking at Creekside High. I will now detail these themes along with evidence that particularly highlights these themes.

Courses are judged by reputation, not by the instruction provided. There are definite biases surrounding the students in each of the Geometry classes. These also align with the race, socioeconomic status, and special education status of each of these classes. There is a defined picture of what students in each class look like and how they are expected to act. These perspectives are very similar to the perspectives identified by Oakes (2005) when she examined teacher perceptions in her seminal study.

An interview with a teacher best revealed these predefined expectations for students. This teacher has more experience teaching the honors level Geometry course than any of the other teachers I interviewed. She reveals the language and attitudes of the privileged teachers and students at the school.

Usually the students who take Geometry Honors are the students who would want to major in Math or a science field in college. They are members of the Math Circles club here on campus. They go to Math contests and Math Olympiads. That's why one of the requirements for all the Honors courses is that they have to take the American Mathematics Competition (AMC) test in February whereas the regular and advanced students don't take this test.

The advanced students are students who still enjoy math, they want to get to Calculus their senior year. Some of the students in the advanced track get to Calculus and some don't. If they take Geometry A their freshmen year they make it to Calculus, but they take Geometry A their sophomore year they don't, unless they take the Algebra 2 summer course.

I would say most of the Advanced students make it to Calculus their senior year and all of the Honors students do. None of the Geometry regular students make it to Calculus their senior year, since it is only a sophomore class. Geometry regular is for students where Math is not their strongest subject, where they don't like Math, where they want to do the minimum required (Personal communication, February 22, 2016).

The teacher's discourse surrounding these three courses is very revealing. A dichotomy of students is revealed placing dedication to Mathematics at the top of student reputation. Teachers hold lower and lower expectations for students as the course level moves down. These attitudes lead to a devaluing of students of color and students with special needs because both groups are overrepresented in these lowest level classes.

Prestige is earned by embodying and defending the status quo. Honors level courses are assumed to be high level because they move quickly and cover more material. A strong math student is identified by working through math problems very quickly. Horn (2007) also identified this type of discourse surrounding student ability and pace of learning; students who learn math slower are viewed as incapable when they really just need more time and a different perspective. Within one of my own professional journal entries I documented an interaction I observed when participating on a Mathematics hiring committee. This committee consisted of Math teacher leaders and assistant principals from across all the secondary schools in the district.

It became even more clear to me the type of class system they have built surrounding mathematical ability. One teacher, who I really liked, talked about using manipulatives to let students explore mathematical practices. The comments afterwards were about how those techniques would work great in a regular or advanced level course, but how they would never use them in an honors course, since they don't have time.

There is a district level bias towards speed and traditional math instruction. Everything is placed on the student; they need to adapt their learning to the preferred style rather than the course coming to them. This level of elitism extends to the hiring level, and I see the hiring committee perpetuating groupthink based on consensus rather than trying to bring in new teachers with new perspectives about the profession (Personal communication, April 2, 2016).

Despite the adoption of Common Core mathematical practices, which suggest that teachers use a variety of modeling practices to encourage all students to think abstractly and precisely, these practices are looked upon as being primarily for lower level students who aren't able to understand Mathematical concepts quickly. The teachers' attitude about students uncovers an assumption that students are inferior if they cannot learn quickly through traditional lecture and independent practice. In an honors level course, students are considered smart enough to learn without participating in active, hands-on, conceptual learning. Students in the honors classes can perform mathematical computations, but it is unclear if they are truly developing a conceptual understanding of Mathematics when using a traditional, lecture-based approach to Mathematics instruction. This is intriguing in light of the observations of Anyon (1980) and Oakes (2005) who observed higher-performing schools and students providing more student-directed instruction with higher levels of critical thinking. Over the last thirty years, things have changed in education, and based on personal observation and anecdotal conversation with other educators, this esteem of traditional instruction at high-performing schools could be a newer, more modern pattern compared to the historic literature on tracking.

These honors classes are looked at with high regard by all the Mathematics teachers within the study. There is prestige for the students and the teachers to move through all of

the honors content. This leads to a defense of traditional instruction because of the perceived prestige.

Community Perceptions

Teacher perceptions are only one part of a broader context. The perceptions of teachers are bolstered by the perceptions and attitudes of the community. To understand the discourse of the community, I conducted a study to answer the following question: what are the community perceptions of detracking in a high-performing school district?

Research Design

This study took the form of a qualitative study of public documents and comments. The data was coded using process and in vivo coding to identify relationships and beliefs while keeping the voice of the community intact (Charmaz, 2014).

Data collection. There are two major data sources for this exploratory study. First, there are transcripts and documents from school board meetings related to the Algebra detracking project. Second, there are articles and public comments from the most prominent online newspaper and blog in the community. The main foci are community authored posts and comments. These anonymous posts can reveal the community discourse surrounding tracking and detracking in a more unfiltered way than other data sources.

Findings

I discovered five themes through the process of coding. I will discuss evidence highlighting each theme.

The image of rigorous math instruction is more important than student learning. There were numerous comments about the image of rigor and the reputation of the district, but there is one specific document that typifies this belief within Golden Valley Unified. In 2011, the Mathematics department of Golden Valley High School, the other high school within Golden Valley Unified wrote a letter to the superintendent and school board opposing Algebra II as a high school graduation requirement:

The alternative, diluting the standards in our regular lane to basic benchmarks which might allow every student to pass Algebra II would end up hurting the district's reputation and, implicitly, all of our students. Our high schools are recognized and respected by colleges across the state and the nation because of our high standards and the ability of our students to apply their high school mathematics in subsequent courses successfully. Colleges know our graduates are proficient in the courses they show on their transcripts, unlike 45% of CSU/UC students who must take remedial math despite having transcripts that make them college eligible (Golden Valley High School Mathematics Department, 2011).

The idea that an Algebra II course could be designed in a way that is rigorous and accessible does not enter into the conversation. Privileging traditionally successful students and instruction leads to an inherently exclusionary definition of rigor; only certain students are able to succeed, and it is lowering standards to redefine Mathematics in an inclusionary manner.

The language of equity is used to justify systemic racism, classism, and ableism. When members of the community oppose detracking, they use language that suggests that tracking is being used to help minoritized students. There is a belief that Black students, Latinx students, socioeconomically disadvantaged students, and students with

special needs are incapable of succeeding in a rigorous Mathematics course. A parent made the following comment:

Placing lower aptitude students with top students is an uneven playing field. There is no way it's going to make them perform better, and if anything, they'll lose hope. Plus, some students usually don't have access to the tutors that other students have, pushing them further behind (Kadvany, 2016).

Placing students in a lower track with lower expectations is viewed as a way of providing equity. Rather than expressing the desire to have classes change, so students do not need tutors, this inequitable, pay-to-play is viewed as a reason for segregating students. These perspectives align with Oakes (2005) observations about tracking in schools; lower expectations are viewed as the way to support minoritized students.

One of the letters to the board also demonstrates a view that systemic racism, classism, and ableism are viewed as supporting students:

During the last board meeting it was said that Algebra 1 course includes a majority of students with IEPs or 504 plans, and that such class is possibly illegal and that in any case Golden Valley Unified should not maintain such classes. I would like to challenge this sentiment.

First, these courses do have facially neutral admission policy, and educational reasons for their existence. This is clearly demonstrated by the widely different achievement of students enrolled in both, as documented by the end of semester achievement data submitted by Creekside High School. . . .

Fourth, both Algebra 1 and 1A have largely similar racial and ethnic composition with only minor differences, as is visible on the chart provided by Creekside High staff.

Consequently, these courses are not discriminatory even by the guidelines of the Office of Civil Rights (OCR) itself (Wurman, 2016).

De facto segregation and divergent educational experiences are presented as equitable because of student performance within traditional classes with traditional instruction. This insinuates that students need to fit into the system that privileges White and Asian middle-class students in order to be considered worthy of rigorous instruction.

There are major misunderstandings and misconceptions surrounding tracking and detracking. The focus on the image of rigor and the language surrounding equity and instruction made me realize that members of the community are unable to conceive of detracked courses using research-based strategies proven to support minoritized students. In an article published in the local newspaper, Kadvany (2016) illustrates how community members don't understand how detracking involves more rigorous, more engaging instruction for all students.

Several other parents voiced concerns Tuesday about what de-laning would mean for higher-achieving students who already find themselves "bored as heck," as one mother put it, in classes that they say lack differentiation.

"I'm all for access; it's the practicality of how do we do it and make sure it benefits all students? Laning, however, allows students like her son "to move at a pace that's suitable for them," she said.

"It keeps them engaged. They truly love math and that allows a high-achieving child who has a passion for the subject to actually stay engaged," she added.

Parents have never been exposed to anything other than traditional lecture-based instruction or poorly constructed group work. They seem to have no understanding that there are other forms of instruction that leverage all students' strengths to engage them in meaningful cooperative learning. This community discourse surrounding the pace of learning and the engagement of students aligns with the teacher discourse and perspectives identified by

Horn (2007). These misunderstandings about tracking are explained by the next theme that became evident through the coding process.

There is no consistent message about tracking and detracking being communicated by site and district administration. Depending on who is messaging about detracking, different messages are shared. At the board meeting about the detracked ninth grade Algebra class, the Chief Academic Officer reported detracking as a way of providing extra supports and one-on-one tutoring while the principal reported detracking as a matter of desegregation of minoritized students. The Chief Academic Officer's stance was very deficit oriented when considering students; however, the principal's response at this time was actually slightly more concerning in light of the work of Yonezawa et. al (2002). Yonezawa et. al examine how detracking does not lead to improved student outcomes when teachers and administrators view social integration as the major goal of detracking. Universal rigor and equity are the key perspectives that Yonezawa et. al identify as critical to successfully implementing detracking. On the other hand, the teachers referred to detracking in terms of how small of a shift they saw when considering detracking Algebra. They identified the pacing and curriculum as the same between the two tracks; the lowest track just happened to also be co-taught, making it a de facto special education course. Future discussions with these teachers reveal that they were just trying to disrupt things as little as possible publically, so they could continue to build a more equitable math program. The perspective of one of these teacher's will be further addressed in chapter 5. The superintendent wouldn't take a stand for detracking but did make a statement about

educating all students: “It's about ensuring opportunity and access for all students to participate and have the support to succeed in rigorous classes, so we can make our vision a reality” (Kadvany, 2016). Not a single site or district administrator mentioned changes in pedagogy as essential for detracking in any public forum. This inconsistency of messaging is what led to the press reporting that parents were entering “panic mode” (Kadvany, 2016) regarding detracking. The importance of messaging and community support is continually iterated by Burris (2008) when she makes suggestions for school leaders looking to implement detracking as she did at Southside High School. The leadership decisions surrounding the lack of communication and speed of implementation will be further discussed in chapter 5.

A small group within the community see the systemic issues and want to help build equitable solutions. There was one school board member who truly understands that pedagogical change is necessary for detracking to succeed. He was the lone board member to state that an educational placement decision should be made by teachers, administrators, and families, not the school board. He stated that “[w]e really want to be relying on having research-based teaching methods that are aligned with the Common Core, and then add supports for those students who need them, not to deal with defects in the course” (Golden Valley Unified School District School Board, 2016). Of twenty-five community comments about Kadvany’s article on detracking, only one person expressed the desire to see a different type of instruction to support detracking. This is a minority of board members and community members, but they do exist. When the Golden Valley Unified

School District conducted their Minority Achievement and Development Committee, they did conduct focus groups to understand the student perspectives around tracking and equity as well. This committee found that a small number of students also understand the need for detracking, even if they don't know how it could be accomplished; they just see themselves as being "laned away" (Golden Valley Unified School District School Board, 2016).

Discussion

There are two distinct cultures within the community and teachers. The current culture within the Golden Valley Unified School District perpetuates a cycle where teacher prestige is gained based on the test scores of their affluent students. These students have been trained from a young age to be successful in school. This is aligned with the theory posed by Reardon (2011) that this early academic training and investment contributes greatly to the socioeconomic achievement gap. Members of the predominant district culture are unable to see how detracked pedagogy is even possible while there is a counterculture who see the need and the possibility for different forms of Mathematics learning. This counterculture is untapped resource despite the fact that there is at least one school board member who publicly supports them. A newly elected board member even has a PhD in Education, and her adviser was Boaler. This board member has written curriculum based on the principles necessary for detracked instruction and has acted as an educational consultant for teaching Mathematics. These board members are the community change agents who have credibility and could publicly support further detracking efforts. Since the initial board meetings, Creekside High School has gotten a new principal, and the Golden Valley Unified

has appointed a new Chief Academic Officer. These changes in leadership and their implications will be further discussed in chapter 5.

As an assistant principal, I have not been privy to higher level conversations, and I have not been given the authority to speak with the press and board members. I may not be able to affect change and opinions at this high level, but I can focus on the implementation of detracking at my school site. At the site level, the teacher counterculture was trying to bring active, student-centered, project-based learning to the school. However, their ideas were unorthodox, and they were generally only implemented on a very limited scale. If a teacher is identified as belonging to the counterculture, their ideas never really gained traction in the broader Math department. This led to a conundrum for myself as a leader, since the excluded counterculture was providing the type of learning experience that I want to encourage for all students at the school. In order to affect instructional change, I identified teachers who straddled both the mainstream culture and the counterculture. These types of teachers are active in the school community, including their union, and they are actively innovating in their classroom. These teacher change agents are able to bring the new thinking of the counterculture into the mainstream. A model of the way teacher and community change agents can support equity in the district is pictured below in Figure 10.

Figure 10. Interaction of Golden Valley Unified School District Culture and Counterculture. Teacher change agents are critical to introducing new ideas into the mainstream culture.

