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Middle School Algebra as a College and Career Readiness Indicator

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Educational Leadership Doctoral Program

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ABSTRACT

A goal of historic and current educational policy in American public schools has been to increase middle school student completion of Algebra I. The purpose of this study was to investigate equitable strategies for mathematics acceleration of diverse populations of middle school students. The context of this inquiry was a mid-sized school district that offers accelerated mathematics pathways to select middle school students throughout the district. My study demonstrated outcomes that align with current college and career readiness literature and support school-wide implementation of the Advancement Via Individual Determination (AVID) system.

PREFACE

I have enjoyed a diverse professional experience in my 20 years in education. I taught all core academic subjects to elementary and middle school students in both urban and rural communities. I was also actively involved in my sons' education for the past 13 years. As a parent, I noticed academic supports were readily available for reading but math was rarely addressed through my sons' elementary years. As a teacher, I knew one of my sons found mathematics to be more of a challenge than my other son and I provided the necessary interventions at home to help him feel confident and to succeed.

When he attended middle school, a strong emphasis was placed on state test scores as an indicator for advanced math course placement which also increased his anxiety in an already challenging subject. Because I am an educator, I knew the value of Algebra I completion by the end of eighth grade. Although my son did not achieve the state test score that was traditionally viewed as an acceptable cutoff for Algebra I access, I advocated for his enrollment. I provided the academic and non-academic support at home.

My younger son found math to be much less challenging than other subjects and earned high scores on state math tests, yet he also experienced a barrier to advanced mathematics enrollment when he attended middle school. I advocated for his placement in Algebra I honors when he was a seventh-grade student to ensure he had the opportunity to take Pre-Calculus in high school. I found the process of advocating for my children's educational opportunities to be exhausting and frustrating.

I had the opportunity to serve my school district as an administrator in the central office and encountered parents who had similar experiences to mine with middle school math course placement. I visited schools and observed demographic disparities in student course enrollment which led me to question the equity of middle school mathematics enrollment practices. My topic is relevant to all stakeholders including administrators, educators, parents, and community members. Opportunities to learn advanced mathematics affect a student's academic and career pathways which in turn, impact the community at large.

The main leadership lesson I learned through this experience is that schools are a reflection of the communities they serve, and a shift in perspective requires a culture of care and empathy to change the hearts and minds of stakeholders. I also learned that a focus on one goal such as access to advanced mathematics, has the potential to uncover deep-rooted loyalties and culturally ingrained values. A need for systemic change can be first observed through one output such as limited advanced course access, but strategic change agents should view the output as a clue to a larger critical need. In this program evaluation, the problem of limited student access to advanced mathematics coursework illuminated the need for an alignment of district systems to leverage federal goals and resources.

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DEDICATION

I dedicate this work to those who had a share in the sacrifices that were made to make this research and doctorate a reality for me.

First, to my husband Billy, I would not have completed this work without your unwavering patience and constant support. For nearly 30 years, you have been by my side, cheering me on, and catching me when I fall. My truest friend, I could not have done any of this without you.

To my son Cole, I have learned so much about being courageous and determined from how you persisted through your experiences this year. When I wanted to give up, I only had to think of the challenges you faced and how you remained light-hearted and optimistic through it all.

To my son Joey, you have always marched to the beat of your own drummer and I admire that in you. Being your mom has taught me to see the world from a broader perspective and to be more accepting of the uniqueness in myself and others. Your quirky humor is delightful, and it reminds me to take time to appreciate the fun and silly things in life.

To both of my sons, I strive to be an example of courage, diligence, and a champion for social justice. Have compassion for others and fight relentlessly for those who do not have the voice to fight for themselves.

To my mom Cindy, when I feel like I am not good enough, you remind me who I am. When I feel like I cannot continue, you remind me that I am strong. You push me to be the best version of myself.

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CHAPTER ONE

Introduction

Since President Johnson signed the Elementary and Secondary Education Act (ESEA) into effect in 1965, socioeconomic and racial inequities in education have been a national concern. Numerous reports and research papers have illuminated achievement gaps, disparities in student opportunity to access advanced courses, limited resources, and low academic expectations for students of color and students in poverty. In 2002, No Child Left Behind (NCLB) increased accountability measures for schools. As emphasis on assessment and accountability grew, state departments of education created school assessment and accountability divisions to measure and report progress toward federal, state, and local educational equity goals. In 2015, the Every Student Succeeds Act (ESSA) increased pressure on state accountability systems to include college and career readiness (CCR) measures for all students. Another provision required states to devise a system that “meaningfully includes all students, including historically underserved students” in school accountability metrics (U.S. Department of Education, 2016, pp. 2-3). States maintained autonomy to determine specific indicators and weights to meet the ESSA regulations on accountability and data reporting.

The district under study was a mid-sized suburban and rural school district. According to the ESSA Plan in the state in which the district was located, the state accountability system used an A-F school grade model (citation withheld to protect confidentiality). Middle schools earned points for nine indicators to determine the annual school grade and high schools earned points for 10 indicators. Middle school students who completed the high school mathematics courses of Algebra I or geometry also took an end-of-course (EOC) examination at the end of the school year. Algebra I and Geometry EOC ASSESSMENT results were calculated into the achievement, learning gains, and lowest 25% learning gains components of the mathematics indicator and the middle school component of the Acceleration Success indicator. As shown in Table 1, the nine components of the state school grade model for middle schools.

Table 1

2018-19 School Grades Model

English Language Arts	Mathematics	Science	Social Studies	Graduation Rate (high school only)	Acceleration Success
Achievement (0% to 100%)	Achievement (0% to 100%)	Achievement (0% to 100%)	Achievement (0% to 100%)	4-year Graduation Rate (0% to 100%)	High School (AP, IB, AICE, Dual Enrollment or Industry Certification) (0% to 100%)
Learning Gains (0% to 100%)	Learning Gains (0% to 100%)				Middle School (EOCs or Industry Certifications) (0% to 100%)
Learning Gains of the Lowest 25% (0% to 100%)	Learning Gains of the Lowest 25% (0% to 100%)				

Note: Citation withheld to protect confidentiality

In 2010, an emphasis on college and career-readiness prompted the National Governor's Association for Best Practices and the Council of Chief State School Officers to develop the Common Core State Standards (CCSS) for mathematics and English Language Arts (ELA) with a strong focus on algebra readiness skills throughout grades K-12 (National Center for Teachers of Mathematics [NCTM], 2014). The state's iteration of the CCSS, emphasized algebra readiness skills as early as kindergarten. Student enrollment in Algebra I in middle school became increasingly important as parents became more aware of which courses were required for college admission and for Career and Technical Education (CTE) certifications (Wang & Goldschmidt, 2003).

Mathematics courses follow a hierarchical pathway of skill exposure with algebra as the gateway course to all higher mathematics (U.S. Department of Education, 1997). Students must take Algebra I prior to geometry and geometry must be taken before Algebra II. With the linear progression of focus, coherence and rigor, students who complete Algebra I in eighth grade, have an opportunity to learn (OTL) calculus in high school. Exposure to higher-level mathematics also opens the door to advanced science courses that require algebraic skills such as chemistry and physics. If exposure to algebra for all students is the goal of historic and current educational policy, students of all subgroups should have equitable access to Algebra I in the middle school grades.

Purpose of the Program Evaluation

The purpose of my program evaluation was to investigate equitable strategies for mathematics acceleration at the middle school level in a mid-sized school district. Middle school leaders in the district under study had the option to academically accelerate students in mathematics through enrollment in high school level Algebra I Honors and Geometry Honors courses. Students earned high school credit when they completed the course and their high school grade point average (GPA) was impacted at the completion of the courses. There were ten middle schools and seven high schools in the district. Each of the 10 middle schools implemented acceleration models that were highly selective in nature. The process of questioning historic practices was intended to develop a baseline understanding of the impact on student achievement as it related to acceleration in mathematics on various populations of middle school students.

Rationale

I have served as a central office administrator in the district under study since 2017 and have noticed a trend of middle school administrators limiting access to advanced courses to students who were deemed the most proficient according to individual school-based metrics. Algebra I enrollment in the middle schools has been available only to students with the highest achievement scores on the end of the year state assessment, who had teacher recommendations, and who had consistently high mathematics course grades or a passing score on a teacher created placement test. As a result, enrollment in the high school credit classes of Algebra I and geometry were limited to a select few middle school students, and the student demographics of the accelerated courses did not reflect the demographics of the school. Students were denied access for many years, it seemed as long as stakeholders could remember.

Leaders from the state Department of Education annually assigned a letter grade to all public middle schools in the state based on (a) scores earned in nine student success measures; achievement in each of the four content components of English Language Arts, mathematics, science, and civics; (b) learning gains in two of the content components of mathematics and English Language Arts; and (c) acceleration success and maintaining a focus on students who needed the most support in mathematics and English Language Arts. These components included student performance on statewide assessments, including a comprehensive standards assessment and EOC assessments. The components measured the percentage of full-year enrolled students who achieved a passing score of a 3 or higher on a scale of 1 to 5.

The middle school acceleration component was part of the calculated school grade. This component was based on the percentage of eligible students who passed a high school level EOC assessment in the current school year or earned an industry certification in the prior school year. According to the state education reporting system illustrated in Table 2, the middle school acceleration score for the state in the 2015-2016 school year was 62%, while the school district under study earned 44%. In the 2016-2017 school year, the state score was 69%, while the district under study earned 52%. At the beginning of the 2017-2018 school year, the Director of Secondary Education for the school district advised all middle school leaders to enroll more students in Algebra I and geometry. The state score for 2017-2018 was 72%, while the district score increased to 62%.

Table 2

Middle School Acceleration Averages

	Middle School Acceleration		
	2015-2016	2016-2017	2017-2018
State	62%	69%	72%
District	44%	52%	62%

Many educators refer to Algebra as the gatekeeper to higher math courses. The National Council of Supervisors of Mathematics (NCSM) and TODOS: Mathematics for All (TODOS) collaborated on a mathematics social justice position paper to explain:

> Algebra in particular, plays a significant and historical role as gatekeeper to more advanced study in math and post-secondary education because of its institutionally sanctioned reputation as the more sophisticated and "abstract" domain that only some can and should study. (National Council of Supervisors of Mathematics and TODOS, 2016, p. 2)

Without adequate exposure to higher mathematics, students are limited in postsecondary opportunities. The Scholastic Aptitude Test (SAT) that most juniors in high school take to determine college readiness assesses a student's knowledge of mathematics skills that are initially introduced in Algebra I and are continually explored through Geometry and Algebra II (College Board, 2019). If they chose to take the SAT, students who had not taken Algebra II by their junior year of high school were at a marked disadvantage compared to students who had taken Algebra I in eighth grade, Geometry in ninth grade and Algebra II in tenth grade because they will not have had the opportunity to learn the content being assessed on the test (Ayieko, 2018).

The role of middle school mathematics course taking and algebra readiness is vitally important as "high schools appear to be unable to facilitate students' ability to close achievement gaps that exist prior to entering high school" (Wang & Goldschmidt, 2003, p.15). Students in middle school have a higher probability of earning a proficient score on the Algebra EOC assessment than students who take the Algebra I course in high school. Students who had access to an Algebra course by the eighth grade had been placed on an accelerated academic track and had opportunities to engage in key topics that prepared them for complex content such as functions, slope and geometric constructions while students who were not placed on the accelerated track engaged in basic arithmetic learning tasks similar to those they encountered in previous grades (Schmidt & McKnight, 2012).

I knew that many schools in the district under study limited access among middle school students to high school mathematics courses such as Algebra I Honors and Geometry Honors based on teacher recommendations, state test score trends, and the results of teacher created tests that often did not assess algebra readiness skills. If I had not advocated for my sons, their exposure to algebra in middle school would have been denied based on one or more of these factors. My older son scored in the below-proficient range in math for two consecutive years prior to my advocating for his placement in an Algebra I Honors course in his eighth grade year. Both of my sons took Algebra I Honors in middle school and earned scores in the proficient range on the state EOC assessment, which afforded them opportunities to take Pre-Calculus and statistics at the high school level.

Middle school parents contacted the district office to express concerns regarding denial of student access to Algebra I. Parents commented that selection for enrollment in advanced courses was subjective and negatively affected their students' self-esteem and limited their children's ability to take higher-level math courses such as statistics, calculus, and trigonometry, or to complete collegiate dual enrollment coursework. Teacher recommendations and scores on teacher created tests were used as primary indicators for enrollment in high school credit courses in middle school. Several parents indicated that they used virtual school as an avenue for gaining access to Algebra I prior to the ninth grade. This practice affected the school district financially. As more students enrolled in state run virtual courses, the full time equivalent (FTE) funding for students enrolled in virtual courses transferred to the virtual school rather than the school district.

I was concerned that many parents were either unaware of tracking and placement practices or were otherwise unable to advocate for their children. I would guess this was especially the case for minority and economically disadvantaged families as I observed fewer minority and economically disadvantaged students enrolled in advanced math courses in middle school. By evaluating Algebra I Honors and Geometry Honors placement practices in middle schools, I hoped to increase the access to higher mathematics for all students.

Goals

An overarching goal of my evaluation was to analyze equitable middle school access to high school credit math courses. According to state educational equity and access statute, the intent of the Legislature was to "insure that secondary students have access to high-quality, rigorous academics with a particular focus on access to advanced courses" (citation withheld to protect confidentiality). Algebra I EOC examination results showed that during the 2015-2016 school year, only 19% of the 3,234 middle school students in the district under study were enrolled in the high school Algebra I course (citation withheld to protect confidentiality). In the same school year, the mathematics achievement gap between White and Black students in the district was 24 percentage points. The achievement gap between White and Hispanic students in the district was 10 percentage points and the achievement gap between non-economically disadvantaged students and economically disadvantaged students in the district was 22 percentage points. It was my goal to analyze the enrollment criteria for middle school students to insure equitable access to advanced coursework in the school district under study.

Definition of Terms

Sustained academic growth has been a perennial, national concern. In response to nearly six decades of state and federal educational policy that addressed quality, well-rounded educational opportunities for all students, standards-based instruction and annual assessment of student progress have been at the forefront of educational research and initiatives. In an effort to provide equitable learning experiences to all students, a constant focus has been on language arts and mathematics achievement as indicators to determine if academic goals have been met.

The disparity in mathematics academic performance between groups of students has been of particular interest in the technology age. Students need access to advanced math in secondary and post-secondary education to gain access to science and technology careers. The academic preparedness of high school graduates for science and technology careers is highly stratified along race and social class lines. Specific educator actions should be paired to student needs to increase equitable access to advanced mathematics in the middle grades, which will therefore influence high school course trajectories.

Additional definitions helpful to understanding the topic include:

Ability grouping. Small, informal groups created by a teacher or group of teachers usually within a single classroom. Assignment to an ability group are often short-term, never longer than a school year, and varies by subject matter (Abiola, 2016).

Academic middle. Students who earn standardized test scores in the mid-range on a 5-point scale, earn Bs, Cs and potentially some Ds in coursework (Pannoni & Moody, 2019).

Achievement gap. "Achievement gaps occur when one group of students (such as, students grouped by race/ethnicity, gender) outperforms another group and the difference in average scores for the two groups is statistically significant" (National Center for Education Statistics, 2020, para. 1).

Advancement Via Individual Determination (AVID). An educational, not for profit organization that provides a system of support for schools to identify and close equity gaps (AVID Center, 2020).

Conceptual Understanding. The connection of concepts and operations that establishes the foundation for developing procedural fluency (NCTM, 2014).

Ethnomathematics. The study of mathematical work and an identified culture group (Gutierrez & Irving, 2012).

Hyper-acceleration. Academic course acceleration beyond student academic and developmental preparedness (Galanti, 2019).

Mathematics identity. "The dispositions and deeply held beliefs that students develop about their ability to participate and perform effectively in mathematical contexts and to use mathematics in powerful ways across the contexts of their lives" (Aguirre, Mayfield-Ingram, & Martin, 2013, p. 14).

Opportunity to Learn (OTL). Time allowed for learning a task through quality instruction (Carroll, 1963).

Opportunity Knowledge. "Students research opportunities, set goals, make choices that support their long-term aspirations, and successfully navigate transitions to the next level" (AVID Center, 2020, p. 4).

Person-environment fit theory (P-E). "People seek out and create environments that allow them to behaviorally manifest their traits; the extent to which people fit their work environments has significant consequences with better fit associated with better outcomes; and P-E fit is a reciprocal and on-going process whereby people shape their environments and environments shape people" (Su, Murdock, & Rounds, 2014, p. 83).

Rigorous Academic Preparedness. "Students have the academic skills and can successfully complete rigorous college and career preparatory curriculum and experiences" (AVID Center, 2020, p. 4).

Selection bias. "Pre-existing differences in treatment and control groups so that one group would do better than the other regardless of the treatment receipt" (Rickles, 2013, p. 252).

Self-efficacy. The development and strength of mathematics identity or the ability of students to see themselves as worthy and capable of doing math (National Council of Teachers of Math, 2014).

Student agency. "Students believe in and activate their own potential, build relationships, persist through obstacles, and exercise their academic, social, emotional and professional knowledge and skills" (AVID Center, 2020, p. 4).

Tracking. An entire school population is separated into groups for all subjects or certain classes according to predetermined measures (Wheelock, 1992).

Research Questions

I conducted research in accordance with one over-arching question and three guiding questions to ensure the relevance of the study for the school district as well as broader educational issues such as the goals highlighted in the state Department of Education Strategic Plan: "Goal 1, Metric 3: Closing the Achievement Gap" and "Goal 2, Metric 3: Access to High-Quality K-12 Educational Options" (citation withheld to protect confidentiality). The single over-arching question that drove this program evaluation was: What is the relationship between course assignment and student characteristics in middle school mathematics acceleration?

From this overarching question, supporting research questions included:

1. What criteria do educators consider when determining Algebra I placement for middle school students?

2. What criteria do school-based administrators consider when determining Algebra I placement for middle school students?

3. What do educators believe is the long-term impact on a student's middle school math course placement?

4. What do administrators believe is the long-term impact on a student's middle school math course placement?

The additional secondary research question related to the evaluation is: What opportunities exist to bridge possible learning gaps for middle school students seeking access to Algebra I by eighth grade?

Conclusion

In my role as a central office administrator, I utilized the Coaching and Certification Instrument (CCI) from AVID Center to assist schools in implementing a plan throughout the school to confront barriers and to ensure equity in school policies and written documents (AVID Center, 2019). To provide increased opportunities for student enrollment in rigorous, college preparatory courses, the school site plans were created and implemented by each school with coaching support from the district office. This program evaluation addressed social justice topics by challenging inconsistencies in educational opportunity.

CHAPTER TWO

Review of the Literature

Since President Johnson's Great Society Program first outlined the Elementary and Secondary Education Act of 1965, a key concern of all subsequent policy has been quality, equal educational opportunities for all students. Schools serve as societal sorting machines by categorizing students into the social and economic categories that exist in the community (National Council of Supervisors of Mathematics [NCSM] and TODOS: Mathematics for All, 2016). Accountability measures sustained the sorting process through the labeling of student groups as "bubble kids," the "high group," or "the bottom quartile" (NCSM & TODOS, 2016, p. 2). Mathematics education has become a focus of social justice policies because of its universal importance. Mathematics achievement has been used as a gatekeeping tool to sort students into various tracks that impact higher education opportunities, employment potential and socio-economic status (Domina, Penner, & Penner, 2017).

In this review of the literature, I investigated the ways in which the differences in learning experiences as a result of grouping by achievement created disparities in access to quality, mathematical learning experiences. By applying the frameworks of equitable opportunities to learn mathematics, instructional leadership, and person-environment fit theory, I was able to analyze the social processes that produced variation in student learning experiences within the school district under study. I was also able to draw conclusions as to how the processes contributed to social inequalities and to investigate possibilities for solutions.

Opportunity to Learn

Student tracking policies were initiated early in the 20th century when a growing number of immigrants were integrated into the public school system (Wheelock, 1992). Multi-cultural and multi-lingual tiers of support were virtually non-existent, so mechanisms were adopted to separate less academically prepared students from those who were deemed ready for proper schooling. Although the foundational principle of the American Public School System is that education is equal for those who have the desire to learn (Schmidt & McKnight, 2012), differing course trajectories result in unequal economic opportunities (Rickles, 2013). Tracking practices are largely associated with family socio-economic status, race, and gender (Rickles, 2013). Greater percentages of Black, Hispanic, and English Language Learner (ELL) students were enrolled in lower level or remedial math courses while larger proportions of Asian and White students were enrolled in Algebra I in middle school (Spielhagen, 2006; Wang & Goldschmidt, 2003). Because categorical patterns reflect cultural beliefs and attitudes that exist in contemporary society (Werblow, Urick, & Duesbery, 2013), they are maintained through policy, protocol, and allocation of resources (Domina et al., 2017).

Impact of universal enrollment policies. Over the last few decades, policy makers have intensified efforts to increase student mathematics experiences. This movement was predicated on the highly publicized message in *A Nation at Risk* (National Commission on Excellence in Education, 1983), that the quality of schools in the nation threatened not only the American economy, but also the national security. Schools attempted to bolster math instruction, and in response, math acceleration initiatives pushed algebra into the middle school curriculum. While this change was congruent with the curriculum progression in other economically developed nations, the United States' policy initially allowed access to algebra for a very select group of academically advanced students in middle school (Domina, 2014).

Nationally, universal algebra enrollment policies were less successful than earlier, more selective policies (Domina, 2014; Dougherty, Goodman, Hill, Litke, & Page, 2015; Nomi, 2012; Rickles, 2013). Initiatives to increase middle school algebra enrollment emerged in the 1990s when access to advanced mathematics was initially viewed as a civil right (Ayieko, 2018) as a result of *The Coleman Report* (Coleman et al., 1966) and through the efforts of the Algebra Project (Moses, Kamii, Swap, & Howard, 1989). Universal mathematics enrollment policies addressed algebra in particular, because of its traditional role as the gatekeeper to rigorous opportunities to study advanced topics in secondary and post-secondary education (NCSM & TODOS, 2016). Gutierrez (2013) explained that sociopolitical perspectives on equitable mathematics access have historically been interpreted as equality of inputs. The NCTM (2014) explained that mathematical equity "does not mean that every student should receive identical instruction; instead, it demands that reasonable and appropriate accommodations be made as needed to promote access and attainment for all students" (p. 59).

To increase access to opportunities to learn, students were enrolled in algebra classes without consideration of prior academic preparation (Dougherty et al., 2015) or developmental needs (Reyes & Domina, 2017). In the first year of one algebra-for-all policy, enrollment increased from an average of 30% of eighth graders in prior years to 55% in the first year and 70% in subsequent years of the study (Dougherty et al., 2015). By demographic group, low socio-economic student enrollment increased from 40% to

90%, and Black and Hispanic enrollment doubled from about 45% to 90%, although neither group achieved representation that was proportional to their district enrollment (Dougherty et al., 2015). Although the algebra for all enrollment data could be initially interpreted as a success for the program, simply mandating that all students take algebra had unintended negative consequences for the very students the initiative was designed to help. Students placed on a track for which they were not academically or developmentally prepared (Domina, 2014) did not continue on the path of acceleration (Dougherty et al., 2015).

Universal enrollment policies did not offer supports for students who were enrolled in algebra with weaker math skills (Nomi, 2012) and did not allow for consideration of motivational declines of students in the middle school years (Domina, 2014). One study found that universal enrollment policies in urban settings negatively affected the achievement of high skilled students who were enrolled in heterogeneous classes (Nomi, 2012). Rickles (2013) suggested future research should include instructional practices, classroom resources and the effects of hyper-acceleration, or acceleration beyond student academic and developmental preparedness. Hyper-acceleration could negatively impact students as pressures to maintain socially constructed identities of smartness often interfered with understanding of content.

Families and mathematics self-efficacy. Domina et al. (2017), Grant, Crompton and Ford (2015), and Werblow et al. (2013) argued that students in need of academic and developmental support prior to algebra enrollment are often placed on lower academic tracks where rigorous instructional opportunities, experienced educators, and additional resources are limited. The relationship between finance and student achievement has been argued in prior litigation throughout the country, but economics has not been isolated as the sole variable that impacts student achievement. The researchers of an extensive survey reported in the *Equality of Educational Opportunity* factors such as racial segregation, the impact of socio-economic status of students, student achievement and motivation, higher education, Project Headstart, “the disadvantage associated with foreign language in the home,” and vocational education sparked a debate on the relationship between per-pupil expenditures and student achievement (Coleman et al., 1966, p. 523). Because the survey was initiated by the Civil Rights Act of 1964, the primary purpose was to compare educational opportunities of White students to the opportunities of racially and ethnically diverse students. The topic of per-pupil expenditures was included in a brief segment that spanned only three pages and the authors included a cautionary statement regarding interpretation of data. “There are a variety of precautions necessary in interpreting the results of such analyses. They do not prove that the factor caused the variation; they merely indicate that the two are related” (Coleman et al., 1966, p. 292). The survey, commonly known as *The Coleman Report*, did not disregard inequities in resource allocation for students in need. Instead, families were found to play a substantial role in the outcomes of schooling, moreso than allocation of resources (Coleman et al., 1966).

The role of families in student access to rigorous coursework, achievement, and self-efficacy was a consistent finding in more recent research. Moses et al. (1989), the founder of the Algebra Project, found that helping students transition from arithmetic to algebraic thinking requires a series of steps. The first step in this transition is to start with a physical or conceptual representation of the algebraic concept. Moses et al. found that involving parents in the teaching and learning through the work of the Algebra Project provided students with stronger conceptual models as parents helped students access prior home knowledge when presented with new concepts. Additionally, the collective conversation and learning opportunities created a sense of belonging and value in the content. Parents described their children's experiences in the Algebra Project positively.

> My daughter began to overcome her fear of math and distorted perceptions of what she is capable of doing and why it is important. I believe this was due to several factors including the climate of the classroom, the demystification of the subject by relating it to life experiences and the fact that her mother and other community members were taking the course on Saturdays. (Moses, et al., 1989, p. 430)

Matthews and Farmer (2008) and Domina (2014) agreed that parent educational level, family socio-economics, and parent ability to understand and communicate the importance of mathematics are significant factors that impact student mathematics access, achievement and self-efficacy. Because learning algebra has procedural and conceptual foundations, Gutierrez and Irving (2012) contended that familial impact is so significant that culturally relevant instructional pathways and tiers of support should be considered to gain traction in the four dimensions of equity: access, achievement, identity, and power.

School relationships and mathematics self-efficacy. Throughout the literature, mathematics self-efficacy was described as development and strength of mathematics identity or the ability of students to see themselves as worthy and capable of doing math. Schools should empower students to build a positive relationship with mathematics that is founded in their own culture (NCTM, 2014). Although external factors such as family dynamics, parental education level, and socio-economic status impact self-efficacy and student achievement greatly, social belonging at school also plays an integral role in the development of mathematics identity (Domina, 2014). Hattie (2009) explained that schools should be careful not to undermine the impact of relationships and student belonging on student achievement. Allen, Kern, Vella-Broderick, Hattie, and Walters (2018) found that when students felt that they were not part of a group, their sense of belonging was lower, which led to a diminished value of academic acceleration opportunities. A culturally relevant approach to access and instructional methods is necessary to develop strong mathematical identities (Gutierrez, 2009). Moses et al. (1989) reported high achieving Black males felt uncomfortable moving to a more advanced mathematics track when their friends were taking courses on lower tracks. Students, particularly at the secondary level, felt the need to be similar to their peers as they developed mathematical identities (Domina, 2014; Moses et al., 1989).

Reform movements to close the mathematics achievement gap through remedial mathematics programs and universal enrollment policies have done little to benefit marginalized student populations (Grant et al., 2015). Common findings throughout the literature showed that student motivation, self-esteem and mathematics engagement varied greatly depending on academic track placement (Grant et al., 2015; Ma, 2002; Reyes & Domina, 2017). Reyes and Domina (2017) found that low track student course enrollments depended on post-secondary goals and student knowledge of academic expectations while higher track students were enrolled in courses based on self-efficacy, interest, and a sense of peer belonging. Students placed on a lower academic track were

60% more likely to drop out of school than students on higher academic tracks (Werblow et al., 2013) and school climate, sense of belonging, purpose and value of educational experiences were identified as reasons for dropping out in exit surveys (Rumberger, 2001). Young people finding their academic voice and having the opportunity to advocate for their needs instead of being spoken for increased their self-efficacy and ability to transform their own future pathways (Moses & Cobb, 2001).

Implications and possible strategies. The limitation of high-quality mathematics experiences creates academic barriers that restrict college entry and advanced technical career pathways; therefore, limiting economic prospects (Ayieko, 2018). Black males in restrictive school climates with less rigorous academic opportunities and limited post-secondary expectations often experienced negative outcomes even if they demonstrated academic interest and self-efficacy in mathematics in their elementary years (Grant et al., 2015). A growing body of research demonstrated that a social-cognitive approach to close the achievement gap resulted in addressing the needs of the whole child instead of focusing on strictly academic outputs. Bandura (2005) described the social-cognitive theory as a symbiotic relationship between student agency, behaviors, and school climate. "To be an agent is to influence intentionally one's functioning and life circumstances" (Bandura, 2005, p. 9). The dimensions of equity: access, achievement, identity, and power (Gutierrez, 2009) require whole school, strategically applied interventions that address the individual as well as the school as a system (Allen et al., 2018; Wehmeyer, et al., 2012). Advancement Via Individual Determination (AVID) provides a structure for whole school, systemic support strategies to address educator actions and student needs through the Coaching and Certification Instrument (CCI) domains of instruction, systems, leadership, and culture.

Instructional Leadership

Instructional leadership decisions about effective content and pedagogy, available course offerings, and intentional student course enrollment bring light to educational inequities that can potentially change the economic future for underrepresented student populations. The level of mathematics preparedness for students entering high school significantly impacts post-secondary opportunities because mathematics is a rigidly hierarchical subject (Dougherty et al., 2015; NCTM, 2014; Wang & Goldschmidt, 2003). Algebra I foundations are necessary for academic success in geometry and Algebra II (U.S. Department of Education, 1997). Students who take four years of high school level math are on track to complete an Algebra II course prior to graduation, which is the minimum requirement for students to be college ready (College Board, 2019).

Mathematical skills introduced in Algebra I, geometry, and Algebra II are assessed on the Scholastic Aptitude Test (SAT), which most juniors in high school take to determine college readiness (College Board, 2019). However, in a study from 2017, just "two thirds of United States high school graduates took mathematics courses in all four of their high school years" and some of those courses were remedial in nature (Reyes & Domina, 2017, p. 2). Students who have access to algebra in middle school are on an academic track to complete more math courses and courses of greater complexity.

In a 2006 longitudinal study, Spielhagen found that 77% of students who had access to middle school algebra were enrolled in trigonometry, advanced algebra, or pre-calculus by 11th grade. Students who remained on a lower track engaged in repeated arithmetic learning tasks and rote memorization of procedures that were similar to those encountered in earlier grades (Schmidt & Knight, 2012). Abiola (2016) found that students placed on lower academic tracks felt their academic fates were out of their own control.

Early mathematics opportunities. Academic tracking starts in elementary school in the form of ability grouping and continues through middle school and high school as academic course tracking (Faulkner, Stiff, Marshall, Niefeld, & Crossland, 2014). This practice grossly affects students of color and students in poverty as it insures not all students will have the same mathematics learning opportunities by eighth grade (Faulkner et al., 2014). To a large degree, elementary opportunity and access to strategic supports dictate success in middle school algebra (Domina, 2014; Faulkner et al., 2014; Knuth, Stephens, Blanton, & Gardiner 2016). Domina (2014) found that as early as kindergarten, students who scored more than two thirds of a standard deviation higher than their peers on common assessments were more likely to enroll in algebra by eighth grade. Rickles (2013), Knuth, Stephens, Blanton and Gardiner (2016), and Spielhagen (2006) agreed that early elementary mathematics enrichment and strategic support provided benefits to extending mathematics foundational skills. Domina (2014) specifically stated that a student's proficiency with fractions in elementary was a key factor in a student's future success in algebra. Knuth et al. found that traditional, arithmetic-based approaches to elementary school mathematics curricula and instruction does little to prepare students for understanding of foundational algebraic concepts and skills.

Professional learning. Because the rate of mathematics growth from grades 6 to 9 is slower than that of grades 3 to 6 (Mok, McInerney, Zhu & Or, 2015; Wang & Goldschmidt, 2003), "preparation for algebra must come under scrutiny, specifically mathematics pedagogy in the elementary grades" (Spielhagen, 2006, p. 40). Gutierrez (2013), Faulkner et al. (2014), and Domina et al. (2017) found that academic tracking had distinct demographic trends, and the quality of teacher content knowledge and pedagogy had a marked impact on ability grouping and tracking. Teachers in schools with many disadvantaged students were often those with the least professional experience, and therefore, had limited pedagogical mathematical knowledge (Abiola, 2016).

In schools of high poverty and large populations of Black and Hispanic students, teachers used subjective judgements of academic abilities and lowered curricular expectations (Abiola, 2016; Spielhagen 2006). This finding was consistent with data from a 2014 study that showed high-performing minority students were excluded from advanced tracks when teacher evaluation of academic ability was a contributing factor in placement (Faulkner et al., 2014). Speilhagen (2006) found that parents of minority and low-income students generally did not question the placement of their students in ability groups or academic tracks while affluent and privileged families lobbied for position in competitive learning environments. Gutierrez and Irving (2012) found that educators often ignored or rejected students' prior cultural mathematical knowledge in multiethnic classrooms. Academic tracking institutionalized categorical inequities and created a fixed mindset about students and their capacities to learn mathematics (Boaler, 2015).

Efforts to de-track middle school mathematics have largely fallen short because of lack of student readiness to study algebra when universal tracking policies were put into place. A common frustration of educators was the feeling of parent and administrative interference in traditional placement protocols (Spielhagen, 2006) and the lack of quality professional learning support in meeting the needs of a more heterogeneous student population when algebra enrollment was increased (Dougherty et al., 2015). In heterogeneous classrooms, providing quality instruction was often more challenging. Successful de-tracking efforts required a host of educator supports such as a shared belief in the need to remove barriers, an insistence on rigorous practice and robust professional development (Wheelock, 1992) that addressed culturally inclusive pedagogical practices and additional supports for students who needed them (AVID Center, 2020; Gutierrez & Irving, 2012; Nomi, 2012).

Teacher content knowledge in mathematics significantly impacts student achievement because teachers cannot evaluate and address student misconceptions without a strong knowledge of procedural and conceptual understanding of mathematic concepts. Knowledge of content should be developed by analyzing the progression of mathematics standards complexity through the grade levels (Student Achievement Partners, 2018) through collaborative, immersive professional learning experiences (Magiera, van den Keiboom, & Moyer, 2013; Telese, 2012). Telese (2012) found that

> Professional development may be conducted in a variety of ways, such as study groups, curriculum development or mentoring, but it is commonly in the form of workshops, seminars or college coursework…any more than a small extent of professional development was associated with lower [student] achievement. (p. 109)

Professional learning that embeds collaborative inquiry and practice in flexible teaching styles leads to better pedagogy as teachers identify opportunities to embed discourse into their own instruction (Magiera et al., 2013; Moses et. al., 1989). Student opportunity to learn rigorous mathematics increases as teachers shift traditional practice to assume the role of coach and facilitator of learning (Galanti, 2019). Student exploration of mathematical concepts to make connections, engage in problem solving, and verify their own solutions increases as teachers adjust traditional beliefs about the teaching and learning of mathematics to include the Standards of Mathematical Practice, which are:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning. (NCTM, 2014, p.8)

Culturally relevant teaching. Recent mathematics research has focused on quality mathematics as a social interaction instead of a purely cognitive practice. Gutierrez and Irving (2012) identified socio-cultural interactions with mathematics, or ethnomathematics, as an opportunity to weave diverse histories and perspectives into development of student mathematical identities. Ethnomathematics places value on the roles cultural diversity and social awareness play in developing self-efficacy and student agency by developing new content understanding from student prior experiences.