To support the implementation of detracking, teacher leadership was changed within the Mathematics department at the school. I made sure the new department head, Robert, was selected despite the reservations of the prior principal. Robert is a definite teacher change agent. Robert grew up in the Golden Valley community and has spent twenty years teaching at Creekside High School. Yet, Robert still wants to support fundamental instructional reform. He is an asset for providing coaching to teachers and setting a positive,

innovative tone within the department. It is important to be transparent that Robert is a close colleague, and I consider him a friend. I also chose a teacher change agent, Louise, to lead the course team. Louise was also chosen to become a teacher-on-special assignment assisting with schoolwide teaching and learning initiatives. She participated in the initial teacher perception study and was identified as a result of the study. She is also a close collaborator, and someone I consider a friend. It is necessary for me to be transparent about these relationships since I studied collective efforts I participated in alongside these teachers. Having these leaders in place is absolutely critical, and their roles remind me of the teachers and department leaders who were responsible for instituting detracking at Railside High as documented by Boaler (2006) and Horn (2006, 2007). Having these strong leaders in place was critical for Railside High, and these leaders definitely helped to move things forward.

I was not involved with the initial conception of the project, but I tried to make sure the right people were on the course team for the ninth grade Algebra course. Two of the teachers from the Year 0 team were not coming back to the school for the next school year, and I made the conscious decision that the third member of the Year 0 team was not the best fit for the team. I tried to convince Robert to teach and lead the Algebra team, but he was unsure of taking this on along with taking on department leadership for the first time. Louise agreed to teach and lead the team despite the fact that she had not taught ninth grade Algebra for a few years; her expertise was mostly in Geometry and Statistics. We hired five Math teachers the Spring before Year 0, so the other two members of the course team were two new teachers. My hope was that young teachers, who had just participated in a teacher

preparation program, would be better equipped with instructional strategies appropriate for heterogeneous classrooms. Robert agreed to take on an advisory role for the team; he attended all of the team meetings and provided his experience and guidance to the team.

I also took on the role of coordinating professional learning for the course team. I arranged site visits to other heterogeneous ninth grade classrooms and schools offering alternative forms of Mathematics instruction. To make cost not a barrier, I found free and open curriculum and assessments. I coached Louise on leading a team when she was having interpersonal difficulties amongst the team members. I approved the use of professional development funds for teacher work days and conference attendance. Finally, I arranged for the whole team to attend a workshop on heterogeneous Math instruction together during the summer after Year 1. This workshop was provided by Boaler and her professional development organization out of Stanford University.

I have put tremendous amounts of personal effort into this detracking project. The emotional toll taken by hostile late-night board meetings and parent advisory committee meetings is huge. Mentoring and caring for Louise as a leader, teacher, and friend is rewarding, but it requires me to exert quite a bit of my emotional capacity. This makes it impossible for me to be objective, but it also makes me intensely interested in investigating the student outcomes and changes in teacher pedagogy and perceptions that I have had a part in shaping. In chapter 3, I will examine the nuanced, contradictory student outcomes of the new course, and in chapter 4, I will study the changes that have occurred in teacher

perceptions and pedagogy as a result of the implementation of the detracked Algebra course and these leadership decisions.

Chapter Three: Evaluating the Student Outcomes of a Newly Detracked Algebra Course in a High-Performing Public High School

Understanding the context of tracking within Creekside High and Golden Valley Unified was critical to making the leadership decisions to implement a detracked Algebra course. Detracking one course at a time within certain subjects is a model that Creekside High adopted based on the experience of Burris (2008) at Southside High School while she was a principal. However, after a year of implementation, it is necessary to move beyond models from other schools and studying the local context to examine the results of course in terms of student outcomes and teacher perceptions and pedagogy. This will allow me to study my own leadership, in particular, the decisions I made leading into the first year of implementation. This chapter focuses on student outcomes by answering the following research question:

- What are the student outcomes of the first year of a detracked ninth grade Algebra course within a high-performing public high school?

Answering this question will help to measure the success of the project, making it possible to make plans for moving forward and to analyze the effectiveness of my own leadership. The quantitative analysis of student outcomes in this study complements and gives context for the qualitative study of teacher outcomes in Chapter 4.

To assist with data collection and to develop a formal presentation to the school board about the program, a thorough program evaluation was created by the Golden Valley Unified Department of Research, Evaluation, and Assessment, and the Golden Valley

Unified School Board. This program evaluation seeks to examine the difference in student outcomes between what is labeled “Year 0” and “Year 1.” The program evaluation serves as a data source for the results of meso-cycles one and two of the design-based research macro cycle defined in Figure 8 and Appendix D. The 2015-16 school year, or Year 0, is when two separate tracks of Algebra were still run, but each course used roughly the same curriculum and the same summative assessments. Special education students with a disability related to Mathematics were all placed into the lowest track of classes where the classes were supplied with a co-teacher to support better differentiation and universal design. During the 2016-17 school year, or Year 1, the school ran only one track of Algebra 1 with certain sections allocated a co-teacher.

The data collected for the program evaluation includes course grades, course exam scores, state testing scores, standardized math diagnostic scores, student course surveys, and math confidence surveys. The same semester final exams were given in both year 0 and year 1 to allow for comparative data. Eighth grade California Assessment of Student Performance and Progress (CAASPP) scores were used as an initial diagnostic along with the MDTP (Mathematics Diagnostic Testing Project) assessment for Algebra readiness. The MDTP assessment for Geometry readiness was used at the end of the year. Student course surveys at the end of the semester are standard practice within the Golden Valley Unified School District, so these surveys also became part of the district program evaluation. Math confidence surveys were given to students at the beginning and end of the year, as well. Overall, the district program evaluation is so comprehensive that it was necessary to narrow

down the data to provide for this study to provide the most succinct explanation of the results possible. This study uses course exam scores, course grades, math confidence survey results, student course selections, and course grades in students' subsequent Geometry class to quantitatively evaluate the student outcomes of the course. The standardized Math scores are not a usable data source since the team used different versions and different levels of the MDTP score to help find the data most applicable for them to drive forward the team's practice. This made the internally developed metrics more reliable across Year 0 and Year 1.

Research Design

This chapter takes the form of a quasi-experimental study. During Year 0, all ninth-grade students enrolled in Algebra were members of the tracked courses, serving as a control group. In contrast during Year 1, all ninth-grade students enrolled in Algebra were members of a detracked course, serving as an experimental group. It is not a truly random selection of students since these are all the students in the Creekside High School feeder pattern who were not selected for acceleration during middle school. However, this quasi-experimental study allows for data to be collected to help draw conclusions about the effectiveness of the detracked course. Random assignment to the control or experimental group is not possible in this situation. One critical aspect of design-based research is operating in a real context, rather than creating a formal experiment with randomization of participants between the two conditions that is unlikely, and even unethical, in a normal school setting.

The relationship between student performance during Year 0 and Year 1 of the project was examined using second semester final exam scores and second semester course

grades. Only second semester final exam data were studied since this provides a view of the students' skills at the end of the year even though the exam only includes content from the second semester. Common Core Mathematical Practices that students have learned through the entire year are applied to the second semester's content, so this exam is an accurate measurement of the summative skill level of students. Math confidence surveys were only administered during year 1. The team used the Attitudes Towards Mathematics Survey (ATMI), included in Appendix E. The results from this ATMI survey were used to provide further context and explanation for the comparison of student assessment results and grades between Year 0 and Year 1. The findings from this study allow the course team to make better curricular decisions as they move through successive cycles of design-based research and allow leaders to make better decisions as to how to support the team moving forward.

Data Collection

Assessment data were collected for all students enrolled in Algebra during Year 0 ($n=140$) and Year 1 ($n=127$). All student data had personal identifying information removed, but demographics were collected to correlate with course exam scores. The demographics chosen were race, gender, and special education status. These are the most significant demographics in the course and, therefore, can provide the largest statistical significance. The number of students with low socioeconomic status is small enough that they do not compose a significant portion of the population for study. For year 0, data were also collected indicating whether they belonged to the low or high track of the Algebra course. The most significant racial subgroups were chosen to study: Asian, White, Hispanic or

Latino, and Black or African American. Black students are not numerically significant at Creekside High School as discussed in chapter 1. However, as demonstrated in chapter 1, Black students are overrepresented within special education, making them a group of particular importance. Second semester course exam scores were provided directly by the teaching team. The course team administered the ATMI, and initial analysis was performed by district department of research, evaluation, and assessment. Finally, the school's student information and data analysis systems were used to collect and examine student course selections and grades in subsequent Geometry courses.

Data Analysis Approach

To study student outcomes first requires detailing how student outcome data was independently analyzed for Year 0 and Year 1. Statistical analysis was conducted via the statistical analysis software package JASP (Jeffreys's Amazing Statistics Program). JASP is an open-source project created by the University of Amsterdam to provide a free, more user-friendly alternative to IBM SPSS Statistics. This includes features that guide the user towards using the correct statistical tests that fit the distribution of the data detected by JASP and the use of more accurate, newer versions statistical measurements than may be traditionally used.

Descriptive statistics were generated for the exam score and grades, and a distribution was created for these data. Analysis of variance (ANOVA) was used to determine if race, gender, special education status, or course membership result in exam scores and grades that vary from the mean with statistical significance. Finally, when ANOVA indicated that any demographic group varied from the mean, a Pearson correlation

between membership in a specific demographic group and course exam scores or grades was conducted. This correlation revealed if there was a positive or negative, linear relationship between membership in a specific demographic group and course exam scores and grades. The same data analysis was performed on data from both Year 0 and Year 1.

The student outcomes between Year 0 and Year 1 were compared by examining descriptive statistics and conducting a t-test. The mean and median exam scores and grades were compared between years, and the distribution of scores and grades were also compared. A t-test was performed between Year 0 and Year 1 exam scores and grades to determine if there is a statistically significant difference between the two years. Once the difference between Year 0 and Year 1 was determined, a Pearson correlation was performed to determine if there is a positive or negative relationship between student performance in the control and experimental year. Raw data, descriptive statistics, and ANOVA can point to differences in results, but do not point to the extent of the relationship between course membership and student outcomes the way that a correlation can. Results of the ATMI from Year 1 were used to provide some insight into the relationships identified through analysis of exam scores and course grades. Future student course selections are examined through straight comparison of raw numbers of students enrolling in the lowest or middle lane or Geometry for their next year. Finally, raw distributions of first semester Geometry course grades were examined to study if students were being prepared for their next course with adequate rigor.

Findings

The findings for Year 0 and Year 1 will be analyzed and discussed in an integrated manner rather than examining each year separately.

Exam Scores

For Year 0, the mean score on the course exam was 60.76% and the median score was 65.00%. This places both averages within the “passing” range, but the distribution of scores in figure 11 gives a more complete picture of student performance.

Figure 11. Distribution of student course exam scores for Year 0. This figure shows a very wide distribution of scores.

The distribution of scores shows a wide range, and there is a peculiar bump in the 10- to 15-point range. These scores would follow a normal distribution if it were not for this bump.

There are large number of students scoring thirty points or higher on this exam, but there is still a rather large tail of low scores.

For Year 1, the mean score on the course exam was 55.06% and the median score was 56%. This places both scores slightly below passing. Examining the distribution of these scores provides more insight into these low average scores. Figure 12 illustrates the distribution of exam scores. This distribution shows a flat curve. It is evenly distributed, with a long shallow tail.

Figure 12. Distribution of student course exam scores for Year 1. This figure shows a very wide distribution of scores.

Year 1 had a slightly lower mean exam score and mean course grade than Year 0. To determine if this change was statistically significant, Welch's unequal variances t-test was used. Welch's t-test was selected because Levene's test is significant for both exam scores

and grades ($p < .05$), suggesting a violation of the equal variances assumption. There is no statistically significant difference in exam scores between Year 1 and Year 0 ($p = .099$).

Next, ANOVA was performed on the student exam scores for both Year 0 and Year

1. Below, in Table 1, this ANOVA is provided followed by a narrative to explain the values.

Table 1
Year 0 - 2nd Semester Final - ANOVA

Cases	Sum of Squares	df	Mean Square	F	p	ω^2
COURSE	1706.698	1	1706.698	25.207	< .001	0.139
Gender	1.090	1	1.090	0.016	0.899	0.000
Asian	12.956	1	12.956	0.191	0.663	0.000
White	22.506	1	22.506	0.332	0.565	0.000
HispanicLatino	614.492	1	614.492	9.076	0.003	0.046
Black	38.600	1	38.600	0.570	0.452	0.000
IEP/504	428.851	1	428.851	6.334	0.013	0.031
Residual	8937.188	132	67.706			

Note. Type III Sum of Squares

For Year 0, there was a statistically significant difference in means corresponding with course membership ($p < .001$), identification as Latino ($p = .003$), and special education status ($p = 0.013$). Course membership ($\omega^2 = 0.139$) has a much larger effect size than Latino identification ($\omega^2 = 0.0046$) or special education status ($\omega^2 = 0.031$).

Once a possible relationship was identified between course membership, identification as Latino, and special education status, a Pearson correlation was conducted for these factors. The correlations for these demographics are provided below in Table 2.

Table 2
Year 0 - 2nd Semester Final - Pearson Correlations

		Sem2final	COURSE	Latino	IEP/504
Sem2final	Pearson's r	—	0.456	-0.372	-0.258
	p-value	—	< .001	< .001	0.002
COURSE	Pearson's r		—	-0.217	-0.111
	p-value		—	0.010	0.192
HispanicLatino	Pearson's r			—	0.132
	p-value			—	0.121
IEP/504	Pearson's r				—
	p-value				—

There was a moderately positive linear relationship between exam performance and course membership ($p < .001$, $r = 0.456$). This indicates a measurable negative relationship for students who were enrolled in the lower track of Algebra during Year 0. There are also moderately negative linear relationships between identification as Latino ($p < .001$, $r = -0.372$) and special education status ($p = 0.002$, $r = -0.258$) and exam scores. Course placement has a larger effect size when conducting ANOVA and has a stronger relationship with student performance when compared to identification as Latino and special education status. Membership in the Latino and special education demographics has a small effect size but with a measurable relationship. Because of the co-taught inclusion model, more special

education students were likely to be placed in the lower course, and Latino students are overrepresented inside special education. Latino students are then more likely to have been placed in the lower lane due to their special education status. The intersection of special education status, race, and course placement will be explored further in the discussion section of this chapter.