Culturally relevant mathematics instruction promotes a learning through peer interaction and places the teacher in a decentralized teaching role as a facilitator of, as well as an active participant in, academic discourse (Grant et al., 2015). Strategic remedial interventions such as technology intervention programs, intensive mathematics courses, and a double dose of algebra approach that results in extended instruction time over two school years have had mixed success (Dery, 2019; Nomi, 2012). Culturally relevant continual professional development on pedagogies needed for facilitating highly cognitive tasks such as Socratic discussions and collaborative study groups have been shown to increase student agency and academic achievement steadily over time (AVID Center, 2020; Galanti, 2019; Grant et al., 2015).

Person-Environment Fit Theory

Person-environment (P-E) fit theory originated shortly after the Great Depression. Employers valued extensive prior work experience in potential candidates, but the strained national economic system caused candidates to have significant gaps in employment history. Vocational counselors developed a series of assessments as a mechanism for marketing a potential candidate’s work ethic, values, cognitive abilities, and other highly desired employability skills (Rounds & Tracey, 1990; Su et al., 2014). Career assessments expanded into the armed forces during World War II when enlistment officers were tasked with placing recruits into appropriate career fields quickly (Johnson, 2008). The practice of assessing employability skills of potential military personnel with the Armed Services Vocational Aptitude Battery (ASVAB) continued after the war and is still in use today.

P-E fit, as it related to child development and academic course placement, had not been considered until the last decade. Domina (2014) recommended the use of a P-E fit analysis to consider placement for middle school algebra when universal enrollment policies and cognitive assessments resulted in limited success in increasing algebra enrollment for minority students and students living in poverty. As national academic goals shifted from preparing students for graduation to preparing students for post-secondary opportunities with the reauthorization of the Every Student Succeeds Act (ESSA), state standards also shifted to reflect the rigor necessary for students to be college and career ready (Morningstar, Lombardi, & Test, 2018; Schneider, Kitmotto, Muhisani, & Zhu, 2015). An increased emphasis on school accountability measures under ESSA was due, in part, to a national focus on career and technical education and employment (Ayieko, 2018). A comparison of ESSA state plans showed that 33 states, including the District of Columbia included a college and career readiness measure in their school accountability systems (Education Commission of the States, 2018). The College and Career Readiness and Success Center identified several accountability measures within a continuum of college and career readiness, one of which was the completion of eighth grade algebra (English, Rasmussen, Cushing, & Therriault, 2016).

Middle school is the appropriate time to begin career exploration because of the long-term impact of middle grades academic course placement. Development of positive self-efficacy and interest toward a college or career pathway during middle school can result in persistence on that pathway throughout high school and onto post-secondary success (Glessner, Rockinson-Szapkiw, & Lopez, 2017). Student enrollment in middle school algebra is increasingly important as parents become more aware of courses required for college admissions and advanced career and technical success (Wang & Goldschmidt, 2003). Several mathematical content clusters are identified as widely applicable prerequisites for a range of college majors and CTE careers (Student Achievement Partners, 2018). These clusters should be mastered prior to algebra coursework.

Monitoring of college and career readiness milestones, such as eighth grade algebra enrollment and success, allows schools to provide necessary supports and interventions to keep students on track for college and career readiness pathways. Recommendations in recent literature incorporated academic and nonacademic skills into a college and career readiness framework (Morningstar et al., 2018). The structure of support developed by Morningstar et al. (2018) was predicated on current secondary education and school reform research. The framework expanded the multi-tiered system of support (MTSS) structure already utilized in secondary schools to address critical student competencies across six domains: academic engagement, mindsets, learning processes, critical thinking, interpersonal engagement and transition competencies (Morningstar et al., 2018). AVID Center (2020) introduced a College and Career Readiness (CCR) Framework that expanded their Coaching and Certification Instrument to identify and address student needs in three categories: rigorous academic preparedness, opportunity knowledge, and student agency. Consistent with recommendations from the American Institutes for Research (Balestreri, Sambolt, Duhon, Smerdon, & Harris, 2019) to support student needs with educator capacity building efforts such as instructional coaching, continual professional learning, and alignment of reform efforts, the CCR Framework developed by the researchers at AVID Center contains four structural components to support adult behaviors: (a) insist on rigor, (b) break down barriers, (c) align the work, and (d) advocate for students (2020).

Federal and State Initiatives

Educational policy and practice at district and school levels originated from federal and state legislation and judicial decisions. The 1954 Brown v. Board of Topeka U.S. Supreme Court decision that repealed the 1896 Plessy v. Ferguson landmark decision was an instrumental victory in the fight for equal educational opportunity. "Separate but equal" educational facilities were determined to be in violation of the Equal Protection Clause of the Fourteenth Amendment of the U.S. Constitution (1868). Ten months after the Civil Rights Act of 1964 banned segregation on the basis of race, religion, national origin, and gender in the workplace, schools, and other public places, President Lyndon B. Johnson passed the Elementary and Secondary Education Act (ESEA) of 1965 as a key component of his "War on Poverty" platform. The ESEA stressed rigorous academics and accountability and established funding allocations to support the various aspects of the legislation. Title I focused on providing all children with the opportunity to receive a well-rounded, high quality education by allocating funding and guiding principles for supporting disadvantaged children (ESEA, 1965). Title IV focused on preparing, training, and recruiting high quality educators and administrators (ESEA, 1965).

As states and districts struggled to address competing agendas in educational policy and limited resources for implementation, several federal programs complemented each other with goal alignment so local educational agencies could focus on efficiency. The most recent authorization of ESEA is the Every Student Succeeds Act (ESSA) of

2015. The provisions under Titles I, II, and IV of ESSA supported and aligned to prior college and career readiness legislation under the Carl D. Perkins Career and Technical Education Act of 2006. The most recent authorization of the Perkins V Act, the Strengthening Career and Technical Education for the 21st Century Act of 2018, expanded college and career readiness preparation to include alignment and integration of academic and non-academic standards to CTE programs of study and an assessment of career pathway indicators. The Individuals with Disabilities Education Act (IDEA) of 2004 ensured a free and appropriate public education in the least restrictive environment for the student. The intent of IDEA was to provide students with equal educational opportunities with necessary identification and intervention systems and transition plans. Researchers at College and Career Readiness and Success Center identified the three goals and expectations indicators of Academic and Technical Content, Employability Skills and Credential Attainment. These indicators spanned across the three laws to describe what students should be able to know and do to be college and career ready (Cushing, English, Therriault, & Lavinson, 2019).

Conclusion

Decades of research on equal access and opportunity have done little to impact the unrelenting gaps in achievement and college and career readiness success for diverse student populations. Educational policy and practice have historically addressed student needs and academic outputs in a fragmented manner. Recent literature shifted the focus from remedying student skills and dispositions to analyzing the local educational system as a whole to provide support for educator actions and student needs for college and career readiness and success. An under-explored gap in the literature is the combination of college and career systems of support for students with culturally relevant and academic professional support for teachers through a multi-tiered system of support framework. In Chapters 5 and 6, I addressed this gap through a combined college and career readiness and multi-tiered system of support framework with an equal emphasis on student supports and educator actions.

CHAPTER THREE

Methodology

Research Design Overview

The program evaluation investigated strategies for equitable middle school mathematics acceleration. In my research study, I utilized a social justice focus and a questions-focus approach (Patton, 2008). The process of questioning historic practices was intended to develop a baseline understanding of the impact of acceleration on various populations of middle school students. Patton (2008) described the questions focus approach to evaluation as a process in which the actual content and form of the research is determined internally, by primary intended users. As initial questions to guide the research were created, a social justice framework, or one that investigates and analyzes the equitable distribution of resources, emerged as evaluation can "enhance fair and just distribution of benefits" (Patton, 2008, p. 181).

To investigate the historical methods for determining which students were provided access to advanced mathematics coursework in middle school, I conducted research in accordance with one overarching question and four supporting questions. The focus question was: What is the relationship between course assignment and student characteristics in middle school mathematics acceleration? From the focus question, the supporting questions included: (a) What criteria do educators consider when determining Algebra I placement for middle school students? (d) What criteria do school-based administrators consider when determining Algebra I placement for middle school students? (c) What do educators believe is the long-term impact on a student's middle school math course placement? (d) What do administrators believe is the long-term impact on a student's middle school math course placement? I analyzed information I gathered in response to the focus question and guiding questions for trends by using qualitative methods.

Participants

The setting for the program evaluation was a mid-sized public school district in a southern state. Student demographics for the district included 66.3% economically disadvantaged students, 49.8% White, 22.6% Hispanic, 20.2% Black, 5.1% Multi-racial, 1.7% Asian, 0.4% American Indian, and 5.7% English language learners (ELL) (citation withheld to protect the confidentiality of the district). There were 10 middle school sites and seven high school sites in the district. Student attendance zones primarily followed geographic feeder patterns.

I selected two middle schools to conduct the evaluation. The student population of the middle schools I selected for the study were also diverse. Both middle schools were within the attendance zone for the same high school. Student demographics for the high school included 56.2% economically disadvantaged students, 37.6% White, 33.9% Hispanic, 19.0 Black, 4.8% Multi-racial, 2.4% Asian, and 4.4% ELL (citation withheld to protect the confidentiality of the district). While the high school attracted students from outside the geographic attendance zone through the magnet or student choice program, neither of the two middle schools in the feeder pattern attracted students through magnet or choice when the study was initiated. One of the middle schools began attracting students to a new magnet program in the second year of the study and the other middle school began implementation of the AVID system in the final year of the evaluation.

I conducted interviews with seven middle school math teachers who taught at least two sections of Algebra I Honors to middle school students during the evaluation period. I asked each of the teachers verbally if they would agree to an interview. I also conducted interviews with three school-based administrators and two administrators from the district office. I interviewed the school-based administrators to determine goals, knowledge of potential strategies, and challenges associated with middle school mathematics acceleration.

Data Gathering Techniques

To conduct the evaluation, I used the following procedures to obtain qualitative and quantitative data. Patton (2008) shared that using a mixed methods approach to data collection and including various groups of stakeholders leads to triangulation and a more reliable evaluation. I used student extant data and interview data to accomplish the goal of triangulation. District data gave insight into demographic enrollment and course completion trends over time, as well as End of Course (EOC) examination score and reporting category comparative results. Teacher interviews provided information about teacher perception regarding acceleration practices, goals, and possible solutions to unintended consequences. Administrator interviews regarding acceleration practices and goals provided insight into broader social justice goals for the district.

Extant Data

After I obtained permission from the district, I accessed and analyzed school student enrollment and demographic data collected from the district's student information system for the district as a whole and for the two middle schools under study. I also obtained student demographic data for the state from the state reporting database. These data were used to compare student enrollment for the state and district to enrollment data for each of the two middle schools under study, as well as students enrolled in accelerated, high school courses in the two middle schools.

I obtained Algebra I EOC examination scores and reporting category results for middle school student course completers from each of the two middle schools under study. I compared these data to the enrollment and course completion demographic data from the district student information system to look for trends in student placement and completion. I analyzed the EOC examination reporting category results to identify potential trends in skill proficiency levels of students over time.

Interviews

I conducted teacher, school-based administrator, and district-based administrator interviews to identify trends in student selection criteria for advanced mathematics courses in middle school and to identify commonly perceived concerns and benefits of middle grades acceleration. Varied student populations across the district and rigid student acceleration expectations in some schools led to four educators teaching accelerated mathematics courses in some schools while only one teacher was assigned an accelerated course in other schools. These variances accounted for the differences in the number of teachers I interviewed from each school. The interviews occurred during non-student time, which was before or after student hours. Each of the participants agreed to one four-question interview that would last no more than 10 minutes. I scripted and recorded the interviews for transcription at a later date.

Data Analysis Techniques

I analyzed teacher and administrator interviews and district level assessment and student enrollment reports for my program evaluation. I recorded, transcribed, and coded the interviews by using an open coding system to identify trends. The trends analysis allowed for a qualitative evaluation of middle school mathematics acceleration. I sorted the results by leadership level and position as well as by perspective on student open access to mathematics courses and foundational skill proficiency. I compared state, district, and school demographic data to student demographic composition of the accelerated math courses. The purpose of this comparison was to identify any trends in the student population from enrollment to completion of the accelerated math course in each school. I analyzed EOC examination data to identify any trends in reporting category and score results. The purpose of this comparison was to analyze mathematical foundational skill results within the reporting categories.

Ethical Considerations

Anonymity of participants was a primary consideration throughout the program evaluation. I assigned a random code to each school, and I referred to the schools by that code for the entire research study. I assigned individual participants with a numerical code and referred to each by the school code and numerical code for the entire program evaluation. I provided participants in any portion of the program evaluation with a informed consent form that included the purpose of the program evaluation and an explanation of how the data collected was to be used. I provided participants with an opportunity to decline the use of their responses in the study. Only one individual requested that her transcribed interview be excluded, but later submitted an email indicating her approval to utilize her responses.

I assigned student EOC examination score results to individual student identifiers within their school of attendance. Because I assigned schools within the study a random code at the beginning of the evaluation, student anonymity was protected. I did not interview students; therefore, there was no impact on minors in the research. Additionally, I had sole access to the interview recordings, transcripts, and extant data spreadsheets in a locked cabinet.

Limitations

The district in which the program evaluation was conducted had only one individual who oversaw middle school curriculum and instruction and one individual who oversaw secondary education as a whole. Because of the vast responsibilities within those positions, targeted focus on middle school mathematics acceleration was a limitation. A second limitation was the short duration of the evaluation. One of the purposes in investigating equitable strategies for mathematics acceleration in middle school was to determine whether enrollment in advanced coursework impacts future enrollment in advanced courses. This question was difficult to answer within the short time frame.

Conclusion

In an effort to balance developmentally appropriate placement and equitable acceleration strategies, I designed this program evaluation to develop a baseline understanding of the impact access to accelerated mathematics courses may have on student success in future courses and student self-efficacy. It was also my goal to answer questions regarding student selection bias which was illuminated through demographic comparisons, interviews, and analysis of examination data.

CHAPTER FOUR

Results

My study included the use of interviews, course participation and completion data, and state End of Course (EOC) assessment results for Algebra I Honors. I held interviews with math teachers who instructed at least two sections of Algebra I, building administrators, and two district administrators. I completed the data review by analyzing district data for student course participation and the state EOC assessment database for course completion and achievement result data. Data collection instruments and methods allowed for a mixed-methods, social justice focused evaluation of current practices (Patton, 2008).

Findings

The setting for the program evaluation was a mid-sized public school district in a southern state. Student demographics for the district included 66.3% economically disadvantaged students, 49.8% White, 22.6% Hispanic, 20.2% Black, 5.1% Multi-racial, 1.7% Asian, .4% American Indian, and 5.7% English Language Learners (ELL) (citation withheld to protect the confidentiality of the district under study). There were 10 middle school sites and seven high school sites in the district. Student attendance zones primarily followed geographic feeder patterns. I selected the high school and two associated feeder middle schools with student demographics that most closely reflected the demographics of the school district under study. The student population of the two middle schools selected for the study were also diverse. Both middle schools were within the attendance zone for the same high school. Student demographics for the high school included 56.2% economically disadvantaged students, 37.6% White, 33.9% Hispanic, 19.0 Black, 4.8%

Multi-racial, 2.4% Asian, and 4.4% ELL (citation withheld to protect the confidentiality of the district under study). While the high school attracted students from outside the geographic attendance zone through magnet or school choice programs, neither of the two middle schools in the feeder pattern attracted students through magnet or choice when the study was initiated. One of the middle schools began attracting students to a new magnet program in the second year of the study and the other middle school began implementation of the AVID system in the final year of the evaluation.

I compared the demographics of the school district to the demographics of each of the seven high schools and selected the school with demographics that were most similar to the district demographic composition over three school years. The middle school feeder schools for the selected high school were also very diverse in student body composition. The student population of the middle schools under study were primarily composed of students who lived in the neighborhood zone for the middle school.

Mathematics Teachers Interviews

In my professional role as an administrator in the central office in the district under study, I frequently visited the middle school campuses and engaged in professional and congenial conversations with each of the middle school teachers. I requested an interview with the middle school Algebra teachers individually, obtained written consent and established a time to conduct the interview in the teachers' classrooms. I requested interviews from five teachers at one feeder middle school for the selected high school and two teachers from the other feeder middle school for the high school. All seven consented to an interview, thus the response rate for teacher interviews was 100%. The range of the interview times were 2 minutes and 55 seconds to 9 minutes and 40 seconds.

Through my first interview question, I gathered data about teacher beliefs regarding middle school mathematics acceleration criteria. The question was: What factors should be considered when enrolling students in Algebra I Honors or Geometry Honors in middle school? The responses revealed beliefs that included the importance of previous year teacher recommendations, teacher-created placement, and prior course grades and achievement level scores on the prior year's state mathematics assessment. Four of the teachers I interviewed clarified that intent of obtaining prior teacher recommendation was to identify student work ethic or student maturity level. One teacher said students should have the opportunity to select the Algebra I course from a course request list when selecting upcoming school year courses. One teacher suggested using quarterly local assessment data to determine if a student should remain in the course once enrolled. If the results of the quarterly assessment were too low in the first quarter of the school year, the teacher would recommend the student be removed from the course. If a student were removed from Algebra I in middle school, the alternate course path for the school district had traditionally been Pre-Algebra if the student was an eighth grader, or seventh grade Advanced Math if the student was a seventh grader.

The second question enabled me to gather data about teacher understanding of the mathematics course trajectory of a student after middle school. The second question was: What do you believe is the long-term academic impact on a student who is enrolled in Algebra I Honors or Geometry Honors in middle school? While all but one of the teachers' responses described student opportunity for "higher level math," dual enrollment and the Early College Program, or access to Advanced Placement (AP) math coursework, a strong trend of responses suggested the opportunities should be available for only some students. One participant explained,

> You know, there are some students who can get into the dual enrollment program and they are always just around a higher, faster academic pace than everyone else, and they'll do well. But on the other side, there are those who breathe a sigh of relief when they go back to the lower class because they just aren't motivated for the acceleration like some of the others. (Personal communication, May 24, 2019)

Another participant stated, "Students can have more of an opportunity to compete, but if they don't have the commitment to learning, they aren't ready" (Personal communication, May 24, 2019).