ANOVA was also performed on student exam scores for Year 1 to determine if there is a difference from the mean based on race, gender, or special education status. This analysis is presented below in Table 3.

Table 3
Year 1 - 2nd Semester Final - ANOVA

Cases	Sum of Squares	df	Mean Square	F	p	ω^2
Gender	77.32	1	77.32	0.681	0.411	0.000
Asian	962.16	1	962.16	8.469	0.004	0.054
White	638.68	1	638.68	5.621	0.019	0.033
HispanicLatino	29.46	1	29.46	0.259	0.612	0.000
BlackOrAfricanAmerican	45.38	1	45.38	0.399	0.529	0.000
IEP/504	495.04	1	495.04	4.357	0.039	0.024
Residual	13406.46	118	113.61			

Note. Type III Sum of Squares

There was only a statistically significant difference for special education students ($p = 0.012$, $\omega^2 = 0.044$). This is a small effect size, so special education status is not a large predictive factor for scores on this exam. After performing ANOVA on the results for Year 1, a Pearson correlation was performed to determine the extent of the relationship between

special education status and course exam results. A table of all correlations conducted for Year 1 is presented in Appendix E. The correlation showed a small-to-moderate negative linear relationship ($p < .001$, $r = -0.407$). Special education status was still a predictor for student scores on this exam.

These data show that racial relationship on exam performance was eliminated during Year 1, but the same cannot be said for special education status. Comparing the ANOVA for special education status between Year 0 ($\omega^2 = 0.031$) and Year 1 ($\omega^2 = 0.051$), points to a larger effect size, and comparing the Pearson correlation between Year 0 ($r = -.258$) and Year 1 ($r = -.407$) points to a more negative relationship between special education identification and exam scores during Year 1. Possible reasons for this relationship will be articulated within the discussion section of this chapter after comparing student grades between Year 0 and Year 1 and examining the results of the ATMI survey.

Grades

The mean second semester grade during Year 0 was 2.757 and the median grade was 3.000. This was measured using a standard four-point scale for letter grades (A = 4.0, B = 3.0, C = 2.0, D = 1.0, F = 0.0). Figure 13 shows how the majority (87.8%) of students received a passing grade of 2.0 or higher. A frequency table for these grades is also presented in Appendix F.

Figure 13. Distribution of second semester course grades for Year 0. A large number of students received a passing grade indicating proficiency in the course.

The distribution for exam scores from Year 0 looks very different from the distribution of second semester grades. Exam expectations and course grade expectations do not appear to be in alignment.

During the second semester of Year 1, the mean semester grade was 2.550 and the median grade was 3.000. Figure 14 demonstrates how a large majority of students (78.3%) received a passing grade. The frequency table for these grades is presented in Appendix G.

Figure 14. Distribution of second semester course grades for Year 1. A large number of students received a passing grade indicating proficiency in the course.

The grade distribution does not align with the distribution of scores from the course exam. There is a much higher frequency of 4.0 grades than scores of 90% or higher on the course exam. Across both years, students passed the class even if they are not reaching the level of mastery expected of them on the exam. This relationship will provide context when discussing the implications of the entire dataset of exam scores, grades, and ATMI surveys.

When ANOVA was performed for Year 0 to examine letter grades two groups were found to vary from the mean: Latino ($p = 0.021$, $\omega^2 = 0.029$) and special education ($p = 0.049$, $\omega^2 = 0.019$) students. This analysis is presented below in Table 4.

Table 4 – Year 0 - 2nd Semester Grades - ANOVA

Cases	Sum of	df	Mean	F	p	ω^2
	Squares		Square			
Gender	0.230	1.000	0.230	0.205	0.651	0.000
Asian	0.253	1.000	0.253	0.226	0.636	0.000
White	0.002	1.000	0.002	0.002	0.963	0.000
HispanicLatino	12.873	1.000	12.873	11.468	< .001	0.068
BlackOrAfricanAmerican	4.809	1.000	4.809	4.284	0.040	0.021
SPED/504	5.246	1.000	5.246	4.673	0.032	0.024
Residual	149.296	133.000	1.123			

Note. Type III Sum of Squares

The effect sizes for these demographics is rather small, so examining the level of the relationship between these demographics and course grades is necessary. A Pearson correlation found a moderately negative correlation ($p < .001$, $r = -0.376$) between Latino identification and course grades and a small negative correlation ($p = 0.008$, $r = -0.225$) between special education status and course grades.

Once ANOVA was performed for Year 1, three student groups were identified as varying from the mean: Latino students ($p = 0.004$, $\omega^2 = 0.051$), Black students ($p = 0.009$, $\omega^2 = 0.040$), Pacific Islander students ($p = 0.003$, $\omega^2 = 0.053$), and multiracial students ($p =$

0.050, $\omega^2 = 0.019$). This analysis is presented below in Table 5. Table 5 illustrates how these are all small effect sizes; none of these differences reach a moderate effect size of 0.06.

Table 5 - Year 1 - 2nd Semester Grades - ANOVA

Cases	Sum of Squares	df	Mean Square	F	p	ω^2
Gender	3.404	1	3.404	1.993	0.161	0.008
Asian	5.435	1	5.435	3.182	0.077	0.017
White	2.532	1	2.532	1.482	0.226	0.004
HispanicLatino	1.695	1	1.695	0.992	0.321	0.000
BlackOrAfricanAmerican	0.933	1	0.933	0.547	0.461	0.000
IEP/504	1.455	1	1.455	0.852	0.358	0.000
Residual	201.538	118	1.708			

Note. Type III Sum of Squares

Finally, for Year 1 Pearson correlations were conducted between the demographic groups identified by ANOVA and course grades. First, these correlations uncovered that there is not a relationship ($p = 0.285$) between belonging to the multiracial demographic and course grades. Identification as Latino ($p = 0.002$, $r = -0.283$), Black ($p = 0.050$, $r = -0.179$), or Pacific Islander ($p = 0.016$, $r = -0.219$) indicates a very weak negative relationship with course grades. Across both years, ANOVA and correlations point to different predictive factors for grades than for exam scores.

Year 1 grades were found to be lower than Year 0 scores when using this t-test ($p = .040$, Cohen's $d = 0.220$). There is a statistically significant difference, but the effect size is small. The importance of these results is further diminished after conducting a Pearson

correlation between cohort membership and course grades since there is no statistically significant relationship between these values ($p = 0.192$).

Comparing Year 0 and Year 1 leads to changes in the predictive nature of demographics when analyzing student grades. During Year 0, there was a negative correlation between identification as Latino or special education status and course grades. During Year 1 there was a negative relationship between identification as Latino, Black, or Pacific Islander and course grades. Special education students saw the elimination of a negative relationship, but Black and Pacific Islander students saw the addition of a negative relationship. Compared to Year 0, Latino students had a larger effect size when performing ANOVA and had a stronger negative relationship with course grades during Year 1. Further analysis of the possible causes for these results will be detailed in the discussion section of the chapter because of these contradicting results. The detracked course aided in eliminating racial performance disparities on assessments but exacerbated these disparities when examining course grades. Special education students then saw the reverse relationship where disparities for student performance on the assessment grew and disparities in course grades shrunk.

Looking at overall exam scores and course grades points towards Year 1 results being very similar to the results from Year 0. To understand how the relationships between student outcomes and student demographics changed between Year 0 and Year 1, the ATMI survey results became critical.

Math Confidence Surveys

The ATMI was conducted at the start and end of Year 1; however, it was not part of the initial design of year 0. This means that this survey can be used to help explain the data between Year 0 and Year 1, but a true statistical comparison is not possible. The ATMI consists of four categories: enjoyment, confidence, motivation, and value. Analysis of these surveys was conducted by the Golden Valley Unified district department of research, evaluation, and assessment. These results were provided to the team. This full analysis is provided in Appendix F. This analysis found that overall, there was not a statistically significant difference in ATMI scores between the beginning and end of the year. However, certain groups benefited from the detracked course of Year 1. Students with special needs and students with lower than a 4.0 grade saw gains in their enjoyment of Math. Students with special needs also saw gains in their value of mathematics, while students with lower than a 4.0 saw gains in their motivation to complete Math. It is important to note that students receiving an A in this Algebra course had slightly lower math confidence. These students did not see a change in their exam scores and grades, so the experience of students showing mastery needs to be considered moving forward. These results are not statistically significant enough ($p = 0.10$) to make conclusive generalizations but provide insights into the reasons for the differences in student outcomes between Year 0 and Year 1.

Student Course Selections

Future student course selections did change between the Year 0, Year 1, and Year 2. Figure x illustrates these changes in course taking patterns. In Figure X, the advanced and

honors levels of Geometry (see appendix B) were joined together because across all years, the number of students moving into the honors level of Geometry are very minimal ($n=2$).

Figure 15. Student course selections after each year of implementation. A smaller percentage of students did select enrollment in higher levels of Geometry after Year 1, but these proportions started to shift back after Year 2.

Figure 15 clearly illustrates how there was a slight dip in students enrolling in higher level Geometry courses after Year 1. However, with the increased rigor of Year 2, these numbers started to increase again. Further implications for these course taking patterns will be discussed in the discussion section of this chapter.

Subsequent Geometry Course Grades

Even though fewer students enrolled in the higher levels of Geometry after Year 1, the students who did enroll in higher levels of Geometry achieved higher grades than in Year 0. This pattern held for the students in the lowest level of Geometry as well. These grade distributions are displayed below in figure 16. As with the student course selection data, Geometry A+ refers to students enrolling in the advanced and honors level courses rather than the lowest college prep level.

Figure 16. Comparison of subsequent first semester Geometry course grades between Year 0 and Year 1. Students from Year 1 were found to be more successful in their future Geometry courses than students from Year 0.

Geometry and Algebra are very different courses, but the Geometry teams at Creekside High make a concerted effort to include as much Algebra as possible into their Geometry courses because they have identified Algebra skills as an area of student need. This means that the skills gained in their ninth grade Algebra course are translating into their success within Geometry courses.

Discussion

Implications, suggestions for practice, and areas of further study will be detailed based on the data analysis. However, these data are only part of one cycle of design-based research, so this discussion will only focus on the implications, suggestions for practice, and areas for further study that are applicable for the Algebra team as they complete Year 2 and move forward into Year 3. A larger discussion focusing on school- and district-wide implications, suggestions for practice, and areas for further study will be included in chapter 5.

Implications

Analysis of these outcomes demonstrate that the detracked Algebra course holds promise for ensuring a rigorous understanding of Algebra for all students at Creekside High School. Students with special needs and lower performing students saw small gains in their math confidence as measured by the ATMI. Further, student achievement does not differ significantly between the tracked course in Year 0 and Year 1. Despite a decrease in students enrolling in higher level Geometry courses, the changes student outcomes in future Geometry courses are also promising. The pilot demonstrates that the detracked course did

not harm higher performing students and saw gains with traditionally underperforming groups, and there is evidence of higher levels of success in subsequent math courses.

The changing relationships from Year 0 to Year 1 across student characteristics demonstrate that student performance is related to their attitudes about the course. These changes are contradictory. There was no longer a relationship between Latino students and low exam performance, but there was an increased association between Latino students and lower grades. Students with special needs saw the opposite relationship. The association between special education status and exam scores grew stronger and more negative, but the association between special education status and course grades was eliminated. However, the ATMI scores from Year 1 help to provide some explanation. Special education students saw the largest confidence gains when it came to valuing mathematics. Students who value a course will be more likely to complete all of their work, which leads to a higher grade despite lower achievement on the summative assessment. Lower performing students, who did not receive a 4.0 grade in the course, saw gains in enjoyment and motivation on the ATMI. Latino students make up a significant portion of these lower scoring students as made evident by the ANOVA and Pearson correlation conducted on the course grades from Year 1. Seeing enjoyment and motivation increase could account for the higher performance of Latino students on assessments. Course grades are dependent on completion of work, so without a corresponding increase in the perception of value of mathematics, students may not be engaging in work they don't see of value. Thus, the results of the ATMI could

provide a possible explanation for the gap between Latino assessment performance and grades.

Suggestions for Practice

After examining the changes in student outcomes between Year 0 and Year 1, three areas of focus become apparent for the course team: course grades for students of color, special education student assessment achievement, and high-performing student motivation. The team should continue to track this data as they build the course further. After developing a prototype during Year 1, the team now knows which data are most important for them to use to drive further cycles of design-based research. The team is structured as a Professional Learning Community (PLC). The PLC has dedicated time to develop an examine common formative assessments and to then provide student intervention and enrichment based on this data. This PLC process can be harnessed to conduct ongoing-design based research with the team. I suggest the following areas of focus for the team moving forward: grading and assessment, curriculum, instructional strategies, and student mindset.

Grading and assessment. During Year 0, the course used a traditional category and points-based grading system. During Year 1, they moved to a hybrid between a standards-based grading system and a traditional system. A standards-based grading system determines grades using student mastery as measured by formative and summative assessments rather than basing grades on an arbitrary points system. Mastery is generally an aspect of standards-based grading, so students can be allowed opportunities to revise and reassess in a standards-

based system. During Year 1, they gave standards-aligned assessments and allowed retakes, but they were still using a standard point scale that included categories for things like homework and classwork. During Year 2, the team has been building more consistent rubrics for their standards-aligned assessments, and they still allow for revisions and retakes. This makes their system more standards-based, but they are still using categories and points. I suggest that moving forward into Year 3 and beyond that the team shift to an entirely standards-based gradebook. This will benefit Latino students since their mastery will be more accurately reflected in their grade, hopefully illuminating their achievement and confidence. It will benefit special education students because the data point towards these students receiving grades higher than their level of mastery; this is setting a lower standard for special education students, and the goal of this course to provide a universally rigorous experience. A pure standards-based gradebook helps to ensure a universal standard that is based on evidence of learning; it helps to keep the bar high. With a standards-based grading system, proficiency and extended mastery are defined by teachers through the use of rubrics. Rather than making high-performing students guess where they can take their learning further, it is visible and attainable. Therefore, a standards-based grading system could make an impact on all three identified areas of need/concern

Curriculum. During Year 0 and Year 1, much of the content at the beginning of the course was review from the Math course that students took in eighth grade. With the adoption of the Common Core standards, much curriculum that was traditionally reserved for ninth grade Algebra was moved into eighth grade math. However, until the middle of

Year 1, the middle school and high school math departments had not shared student learning outcomes with each other. After the duplication of material was discovered, the team adjusted their learning outcomes for Year 2. This allows for more grade level Algebra in ninth grade, time for student intervention, and time for student enrichment. High-performing students will also be more engaged if their class consists of far less repeated content.

With adjusted outcomes, the team can focus on adopting much higher-quality curriculum. I suggest that the team adopt and create more non-traditional math curriculum that focuses on problem-solving, critical thinking, collaborative learning, and performance-based assessment. I also suggest that they adopt adaptive software for homework. This allows students who need support to get automated help outside of the classroom and allows students who wish to move at a faster pace the opportunity to move forward. Transitioning towards adaptive homework and giving class time to work on this practice could pay dividends in helping to differentiate instruction for a heterogeneous student group. The team is experimenting with using adaptive homework, but ongoing funding for licenses is always difficult to secure.

Instructional strategies. There are two major sets of instructional strategies that I suggest the team learn more about. The team should engage in professional learning surrounding Complex Instruction (Boaler, 2006; Cohen, 1998; Cohen & Lotan, 1997; Cohen et al., 1999; Horn, 2006; R. A. Lotan, 2003; Watanabe, 2012) and culturally responsive instructional strategies (Delpit, 2012; Duncan-Andrade, 2008; Ladson-Billings,

1995). The team has been introduced to some elements of Complex Instruction from a workshop they attended before the start of Year 2. However, for the team to move forward in implementing a more collaborative, problem-solving based course, they will need to adopt a framework for providing this type of instruction. Complex Instruction is a well-researched system of instructional strategies that would serve this team well. Complex Instruction allows for students of all ability levels and backgrounds to interact with highly challenging material, and this is what is demanded out of the detracked Algebra course.

When examining grades for students of color and how lower-performing students value Math, it becomes evident that there are still cultural aspects surrounding the course and school that are getting in the way of students being successful. The Golden Valley Unified School District has provided unconscious bias training (Nakamoto, 2017) to all teachers and all new hires, but there has been no introduction to any type of culturally responsive instructional strategies. Therefore, the team should engage in more professional learning for culturally responsive instructional strategies, so they can assist students in finding more value and voice in their Math class.

Student mindset. To work towards improving math confidence for all students in the course, I suggest adopting the course “How to Learn Math: For Students” available online from Stanford University (“How to Learn Math: For Students,” n.d.). At the beginning of a school year, students participate in six, ten- to twenty-minute lessons, about mindset, neural science, and strategies for actively learning Mathematics (“How to Learn Math: For Students,” n.d.). This type of universal intervention can help all students see the

value in struggle and problem-solving in Mathematics. In addition to students engaging in this learning, I also suggest that the team participate in their own professional learning related to the same topics and how to integrate them into the classroom. Making mindset an explicit topic of instruction turns student math confidence into a measurable goal rather than a vague concept for teachers and students. These changes in mindset lead to students more capable of engaging in the high levels of rigor necessary to give students a solid foundation in Algebra.

Areas for Further Study

The long-term outcomes of the students in this Algebra course are very important. This is why it will be necessary to conduct a longitudinal study of student achievement through the entire Creekside High School Math course sequence including course-taking patterns, course attainment, grades, college acceptance, and college Math placement. This study is beyond the scale of an individual school and will need the assistance of the Golden Valley Unified department of research, evaluation, and assessment to take part in this level of unprecedented data tracking within the district. This further study is already being built and examined, but it is the only way to know how this course impacts the entire system of mathematics at Creekside High School.

On a smaller scale, it is crucial to study how the team was able to demonstrate promising results despite all the factors that could hold back the team including teacher team membership, the lack of a design process, and student demographics being influenced by initiatives taking place at feeder middle schools. From Year 0 to Year 1, there were no

returning team members, and two out of four of the new team members were brand new teachers. This level of inexperience would lead one to believe that the project could expect to see negative results. There are aspects of the school and the district systems that also contributed negatively to this team. At the course level, there was a lack of initial design. A structural change was enacted by the former principal of Creekside High, but there were no resources allocated towards using a design process to create the detracked course. The teachers during Year 1 were developing and designing the course on a day-to-day basis without a larger design process or framework to guide them. At the school level, there are a lack of school systems for supporting struggling students. These systems are just being developed and prototyped now, so teachers were on their own to provide intervention, remediation, and enrichment for students. Without a systemic support structure, it is very difficult to support minoritized students. At the district level, there was a high level of pressure coming from the school board about the results for this course, leading to stress on the part of the inexperienced team. Since there was no initial design presented to the school board, the school board chose to use the same teacher-developed course exam between Year 0 and Year 1 without recognizing that the course would be changing its approach to Math instruction. The curriculum and the instruction were no longer in explicit alignment with a traditional, multiple choice Mathematics course exam. Finally, the demographics of the ninth grade Algebra course changed between Year 0 and Year 1 because one of our feeder middle schools is also enacting its own equity focused reform within their Mathematics courses. They are accelerating more students in their Mathematics studies in middle school.

This leads to fewer, lower-skilled students enrolling in ninth grade Algebra. This is illustrated below in figure 17.

Figure 17. Eighth grade CAASPP Mathematics Scores for Students Entering Ninth Grade Algebra. Fewer students enrolled in Algebra 1 for Year 1, and a higher percentage of them did not meet standard on the exam.

As the middle school is more successful in making their Algebra course more heterogeneous, the high school course will once again become more homogenous. If this follows the pattern of the school and the district, this ninth grade Algebra course will become a course with a non-representative population of low performing, minoritized students. This is a very different situation than the one described by Burris (2008) where the middle schools feeding into Southside High were not yet providing heterogeneous instruction. This demonstrates

how the success of detracking implementation is highly context dependent and needs to be adapted to work in varied school environments.

Moving forward, chapter four will examine the perceptions of teachers and the pedagogy being used within the course. Studying these two aspects helps to illuminate how the teachers were able to achieve these results. This becomes very relevant in chapter five where I will examine how the district system has negatively impacted the implementation of this detracked, ninth grade Algebra course.

Chapter Four: Evaluating the Effects of Detracking on Teacher Pedagogy and Perceptions in a High-Performing Public High School

Chapter three evaluated the student outcomes of a newly detracked ninth grade Algebra course, and it found results similar to those of tracked Algebra courses when accounting for the ability level of students entering the course. This reduces the outcomes of this course to assessments and course grades, ignoring any qualitative changes that may have occurred in teacher perceptions and pedagogy. This is where this dissertation diverges from the Golden Valley Unified School District's program evaluation; I seek to examine detracking for multiple angles, not just from a traditional, assessment-based conception of educational success. When defining detracking in Figure 6 and Appendix D, perceptions and pedagogy hold equal weight with student outcomes and structural changes. This chapter seeks to answer the following research question: how does detracking affect teacher perceptions and pedagogy in a high-performing public high school? Chapter three focused on specific instructional changes that could be suggested after studying the quantitative results of Year 1. This was a very teacher-focused perspective. Answering the research question for chapter four will lead to schoolwide suggestions and more theoretical implications. Chapters three and four work together to provide a multi-stage mixed methods examination of the course to provide quantitative and qualitative insights at the course and school level. This leaves chapter five to examine the final aspect of detracking: leadership. Chapter five will take the broadest and most theoretical perspective by focusing on

systemwide patterns made evident by examining a detracked ninth grade Algebra course as an intervention.

Research Design

This chapter takes the form of a qualitative study using grounded theory methodology, based on the recommendations of Charmaz (2014). Grounded theory methods systematically collect qualitative data to construct theories based on the data itself through the use of an iterative form of data collection and analysis (Charmaz, 2014). This focus on qualitative data is designed to bring forward the voices of the teachers who have been teaching this detracked Algebra course. Their story deserves to be elevated, so that the team can gain further systemic support. This study shows how this team has been able to achieve success despite the systemic issues that have been placed in front of them. Understanding their story is understanding social justice in action in an unlikely place. I am able to provide a unique perspective on a Mathematics department that is in the midst of a transformation in teacher perceptions and pedagogy.

Data Collection

A grounded theory approach makes it necessary to collect and analyze a wide variety of qualitative data sources. This study uses classroom observations, focus groups, observations, and field notes as qualitative data sources.

Classroom observations. As part of my job as an assistant principal, I conduct numerous teacher evaluations. I record all of these as inference free notes that act as a transcript. They are stored in an online database of classroom observations. The former

principal of Creekside High also generated some of the classroom observations that I downloaded and used as documents for analysis. During Year 0, I have two classroom observations that were typical of the higher lane of Algebra. During Year 1, I have eight classroom observations of the course. I have a wide variety of observations from all of the teachers on the team. I am able to understand what pedagogy looked like as the course was developed and instruction adapted. Finally, I have two observations from Year 2. These allow me to really compare the development of the course that occurred through Year 1. The distribution of these observations across the years is not equal, and this could impact the patterns I have observed in the pedagogical approaches taken between years. Other sources of data have also been used to account for the possibility that changes in pedagogy could just be an artifact of having a larger number of observations during Year 1.

Focus groups. During Year 1, teacher focus groups were conducted by the Golden Valley Unified department of research evaluation and assessment: one at the beginning of the year and one at the end. I used the transcripts from these focus groups as data sources. I also conducted my own focus group of teachers at the start of the second semester of Year 2, the 2017-18 school year. This allowed me to track teacher perceptions during and through the pilot year.

Field notes. I kept a professional journal documenting experiences and feelings related to working with this project. These field notes have allowed me to participate in narrative inquiry and professional memoir. My own experience is a critical aspect of this study, so I use techniques of narrative inquiry in this study; autobiographical self-reflection is

a critical aspect of narrative research (Bold, 2012). My research involves “walking into the midst of stories” (Clandinin & Connelly, 2004, p. 63). I am living my own story while intersecting with the stories of others and the story of the institution I work within. This means that I must place my work “in place” (p. 146). Nothing exists without a context, and everything is in a state of becoming rather than a static state of being (Clandinin & Connelly, 2004). The only place I can start from is my own story. Specifically, my own experience as an educator in this project provides extra context for the data. This places my work in the genre of professional narrative, much like Reddick and Saenz (2012) who “utilize scholarly personal narrative to reflect on their trajectory from undergraduates at a predominantly White institution—one prominently mired in a legacy of discrimination and exclusion toward people of color—to faculty members at that same institution” (p. 353). I, too, am reflecting on my trajectory as an educator, but I am examining it from the opposite angle. I am the benefactor of large amounts of privilege in society as a white male. I am writing about how I have discovered how I can use this privilege to work towards the goal of social justice and equity even though I am working within an inherently privileged, high-performing school district built upon systemic racism.

Data Analysis Approach

All the data were converted into written documents and were then coded for analysis via process and in vivo coding. Following Charmaz (2014) I used process and *in vivo* coding because I wanted to preserve the actions and voices of the participants. However, I also included myself as a participant in this research, acknowledging my role as a participant-

researcher working in partnership with teachers through design-based research. I then sorted these codes into categories, and I developed themes based on these categories. I used the software NVivo to assist with this qualitative analysis. This allowed me to add codes and memos on the fly and allowed me to code and transcribe audio files directly within the software. NVivo also allows me to use graphical approaches to identifying patterns and connections between qualitative data. The visualizations provided by NVivo act as a crucial step after my first round of coding. The memos I am able to attach to these visualizations then help me to develop concise themes that are easy to express in simple declarative sentences.

Findings

While the quantitative outcomes between Year 0 and Year 1 were very similar, the qualitative outcomes vary dramatically between Years 0, 1, and 2. I will start by providing a general overview of the classes across Year 0, Year 1, and Year 2. This will be followed by an examination of the rigor and instruction across all three years. Finally, I will describe an exemplar lesson that demonstrates the unique characteristics of each year before moving into a discussion of teacher perceptions.

Pedagogy

Year 0 classrooms were very teacher-centered and followed a traditional model of direct instruction. The methods used for building classroom community and student mathematical confidence were surface level: platitudes were shared and students were praised. Deep mathematical exploration and discussion was short-circuited with a focus on

quizzes and specific algorithms; I observed students have their ideas actively silenced in service of moving forward with a lesson, rather than attempting to build on students' intuitive mathematical ideas.

In contrast to the teacher-centered traditional approach in Year 0, Year 1 classrooms were very active and experimental. These classrooms used a multitude of student engagement and community-building strategies. Some of these strategies were more successful than others and some became repetitive for students and teachers like using “around the room” activities containing problems of escalating complexity posted on the walls of the classroom. Teachers attempted and developed projects and explorations. The team-built assessments and student just in time, and the specter of the school board was hanging over the teams' heads.

While Year 1 pedagogy demonstrated a chaotic explosion of ideas, Year 2 has been a year of refinement. Viewing a graphic comparing my process codes of Year 1 and Year 2, I am reminded of the pruning of neurons. Year 1 was a shock to the system with many new ideas, and Year 2 continued to develop the techniques that worked during Year 1 while continuing to build a more universally rigorous experience. Year 2 marks the start of a new meso-cycle of design-based research as indicated in Figure 8 and Appendix D. The early prototype stage is done, and it is now time for the team to move forward in using their promising new course to pay off the educational debt of minoritized students at Creekside High School. To understand these changes in the courses, I will next evaluate pedagogy in

much greater detail by examining the rigor of the courses and the instruction within the courses.

Rigor. Rigor can be an ill-defined term. I am going to define rigor as existing along two continuums: there is a rigor floor and a rigor ceiling. The rigor floor is the minimum level of learning necessary for every single student to exit a course. This includes setting high, coherent standards for universal student mastery and developing scaffolding to support every student in reaching these standards. The rigor ceiling refers to the level of differentiation and individualization available to high performing students. In a universally rigorous classroom, there is a very high rigor floor and very high or infinitely high rigor ceiling. In reality, most classes exist within a continuum of these two limits.