The next question was: What do you think is the long-term social or emotional impact on a middle school student who is enrolled in Algebra I Honors or Geometry Honors? There were three main trends that emerged from the responses to this question. Five of the seven teachers believed that those students who did well would likely experience a boost in confidence and their success would potentially prompt desire to continue to accelerate beyond middle school. Two of the teachers explained that students in advanced mathematics courses in middle school belonged to a cohort of students who were tracked together throughout the day. Their course options became "locked" because of the limitations in a master schedule in middle school. The cohort nature of their peer group also might have contributed to building confidence among the students through a sense of belonging.

The second trend was that those who struggled in Algebra I or Geometry in middle school were removed from the course before the end of the school year. Three of the seven interviewees explained that if the student's course was changed midway through the school year, the student may have thought that he or she wasn't good at math, and he or she may have been embarrassed because of returning to their grade level course of seventh grade math or the traditional eighth grade course of Pre-Algebra. One participant suggested that the students who were removed from Algebra I may have become behavior concerns because of their embarrassment. Six out of seven of the participants said that students who struggled but remained in the course may have earned a passing EOC assessment score but were lacking strong foundational skills and would experience difficulty in advanced math in high school.

The final question on the teacher interview was an open response question that invited teachers to share any additional information regarding mathematics acceleration that they had not had the opportunity to explain through the previous questions. The question was: Do you have any other opinions regarding mathematics acceleration that you would like to share? Each of the participants initially responded, "No," but continued to share concerns about foundational algebra readiness skill gaps. Teachers identified a need for lesson ideas to teach skills that may be on course maps from seventh grade Advanced Mathematics and eighth grade Pre-Algebra to which the students were not exposed if they were accelerated from sixth grade Advanced Mathematics to seventh grade Algebra I Honors, or from seventh grade Advanced Mathematics to Algebra I Honors in eighth grade. One teacher stated,

> We did a better job of placing them in the past. I think they try to put too many kids in Algebra I in the hopes that they all succeed, and it's not for all of them, yet. It's not for all of them. (Personal communication, May 23, 2019)

All teachers described increased opportunities for acceleration beyond middle school when students had access to Algebra I prior to leaving the middle grades as a benefit, but they expressed concerns regarding student selection for student placement into Algebra I by eighth grade. The teachers identified student work ethic and motivation as primary concerns when selecting students for acceleration, but only one teacher suggested student interest or self-efficacy should be considered as a predictor for Algebra I readiness. Six out of seven teachers stated that prior mathematics teachers' recommendations and prior mathematics grades could be used as determining factors for work ethic, motivation, and other self-efficacy measures.

School-based Administrators Interviews

I requested interviews with three school-based administrators while visiting their schools. Each of them consented, thus giving a response rate of 100% for school-based administrator interviews. All three administrators were appointed to their positions in April 2017. One of the middle school principals served as the assistant principal of curriculum in the same building prior to promotion to principal. The range in interview times were 3 minutes and 30 seconds to 5 minutes and 33 seconds.

The questions for the teacher interviews and the administrator interviews were identical. I intended the first question to compare administrator beliefs regarding factors that should be considered when enrolling students in accelerated math classes in middle school to the responses of the teachers. The question was: What factors should be considered when enrolling students in Algebra I Honors or Geometry Honors in middle school? All three of the administrators stated that maturity, student interest, and having a “growth mindset” was most important to consider for placement in Algebra I or

Geometry in middle school. Two administrators described student strengths in "general math skills" as an indicator that should be considered. Each administrator clarified that state assessment scores should be used to determine student mathematical ability.

The principals explained that students would be on a path to take rigorous courses in high school, not only in mathematics but also in science if the student was accelerated in middle school. One administrator said,

> You always have to think about the path. We can't deny a student access at 14 years old when they don't know what path they want to be on, yet. Open the doors to all the paths you can in middle [school]. (Personal communication, September 18, 2019)

Thinking about the interests of the whole child was considered an important factor for the administrators as they all mentioned helping a student determine a pathway to college, to earn industry certifications for employment or to enlist in the military.

The second question provided data about administrators' opinions regarding the long-term impact of acceleration on a student. The second question was: What do you believe is the long-term academic impact on a student who is enrolled in Algebra I Honors or Geometry Honors in middle school? Although each had already mentioned considering future pathways for the student when determining placement, they all elaborated on potential programs for students such as the Early College Program, which offered an Associate of Arts degree concurrently with high school coursework at no additional cost to the student. One administrator explained that the student population consisted of a high number of students who were economically disadvantaged, and they considered college a luxury.

Dual enrollment through the Early College Program allowed them to succeed academically as well as financially. Another school administrator explained that some industry certifications for which students wanted to apply required an understanding of math and science. If students had not been exposed to Algebra I prior to high school, they may not have completed enough math or science to succeed on industry certification examinations such as the Bio-technician Assistant Credentialing Exam (BACE), and some certifications earned through the National Center for Construction Education and Research (NCCER). "Acceleration in general, sets up students to have the confidence they needed to succeed," she explained.

In the third question, I asked administrators to consider the social and emotional impact middle school mathematics acceleration could have on a student. The third question was: What do you think is the long-term social or emotional impact on a middle school student who is enrolled in Algebra I Honors or Geometry Honors? All the participants responded that a benefit of acceleration was an increase in student confidence, maturity, and motivation to continue to strive to excel. Participants agreed and one said, "Experiencing rigorous coursework in in the middle grades provides students with the experience necessary to take Advanced Placement courses and succeed on the AP tests in high school" (Personal communication, September 6, 2019). Another perceived benefit was that students who had high motivation and confidence would be surrounded by others who exhibited the same qualities. Two administrators explained that middle school acceleration could push students to maturity faster than their peers and may result in students enrolling in courses at the high school with students who were significantly older.

The final question was an open response designed to allow participants to share opinions they had not had the opportunity to share through previous responses. The question was: Do you have any other opinions regarding mathematics acceleration that you would like to share? All the participants identified a need to open access to middle school Algebra I for more students. A single factor for determining placement should not be utilized. All administrators stated that a placement test or state assessment score was only one data point. The participants identified a need for content related professional development for teachers to ensure skills were not missed when students accelerated in middle school and essentially skipped over either seventh grade math or eighth grade math. Two of the administrators also described the challenge of changing teacher perception to understand the long-term academic impact for an accelerated student.

Teachers and some administrators in the district were not aware of the unintended consequences of acceleration without thoughtful consideration to skill gaps. They used the high Algebra I EOC assessment pass rates as the evidence for their argument to continue pushing open acceleration. Because the state Algebra I EOC assessment score results were scaled, a student could earn a passing score of a level 3 on a 5-point scale but only demonstrate understanding of 35% of the course content. Students placed on an accelerated track could complete Algebra I and pass the EOC assessment but lack many foundational skills necessary for Geometry, Algebra II, and Calculus.

All school-based administrators stated that open access to mathematics acceleration opportunities were beneficial to student long-term academic, social, and emotional interests. All the administrators explained that multiple measures should be considered when determining student mathematics course placement. While the administrator participants' responses were similar to the teacher participants' responses in that work ethic, and motivation were important factors, the administrators unanimously stated that the primary consideration should be mathematics skill ability. They agreed that strong foundational mathematics skills were related to student self-efficacy. One administrator commented, "We could be setting students on a path, and then they won't have the ability to complete [higher level math] when they get to [high school], and the students don't feel confident, then we're really hurting them later" (Personal communication, September 12, 2019).

District Administrators Interviews

I requested interviews with two district administrators. Each of them consented, thus giving a response rate of 100% for district-based administrator interviews. Both district-based participants were new to their positions in 2017. One of the participants was previously a school-based administrator at a high school within the district under study. The other participant was previously a school-based administrator at a school in another state. The range in interview times was 3 minutes and 44 seconds to 5 minutes and 43 seconds.

The questions for the teacher interviews and the district administrator interviews were identical. I designed the first question to compare district-based administrator beliefs regarding factors that should be considered when enrolling students in accelerated math courses in middle school to the responses of school-based administrators and teachers. The question was: What factors should be considered when enrolling students in Algebra I Honors or Geometry Honors in middle school? One district-based administrator described student enrollment criteria as, "open access within reason"

(Personal communication, October 24, 2019). This participant cited state test score trends, teacher recommendations, and student choice as the most important factors to consider. The other district-based participant placed significant emphasis on identifying "student strengths and weaknesses with Algebra readiness predictors and what supports may be available to help a student grow" (Personal communication, October 8, 2019). This participant also clarified that readiness predictors referred to skill sets that were necessary for success in future mathematical applications. The participant referenced the Achieve the Core Mathematics Coherence Map as a tool for identifying "widely applicable prerequisite" skills (Personal communication, October 8, 2019).

According to the Achieve the Core Mathematics Coherence Map (2020), interpreting functions is a widely applicable prerequisite algebra skill with foundational skills in the Expressions and Equations reporting categories in sixth grade and seventh grade mathematics. The same participant explained that there was research regarding providing supports while gently pushing toward acceleration rather than remediating below grade level. The participant recommended supports such as "creative structures to the school day, a school-wide system like AVID, tutoring support at home, or extended day tutoring" (Personal communication, October 8, 2019).

The second question was designed to ask district administrators their opinions regarding the long-term impact of acceleration on a student. The question was: What do you believe is the long-term academic impact on a student who is enrolled in Algebra I Honors or Geometry Honors in middle school? Both district administrators said a benefit of mathematics acceleration was that students had access to higher level math or access to advanced programs such as Cambridge Advanced International Certificate of Education

(AICE), International Baccalaureate, Advanced Placement, or Early College dual enrollment courses. One participant addressed teacher pedagogical skill and explained that if students in Algebra I courses had teachers who focused on conceptual thinking rather than on memorizing steps to solve a type of problem, the student could think flexibly about situations easier when they advanced to higher mathematics. The participant said teachers who teach on a "step by step process don't teach students to build connections and then students don't have a solid understanding because they're just memorized steps" (Personal communication, October 8, 2019).

For the third question, I asked district administrators to consider the social and emotional impact middle school mathematics acceleration could have on a student. The question was: What do you think is the long-term social or emotional impact on a middle school student who is enrolled in Algebra I Honors or Geometry Honors? While both participants suggested that the longitudinal social and emotional impact of acceleration was positive, one of the participants explained that building administrators could minimize the social exposure of young high school students who were accelerated in middle school to older high school students who were near the end of their high school careers with strategic scheduling of courses.

The final question was an open response designed to allow participants to share opinions they had not had the opportunity to share through prior responses. Both district administrators identified a need to develop a plan for supporting accelerated middle school students by identifying standards that were missed by skipping over seventh and eighth grade math to take Algebra I or Geometry by eighth grade. Suggestions to support students included virtual learning, integrating creative methods for teaching with intentionality in Algebra I, and including supports such as an additional academic elective course like AVID or a "math academy" elective. One of the participants described an Algebra selection process that focused on the student as a "whole child"

> …including the student's thoughts and concerns regarding their own abilities and work ethic. Sometimes students are reluctant to go on an accelerated path because math is hard, and they think they struggle with it. Just because they struggle doesn't mean they can't be successful, and sometimes the part they can't deal with is their image of themselves and not exactly with the content. (Personal communication, October 8, 2018)

District and State Reports

I analyzed state and district Algebra I EOC assessment data to identify trends in algebra course completer student demographics. In the 2016-17 school year, the percentage of White middle school students who completed the Algebra I EOC assessment in the state was similar to the total percentage of White students enrolled in middle school grades in the state. In the 2017-18 school year and the 2018-19 school year, the percentage of White middle school students who completed the Algebra I EOC assessment in the state was 8% higher than the total percentage of White middle school students enrolled in middle school grades in the state.

In the 2016-17 school year, the population of Black middle school students who completed the Algebra I EOC assessment in the state was 11% lower than the total percent of the student population of Black middle school students enrolled in middle school grades in the state. In the 2017-18 school year, the gap between Black middle school students who completed the Algebra I EOC assessment in the state and the percentage of Black middle school students enrolled in middle school grades in the state decreased. The population of Black, middle school students who completed the Algebra I EOC assessment in the state was 8% lower than the total percent of the student population of Black middle school students enrolled in middle grades in the state. The trend of closing the gap between Black middle school students who completed the Algebra I EOC assessment in the state and the total population of Black middle school students enrolled in middle school grades in the state continued in the 2018-19 school year. The difference between the total population of Black middle school students who completed the Algebra I EOC assessment and the total population of Black middle school students enrolled in middle school grades in the state was 7%.

In the 2016-17 school year, the population of Hispanic middle school students who completed the Algebra I EOC assessment in the state was 8% lower than the total student population of Hispanic middle school students enrolled in middle school grades in the state. In the 2017-18 and 2018-19 school years, the gap between the Hispanic middle school students who took the Algebra I EOC assessment across the state and the total student population of Hispanic middle school students enrolled in middle school grades in the state decreased to a 1% difference.

I observed trends worth mentioning in the district demographic comparison of total student population and those who completed the Algebra I EOC assessment as are illustrated in Table 3. In the 2016-17 school year, the population of White middle school students who completed the Algebra I EOC assessment in the district under study was 10% higher than the total student population of White students enrolled in middle school grades in the district. In the 2017-18 school year and 2018-19 school years, the population of White middle school students who completed the Algebra I EOC assessment in the district under study increased to 12% higher than the total population of White middle school students in the district.

As is illustrated in Table 3, in the 2016-17 school year, the population of Black middle school students in the district under study who completed the Algebra I EOC assessment was 20% lower than the total student population of Black middle school students in the district. In the 2017-18 and 2018-19 school years, the gap between Black middle school students who completed the Algebra I EOC assessment in the district under study and the total percent of the student population of Black middle school students in the district decreased to 10%. In the 2016-17 school year, the population of Hispanic middle school students who completed the Algebra I EOC assessment in the district under study was 3% lower than the total student population of Hispanic middle school students in the district. In the 2017-18 school year, the population of Hispanic middle school students who completed the Algebra I EOC assessment in the district under study was also 3% lower than the total percent of the student population of Hispanic middle school students in the district. In the 2018-19 school year, the population of Hispanic middle school students who completed the Algebra I EOC assessment in the district under study was 4% lower than the total student population of Hispanic middle school students in the district. In all three years of the study, the population of Multiracial and Asian middle school students who completed the Algebra I EOC assessment in the district under study was similar to the total student population of Multiracial and Asian middle school students in the district. The student demographic enrollment and course completion percentages for the state and district under study are illustrated in Table 3.

Table 3

Total Student Demographic and End of Course Demographic Comparison in Percentages – School A

Middle Grades Student Population	Percentage of White students	Percentage of Black students	Percentage of Hispanic students	Percentage of Multiracial students	Percentage of Asian students
State Total Enrollment, 2016-17	39	22	32	3	3
State Total Completion of EOC, 2016-17	38	11	24	24	4
District Total Enrollment, 2016-17	51	27	22	5	2
District Total Completion of EOC, 2016-17	65	7	19	5	4
State Total Enrollment, 2017-18	39	22	32	3	3
State Total Completion of EOC, 2017-18	47	14	31	4	5
District Total Enrollment, 2017-18	50	20	23	5	2
District Total Completion of EOC, 2017-18	62	10	21	4	4
State Total Enrollment, 2018-19	37	22	34	4	2
State Total Completion of EOC, 2018-19	46	14	32	4	5
District Total Enrollment, 2018-19	50	20	24	5	2
District Total Completion of EOC, 2018-19	62	9	20	4	5

I also analyzed Algebra I EOC examination reporting category trends over three years to gain insight into student academic strengths and limitations. I compared the course enrollment data to the demographics of the school for each of the three years. As is indicated in Table 4, the White student population in school years 2016-17, 2017-18 and 2018-19 was 44%, 42% and 38% respectively for School A. The course enrollment data for School A showed that White students were the highest represented demographic over three years at course start and completion. The average White student enrollment over three years for School A was 41% and the average enrollment of White students in the Algebra I course over three years was 56%. Of all the students who completed the course over three years, 58% were White.

As is indicated in Table 4, the Black student population in school years 2016-17, 2017-18, and 2018-19 was 19%, 19%, and 20% respectively for School A. The average Black student enrollment over three years for School A was 19.5% and the average enrollment of Black students in the Algebra I course during the same period of time was 9.6%. Of all the students who completed the course over three years, 11% were Black.

As is indicated in Table 4, the Hispanic student population in school years 2016-17, 2017-18, and 2018-19 was 29%, 31%, and 34% respectively for School A. The average student enrollment of Hispanic students over three years for School A was 31% and the average enrollment of Hispanic students in the Algebra I course during the same period of time was 21.6%. Of all the students over three years who completed the Algebra I course, 21% were Hispanic.

As is indicated in Table 4, the Multiracial student population in school years 2016-17, 2017-18, and 2018-19 was 5%, 4%, and 5% respectively for School A. The average student enrollment of Multi-racial students over three years for School A was 4.6% and the average enrollment of Multi-racial students in the Algebra I course during the same period of time was 9.6%. Of all the students over three years who completed the Algebra I course, 5% were Multi-racial.

As is indicated in Table 4, the Asian student population in school years 2016-17, 2017-18, and 2018-19 was 2%, 3%, and 3% respectively for School A. The average student enrollment of Asian students over three years for School A was 6.7% and the average enrollment of Asian students in the Algebra I course during the same period of time was 9.6%. Of the students over three years who completed the Algebra I course, 7% were Asian.

Table 4

Student Demographic Comparison in Percentages, School A

	Percent of Students who were White	Percent of Students who were Black	Percent of Students who were Hispanic	Percent of Students who were Multiracial	Percent of Students who were Asian
School A total population, 2016-17	44	19	29	6	2
Students enrolled in Algebra I at course start, School A	67	5	23	1	2
Students enrolled in Algebra I at course completion, School A	66	5	24	0	2
School A total population, 2017-18	42	19	31	4	3
Students enrolled in Algebra I at course start, School A	55	11	21	5	8
Students enrolled in Algebra I at course completion, School A	53	12	20	5	10
School A total population, 2018-19	38	20	34	5	3
Students enrolled in Algebra I at course start, School A	46	13	21	10	10
Students enrolled in Algebra I at course completion, School AA	43	15	19	11	10

As is indicated in Table 5, the White student population in school years 2016-17, 2017-18, and 2018-19 was 26%, 27% and 26% respectively for School B. The course enrollment data for School B showed that White students were the highest represented demographic over three years at course start and completion in Algebra I. The average White student enrollment over three years for School B was 26.4% and the average enrollment of White students in the Algebra I course over three years was 26.6%. Of all he students over three years who completed the Algebra I course, 24.6% were White.