Year 0 was still a tracked Algebra course, so it understandably contained a high rigor ceiling and a low rigor floor. The advanced class catered to the higher-performing students while the lower track class settled for compliant students. This is well illustrated by the student grade patterns presented in Chapter 3. Students may have received higher grades during Year 0, but they did not do as well in their subsequent math course. Students were made to feel successful through gimmicks like calling them “Algebra Conquerors,” but this was unearned success.

During Year 1, many techniques were added to support student mastery. Students were allowed to retake quizzes and these quizzes were much more directly aligned to the desired student outcomes than prior years. However, this did come at the expense of higher-performing students. During one classroom observation, I heard one student say, “[t]his is

hella hard! Middle school was way easier!” and heard another student say quietly to another student “I’m fucking bored.” This was not a secret; students expressed this in course surveys, and the rigor ceiling was a major focus of the Golden Valley Unified School Board and our chief academic officer for secondary education.

During Year 2, the rigor ceiling became a major focus. The teams solidified their essential student learning outcomes and used them to develop concrete rubrics that are shared with students on assignments. This focus on outcomes and assessments has eliminated redundant curriculum between eighth grade math and this Algebra course, so the student complaints about the lack of challenge have diminished. This focus on student outcomes and assessments has also helped to identify students more accurately for intervention and support. There are stretch opportunities for students built into every single project, quiz, and test, and this has also allowed the team to build in more student directed time where they are able to provide individualized support and extensions. These optional stretch opportunities took the form open-ended extensions for projects and challenge problems on quizzes and tests. Year 2 is a more universally rigorous experience than any prior year of the course since the teachers have continued to raise both the rigor floor and the rigor ceiling.

Instruction. Just as I defined rigor on two continuums, I will define the changes in instruction from Year 0 through to Year 2 in terms of two dimensions: instructional openness and instructional complexity. Instructional openness is defined by Hsu et. al (2009) by how much of the thinking load of a course is placed on students. It is possible for a class

to consist of mathematically rigorous, interesting problems that are scaffolded to the point of meaninglessness. A structured classroom with a low level of instructional openness places the thinking load on the teacher while an unstructured classroom with a high level of instructional openness places the thinking load on the students. Balancing scaffolding to account for differentiated skills while maintaining a high level of cognitive load and rigor is a difficult and critical task for the teacher team. One way to maintain a high level of cognitive load and rigor is to adopt the framework of Complex Instruction. As defined in chapter one Complex Instruction involves students working cooperatively on open tasks with multiple solutions (Cohen, 1998; Cohen & Lotan, 1997; Cohen et al., 1999; R. A. Lotan, 2003; Watanabe, 2012). The main strategies of Complex Instruction are grouping students using roles, assigning competence to students who might not usually be recognized, making students feel responsible for each others' learning, setting high expectations, emphasizing effort equally with a developmental definition of ability, assigning group-worthy tasks, and communicating the learning practices that lead to success in mathematics (Cohen, 1998; Cohen & Lotan, 1997; Cohen et al., 1999; R. A. Lotan, 2003; Watanabe, 2012).

During Year 0, the classes were highly directive and teacher-centered. This type of class had a low level of instructional openness and instructional complexity. This type of instruction corroborates the low rigor floor and high rigor ceiling of Year 0 since teacher-centered instruction benefits traditionally privileged students and leaves minoritized students on their own.

During Year 1 the course became much more instructionally open and slightly more complex. Students engaged in more mathematical projects, explorations, and discussions than during Year 0. However, many of these projects, explorations, and discussions were highly scaffolded to the point where they became rote exercises. When students did work together cooperatively, it was generally in partners and tended towards superficial collaboration. This superficial collaboration would commonly take the form of think-pair-share activities where students share ideas with each other or simple checking of work using a partner and individual whiteboards. These tasks were groupwork, but not group-worthy since they did not illustrate important mathematical concepts, include multiple tasks that draw effectively on the collective resources of a student group, allow for multiple representations, and have several possible solution paths (Horn, 2006; Watanabe, 2012). The instruction gained in instructional complexity during Year 1, but still did not align with the equity-centered framework of Complex Instruction due to a lack of truly group-worthy tasks. These instructional shifts align with how the rigor floor increased during Year 1, but the ceiling dropped. The team's effort was focused on supporting struggling, minoritized students and the goal of universal rigor was not accomplished.

However, during Year 2, the rigor floor and ceiling increased and instructional openness and complexity both increased as well. Projects, explorations, and discussions have started to honor student voice and ideas: one phrase heard in an observation was, "I like the way you think. What value do you think would be reasonable?" Students complete more work with partners and groups, and they work to solve more complex problems including

deriving essential Mathematical formulas and concepts and conceiving of algebraic expressions in geometric terms.

Exemplar Lessons. The changes in rigor and instruction are intertwined with each other. By providing an example of a lesson from Year 0, Year 1, and Year 2, I hope to bring to life the descriptions of rigor and instruction. Each subsequent section will provide a specific example from each year.

Year 0. The classroom is organized in rows, and the teacher guides students through some basic algebra questions. The teacher brings up a graphic of a balance with various weights represented by pennies and nickels. The class is asked to talk to a partner without much guidance about how they would set up the problem. Most of the students just do the algebra problem and pay no attention to the graphic. The teacher asks for a student to explain how they did the problem. The teacher then explains how they would do the problem without acknowledging the student solution. The students move on and complete three more problems like this in a row with the teacher explaining every problem. The teacher attempted to use technology and alternative techniques for problem-solving like presenting an Algebra problem as an interactive scale, but these devolved into highly structured algorithms. Students were not exploring and developing their own solutions; in fact, some students in the class had figured out they could just write down the solution once it was explained without attempting the questions on their own. Within this lesson, the teacher also provided surface-level statements about students taking intellectual risks, but did

not provide the structures, environment, and classroom community necessary to foster risk-taking.

Year 1. Students first complete a mindfulness breathing exercise. From there, the students watch a short video about Cesar Chavez to commemorate the holiday. The team attempted to build more community through the use of social-emotional learning strategies and culturally relevant curriculum. However, these additions felt tacked on and show the areas where the team needs the most support. After the video, students moved their desks into small groups to complete a mathematical exploration. These groups were still rather large at six to eight students. The exploration involved developing a line of best fit based on data in order to make mathematical predictions. Students watched a video of Usain Bolt running the 100-yard dash and developed a linear equation representing his speed using the time and distance displayed in the video. Students then used this linear model to predict how fast he might run 200 yards if he kept the same pace. This could be an interesting, group-worthy task with universal mathematical rigor if multiple solution paths and methods for determining the model were included by the teachers. However, the team did not have high expectations for the students in regard to developing these models, so the activity was overly scaffolded. Students were able to fill in numbers without knowing why and even verbalized this: “I get the idea, but I don’t know why I’m writing these numbers.” The team made great progress in changing the instruction during Year 1, but they still fell back into traditional habits of instruction, which aligns with the observations of Hsu et al (2009). With the explosion of new instructional strategies and techniques, some lessons and activities became

more rigorous and complete than others. Some lessons were abandoned while others were carried forward for further development. It was essential that the team was given this space for exploration because the instruction on display during Year 2 would never exist without the experimentation of Year 1.

Year 2. The atmosphere in the classroom is that of a laid back, tight knit learning community. Students refer to their class as their little family. On the day I observed, students were completing a quiz. Some students were working on completing self-paced homework on their Chromebooks, other students were working on a poster for a project, and other students were completing corrections for a prior quiz. The student project consisted of designing a poster modeling exponential growth and decay. Students were given straightforward criteria and a rubric for grading. They were expected to develop their own context and to write their own word problems. They were expected to determine a scale for a graph to accompany a sketch of their growth and decay functions. Finally, students were encouraged to determine the domain and range of their functions as well. The teachers agreed that they wanted to make domain and range mandatory in future years, increasing the rigor floor even more. If students completed their project early, they were provided a preview activity, allowing them to explore multiplication of polynomials in a geometric way before being introduced to the concept algebraically. Other than on the quiz, students were continuously collaborating and using each other as resources within the classroom. However, this is still incidental collaboration, not participation in group-worthy tasks that utilizes Complex Instruction. During Year 2, classroom community was evident, and this

provided student engagement to complete rigorous tasks with little scaffolding. The project was more difficult than when it was given during prior years, and students were more successful on the project and with the unit assessment than in prior years. Universal rigor is evident in the destructured, open nature of the classroom. Instructional complexity only became evident with a group of students who had finished their project and were working on the extension activity together. They were collaborating in a meaningful way on a group-worthy task. This task involved representing different polynomial equations using graphical, algebraic, and numerical techniques to identify patterns and to work towards deriving the standard formulas. It was evident that teachers had participated in some professional learning surrounding Complex Instruction, but still have a way to go in increasing instructional complexity.

Teacher Perceptions

It was possible to make conclusions about the observable changes in instruction and rigor between Year 0, Year 1, and Year 2, but this does not speak to the intentions, thought processes, and feelings of the teachers actually implementing this detracked Algebra course. I will discuss how teacher perceptions changed for two teachers who have participated in both Years 1 and 2. These insights about teacher perceptions are triangulated from focus group data and field notes about informal interactions with these teachers. I will focus on profiling two specific teachers from the team because their stories best exemplify the changes in teacher perceptions that have occurred.

Eugenio. Eugenio is a new young teacher. He is the only Latino in the entire Mathematics department at Creekside High School, and he has the lowest pure mathematical capability of any teacher in the entire department based on college transcripts and the credential he possesses. He did not receive high marks in all of his college Mathematics courses, and he only has a foundational level Mathematics credential, so he is only to teach up through Geometry. To get approval to hire him we had to fight stereotypes on the hiring committee about his mathematical abilities. Having a background that is very different than many other Mathematics teachers at Creekside High School makes his perspective valuable. At first, he expressed some doubt in the possibility of a successful detracked course because his student teaching occurred in a poorly developed detracked system. He had never encountered instructional strategies like Complex Instruction; using manipulatives to represent numbers was a stretch in his prior environment because of a lack of resources and support for active learning. However, through further interactions with Eugenio, it became evident that he has been building a nuanced, complex view of Mathematics as a system of thinking. This messy view of Mathematics is critical for the successful implementation of detracking (Horn, 2006). He wants to know why things work, and he wants to communicate this to students. I have seen him take the lead on developing computer-based explorations for all of the Algebra students and within his Geometry courses I have seen him implementing many different types of hands-on explorations and constructions. Within the focus group during Year 2, he was pushing for the Algebra course to contain more conceptual explorations and derivations. This view was supported by Linda, the original

progenitor of the project. Throughout Year 1, Louise was the leader of the team. She became frustrated by a lack of progress in these areas, yet with a new leader, the team has started to make much more progress. Eugenio's voice is heard more, and his confidence is building. His views of rigor and student learning stand in contrast to Tina, the other member of the team who participated during both Years 1 and 2.

Tina. Tina is a young, White woman from the Midwest. She moved to northern California when her college boyfriend received a job at a tech company. She is professional and has a good rapport with students and colleagues. Her instruction is the most teacher-centered and traditional of any other member of this team. However, this is partially because of co-teaching. She teaches all the co-taught sections, so she has a more homogenous group of students that includes students with special needs and other students with behavior needs. Co-teaching is designed to support students with specific learning disabilities related to Mathematics; however, students are often placed into co-taught courses based on perceptions of counselors, parents, and students. There are also support programs on campus that lead to more struggling students ending up in co-taught courses due to when the course is offered. Tina has had the most difficult time with the project and with deconstructing her classroom. In the beginning, she did not think we should combine the classes because she supported ability grouping. This was evident when she spoke of students' inability to participate in deeper problem-solving due to deficits in students' computational skills. She had a very traditional, hierarchical view of Mathematics unlike Eugenio. However, by the end of the first semester, she had changed from viewing the courses as a mistake to

searching for solutions to make the course serve students better. This was very evident when we had a meeting for all Algebra teachers in the Golden Valley Unified School District. Teachers from Golden Valley High School spoke in disbelief of the project and categorized students based on being enrolled in college prep, advanced, or honors Mathematics. During this meeting, Tina expressed her frustration working with a heterogeneous group of students, but she was no longer questioning the project. Instead, she started asking as many questions as possible of middle school Mathematics teachers in our district who are much more accustomed to teaching heterogeneous groups of students. Her conceptions of equity changed over this time; she is only on the beginning of a journey of discovering her own privilege and her own assumptions, and this is very evident in how she has adopted critical, equity-focused views of the co-teaching model employed in the Golden Valley Unified School District. During the Year 2 focus group, the co-teaching model became a major topic of discussion. Tina sees it as essential to the success of the project, but also views the situation as untenable in the long run. Co-teaching provides support for struggling students, but she sees the co-taught sections of the course as a place where students with behavior issues and disabilities unrelated to Mathematics are placed, so co-teaching ends up making classes more homogenous. This homogeneity is the opposite effect that co-teaching seeks; co-teaching wants to include students with disabilities within heterogeneous environments. Even though Tina has made great progress in being a more critical educator, she will also be the teacher standing in the way of the team adopting a fully alternative grading system. Her resistance to change is not insurmountable, and I believe that Tina wants to open her

classroom to employ more complex instruction. However, she is perceptive about how complex heterogeneous instruction really is, and she sees that the systemic support from school and district administration could disappear. She places student needs and student community at the center of all of her decisions. Even though she did not immediately appear to be an ally of the project, she rose to the challenge demanded of her and has become a much stronger teacher and person.

Discussion

Examining pedagogy and teacher perceptions has revealed a team in the midst of instructional transformation. It has been incredible watching the project proceed from an ill-defined idea to a fully evaluated, design-based project. I feel an immense sense of pride in the team of teachers and what they have accomplished. Teachers have made immense strides in changing instructional practice while causing no harm to students.

Implications

The largest implication is that instructional change is possible at Creekside High School. With the right combination of structure, design, learning, and leadership, a small team of teachers was able to affect change. This extends beyond this single Algebra team. Robert participated in the Algebra team and leads the department. He develops professional learning for the department in partnership with myself. New Mathematics pathways and courses are launching and flourishing; this Algebra team is one single case of an entire department in the midst of instructional transformation. Replicating this design-based structure for further detracking within this department and other departments across the

school could lead to even more widespread instructional change at Creekside High School since detracked courses lead to the adoption of Complex Instruction and other heterogeneous teaching techniques out of the necessity of supporting a diverse group of students. It is possible to make these changes in the current structure, but the need is not necessarily visible to all teachers. However, a visible detracking process could establish the opportunity for more teachers to participate in the instructional change process. Teachers are powerful and when they are given the opportunity and support, they are able to accomplish great things.

Suggestions for Practice

In this chapter, I will focus on suggestions for practice at the school level. Chapter Three focused on suggestions for the course team, and chapter five will be focused on suggestions for the entire district system. One concrete suggestion for practice at the school level would be to work towards collapsing the entire course structure into two tracks rather than three using the same design-based research process. This would start with Geometry courses, move on to Algebra 2 courses, and would end with the reduction of tracks at the Precalculus level. As outlined in chapter 2, it would be politically infeasible to detrack the entire course structure all at once like the SFUSD model included in Appendix A, but following the model outlined by Burris and Garrity (2008) of gradual detracking could be feasible within the Golden Valley Unified School District. This would also make it possible to encourage more students to enroll in more rigorous courses after Algebra since they would not have a de facto remedial option to choose from.

However, continuing to support detracking in the long term involves much more systemic change at the site level. Teachers are accomplishing great things, but without a system to support students emotionally, behaviorally, and academically, there will not be much progress in eliminating educational debt for minoritized students at Creekside High School. We can pour an infinite amount of resources into this Algebra course, and it will not lead to the type of transformational systemic change that needs to occur at Creekside High School. To assist in this transformational change, Creekside High School is currently prototyping a Multi-Tiered System of Support (MTSS) for students, but this system needs to be supported much more systemically. These extra supports include the creation of a permanent team dedicated to monitoring and on ongoing development of the MTSS. Creekside High School should also partner with other secondary schools and the district office in Golden Valley Unified School District to apply for a state grant to assist with the development of the MTSS. These funds could be used to provide further professional learning to assist in developing schoolwide systems that support the implementation of more heterogeneous instruction.

The MTSS is divided into three tiers: Tier 1 consists of high quality, rigorous instruction for all students, Tier 2 consists of targeted, just-in-time, intervention for selected students, and Tier 3 consists of concentrated remediation of fundamental academic skills. The further suggestions for practice will be categorized by tier in Table 6.

Table 6 Further Systemic Supports Necessary for Continuing Transformational Instructional Change	
<u>Tier</u>	<u>Support Needed</u>
Tier 1	Increased qualified co-teaching FTE Increased qualified teaching aide FTE Department wide professional learning in Complex Instruction School wide professional learning in culturally responsive instructional strategies and Universal Design for Learning (UDL)
Tier 2	School wide professional learning in small group intervention strategies
Tier 3	Development of a school wide universal screening system for Mathematics Development and/or adoption of an Algebra support course

At Tier 1, resources are essential. Increased FTE for co-teachers and aides would support the team greatly in providing more heterogeneous instruction within the current support system. Traditionally, special education is considered a Tier 2 and Tier 3 service. However, with the co-teaching model, special education teachers are used to provide inclusive instruction for all students, not just special education students. This involves the master scheduling process and advocacy for this FTE from the district office by the administration of Creekside High School. The Algebra team has received an introduction to Complex Instruction, but this is a framework that should really be adopted across the entire Mathematics department. Supporting this type of instruction across all courses would help lead to more universal acceptance of instructional change. Separate from Mathematics, the

entire teaching staff could benefit from learning how to implement more culturally responsive instructional strategies and UDL. These techniques are what could lead to the elimination of co-teaching by inclusively supporting all students in universally rigorous classrooms with a MTSS to support students who need more time and effort to learn.

At Tier 2, the entire teaching staff could use professional learning related to small group intervention strategies. Instructional change is occurring at Tier 1, but the Algebra team still felt powerless to support students who struggled to understand the initial instruction. These are skills that need to be developed and practiced. As teachers become more comfortable with these strategies, it might involve changing the bell schedule of Creekside High School to accommodate for more flexible intervention and enrichment time much like the model developed by Burris and Garrity (2008).

Finally, at Tier 3, it is critical that a universal screening system is developed for identifying students with fundamental skills deficits in Mathematics. Currently, students coming from outside the district take an assessment for placement. We receive state standardized test scores in the Fall, and we also give an assessment to verify course placement for ninth grade students in the Fall. However, this is still too late to place students into a support course if necessary. Creekside High School needs to develop a way to partner with their feeder middle schools to generate a shared point of data that can be used to identify lower skilled students before they enroll in courses for their ninth-grade year. This would make it possible to implement an Algebra support course. This would not just be for incoming ninth grade students taking Algebra, but for all students who have been identified

as lacking basic math and algebra skills. Currently, this type of support class only exists for special education students; this type of course needs to be universally accessible. This type of extra support is the only way that course teams can continue to support students with grade level math while students simultaneously receive additional, remedial support.

The Algebra course team can continue to participate in successive cycles of design-based research, and the course will continue to become more refined, more rigorous, more instructionally open, and more instructionally complex. I have full faith in the teachers on the Algebra team. Building and maintaining a larger MTSS is the most promising way for Creekside High School to make as much progress on quantitative student outcomes as they have on qualitative instructional outcomes. Heroic teams of teachers can develop incredible curriculum and classroom community, but they do not create sustainable systems for eliminating educational debt for minoritized students.

Areas for Further Study

A larger scale case study of the entire Mathematics department of Creekside High School could be very useful for practitioners and researchers. The entire department is undergoing transformational instructional change and documenting this larger scale process would provide guidance for school and district administrators.

A long-term study of the perceptions and pedagogy of Eugenio and Tina would provide tremendous insights as well. It would be very interesting to see how participation in this project at the start of their careers affects their practice in the long-term. I believe I will see these teachers take on leadership in the future and tracing this trajectory would be a

fascinating study of how systemic change and reform impacts the lives and careers of individual educators.

Chapter Five: Conducting a Self-Study to Propose the Leadership Framework of Critical Design-Based School Leadership

Referring back to the construct of detracking defined in Chapter 1 and Appendix B, there is one major aspect of this construct that still needs to be addressed in this dissertation: leadership. This final chapter is a self-study of my own leadership related to the detracked ninth grade Algebra course. Unlike prior chapters, my self-study does not focus on a single micro- or meso-cycle of the design-based research cycle for this project, as illustrated in Chapter 1 and Appendix D, but instead takes a broad view of the entire macro-cycle. Chapter 3 and 4 chapters focused on developing practical understandings at the course team and site level. This chapter seeks to develop a theoretical understanding of leadership and will then propose implications and a plan of action flowing from this theoretical understanding.

Design-based research is unique in its focus on practical and theoretical understandings (McKenney & Reeves, 2012). I seek to develop a theory based off of my own living experience, or a Living Educational Theory (Barry, 2012; Campbell, Delong, Griffin, & Whitehead, 2013; Delong, 2013; Ferguson, 2016; McNiff & Whitehead, 2010; Qutoshi, 2016; Ukani & Rawal, 2016; Whitehead, 2008, 2013; Wood, 2010). I will be proposing a framework for leadership as my Living Educational Theory. The framework I will introduce will be the framework of Critical Design-Based School Leadership. It is important to note that this theory is very tentative and grounded in the specific context of the study. This is where the theory I propose is similar to a grounded theory as well

(Charmaz, 2014). Much further, and larger scale, design-based research needs to occur to develop this into a larger, more generalizable framework for leadership. At this point in time, Critical Design-Based School Leadership, will live as my own personal leadership framework that I hope to implement, evolve, and promote over time as a publishing practitioner.

This chapter will take the form of a more standard research study. It will start with a section on relevant literature where I will develop a framework for leadership based on existing literature. From there I will move into my self-study in earnest including a research question, research design, findings, and a discussion of implications.

Relevant Literature

To study my own leadership and to develop my own Living Educational Theory, I found it necessary to develop an initial framework for leadership based on current leadership literature. The leadership framework from which I initially operated involves adopting a working definition of leadership and examining other existing frameworks for leadership.

As demonstrated within the construct of detracking in Chapter 1 and Appendix B, leadership is one part of the process of detracking. However, I adopt a definition of leadership that exists as a process within the process of detracking. My definition of leadership comes from literature on situational leadership: “[l]eadership is a process of motivating people to collaborate to accomplish great things“ (Vroom & Jago, 2007, p. 18). Viewing leadership this way makes leadership universally accessible. Leadership is not something dependent on one person or something people are born with; it is a process that can be participated in. This definition also allows itself to be adapted to many situations:

how people are motivated and the “great things” they seek to accomplish varies based on local context (2007).

Beyond adopting a definition of leadership, I also adopted various frameworks for leadership to address all aspects of this definition. In chapter 1, I defined what “great things” we seek to accomplish at Creekside High School: the elimination of educational debt for minoritized students. However, this does not address how to motivate people or how the process of leadership actually happens. I take a moral and critical stance in order to motivate people. This follows the recommendations of Fullan (2001) who contends that all successful change leadership flows from a moral core. I adopted transformative leadership as the framework for defining the moral argument undergirding our detracked, ninth grade Algebra course. Shields (2010) defines transformative leadership as placing a focus on liberation and emancipation. A transformative leader recognizes that outside material realities and disparities beyond the walls of an educational organization have major effects on the success of individuals within the organization, including teachers and students (Shields, 2010). Transformative leadership exists as a framework for bringing critical theory to leadership; a transformative leader seeks to eliminate oppression, so it is essentially a Freirean framework. However, transformative leadership only defines a moral argument and a framework for thinking; it does not address how people collaborate to accomplish transformative outcomes.

To address how people collaborate, I also adopted the frameworks of inclusive and distributed leadership in addition to transformative leadership. Inclusive leadership is

dependent on allowing the voice of all stakeholders to be heard and valued in decision making processes (Ryan, 2006). Inclusive leadership provides a vehicle for including everyone in a decision-making process, but it does not involve assigning responsibility for the implementation of decisions. Distributed leadership provides the method by which inclusive decisions can then be implemented. Distributed leadership views leadership as an activity undertaken by entire organizations, not something that resides in single individuals with formal titles (Bolden, 2011). This means that responsibility is distributed and that individuals fluidly take on leader and follower roles depending on the situation (Bolden, 2011). This allows for individuals who may not have formal titles to take ownership of the actions of the system. In a school, this comes in the form of staff leadership. Teachers and classified staff are untapped resources for leadership and action. To build this capacity, decisions do need to be made inclusively. Ultimately, distributed leadership is the process by which inclusive decisions can be implemented to achieve transformative outcomes.

Research Question and Design

This chapter is a self-study, but, ultimately, this chapter is developing theoretical knowledge through the examination of my personal experience. Even though I am the data source and the subject of this study, this chapter wants to use this data to view this ninth grade Algebra detracking project at a much larger scale. So, through my self study I hope to answer the following research question:

- How can critical theory and design-based research be applied to the practice of leadership?

Data Collection and Data Analysis Approach

This study combines all the data sources from Chapters 2, 3, and 4. This means that this study contains an extensive mixed methods dataset including: student achievement outcomes, classroom observations, teacher interviews, teacher focus groups, field notes, school board meeting minutes and correspondence, online newspaper articles, online article comments, course syllabi, and district documents. As I collected this data for the prior chapters, I built a master dataset consisting of all of this data. I coded this data as it was collected using process and *in vivo* coding (Charmaz, 2014). I focused this coding on leadership rather than perceptions, outcomes, or classroom practices as in the prior chapters. I was then able to organize these leadership into categories and themes and finally used this dataset to propose the leadership theory of Critical Design-Based School Leadership.

Findings

I am going to structure my findings around moments of critical self-reflections. This means that my findings are going to take the form of narrative inquiry and professional memoir as defined in Chapter 4. I will focus on telling my story about the project from the beginning to end.

When I first arrived on my new job as an assistant principal at Creekside High, I had an initial concern about taking this job in an affluent area. However, when I examined student achievement data and the Mathematics tracking system, it became evident that there was still a place for myself as a critical educator with a focus on equity even within a high-performing school.

I understood how tracking contributes to inequitable student access and outcomes, but I found myself on multiple occasions having to defend and make placement recommendations. I have had to develop a full understanding of this system to support students. This system may need to change, but this takes time, and I have to exist within the system. I contribute to inequality by serving this system, and this is why I was excited when I heard there were plans to pilot a new detracked Algebra course, and I would be managing the project. However, once the project started, there are some specific moments where I realized that the initial design of this project was non-existent. Essentially, teachers worked with the principal of Creekside High to develop a plan for Year 0 where they would teach the same Algebra curriculum with common assessments to both existing levels of Algebra. However, there was no program design or evaluation and there was no professional development plan or instructional framework to guide implementation.

As discussed in Chapter 2, when a detracked Algebra class was placed into the course catalog, it caught the school board and community off guard. I believe this is because the principal saw no other option to get detracking off the ground and Creekside High. She believed that it was not possible to build a coalition to implement and design this project in an inclusive and distributed manner. When I interviewed her, she even compared the practices she wants to bring to the school like a virus; the body wants to reject them (Personal communication, 2016). However, pushing practices and initiatives on people without practicing inclusive leadership leads to resentment and divisiveness. This caused me tremendous personal anguish being caught in the middle. I sought mental health treatment

and require anti-anxiety and sleep medication to cope with the approach of the former Creekside High School principal. She had transformative outcomes in mind and was, and continues to be, a powerful, equity-focused leader. She wanted to see instruction become active and student-centered, with alternative grading all within a completely detracked, universally rigorous system. My values mismatch with her was entirely with the method of implementation not with the goals or assumptions behind the ninth grade Algebra project.