The average Black student enrollment over three years for School B was 26.1%, and the average enrollment of Black students in the Algebra I course during the same period of time was 22.6%. Of the students who completed the course over three years, 20.3% were Black.

The average student enrollment of Hispanic students over three years for School

B was 40.2%, and the average enrollment of Hispanic students in the Algebra I course during the same period of time was 38%. Of the students over three years who completed the Algebra I course, 41.3% were Hispanic.

As is indicated in Table 5, the Multiracial student population in school years 2016-17, 2017-18, and 2018-19 was 6%, 6% and 5% respectively for School B. The average student enrollment of Multiracial students over three years for School A was 5.6% and the average enrollment of Multiracial students in the Algebra I course during the same period of time was 8.6%. Seven percent of all the students over three years who completed the Algebra I course were Multiracial.

As is indicated in Table 5, the Asian student population in school years 2016-17, 2017-18, and 2018-19 was fewer than 10 students, 2% and 1% respectively for School B. The average student enrollment of Asian students over three years for School B was 1% and the average enrollment of Asian students in the Algebra I course during the same period of time was 1.6%. Of all the students over three years who completed the Algebra I course, 1.3% were Asian.

Table 5

Student Demographic Comparison in Percentages, School B

	Percent of Students who were White	Percent of Students who were Black	Percent of Students who were Hispanic	Percent of Students who were Multiracial	Percent of Students who were Asian
School B total population, 2016-17	26	27	39	6	*
Students enrolled in Algebra I at course start, School B	28	16	38	12	2
Students enrolled in Algebra I at course completion, School B	23	16	42	12	2
School B total population, 2017-18	27	27	38	6	2
Students enrolled in Algebra I at course start, School B	30	28	33	5	3
Students enrolled in Algebra I at course completion, School B	29	29	36	5	2
School B total population, 2018-19	26	24	43	5	1
Students enrolled in Algebra I at course start, School B	22	24	43	9	*
Students enrolled in Algebra I at course completion, School B	22	19	43	4	*

Note. * indicates fewer than 10 students represented

I also analyzed Algebra I EOC examination reporting category trends over three years. According to the 2018 *Test Design and Summary Blueprint: Mathematics* (citation withheld to protect confidentiality), the Algebra EOC examination consisted of three reporting categories. Content standards were assessed within the reporting categories and critical areas of focus were considered when the percentage for each reporting category was determined (citation withheld to protect confidentiality). Critical areas of focus were skills that were widely applicable across a range of advanced mathematical study. Widely applicable prerequisite skills were necessary for students to be college and career ready (Student Achievement Partners, 2018). Algebra and Modeling made up 41% of the test, Functions and Modeling made up 40% of the test, and Statistics and the Number System made up 19% of the test.

My analysis of the EOC examination reporting category scores by average scores over the 3-year period of time, and between the two schools, indicated that there were differences in the students' scores worth mentioning. The sample size for School A increased for each school year of the study (N=94, N=109, N=121) while the sample size for School B varied (N=40, N=63, N=47). A comparison of mean reporting category scores revealed that the lowest mean reporting category scores for both schools over all three years was consistently the Statistics and the Number System Category. Although the mean for this category increased each year for both schools, the standard deviation also increased.

The average score for School A in the Statistics and the Number System reporting category increased each year of the study but the variance of scores also increased each year as is indicated in Figure 1. In the 2016-17 school year (M=34.6, SD=15.8), the average reporting category score was lower than subsequent years. In the 2017-18 school year, (M=43.9, SD=15.9), the average reporting category score was higher than the previous year. In the 2018-19 school year, (M=44.6, SD=18.9), the average reporting category score was the highest of the three years.

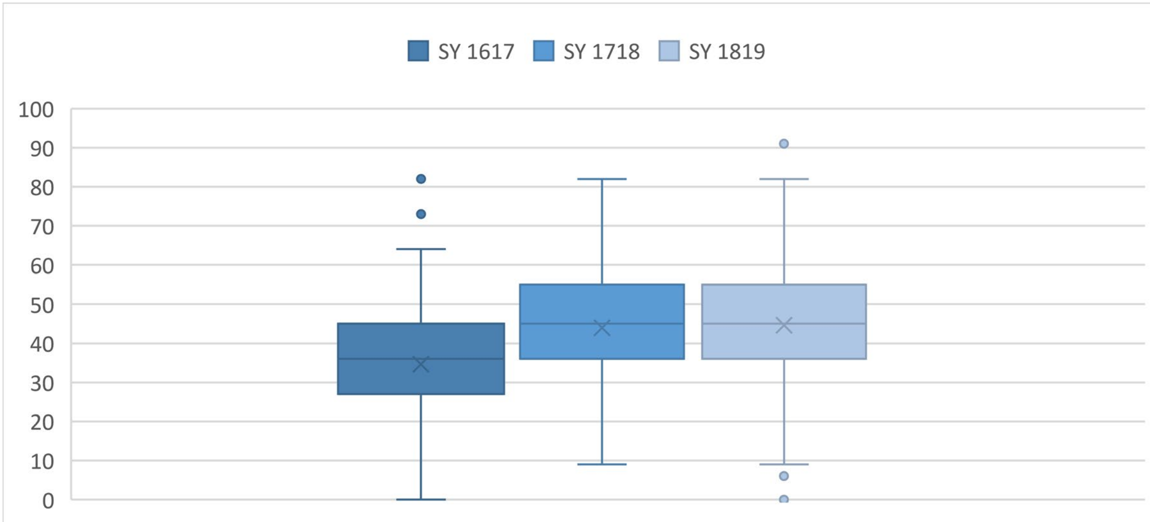

Figure 1. School A: Statistics and the number system reporting category mean and distribution of scores.

The average score for School B in the Statistics and the Number System reporting category increased each year of the study, but the variance of scores also increased each year as is indicated in Figure 2. In the 2016-17 school year (M=30.5, SD=14.9), the average reporting category score was lower than subsequent years, but the range of scores in the data set was less varied than the following two years in the study. In the 2017-18 school year (M=46.7, SD=15.7), the average reporting category score was higher than the previous year, but the scores in the data set were more broadly distributed than the 2016-17 school year. In the 2018-19 school year (M=51.6, SD=21.3), the average reporting category score was the highest of the three years, but the scores in the data set were the most broadly distributed over a wider range of the three years in the study.

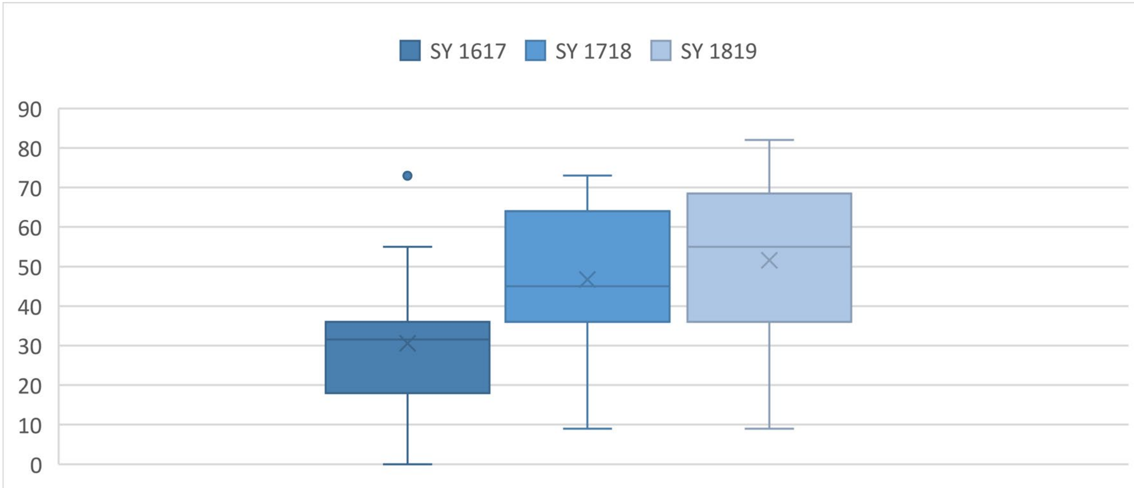

Figure 2. School B: Statistics and the number system reporting category mean and distribution of scores.

The distribution of scores within the statistics and the number system reporting category changed with each year of testing. The scores in the first year of the study for School A and School B (SY 2016-17) were positively skewed with mostly low scores in frequency distribution and few high scores as is indicated in Figures 3 and 4. In the 2017-18 school year, the scores for School A were also positively skewed but the distribution of scores for School B were multimodal with two groups of scores that were different from each other as is illustrated in Figures 5 and 6. In the 2018-19 school year, the distribution of scores for both schools were multimodal as is illustrated in Figures 7 and 8.

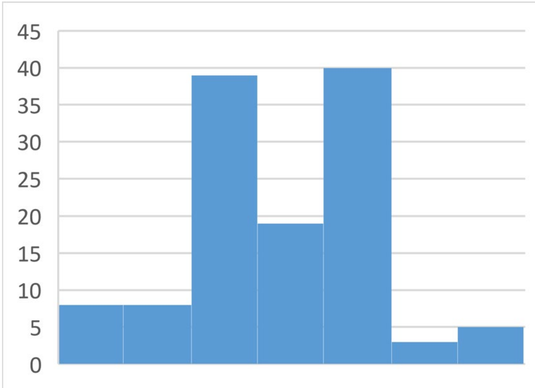

Figure 3. School A: Statistics and the number system student score distribution, SY 2016-17.

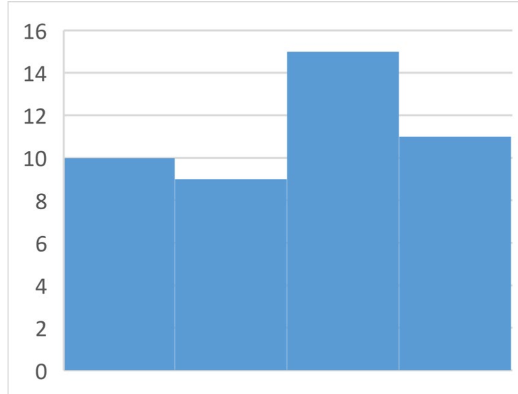

Figure 4. School B: Statistics and the number system student score distribution, SY 2016-17.

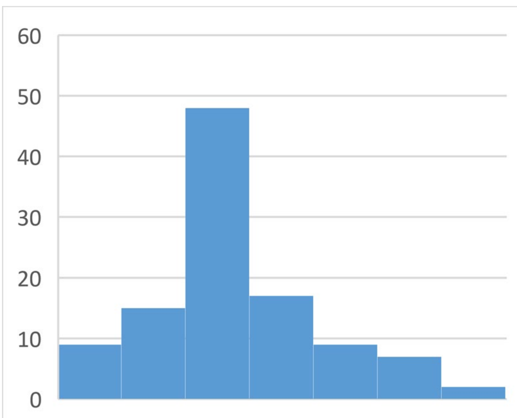

Figure 5. School A: Statistics and the number system student score distribution, SY 2017-18.

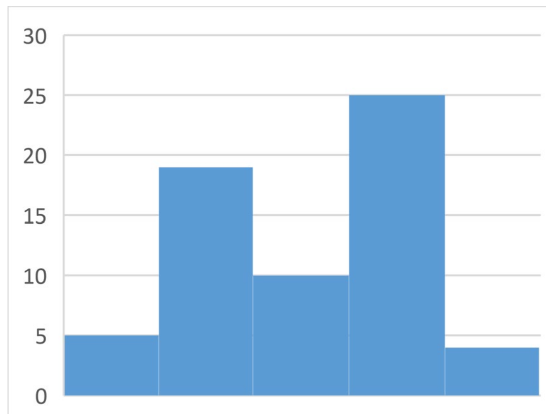

Figure 6. School B: Statistics and the number system student score distribution, SY 2017-18.

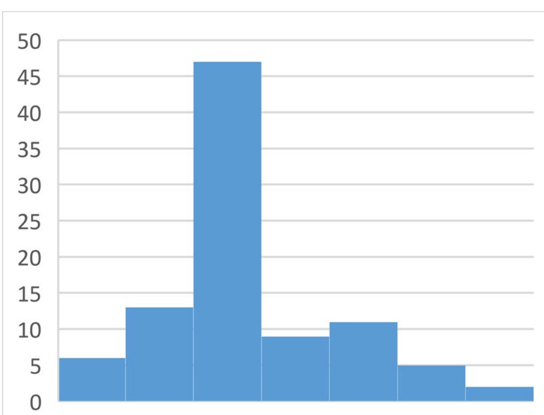

Figure 7. School A: Statistics and the number system student score distribution, SY 2018-19.

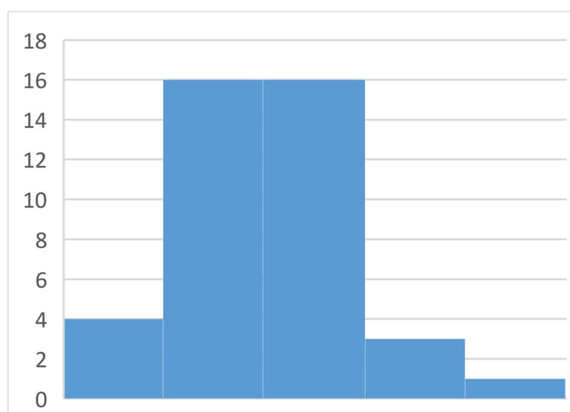

Figure 8. School B: Statistics and the number system student score distribution, SY 2018-19.

The highest mean scores for both schools were in the Algebra and Modeling reporting category. The mean scores for School A in Algebra and Modeling consistently increased each year of the study, but the variance of scores also increased each year as in illustrated in Figure 9.

In the 2016-17 school year (M=50.2, SD=14.6), the average student reporting category score was lower than the subsequent years of the study. In the 2017-18 school year (M=54.8, SD=13.8), the average reporting category score was higher than the previous year. In the 2018-19 school year (M=64.9, SD=16.4), the average reporting category score was the highest of the three years but the scores in the data set were more broadly distributed over a wider range.

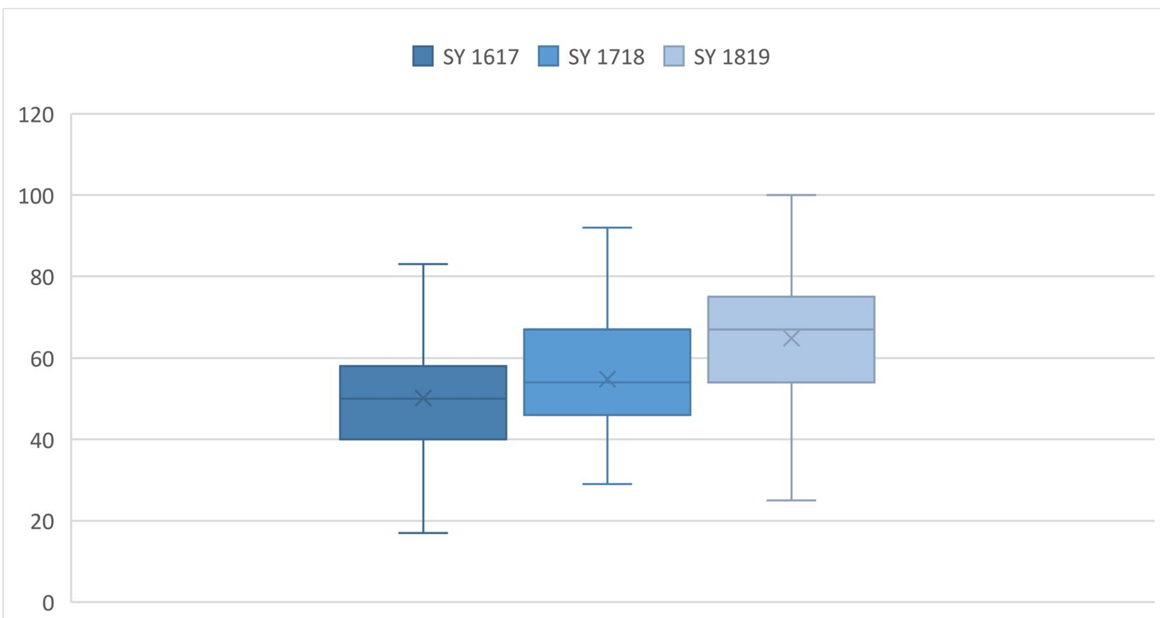

Figure 9. School A: Algebra and modeling reporting category mean and distribution of scores.

I observed a similar pattern in mean scores for School B in the Algebra and Modeling category as is indicated in Figure 10. In the 2016-17 school year (M=51.6, SD=21.3), the average student reporting score was lower than the subsequent years of the study. In the 2017-18 school year (M=55.2, SD=14.7), the average reporting category score was higher than the previous year. In the 2018-19 school year (M=69.4, SD=15.3) the average reporting category was the highest of the three years, but he scores in the data set were more broadly distributed over a wider range.

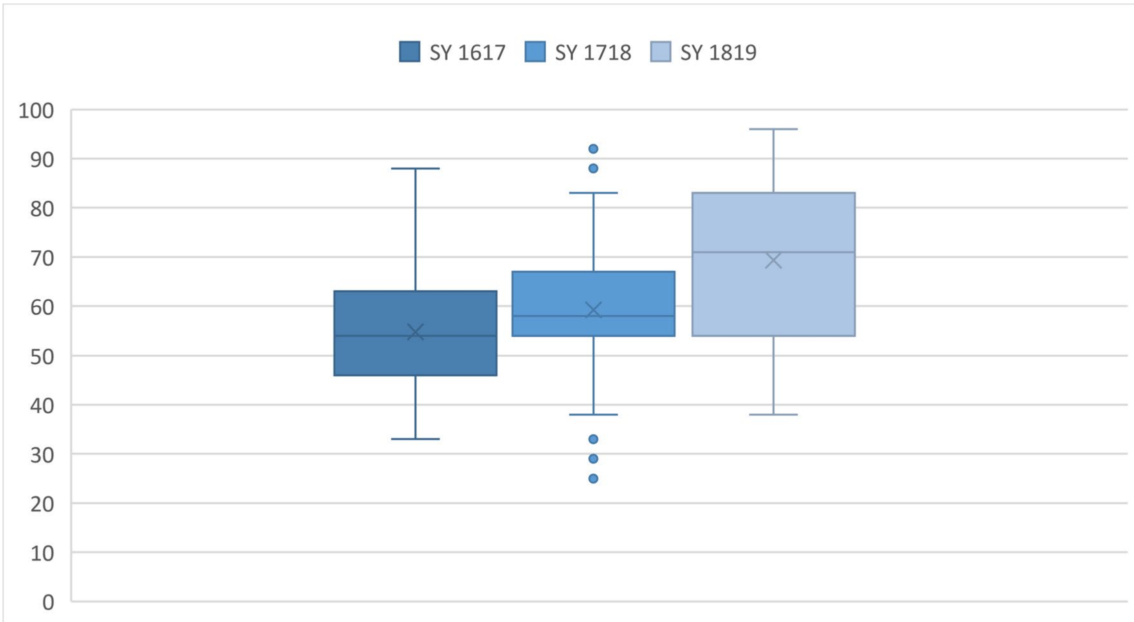

Figure 10. School B: Algebra and modeling reporting category mean and distribution of scores.

The distribution of scores within the Algebra and Modeling reporting category also changed with each year of testing. The distribution scores in the first year of the study for School A (SY 2016 -17) were multimodal with two groups of scores that were different from each other. School B scores were positively skewed with mostly low scores in frequency distribution and few high scores as illustrated in Figures 11 and 12. In the 2017-18 school year, the distribution of scores for School A were positively skewed. The scores for School B fell into a normal leptokutic curve, or one where the scores are similar with few differences, although the distribution was positively skewed as illustrated in Figures 13 and 14. In the 2018-19 school year, the scores for both schools were normally distributed among the distribution of the mean in a curve as illustrated in Figures 15 and 16.

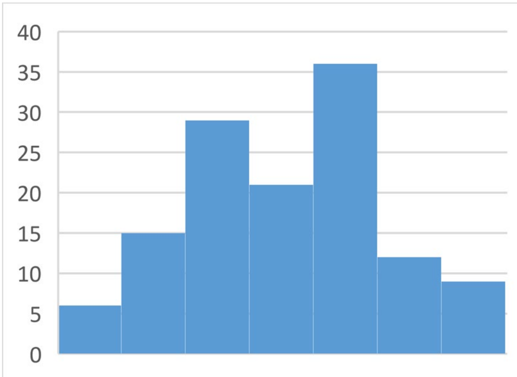

Figure 11. School A: Algebra and modeling student score distribution, SY 2016-17.

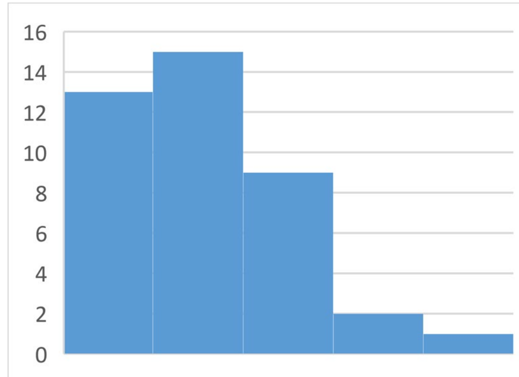

Figure 12. School B: Algebra and modeling student score distribution, SY 2016-17.

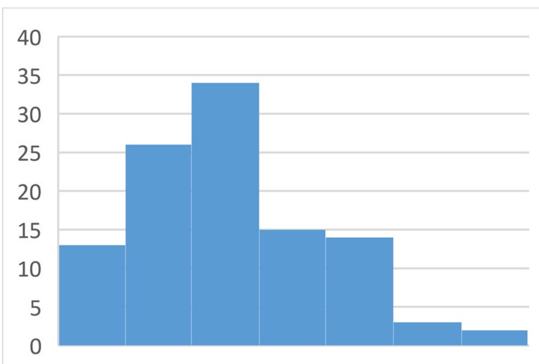

Figure 13. School A: Algebra and Modeling Student Score Distribution, SY 2017-18.

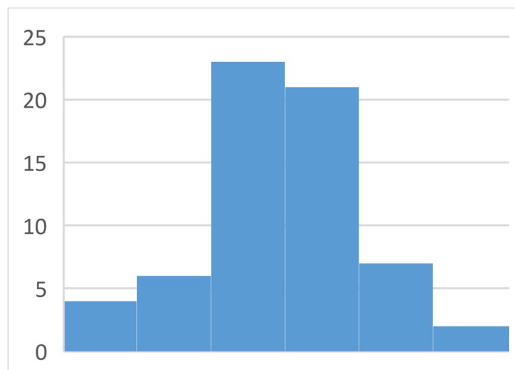

Figure 14. School B: Algebra and Modeling Student Score Distribution, SY 2017-18.

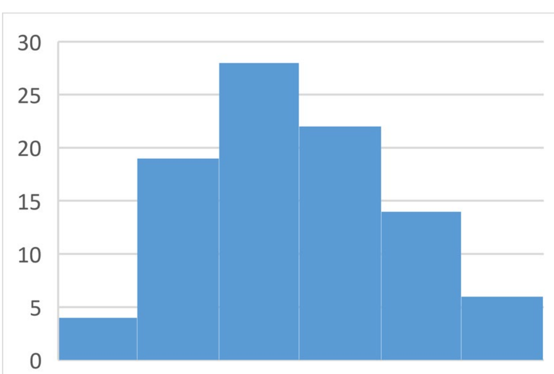

Figure 15: School A: Algebra and Modeling Student Score Distribution, SY 2018-19.

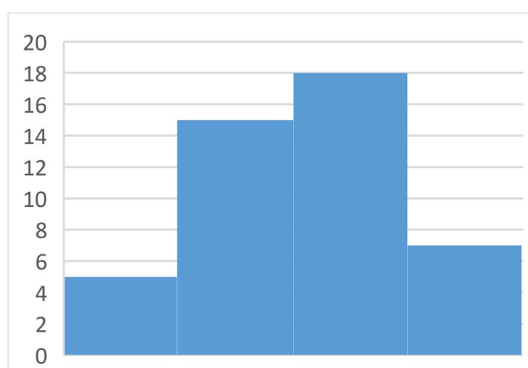

Figure 16: School B: Algebra and Modeling Student Score Distribution, SY 2018-19.

The mean scores for both schools in the Functions and Modeling reporting category did not follow a pattern of increased mean and standard deviation like the Statistics and Number System and Algebra and Modeling categories as illustrated in Figure 17. The mean scores in Functions and Modeling for School A increased from the 2016-17 school year (M=47.4, SD=14.3) to the 2017-18 school year (M=51.7, SD=13.6) while the interquartile range was slightly more compact in the second year of the study. In the 2018-19 school year (M=49.3, SD=15.4), the mean reporting category score decreased while the interquartile range was the broadest in the study.

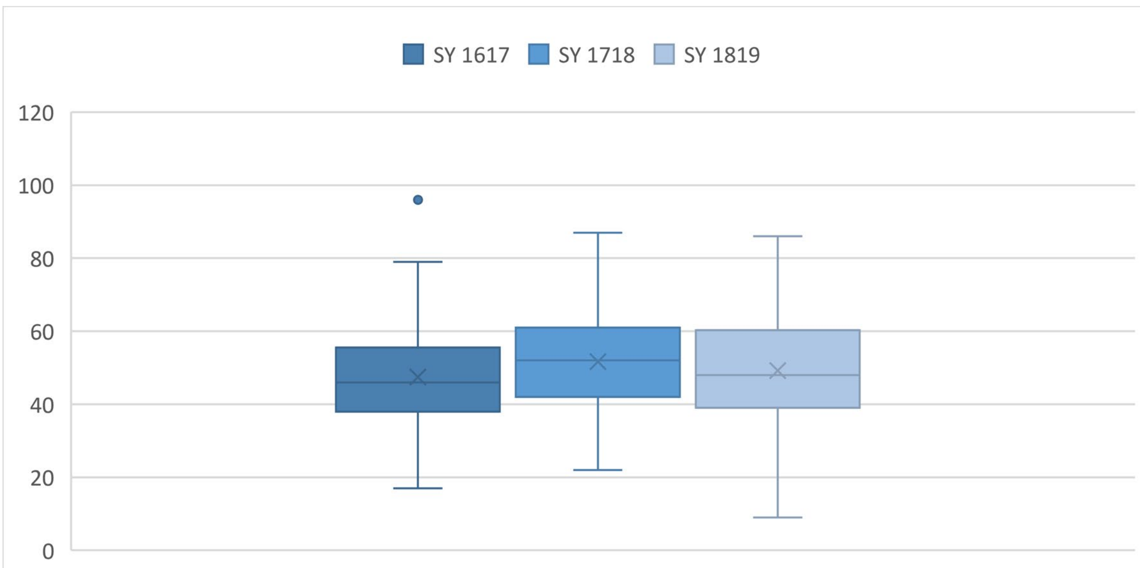

Figure 17. School A: Functions and modeling category mean and distribution of scores.

I observed a similar pattern in mean scores for School B in the Functions and Modeling category as indicated in the Figure 18. From the 2016-17 school year (M=48.4, SD=14.1) to the 2017-18 school year (M=57.9, SD=14.6). The interquartile range increased slightly from the previous year. In the 18-19 school year (M=55.0, SD=14.7), the mean reporting category score decreased while the interquartile range increased from the previous year.

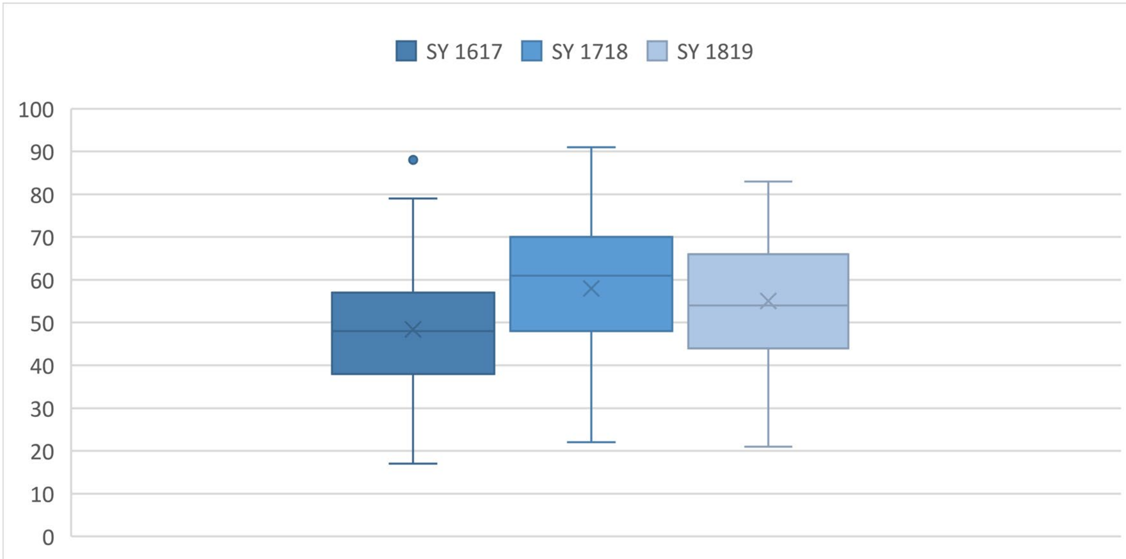

Figure 18. School B: Functions and modeling category mean and distribution of scores.

Of the three reporting categories, the distribution of scores within the Functions and Modeling reporting category changed the least over the three years of the study. The scores in the first year of the study for School A and School B (SY 2016-17) fell into a curve that was positively skewed with mostly low scores in frequency distribution with a few outlying scores distributed at the high end of score range as is illustrated in Figure 19 and Figure 20. In the 2017-18 and 2018-19 school years, the distribution of scores for both schools also fell into a curve that was positively skewed with slight movement toward a normal distribution as illustrated in Figure 21 and Figure 22 for the 2017-18 school year and in Figure 23 and Figure 24 for the 2018-19 school year.

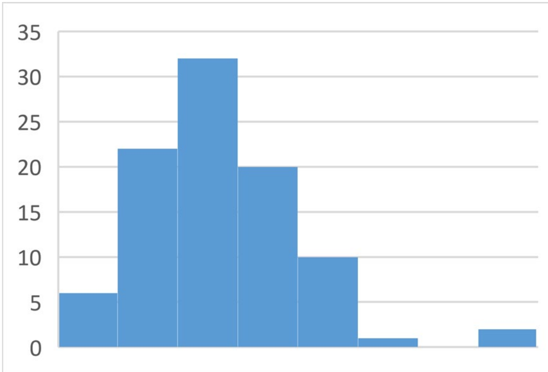

Figure 19. School A: Functions and Modeling Student Score Distribution, SY 2016-17.

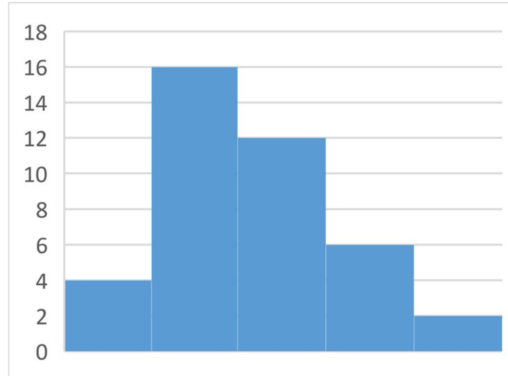

Figure 20. School B: Functions and Modeling Student Score Distribution, SY 2016-17.

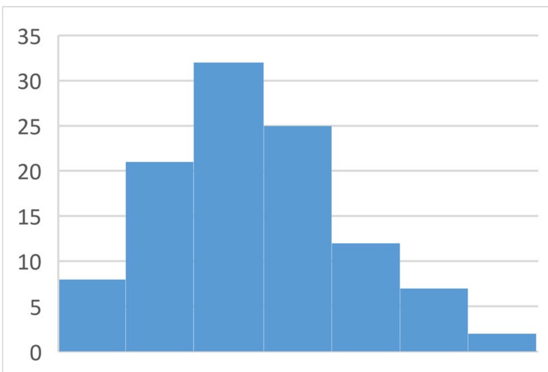

Figure 21. School A: Functions and Modeling Student Score Distribution, SY 2017-18.

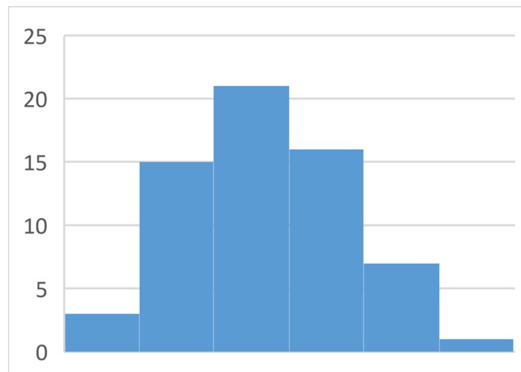

Figure 22. School B: Functions and Modeling Student Score Distribution, SY 2017-18.

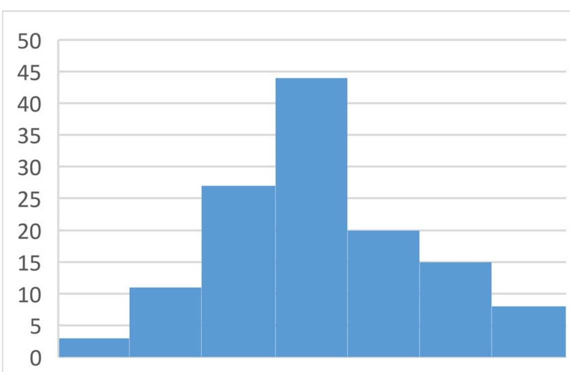

Figure 23. School A: Functions and modeling student score distribution, SY 2018-19.

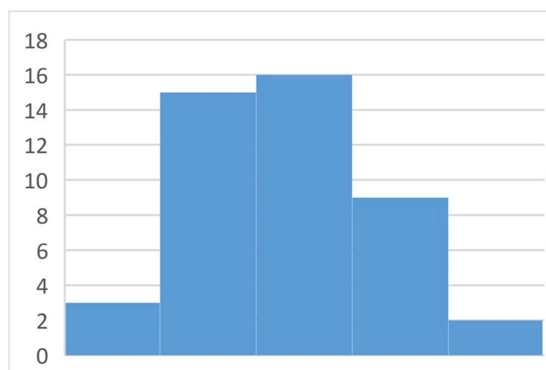

Figure 24. School B: Functions and modeling student score distribution, SY 2018-19.

Context

The goal of this study was to develop an understanding of the relationship between mathematics course assignment and student characteristics. A common myth in education places strong emphasis on individual accountability for learning and opportunities to learn. The core premise of this myth is that schooling is equal for students who desire to have the opportunity to learn (Schmidt & McKnight, 2012). An investigation into the distribution of the opportunity to learn advanced mathematics across varying schools and demographics in the district under study showed that student access to Algebra I in the middle grades was traditionally limited.

Racial and socioeconomic inequities in education became more transparent when the Elementary and Secondary Education Act (ESEA) of 1965 was signed into law. This landmark federal policy sparked a generation of educational policy that focused on quality of educational opportunities for all students. ESEA was reauthorized eight times since 1965, the most recent iterations were NCLB in 2002 and the ESSA in 2015. The NCLB and ESSA increased school accountability in providing students with rigorous instructional opportunities through annual testing and reporting criteria.

In the 2011-2012 school year, the state Department of Education for the district under study made changes to the state standards to align them more closely with the Common Core State Standards (CCSS). According to Richard Laine, the education division director of the National Governor's Association Center for Best Practices and Chris Minnich, the Executive Director of the Chief of State School Officers, the movement from state standards to CCSS occurred in response to a need for more rigorous standards to better prepare students for post-secondary experiences (2013). A new state assessment that aligned more closely to the CCSS was implemented first in the 2015-2016 school year. The rationale for the standards and assessment change in the state was the need for increased academic rigor as the previous state test results were significantly lower than student results on national tests such as the National Assessment of Educational Progress and SAT (citation withheld to maintain confidentiality).