At the end of the first micro-cycle of year 1, at the end of the first semester, a misreading of assessment data led the entire team to question the project and our approach. We looked at the student assessment data from the first semester final, and it looked as though we were seeing drastically lower results for the students in the detracked course compared to the tracked course. This led all of us to adopt a reactive, panicked stance. I pulled together resources and started consulting with more experts, went on site visits, and found more curriculum to pilot. The course team focused on ways that unsuccessful students could demonstrate further knowledge and improve their grades and scores from the first semester. This panic made us move a little faster, but it came out of sheer fear of the school board. However, we realized our panic was not called for. Comparing scores between gradebooks meant we were comparing curved scores from Year 0 with raw scores from Year 1. Once we completed our formative evaluation with district department of research, assessment, and evaluation, we were able to see raw scores compared and found that Year 0 and Year 1 had similar results.

When the team was able to exit from their panic, I was able to participate in my own critical self-reflection. I realized that the former principal of Creekside High, the former superintendent of Golden Valley Unified, and myself were focused almost entirely on outcomes. As discussed in Chapter 1, Dewey (1926, 1997) proposed that exclusively focusing on outcomes robs the present of all meaning. The former principal spoke of detracking and desegregation as the outcomes, with a change in pedagogy as secondary, while the superintendent focused on getting more underrepresented students into higher level Math courses (Personal communication, 2016). The former superintendent only mentioned instruction when asked about it, and I could see his wheels turning to give a response that would appeal to me as an interviewer (Personal communication, 2016). It was most difficult to acknowledge that I had been sucked into focusing on the outcomes. My main goal was to see changed pedagogy in the classroom, but I was still focused on this as an outcome. I was still taking meaning away from the experiences of students and the teachers that I support. This made me come to an entirely different realization about my conception of my research. I am not exclusively focused on the outcomes of detracking. I need to focus on how I can help support more meaningful student experiences that lead to measurable gains in student achievement. Detracking is just one strategy that can be used to help create more meaningful student experiences. There are a multitude of strategies that have been outlined by research, but a very small amount of this research is visible in public school classrooms. My goal is really closing the research practice gap, so I can help support the development of more meaningful student experiences. This change in perspective was

fundamental for me; this chapter would not exist without this shift. I would have focused entirely on the narrow scope of detracking instead of realizing that detracking is just one way for a leader to enact equity-focused change. I needed this panic and this reflection to occur in order to reconceive of this study and of myself as a leader.

Shortly after I had come to a new understanding of the project, another event occurred that made me see what high pressure and a focus on outcomes can do to moral leaders. Students in the Algebra pilot course had selected their courses for the next year; we had gone open access the year before, so students and families chose if students would stay in the advanced lane, move down to the college prep lane, or move up to the honors lane. A visual of this course structure was included in Chapter 1 and in Appendix C. Not many students signed up for the honors lane, and they weren't advised to enroll in the honors lane except in a few situations. I fully support detracking, but with the curriculum and instruction of the Algebra course in its current state, not all students are prepared to move on to the level of rigor within the Honors track. It is going to take time for the course to develop to this level. The assistant principal of student services had noticed these enrollment numbers and crafted a communication to students to remind them of the course options they could choose from. She sent a draft of this email to myself and the principal of Creekside High School. She did not include the Mathematics department lead. I was asked to make sure the department lead was in the loop, so I forwarded the email to him. He replied to me and the assistant principal of student services. This led to me receiving a reprimand for forwarding an email to someone without permission, someone who has a very real stake in the

conversation. I was called unprofessional for including a colleague in a communication that involves them. This was irritating and frustrating, but it does not even begin to address what happened next.

Rather than sending an email, the assistant principal of student services called in students four or five at a time and attempted to coerce them to enroll in the Honors level Geometry course. The students felt uncomfortable about this and told their teachers. I was only told that the assistant principal of student services had called some students in. The news of this reached the Mathematics department lead. I was out very sick for three days, and the Mathematics department lead met with the principal, the assistant principal of student services, and the lead counselor. He managed to navigate the situation to undo as much of the damage as possible by allowing students to change their course selection if they had felt coerced into signing up for an Honors course they did not feel prepared for. I am proud of him as a teacher leader. This situation really disturbed me. These are the types of actions that can doom positive reforms within a school. How and why would something like this happen? As time has passed, I have realized that the former principal was receiving unknown pressure from the superintendent, and she was passing this pressure onto the assistant principal of student services. A high-stakes focus on outcomes led to negative behaviors from good people who felt their back was against the wall.

There is one final realization I had that once again changed my entire conception of this study. As I analyzed the data for Chapter 2 for, I realized that this ninth grade Algebra course is successful now but will actually encounter a death spiral. Over time, more and

more students are being accelerated and taking Algebra in eighth grade. This will make the ninth grade Algebra course smaller, with lower skilled students every year. No matter what type of curriculum and instruction the teachers use, this course will eventually turn into a de facto remedial course once again. The course is really a heterogeneous mix of non-accelerated students. This made me realize that no matter how many resources we put into this course, we will only get so far working at the course team level alone. It was a harsh reality to accept, but it made me realize that without a broad, systems view of the situation, we will continue to have pockets of success in eliminating educational debt at Creekside High, but we will never accomplish the goals for equity we have set for ourselves.

Discussion

Piecing all of the data together alongside my own professional memoir revealed three themes. I will present each of these themes with some brief discussion and then synthesize these themes along with the rest of the data to express the Living Educational Theory of Critical Design-Based Research. I do want to make it clear that my critiques of the role of the district office as a system are very different than my views of the individuals whom I have worked with inside the system. Detracking is a messy process, and this study is an honest perspective of this messiness. This study is the story of amazing individuals doing incredible work despite the fact they work within a racist, self-perpetuating, difficult school system.

Themes

The lack of a defined design process hindered the implementation of the detracked Algebra course and made it more difficult to provide meaningful support.

For much of the first semester of Year 1, the teacher team was making things up as they went along. They had a basic outline for the course, some resources the teachers had developed during Year 0, and some curriculum that Robert had assembled for the team after I introduced him to some new online resources for Mathematics curriculum. The team saw the need for a less traditional approach than Year 0. However, if this design process had occurred throughout Year 0, there would have been some prototypes of new types of curriculum and instruction to iterate upon during Year 1. Without a solid design and some prototypes, it made it incredibly difficult to figure out what kind of support the team would need. During Year 1 and Year 2, it became more evident that team needed support with Complex Instruction, grading and assessment practices, and culturally relevant instructional practices. Adopting the design-based research process after a whole meso-cycle meant that this support was not as continuously thoughtful as it could have been if the year of experimentation had occurred before the threat of a summative program evaluation was hanging over the team. It was heartbreaking and insightful when during a focus group I asked the entire team about how supported they felt. They reported that although the site and district admin seemed to be on their side, the school board did not trust them or their professional judgement. However, Linda, the former department leader who started the

project and returned for Year 2, pulled this feeling of tension into sharper focus during the focus group:

I don't know what you mean when you talk about teachers being supported. I've been doing this for twenty-five years, and I have always just had to figure out how to do things myself. I saw that these Algebra courses were unequal, and I decided to make this happen. This is how things played out when we combined and eliminated other lanes of Algebra in the past (Personal communication, 2018).

I empathize with this statement because throughout my career as a teacher I felt the same way. I became a school administrator to provide support to other teachers. However, I realize that I also can't have an ego when I am included in her statement. I built a team, pulled together resources, and provided coaching to Robert and Louise to assist with implementation. My work may have been invisible to many, but I see that is critical for the success of the project. I could have made this support much more explicit and targeted if we had been building this project in a design-based fashion from the beginning. Building in fully design-based fashion would have meant that more needs assessment would have occurred at the beginning of the project could have led to earlier, proactive support for the team based on their own view of the project. The team would have owned the design, the evaluation, and the support plan from the beginning of the project, rather than taking the entirety of Year 1 to make the course their own.

Lack of district level coordination leads to competing and duplicate equity efforts. As a system, there was little coordination between equity efforts across school sites. Golden Valley High School has a different, even more highly tracked Mathematics department, and our middle schools are developing programs to accelerate more middle

school students into Algebra 1 using more heterogeneous teaching strategies. This middle school effort effectively sabotages the high school Algebra effort since the success of the middle school acceleration effort makes the high school Algebra class more homogenous. Hopefully, this Algebra course is temporary, and the district can adopt a policy of universal acceleration in Mathematics. However, tracking through acceleration is built into the DNA of the Golden Valley Unified School District. As long as students are separated into two separate math courses in seventh grade, there will never be a truly heterogeneous population in a Mathematics course within the Golden Valley Unified School District. Moving to universal acceleration is a complex task, and the chief academic officer is under resourced and stretched thin. She essentially serves the role of an associate superintendent, a supervisor of all secondary principals, and a director of secondary of curriculum and instruction. She has a small administrative staff, a small staff of two teachers-on-special assignment (TOSA), and a retired teacher volunteering her time. Further, she is new to the job and just figuring things out. Bringing coordination and design to a system that has always been extremely autonomous does not happen immediately. Later in this chapter, I will discuss the resources that would assist the Golden Valley Unified School District in bringing forward more coordination.

Working in partnership with the district office was extremely beneficial. Even though the school board forced the development of a program evaluation, our partnership with the new chief academic officer and the program evaluation coordinator provided crucial support for the project. The chief academic officer has provided key political support with

the school board despite her initial skepticism about aspects of the program. She worried about the overall rigor of the course, but she watched the teachers continually improve since they shared the same concern. She provided strict guidance to the superintendent and school board to leave the teachers out of any discussions the board has about this course. She champions the team and acknowledges their growth. The program evaluation coordinator also deserves immense credit for the success of this course. Instead of approaching the program evaluation as something to be imposed, the program evaluation coordinator worked with the team to develop relevant data collection instruments. She aimed to be as unobtrusive as possible. This made the development of accountability measures for the program a useful experience that was bolstered by the common assessments employed by the teachers within the class. The teachers turned their shared inquiry into something more than just assessment results driving instruction by using these assessments and the formative program evaluations to continually iterate on the design of the course itself.

In the midst of this, I acted as a liaison between site administration, the district administration, the school Mathematics department, and the individual teachers. I created school board presentations to be given by the district administration, I individually coached Robert, the head of the Mathematics department, I provided coaching to Louise about teacher team leadership, and I provided coaching through the evaluation system to the individual teachers on the team. I also located professional development and site visit opportunities. Finally, I organized and helped to synthesize our data into meaningful action steps.

The project was most successful when we assumed a design-based approach where the school and district administrators operated in a way similar to researchers working with the team of teachers. We worked in partnership to iteratively improve on the design of the course using a formal process based around the techniques of formative assessment. This application of design-based research as a method of leadership is the core of the the Living Educational Theory of Critical Design-Based School Leadership.

Critical Design-Based School Leadership

I propose Critical Design-Based School Leadership as a framework for developing self-improving school systems. School systems need to be built like artificial intelligence, not like buildings. The school system itself should be designed in a way that it is always learning to be more equitable and to serve students better. The theoretical framework I defined earlier in this chapter is still applicable to help explain elements of Critical Design-Based School Leadership. I will now present a graphic representing Critical Design-Based School Leadership, and I will define the aspects of this Living Educational Theory.

Figure 18. Critical Design-Based School Leadership. Each aspect of Critical Design-Based School Leadership encourages the development of self-improving school systems.

Critical. A leader is critical when they seek to eliminate power and privilege differentials within their organization. This critical lens can be class-based in the case of a Marxist or Freirean lens, it can be race-based in the case of Critical Race Theory, Transformative Leadership, or Culturally Responsive School Leadership, or based in other critical theories such as gender or queer theory. In every context there exist power and privilege differentials, even if they are not immediately visible. In many cases, these critical views will fall along racial or class lines based on how American society is built, but critical leadership can address other power and privilege differentials in addition to race and class. Intelligently applying critical theory through praxis is key within Critical Design-Based School Leadership.

Design-based. The development of this detracked Algebra course as described and analyzed within this dissertation provides one example of a design-based project in the context of Critical Design-Based School Leadership. Leaders and teachers at all levels need to collaborate within a unified system to provide support for iterative cycles of development based on formative evaluation of data. This partnership places individuals in the position of researcher and participant simultaneous. The roles participants adopt depend on the situation and the educational intervention being designed and iteratively implemented. These iterative, interlocking systems of design-based research are the mechanism by which self-improving school systems are developed. Another important aspect of design-based research is the development of practical and theoretical understanding. Examining the role of school leadership will make it evident how Critical Design-Based School Leadership also leads to theoretical understanding.

School leadership. Leadership is an active process of encouraging collaboration towards common goals (Vroom & Jago, 2007). It is evident how design-based research can be applied as a technique for developing self-improving systems, but it is less clear how a leader can also develop theoretical understanding. I think it is critical that leadership become involved in the practice of publishing and presenting about the practices developed through Critical Design-Based School Leadership. Leaders should seek out ways to consult with other leaders and to establish research partnerships with universities. Critical Design-Based Leadership School Leadership can become one way to help eliminate the research

practice gap. I will next explore the practical implications of Critical Design-Based Leadership for the Golden Valley Unified School District.

Implications

Detracking has proven promising at Creekside High School in combination with instructional changes and changes in grading practices. This combination of practices has increased the rigor, instructional complexity, and instructional openness of the Algebra course; however, this just affects one small group of students at one school within a larger district. Without further detracking at the school and district level, this ninth grade Algebra course will mean little for eliminating educational debt within the Golden Valley Unified School District. The other conclusion is that a design-based approach can be used to work towards more equitable outcomes through pedagogical change. I propose that undergoing the detracking process as defined in Chapter 1 and Appendix B at the district level would lead to fundamentally more equitable student outcomes. However, this is because detracking is a process that involves changing institutional structures, pedagogy, and perceptions through the application of leadership. Without addressing the supports necessary to make these shifts, districtwide detracking would be doomed to fail. Detracking is not a structural means to an end; it is one part of larger, interlocking reforms necessary to eliminate educational debt within the Golden Valley Unified School District. I will explore the policy, personnel, and implementation details that would be necessary for these reforms to be implemented through the practice of Critical Design-Based School Leadership. Finally, I will

discuss this current reality within the Golden Valley Unified School District, and how this affects the possibility of meaningful, equity-focused reforms such as detracking.