An increased emphasis on mathematics achievement was due, in part, to a national effort to prepare students for technical and science or mathematics careers (Ayieko, 2018). The goals of the educational policy were supported by the state's school accountability model. One-third of the school grade assigned by the state Department of Education at the middle school level was calculated by determining student mathematics achievement, annual learning gains of all students and achievement of the most struggling students. One-ninth of the school grade was calculated by determining the percentage of students who completed an accelerated mathematics or Career and Technical Education (CTE) course and passed the related assessment.

Teacher evaluations were an additional accountability measure. According to state statute (citation withheld to maintain confidentiality), a teacher's annual performance evaluation must include instructional performance and student achievement measures. The student achievement measures component of a teacher's annual performance evaluation was calculated from state assessment results. The connection of student assessment results to teacher evaluation scores created pressure for teachers to have high rates of student proficiency on the Algebra I EOC examination. This caused middle school teachers to express reluctance toward a more inclusive model of student enrollment in Algebra I. Consequently, principals relied on teachers to determine which students should be candidates for Algebra I Honors and which students should be placed on a less rigorous academic track.

Rigid, in-district selection measures stemmed from the fear of allowing students the opportunity to attempt Algebra I Honors in middle school who may not earn a passing score of a level 3 on the 5-point scale on the state EOC examination. Interviewees for this study explained that students who earned a level 4 or 5 on the previous years' grade level standards' assessment were traditionally invited to take a placement test prior to course placement. The teacher created placement test consisted of 25 questions with items aligned to the Common Core Standards. The test was designed to determine which students had the academic capacity to skip over foundational mathematics content in order to take Algebra I in middle school and continue to experience success in higher level mathematics at the high school level. The final student list was created based on teacher recommendation, a student's current math grades and a "cut score" from the teacher created placement test.

The Algebra EOC examination assessed student understanding in three reporting categories at course completion. According to the state Department of Education, critical areas of focus for advanced mathematics success were included in the determination of reporting category percentages. Questions on the EOC examination that were designed to assess Algebra and Modeling standards made up 41% of the test, while questions that assessed Functions and Modeling standards made up 40% of the test, and questions that assessed Statistics and the Number System made up 19% of the test. Since the teacher-created placement test was designed to assess foundational skills in algebra readiness, I compared test item alignment to the Algebra I EOC examination reporting categories.

The teacher-created placement test assessed the Algebra and Modeling reporting category more heavily than the other two categories. Functions and Modeling foundational skills were excluded from the placement test and 36% of the test assessed standards that did not align with algebra readiness standards. Table 6 illustrates the grade level reporting category alignment to algebra readiness standards on the teacher created placement test.

Table 6:

Teacher Created Placement Test Item Blueprint

Grade Level Reporting Category	Standard	% of Placement Test	Alignment to Algebra EOC Reporting Categories
Number and Operations Fractions	5.NF.A.1	12	n/a
	5.NF.B.4	4	n/a
Ratios and Proportional Relationships	6.RP.A.3	8	assessed throughout
The Number System	6.NS.A.1	4	Statistics and the Number System
Expressions and Equations	6.EE.B.5	4	Algebra and Modeling and Statistics and the Number System
The Number System	7.NS.A.1	12	n/a
	7.NS.A.2	8	n/a
Expressions and Equations	7.EE.A.1	8	Algebra and Modeling assessed throughout
	7.EE.B.3	28	
Seeing Structure in Equations	HS.A-SSE.1.2	8	Algebra and Modeling
	HS.A-SSE.2.3	4	Algebra and Modeling

I used the Achieve the Core Coherence Map (2020) to trace advanced mathematics standards back through its logical pre-requisites to identify gaps in student knowledge in the middle grades when students are accelerated to Algebra I or geometry by the completion of eighth grade. Some high school standards that were identified on the Coherence Map as widely applicable prerequisites were assessed throughout all three reporting categories on the Algebra EOC examination. These standards addressed quantitative reasoning and the use of correct units to solve problems. The Common Core equivalents of the prerequisite standards were: High School – Number and Quantity 1.1

(H.N-Q.1.1), High School – Number and Quantity 1.2 (H.N-Q.1.2), and High School – Number and Quantity 1.3 (H.N-Q.1.3), none of which were assessed on the teacher created test for middle grades Algebra I course placement. According to the state Principal Leadership Standards for the district under study, a top priority for instructional leaders was to "demonstrate a commitment to the success of all students, identifying barriers and their impact on the well-being of the school, families and local community" (citation withheld to protect confidentiality of the district). Equitable access to advanced mathematics could be traced through a cycle. Historical educational policy focused on equitable opportunities to increase college and career readiness for all students. High stakes accountability measures facilitated increased educator reluctance at opening opportunities to learn which supported student selection bias in determining advanced course placement. Selection bias traditions ensured economic opportunities were limited for traditionally underserved populations which resulted in educational policy reform to address inequities. Educational leaders are charged with addressing the traditions that perpetuated the cycle.

Culture

Cultural aspects of the program evaluation emerged as the schools within the district under study had become accustomed to an autonomous culture for student academic course placement. Heifetz, Grashow, and Linsky (2009) explained that any social system, including schools, operate in the way that they do because either the majority of the people or those with the most leverage want it to work in that way. The leaders in the district office maintained a stance of allowing each school to create individualized policies for placement although feeder patterns between middle and high schools frequently intertwined. Patterns of inequity were even more visible because of the transient nature of the student population in the district. Students gained access to advanced mathematics courses in one school only to have the access denied when transferring schools.

Student tracking policies in American school systems came into practice when a growing number of immigrants were integrated into schools and methods of sorting students were adopted to separate less academically prepared students from those who were native born and were determined to be culturally prepared for schooling (Wheelock, 1992). The literature showed that the tradition of tracking is ineffective, yet the policies that facilitate academic tracks are maintained largely because they are reflective of the cultural beliefs and attitudes of educators and the community (Werblow et al., 2013). Social sorting was historically visible through access to the school building but has become more difficult to see and address when access to academic courses and pathways are denied. According to Heifetz et al. (2009), “No stakeholders operate solo. They have external loyalties, to people outside their group and to the people behind the ideas that matter to them” (p. 93). Increasing access to rigorous courses cannot come from a policy or mandate, it has to be accomplished by changing hearts and minds of influential groups.

Conditions

Mathematics course completion trends have become a focus in recent years because parents and community members have become more aware of which courses are required for students to experience optimal success in college and careers. Given the increased emphasis on mathematics achievement for American high school students, “just two thirds of U. S. high school graduates took mathematics courses in all four of their high school years" (Reyes & Domina, 2017, p. 2). Students who took four years of math in high school were on track to complete Algebra II by the end of high school which was the minimum requirement in mathematics for students to be college ready (Reyes & Domina, 2017).

The Student Achievement Partners (2018) created a coherence map of interrelated mathematics skills to illustrate the hierarchical nature of the discipline. Major, Supplemental, and Additional Clusters appeared throughout the grade level maps to guide teachers in understanding course progression and skill foundations as they related to Algebra. The traditional accelerated middle grades mathematics course progression for the district under study allowed for key foundational skills to be skipped when students advanced to Algebra I prior to high school. The traditional accelerated progression illustrated in Figure 25 was available for students enrolled in sixth grade advanced mathematics.

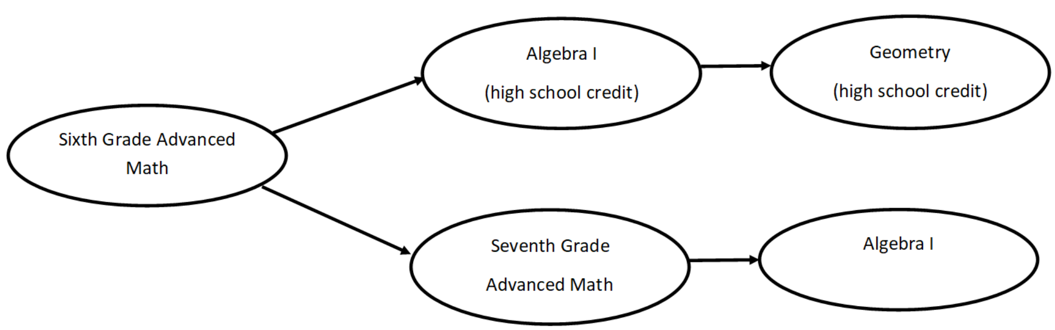

Figure 25. The traditional middle school mathematics acceleration track.

In their seventh grade year, the students were placed on one of two tracks. Students identified as those at the top of their class advanced to Algebra I Honors and then took Geometry in their eighth grade year. Sixth grade advanced students not selected for Algebra I in seventh grade were placed in seventh grade Advanced Math and then advanced to Algebra I in eighth grade, if the student met the selection criteria determined by the school at the end of the seventh grade.

The sixth grade advanced curriculum map embedded some of the key seventh grade skills along with the sixth grade standards, but those standards did not appear until the end of the school year or near the state testing window. The same was true for the seventh grade advanced curriculum map. Key eighth grade skills were embedded into the seventh grade advanced curriculum map along with the seventh grade standards, but not until the end of the school year or near the state testing window for the grade level. Both curriculum maps included a disclaimer in the footnotes that explained that the accelerated standards would not be assessed on the state test.

According to the Achieve the Core Mathematics Coherence Map (Student Achievement Partners, 2018), there were several content clusters that were identified as widely applicable prerequisites for a range of college majors and CTE careers. The clusters that were applicable in post-secondary work had a foundation in traditional middle grades mathematics and should have been mastered prior to Algebra I. Achieve the Core identified this body of knowledge as high priority content in grades 6-8 Mathematics:

- Applying ratios and proportional relationships
- Applying percentages and unit conversions
- Applying basic function concepts
- Applying concepts and skills of geometric measurement
- Applying concepts and skills of basic statistics and probability

- Performing rational number arithmetic fluently

The Student Achievement Partners (2018) also highlighted focus topics by grade level for grades K-8. In grade 6, the focus content should have been on ratios and proportional relationships and early Expressions and Equations practice. In grade 7, the focus content should have been on extending knowledge of ratios and proportional relationships, arithmetic of rational numbers and advanced practice in Expressions and Equations to determine equivalent relationships. In eighth grade, the focus content should have been on continued practice in Ratios and Proportions and Expressions and Equations with a major cluster focus on linear algebra and linear functions. If the suggested content focus guidelines distributed by Student Achievement Partners were followed, many of the key standards that led to success in the higher levels of mathematics would have been taught in seventh and eighth grade mathematics.

The state Department of Education school grade model was designed to correlate with ESSA Indicators. The state grading component allowed for a maximum of 120 points to be awarded to schools for Middle School Acceleration. The correlated ESSA indicator of School Quality or Student Success was worth 320 points and included Science and Social Studies Achievement and Middle School Acceleration. According to the guide for calculating school grades, students were calculated into the denominator of the acceleration component if the eighth grade student scored a Level 3 or above on the mathematics statewide assessment in the prior year (citation withheld to preserve the confidentiality of the district). Students were calculated into the numerator if included in the denominator and they scored a Level 3 or higher on the EOC assessment for the corresponding course (citation withheld to preserve the confidentiality of the district).

This model deemphasized the focus on Algebra readiness skills and created pressure for individual schools to target students for placement in Algebra regardless of skill proficiency, student self-efficacy, or desire.

Prior research on middle school algebra student placement trends investigated the impact of proficiency tests and teacher evaluation of student ability. More recently, few researchers have explored student person-environment (P-E) fit theory as it relates to Algebra placement. The origins of P-E fit theory can be traced back to the early 20th century when employers traditionally valued strong employment histories (Su et al., 2014). Because of the Great Depression, unemployment rates soared leaving many individuals without significant work experience. Career counselors developed a series of assessments to understand and maximize the fit between an individual's traits and the factors required for success in his or her environment (Su et al., 2014). The vocational psychologist community valued P-E fit as an essential theory for career planning, decision making and adjustment in goals based on commonly assessed traits of interests, work values, and cognitive abilities (Rounds & Tracey, 1990). P-E fit, as it relates to child development, indicates that students vary substantially in their capability to benefit from access to opportunities to learn (Domina, 2014). Researchers have repeatedly measured several factors in the study of appropriate math course enrollment for middle school students: prior mathematics achievement levels, literacy skills, student self-efficacy and perceived value of the subject. In the district under study, only prior mathematics achievement levels were used to determine the mathematics course placement in the middle grades.

Competencies

Instructional leaders in the state were charged with "structuring and maintaining a school learning environment that improves learning for all of the state's diverse population" (citation withheld to preserve the confidentiality of the district). When teacher evaluation of mathematical foundational skills is a prominent factor in determining track placement, minority students are disproportionately affected regardless of prior math achievement levels (Faulkner et al., 2014). Among the teachers who were interviewed for this study, 86% explained that previous teacher recommendation of student math skills work ethic should be a key criterion in math course tracking. All three school-based administrators agreed that student skill level and teacher evaluation of that skill should be primary factors in determining placement. One administrator stated "we use data, and luckily, I have a strong enough math teacher that I take her opinion. What's going on in her classroom is important. I take her opinion as gold" (Personal Communication, September 12, 2019).

Many teachers and administrators were knowledgeable about standard math course progression in the district under study but not of the skill progression or pedagogy necessary to accelerate learning of clustered skills. Katterfield (2013) explained that school level leadership is a key support of improved student learning when the principal's vision supports standards based instructional methods. The standards document described by the NCTM emphasized changes to conventional methods of teaching to engage students in developing conceptual understanding of mathematical content through problem solving, making their own connections, and verifying their own solutions (NCTM, 2014). Administrators in Katterfield's study said they relied on math team leaders to guide their math departments through improvement of their craft or provided teachers with disaggregated assessment data but did not engage in specific conversations about instructional methods.

Another common misconception was that students must master the basics, such as memorizing times tables prior to engaging in algebraic problem solving (NCSM & TODOS, 2016). Efforts to de-track mathematics instruction hold promise when professional development opportunities strategically embed a blend of conceptual and procedural instructional methods alongside basic facts practice (Wheelock, 1992). The NCTM explained that methods of increasing access involve debunking myths surrounding mathematics pedagogy. "To support Algebra readiness, mathematics learning should focus on developing understanding of concepts and procedures through problem solving, reasoning, and discourse instead of focusing on practicing procedures and memorizing basic number combinations" (NCTM, 2014, p.11).

Through the open response interview questions, all of the teacher participants identified a need for content related professional development for teachers to ensure key foundational skills were not missed. One participant even suggested,

> I think we might need to have acceleration as early as possible. Even in fifth grade could be key to [the student's] success. They are able to, instead of skipping concepts, they can spread it all out over time. They're getting all they need earlier instead of jumping from just math sixth advanced to Algebra I or from seventh math Advanced to Algebra I. There could be real gaps in the instruction. I'm not sure what those look like though.

Teachers identified a need for authentic opportunities to collaborate and discuss content focus, instructional strategy, and assessment techniques in place of workshop style professional development.

Interpretation

The mathematics course placement evaluation for the district under study can be interpreted through three frameworks, which are (a) opportunity to learn (OTL), (b) instructional leadership, and (c) P-E fit theory. Through the OTL framework, trends of selection biases were evident. Through the participant interviews, teachers consistently agreed that access to Algebra I in middle school should be granted to students who were willing to try the course and were sufficiently prepared for the academic coursework, but the teachers were unsure of appropriate methods for determining student placement. Teachers also expressed a potential need for professional development to assist in closing maturity or academic skill gaps for students who were accelerated. School-based and district level administrators agreed that students who had the opportunity to learn Algebra by eighth grade had access to more advanced courses in high school and would likely have more confidence in their mathematics competency throughout high school, but the administrators, too, were unsure of methods for determining appropriate placement.

Algebra I course enrollment demographic reports over the three years of the study showed that the percentage of minority middle school students enrolled in Algebra I throughout the state was not representative of the minority students enrolled in middle grades throughout the state. Black students were underrepresented in middle school Algebra classes by 11% in the 2016-17 school year and by 8% in the 2017-18 and 2018-19 school years. Hispanic students were underrepresented in middle school Algebra classes by 8% in the 2016-17 school year, by 1% in the 2017-18 school year, and by 2% in the 2018-19 school year. Multiracial students were overrepresented in middle school Algebra courses in the 2016-17 school year but were underrepresented by 1% in the 2017-18 school year and were equally represented in the 2018-19 school year. Asian students were overrepresented by 1% in the 2016-17 school year and by 3% in the 2017-18 and 2018-19 school years.

Each year of the study, White students were increasingly overrepresented in middle school Algebra courses in the state. White students were overrepresented by 1% in the 2016-17 school year and by 7% in the 2017-18 school year and by 8% in the 2018-19 school year. This trend of underrepresentation in Algebra I for most minority groups suggested a potential tradition of selection biases that appeared to be decreasing as course enrollment and overall student population became more aligned each school year. However, White student enrollment in Algebra I was consistently overrepresented in the state.

In the district under study, the Algebra I course enrollment demographic reports over the three years of the study showed that the percentage of minority middle school students enrolled in the district was also not representative of the population of minority students enrolled in middle grades throughout the district. Black students were underrepresented in middle school Algebra classes by 20% in the 2016-17 school year and by 10% in the 2017-18 school year. The disproportionate representation of Black students increased to 11% in the 2018-19 school year. Hispanic students were underrepresented in middle school Algebra classes by 3% in the 2016-17 school year and by 2% in the 2017-18 school year. The disproportionate representation of Hispanic students increased to 3% in the 2018-19 school year. Multi-racial students were equally represented in middle school Algebra classes in 2016-17 but were overrepresented by 1% in the 2017-18 and 2018-19 school years. Asian students were also overrepresented in middle school Algebra classes by 2% in the 2016-17 and 2017-18 school years, and this over-representation increased to 3% in the 2018-19 school year.

White students were consistently overrepresented in middle school Algebra classes in the district. In the 2016-17 school year, White students were overrepresented by 14%. In the 2017-18 and 2018-19 school years, this demographic was overrepresented by 12%. The trend mirrors the demographic comparisons at the state level. This suggests that students who are White, Multiracial, or Asian are more likely to be placed on an advanced mathematics track than students who are Black or Hispanic.