Board Policy and Equity Plan. The board has a mission and vision aligned with equity, but the practices of the district do not follow this mission and vision. First, I propose a board policy that cements educational debt as the model for the district and philosophically aligns the district with detracking as a moral issue. This policy would need to make a statement that the district sees tracking as an issue that promotes inequity and then adopt a goal for the development of a detracked secondary school system. From this policy, the district equity plan would be given larger credence. Complete detracking could then be made an element of the long-term equity plan for the district.

Mathematics Placement Policy. The district Mathematics placement document would serve as a further public statement in support of detracking; the district should adopt a stance of universal Mathematics acceleration in seventh grade. The ideal model for acceleration would follow the SFUSD model in Appendix A where acceleration occurs later in students' academic careers, during high school. This allows students to make important life decisions when they are older and allows students more time to develop a fundamental base of Mathematical knowledge. Despite later acceleration being ideal, the district is closer to realizing the goal of universal acceleration in middle school. The district could make a statement clarifying how optional acceleration, as written in the California Common Core State Standards for Mathematics, helps to create an environment that does not support universal rigor and thus, eleven and twelve-year-old minoritized students are effectively

stripped of possibilities after high school. Furthermore, realignment around equity and detracking would require more than just changes in policy and placement documents; personnel changes would also be necessary.

Personnel. A major reorganization needs to occur within the Golden Valley Unified School District surrounding curriculum and instruction. As discussed earlier in the chapter, the chief academic officer is tasked with in an impossible job. There still needs to be an executive level position of chief academic officer within the district.; however, there does not need to be two executive level positions: one for elementary and one for secondary education. Rather, there should be a single chief academic officer, a director of elementary education, a director of secondary education, and a director of curriculum and instruction. The chief academic officer would work with the board at the strategic level and serve as the public face for teaching and learning for the district. The directors of elementary and secondary education would exist to support site administrators including principals and assistant principals. The director of curriculum and instruction would support the implementation of coordinated, design-based professional learning across the district.

In addition, the district needs to add capacity if the equity plan is going to take a renewed focus and drive action within the Golden Valley Unified School District. For this to occur, the equity coordinator needs to become the director of equity and need to have their own staff. I suggest that the Advancement Via Individual Determination (AVID) coordinator for the district work under the new director of equity. AVID is a program for supporting students with skills necessary to move into post-secondary education.

Furthermore, I suggest and that a new position is added for a Multi-Tiered System of Support (MTSS) coordinator, who would also work under the direct of equity. An MTSS coordinator would coordinate the development, implementation, and evaluation of MTSS across the entire Golden Valley Unified School District. The MTSS coordinator would work with site leadership teams to design and implement customized MTSS for their schools while aligning with a district MTSS framework. The MTSS coordinator would accomplish this through facilitated professional learning that builds the capacity of site leaders to lead their own staff through a design-based process. In the next section, I will define and theoretically describe a districtwide MTSS. I will then provide an action plan for how a districtwide MTSS could be developed using Critical Design-Based School Leadership.

Districtwide Multi-Tiered System of Support (MTSS). In order to implement a universally rigorous curriculum to heterogeneous groups of students, educators must acknowledge that different individuals will require varying amounts of time and effort to learn different subjects. Further, some students learn differently than others and require entirely different modes of teaching and learning for them to be most successful. To accommodate for the varying methods and paces of learning in a heterogeneously grouped school system, student supports and interventions need to be built into the school system itself. Furthermore, students don't only differ academically, but they also differ behaviorally, socially, and emotionally. A MTSS seeks to provide the right kind and level of support for students, so they can access universally rigorous instruction in a heterogeneously grouped environment. This was described in chapter four at the site level, but for the MTSS to work

at the site level, it is critical for Golden Valley Unified to develop a design-based MTSS framework at the district level. The development of this MTSS framework is best expressed below in table 7 where implementation is described as a series of tasks with a description.

Table 7	
Tasks necessary to develop a district level design-based MTSS framework	
<u>Task</u>	<u>Description</u>
Create a district MTSS design team	This team manages the design and implementation of the MTSS at school sites. They collect, monitor, and present data about the health of the system. They provide support for the continual self-improvement of the MTSS. This team also conducts needs assessments to help align professional learning resources with the implementation of the MTSS.
Develop a system of universal screening at the district level	There should be usable data provided to sites and teachers in a timely manner, so they are able to best provide Tier 1 instruction. This includes formative data that can be collected to assist with course selection.
Develop a design-based framework for site implementation of MTSS at the secondary level	Sites design their own MTSS suited to their local context based on criteria and professional learning provided by the district.
Integrate the elementary school RTI system into the design-based MTSS	At the elementary level, there is a robust response to intervention (RTI) system. RTI is a type of MTSS. This program was just evaluated for the first time, and it would need to be integrated into the larger district framework and into a design-based cycle for continual improvement.
Provide ongoing professional learning to a cohort of site-based MTSS leadership teams	Every site forms an MTSS leadership team that shepherds the design-based development of an MTSS at the site level using the district framework. They receive ongoing professional learning, coaching, and technical support from the district for

Establish curriculum councils	<p>implementation.</p> <p>Currently, there are steering committees at the district level that consist only of department leaders. There need to be broader, subject-based groups that are able to conduct design-based work on a longer time scale.</p>
Adopt an equity focused instructional framework for all subject areas	<p>Complex Instruction is one example of an equity focused instructional framework that works particularly well for Mathematics. Complex Instruction has also been shown to provide benefits within social science and science courses (R. Lotan, Cohen, & Holthuis, 1994). Curriculum councils should investigate possible frameworks for their subject areas and should then plan and design the implementation of this framework with support from the district.</p>
Evaluate delivery of special education	<p>A special education evaluation is underway, but much work needs to be done in how we identify and provide support for special education students.</p>
Provide district-wide professional learning in UDL	<p>UDL helps teachers provide access to curriculum for all students. UDL makes universally rigorous, instructionally equitable courses accessible for all students.</p>
Provide district-wide professional learning in culturally responsive instructional strategies	<p>No amount of technical change will help if teachers don't know some techniques that can help them better relate to all students.</p>

Current district context. I have serious doubts that any type of district-wide plan can be implemented within the current climate of the Golden Valley Unified School District. As of this writing, the district has an interim superintendent, and it seems like everyday someone is announcing their departure or retirement as an administrator. The district culture seems to be moving further and further away from teaching and learning and closer and closer to reporting, compliance, and investigation. Despite being well-resourced with extra

reserves available, school board members are asking for budget cuts that continue to diminish the capacity of the district office and school sites. I don't believe the will exists to actually eliminate the educational debt within the Golden Valley Unified School District. The resources and the people are all there, but the system continues to integrate new reforms into its status quo (Elmore, 2004). Golden Valley Unified School District will continue to find small pockets of success due to the educators working inside the system, but no leader can seem to find a way to change the system itself. It's this immense potential combined with lack of support that makes my continued work in the Golden Valley Unified School District heartbreaking and frustrating. I feel as though I was able to make very little impact on this entire system, despite the amount of time and effort I have put into moving individuals forward. I have seen major progress within my sphere of influence, but this level of influence was not enough to make truly systemic change. This is why after the completion of this project, I will be seeking to implement Critical Design-Based School Leadership at a district level. I have learned that it is possible to build teams to make important instructional and systemic change at a site level, and I have seen how much difference a supportive team from the district office can make. I see immense potential in applying the skills I have developed through this project at a larger district level. I hope to help build a self-correcting school system where collaborative design, implementation, and evaluation become the standard way of doing things.

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Appendix A

San Francisco Unified High School Math Pathway

SFUSD High School Mathematics Pathways

Recommended Sequence

Appendix B

Construct of Detracking

Appendix C

Creekside High School Mathematics Course Sequence

Appendix D

Design-Based Research Macro Cycle

Appendix E

Year 1 - Correlation Matrix

		S2Final_Points	S2CourseGPA	MDTPGRpct	Asian	White	IEP/504
S2Final_Points	Pearson's r	—	0.670	0.751	0.247	0.277	-0.363
	p-value	—	< .001	< .001	0.005	0.002	< .001
S2CourseGPA	Pearson's r		—	0.472	0.203	0.178	-0.229
	p-value		—	< .001	0.023	0.048	0.010
MDTPGRpct	Pearson's r			—	0.134	0.258	-0.357
	p-value			—	0.158	0.006	< .001
Asian	Pearson's r				—	-0.458	-0.070
	p-value				—	< .001	0.438
White	Pearson's r					—	-0.381
	p-value					—	< .001
IEP/504	Pearson's r						—
	p-value						—

Appendix F

Year 0 – 2nd Semester Course Grades - Frequency

S2Course_LetterGrade	Frequency	Percent	Valid Percent	Cumulative Percent
0	10	7.143	7.143	7.143
1	7	5.000	5.000	12.143
2	35	25.000	25.000	37.143
3	43	30.714	30.714	67.857
4	45	32.143	32.143	100.000
Missing	0	0.000		
Total	140	100.000		

Appendix G

Year 1 – 2nd Semester Course Grades - Frequency

	Frequency	Percent	Valid Percent	Cumulative Percent
A	40	31.5	31.5	31.5
B	31	24.4	24.4	55.9
C	25	19.7	19.7	75.6
D	12	9.4	9.4	85.0
F	19	15.0	15.0	100.0
Total	127	100.0	100.0	

Appendix H

Attitudes Towards Mathematics Inventory (ATMI)

ATTITUDES TOWARD MATHEMATICS INVENTORY

Directions: This inventory consists of statements about your attitude toward mathematics. There are no correct or incorrect responses. Read each item carefully. Please think about how you feel about each item. Darken the circle that most closely corresponds to how the statements best describes your feelings. Use the following response scale to respond to each item.

PLEASE USE THESE RESPONSE CODES:

A – Strongly Disagree
B – Disagree
C – Neutral
D – Agree
E – Strongly Agree

1. Mathematics is a very worthwhile and necessary subject.
2. I want to develop my mathematical skills.
3. I get a great deal of satisfaction out of solving a mathematics problem.
4. Mathematics helps develop the mind and teaches a person to think.
5. Mathematics is important in everyday life.
6. Mathematics is one of the most important subjects for people to study.
7. High school math courses would be very helpful no matter what I decide to study.
8. I can think of many ways that I use math outside of school.
9. Mathematics is one of my most dreaded subjects.
10. My mind goes blank and I am unable to think clearly when working with mathematics.
11. Studying mathematics makes me feel nervous.
12. Mathematics makes me feel uncomfortable.
13. I am always under a terrible strain in a math class.
14. When I hear the word mathematics, I have a feeling of dislike.
15. It makes me nervous to even think about having to do a mathematics problem.
16. Mathematics does not scare me at all.
17. I have a lot of self-confidence when it comes to mathematics.
18. I am able to solve mathematics problems without too much difficulty.
19. I expect to do fairly well in any math class I take.
20. I am always confused in my mathematics class.
21. I feel a sense of insecurity when attempting mathematics.
22. I learn mathematics easily.
23. I am confident that I could learn advanced mathematics.
24. I have usually enjoyed studying mathematics in school.
25. Mathematics is dull and boring.
26. I like to solve new problems in mathematics.
27. I would prefer to do an assignment in math than to write an essay.
28. I would like to avoid using mathematics in college.
29. I really like mathematics.
30. I am happier in a math class than in any other class.
31. Mathematics is a very interesting subject.
32. I am willing to take more than the required amount of mathematics.
33. I plan to take as much mathematics as I can during my education.
34. The challenge of math appeals to me.
35. I think studying advanced mathematics is useful.
36. I believe studying math helps me with problem solving in other areas.
37. I am comfortable expressing my own ideas on how to look for solutions to a difficult problem in math.
38. I am comfortable answering questions in math class.
39. A strong math background could help me in my professional life.
40. I believe I am good at solving math problems.

Appendix I

ATMI Results

ATMI Final Outputs

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AVERAGE ATMI SCORES FALL AND SPRING

In general, there is very little change in aggregate scores across constructs on the ATMI Math Attitudes Survey. Deviations in average scores are less than a tenth of a likert point across all four constructs (none of which are statistically significant), suggesting that on average, students attitudes towards math did not change over this observation period.

ALL SPREAD CHANGE IN AVERAGE ATMI SCORES

When we disaggregate the data by class performance or special education status, we will see slight differences in math attitudes emerge that suggest that **untracked algebra 1 classes tend to benefit lower performing and SPED students more than their higher performing peers**. Further, there is little evidence to suggest that such an intervention is harmful to higher performing students. The only statistically significant finding showing this intervention may be detrimental to higher performing students indicated much smaller magnitudes of harm, relative to the benefit measured for their counterparts.

FALL-SPRING ATMI CHANGE BY SPED CLASSIFICATION

Examining subgroups based on Special Education (SPED) classification follows this pattern with one notable exception. The students who receive SPED services tended to value mathematics more after a year of heterogeneous math courses, while students who did not receive SPED services tended to value mathematics less. Average survey responses shifted .51 likert points higher and .19 points lower respectively ~~and were weakly statistically significant at a level of 10%~~. Note that the average magnitude of change for students receiving SPED services is much higher relative to the change among students not receiving services. Despite the greater magnitude of change in the way students receiving SPED services value mathematics, the t-scores are nearly identical at around 1.4 due to the smaller n size. Expanding the sample size by including additional years of observations will increase the precision of our observations and help make a better informed decision on expanding or discontinuing the algebra 1 pilot.

FALL-SPRING ATMI CHANGE BY ALGEBRA 1 GRADE

When observing subgroups of students by performance (those who receive an A in the course, and those who do not), we see that math attitudes decrease slightly across all four constructs for high performing students. Students receiving a B or lower tended to end the year enjoying mathematics more, and with higher motivation to learn mathematics. It is worth noting that the among lower performing students, though their confidence in their math abilities and how much they value mathematics decreased, the magnitude of this change is very close to zero, and much smaller than the decrease in similar constructs for higher performing students. However, none of these changes in construct scores are statistically significant.