Initial course enrollment and completion data at the school level also reflected disproportionate demographic representation. In School A, White student enrollment in Algebra I was higher on average than the enrollment of White students in the school, as a whole, over three years. The average White student enrollment over three years for School A was 41% and the average enrollment of White students in the Algebra I course over three years was 56%. Among the students, over three years, who completed the Algebra I course, 58% were White which shows that White students completed the course at a higher rate than students of other demographic groups. The course enrollment data for School B showed that White students were the highest represented demographic over three years at the course start and completion. The percentage of White students enrolled in Algebra I was higher on average than the percentage of White students enrolled in the school, as a whole, over three years. Because of the district trend of relying on teacher evaluation and prior student achievement data to determine student placement, the demographic data indicated that selection bias may have played a role in the disparity in student enrollment and completion of Algebra I in middle school.

Through the framework of instructional leadership, trends in Algebra I EOC examination achievement data emerged that contradicted a teacher misconception that increasing access to Algebra for more students would have a negative effect on school proficiency scores. The sample size for School A increased each year of the study (N=94, N=109, N=121) while the pass rate remained above 90% each year (SY 2016-17=97%, SY 2017-18=100%, SY 2018-19=94%). The sample size for School B varied each year (N=40, N=63, N=47) while the pass rate remained above 95% each year (SY 2016-17=100%, SY 2017-18=98%, SY 2018-19=100%). An unintended consequence emerged from an administrator misconception that simply opening the access for students to take Algebra in middle school would increase the opportunities for students to take higher level math in high school or to qualify for Early College or Advanced Placement courses. Administrators at the school and district levels were not aware of the unintended consequences of acceleration without thoughtful consideration to skill gaps, and they used high Algebra I EOC examination proficiency scores as evidence for their argument. However, the state Algebra I EOC examination scores were reported as scaled instead of raw scores. Students could earn a passing score of a Level 3 but only demonstrate understanding of 35% of the course content. Because of the weights assigned to the reporting categories, evidence of student understanding of content was often distributed in only one or two categories.

Of the three reporting categories on the Algebra EOC examination, the lowest mean reporting category for both schools in the study over all three years was Statistics and the Number System. This reporting category included skills necessary for success in Algebra II such as Interpreting Categorical and Quantitative Data, Making Inferences, and Justifying Conclusions and Conditional Probability and the Rules of Probability (Student Achievement Partners, 2020). Although the mean did increase each year, the standard deviation also increased. This indicated that there was much variance in the students' scores within the reporting category and showed weaker understanding of the content assessed. Future research should be conducted based on the wide variance in the scores in this reporting category to determine the level of teacher understanding of the related content standards, the quality of student learning experiences within the specific standards, and to investigate the prior mathematical skill gaps that had not been considered when selecting students for accelerated mathematics track placement.

The highest mean scores for both schools were in the Algebra and Modeling Reporting Category which made up 41% of the Algebra EOC examination. This reporting category included skills identified as Widely Applicable Prerequisites or those needed across a variety of post-secondary work. Skills included in this category were Seeing Structure in Expressions, Arithmetic with Polynomials and Rational Expressions, Creating Equations, and Reasoning with Equations and Inequalities (Student Achievement Partners, 2020). There was a stronger focus placed on the content in this reporting category prior to this evaluation as was evident through the standard representation on the teacher created placement test. The score results for both schools showed an increase in the mean every year over the three years of my study.

The standard deviation for School A increased slightly over the three years which indicated a wider distribution in the students' scores over time. In the first year of the study (SY 2016-17), the multi-modal distribution of the scores indicated there were two overlapping groups whose scores were very different from each other. In the 2017-18 school year, the distribution of scores was positively skewed. That indicated there were mostly low scores in the data set. In the 2018-19 school year, scores were distributed symmetrically around the mean which indicated most scores fell in the middle of the range with few very high scores and few very low scores. Future research could be conducted to investigate the rationale for changes in the data set over the three years of the study. The differences in the score distributions could be explained by one or more of the following: teacher experience within the content standards strengthens over time, quality academic experiences were more consistently applied over the three years, or students were selected for an accelerated math track placement with similar strengths or skill gaps in prior foundational skills.

The standard deviation for School B decreased as the mean increased every year of the study. This showed that the scores were dispersed more evenly in the data set as the study continued and was an indicator that the students' scores in the reporting category were rising each year. A difference to note between School A and School B was that several teachers' classes were represented in the data for School A while only one teacher instructed all of the Algebra I students in School B each year.

The Functions and Modeling Reporting Category made up 40% of the Algebra EOC examination and also included skills identified as Widely Applicable Prerequisites. Skills included in this category were Building Functions, Interpreting Functions, and

Linear Quadratic and Exponential Models (Student Achievement Partners, 2020). This reporting category was the least represented in the teacher created placement test, although according to the Coherence Map, many of the skills in this category had foundations in the seventh grade standards cluster of Analyzing Proportional Relationships and the eighth grade standards cluster of Defining, Evaluating and Comparing Functions (2020). The scores for both schools in this category had the least change over the three years of the study.

The distribution of scores for both schools consistently fell into a curve that was positively skewed. A worthy trend to mention is that while the mean in Statistics and the Number System and Algebra and Modeling increased for both schools over the three years, the mean and standard deviation in the Functions and Modeling category remained constant with very little variance from year to year. This trend suggests that teachers and administrators may not have had an understanding of the relationship between the standards assessed in the Functions and Modeling reporting category and higher-level math courses.

Trends within the P-E fit theory framework emerged through a combination of analyzing participant interviews, course enrollment data and Algebra I EOC examination reporting category trends. School-based and district administrators suggested multiple measures to select students for advanced mathematics track placement, but school-based administrators admitted they were heavily reliant on teacher evaluation of students' academic ability. The state accountability model also influenced administrators at both levels in their decision-making. According to the state Department of Education, students could be included into the acceleration component of the school grade calculation multiple years in middle school (citation withheld to preserve confidentiality). To be included in the denominator for acceleration, a student must be a full-year enrolled in grade 6, 7, or 8 and enrolled in a high school EOC examination course with a valid, proficient score on the assessment. This means that a single student could be included in the school grade acceleration calculation multiple years. Because a proficient EOC examination score was possible even if a student demonstrated limited understanding of the content, administrators could make decisions to hyper-accelerate, or accelerate students beyond their level of proficiency.

The pressure to increase student enrollment in algebra to seventh graders as well as eighth graders meant students would not have had the opportunity to learn skills they would need in later mathematics courses when they skipped over seventh grade and eighth grade mathematics. Teachers expressed concerns over foundational skill gaps although they were not able to articulate exactly what those skills might have been. One teacher mentioned the need for extended practice in Expressions and Equations, but that skill would fall into the already strong Algebra and Modeling category. Only one district administrator described specific skill deficits in depth. As enrollment in algebra increased in middle school, the proficiency scores were maintained but reporting category trends indicated a need to continue research as it relates to foundational skill support strategies.

As enrollment data increased throughout the study, there was a continued lack of equitable representation of demographic groups. White and Asian students were consistently overrepresented in both schools over the three years of the study. The course enrollment by student demographic in School B was more equitably distributed over the three years, but the percentage of Black students who completed the course was 6%

lower than the percentage of Black students who were enrolled in the school over the same period of time. Two of the teachers interviewed explained that students who were accelerated became part of a cohort where success and "smartness" were valued, and this contributed to students wanting to work hard and remain in the course. The sense of belonging was stronger.

If other aspects of P-E fit were not considered in placement, such as student demographics, it was likely that a student could be placed on an accelerated track and not see other students who were racially or culturally similar. If students felt that they were not represented or part of the group, their sense of belonging was lower and the academic value of acceleration was diminished (Allen et al., 2018). Student self-efficacy is more social than it is grounded in achievement levels. External factors such as family dynamic and sense of belonging in the school greatly impacted student achievement, particularly at the middle school level (Domina, 2014).

Judgments

The middle schools in the district under study had historically limited access to Algebra I for only students who met a series of teacher created criteria. Consequently, few students gained access to the most advanced track for middle school mathematics. The majority of students selected for advanced courses were White. The enrollment demographics did not reflect the diverse racial demographics of the schools. In response, district leaders initiated a strong recommendation to increase student access to Algebra I in middle school in the first year of the study. The basis for this recommendation was two-fold.

The state school grade calculation model awarded schools points based on acceleration which would impact the school grade positively and subsequently, the district grade. This decision was predicated on the belief that increasing students' access to advanced coursework prior to high school would increase students' opportunities to engage in rigorous mathematics coursework in high school. As a result, school leaders increased enrollment quickly, but an unintended consequence of the swift, increased enrollment was an increased potential for selection bias, lack of teacher confidence in the policy changes for enrollment, and hyper-acceleration that resulted in mathematical foundational skill gaps.

Recommendations

The findings underscored the importance of a whole school intervention that addresses the needs of the whole student as well as the school as a system. Hattie (2009) explained that schools should be careful not to undermine the importance of relationships and student belonging. To increase student opportunities to learn while honoring the expertise of the teachers, school leaders should work with teachers to create a school-based committee to create goals that would increase rigorous academic opportunities for students. The team should also identify gaps in supports provided to students with varying academic and social and emotional needs. Instructional support personnel from the district office should assist school committees throughout the school year to meet their goals.

The district office personnel should support content collaborative planning sessions and enhance quarterly data chats by illustrating the connections between content standards taught and assessed on local assessments and the related reporting categories on the Algebra EOC examination. District office curriculum leaders should work with schools to restructure the acceleration criteria, pathways for acceleration, and communication of those pathways to include families, counselors, teachers and most importantly, students in the selection process. The goal of the restructured acceleration pathway would be to provide principals with options to offer the opportunity to take Algebra I in middle school to more students by strengthening the foundational skill set at an earlier grade level and by slowing down the acceleration process to ensure exposure to necessary skills and career options.

Conclusion

Wagner et al. (2006) explained that systemic change occurs through phases. The preparing phase is a period of gathering various forms of data and building trusting relationships with colleagues. Schools in the district under study have been actively searching for new strategies for offering accelerated pathways to more students but have been unaware of the possible consequences of hyper-acceleration or of making decisions about track placement without considering P-E fit. Reyes and Domina (2017) contended that “students’ positions in unequal school structures shape their academic orientations and constrain their future decisions” (p. 4).

It was my goal in this study to provide insight on tracking policies and to offer increased opportunities to learn mathematics for all students with a focus on equitably representing marginalized students in advanced courses. In Chapter 5, I identified currently utilized support structures in the district under study that could be leveraged to facilitate alignment of initiatives and strategies for student academic and non-academic support.

CHAPTER FIVE

To-Be Framework

Through an analysis of the findings for this study and current and historical research, a need for aligned systems to support student educational pathways emerged. The purpose of the program evaluation was to investigate equitable strategies for mathematics acceleration at the middle school level to prepare all students for post-secondary college and career readiness (CCR). Federal and state initiatives are designed to provide guidance and support in preparing all students for academic success under the ESSA (2015). Since 2012, the priority of United States secondary schools has shifted from preparing students for graduation to preparing students for a successful transition to post-secondary education or to the workforce (U.S. Department of Education, 2020). Efforts to prepare students for success after high school emphasized core academics and college readiness over vocational and military pathways largely because of the development of the Common Core State Standards (CCSS) for Mathematics and English Language Arts (NCTM, 2014).

College and Career Readiness

Nationally, college was a primary goal for schools, although robust federal legislative history emphasized a focus on both educational and vocational equity. The ESEA of 1965 charged school districts with addressing disparities in equal access to quality education. Representative Carl D. Perkins, one of the leading congressmen known for his role in supporting ESEA, also was known for making a stand for equity in academics and vocational education and his support of under-privileged individuals (Hunter, 1984). Although federal legislation supporting vocational education can be traced back to the early 20th century with the Smith-Hughes Act of 1917, the Carl D. Perkins Vocational Education Act (1984) was innovative in expanding support to individuals with disabilities, single parents, and low-income individuals and in establishing technical preparation programs to coordinate secondary education and workforce alignment efforts.

The Carl D. Perkins Act was amended and expanded over several decades, yet secondary students were frequently encouraged at the school level to pursue a college track only. Advancement Via Individual Determination (AVID) is a non-profit organization that provides educational support for minority or under-represented student populations and the academic middle, or those who earn test scores in the mid-range on a 5-point scale and earn Bs, Cs and some Ds in academic courses (AVID Center, 2020). As recently as the 30th anniversary of the program in 2010, the mission statement was to "close the achievement gap by preparing all students for college readiness and success in a global society" (AVID Center, 2018, p. 4) and their motto for the same year was "Decades of College Dreams" (AVID Center, 2018, p. 4). In 2017, AVID Center collaborated with the United States Chamber of Commerce and leaders in education and technology to discuss the gaps in student career readiness skills that persist even after decades of academic support (AVID Center, 2017). An AVID CCR Framework to address school support needs was the result of continued collaboration and revision to previous reform efforts designed to support individual students (AVID Center, 2020).

CCR extends beyond core academics. State definitions of CCR include the following skills: academic knowledge (19 states), critical thinking and/or problem solving skills (14 states), social and emotional dispositions (14 states), intrapersonal skills

(8 states), civic involvement (8 states), and other employability skills also referred to frequently as soft skills (6 states) (English et al., 2016). The researchers at the College and Career Readiness and Success (CCRS) Center organized these skills into three domains: academic knowledge, career pathway knowledge and skills for lifelong learning (Cushing et al., 2019). The organizer follows a continuous improvement model format as illustrated in Figure 26 and was developed to guide school districts in aligning initiatives, identifying and implementing potential strategies for student success, assessing indicators of CCR pathway readiness, and providing the necessary supports to ensure resources are used to their fullest potential (Cushing et al., 2019).

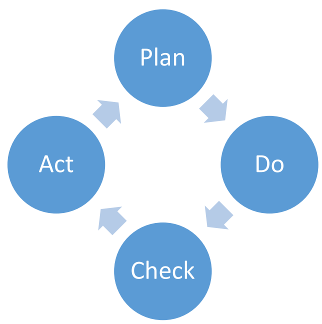

Figure 26. Continuous improvement model.

The indicators of CCR pathway readiness identified by the researchers at the CCRS Center illustrated in Figure 27, align with ESSA accountability indicators measured by state school grade and accountability models and are also embedded within AVID's Site of Distinction Metrics, a recognition awarded to AVID school sites that meet certain indicators on the annually reported Coaching and Certification Instrument (CCI) (AVID Center, 2019). As is illustrated by the Continuum of CCR Pathway Readiness (Figure 27), opportunities to engage in advanced, college-prep coursework or participate in and experience success in Career and Technical Education (CTE) courses in high school are limited if students miss the grade 8 algebra benchmark.

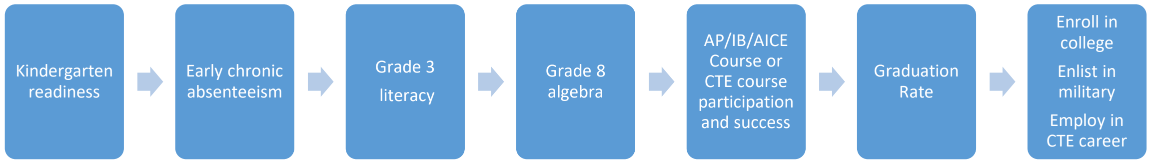

Figure 27. Indicators of college and career pathway readiness.

There is also a relationship between high scores on certain components of the Armed Services Vocational Aptitude Battery (ASVAB), previously earned industry certifications and a military recruit's variety of career field options (Johnson, 2008). If student access to middle school algebra is limited, all three CCR pathways – enroll, enlist, employ – are less accessible.

Envisioning the Success To-Be

The factors that impacted middle school Algebra I enrollment were highlighted by the findings of this study and I organized them into the As-Is organizer (see Appendix D). This analysis model was used to facilitate systemic analysis of the interconnected elements of context, culture, conditions, and competencies of the district under study. To think "systematically about the challenges and goals of change in schools," all four areas must be considered when envisioning the success to be (Wagner et al., 2006, p. 98). To formulate change recommendations, I used the To-Be chart (see Appendix E) to align academic and non-academic structures of support to increase Algebra I enrollment at the middle school level.

In the district under study, middle school students were historically considered for accelerated math pathways as an initiative separate from other goals of the school. Students were selected based on state assessment data and teacher created math placement test scores. School administrators relied heavily on teacher evaluation of student ability. Student interest, self-efficacy, or available supports were not taken into consideration in placement decisions. Because the state school grading model was designed to award points to middle schools for math acceleration, school administrators reacted by placing larger numbers of students on an accelerated track each school year based on the aforementioned criteria. This resulted in teacher frustration with students enrolled in algebra classes who may not have selected the course and may not have understood the value of taking algebra in middle school.

Prior research on mathematics acceleration policies found that middle school "algebra for all" initiatives were largely ineffective because the CCR skill domains of career pathway knowledge and skills for lifelong learning were not considered. Dougherty et al. (2015) found that an "algebra for all" policy in North Carolina resulted in an increase in student Algebra I enrollment across all demographic groups, but neither Black nor Hispanic students achieved "representation in accelerated courses in a way that is proportional to their overall share of district enrollment" (p. 95S).

In a longitudinal study spanning from 1990 to 2011, Domina (2014) found that students in advanced mathematics courses in middle school experience a more teacher driven and less social mathematics experience than in elementary schools which may result in clear "mismatch between adolescents' developmental needs and their middle school environments" (p. 1949). A limitation of a universal Algebra I enrollment policy in Chicago was that many students experienced foundational mathematics deficits in eighth and ninth grades, and educators were not prepared to offer additional supports such as teacher professional learning in pedagogical practices for heterogeneous classroom environments, tutorial support for students, and non-academic supports to facilitate a shared belief in diversity and student ability (Nomi, 2012).

The researchers at AVID Center (2020) refer to knowledge of career pathways as opportunity knowledge and describe the skill domain as “opportunities for students to research career pathways, set goals, make choices that support their long-term aspirations and successfully navigate transitions to the next level” (p. 3). AVID researchers also extended the CCR definition of student agency for educators by describing it as students’ “belief in and activation of their own potential, build relationships, persist through obstacles, and exercise their academic, social, emotional, and professional knowledge and skills” (AVID Center, 2020, p. 4).

A system of support for the three CCR domains is necessary to equitably address the needs of all students. Multi-tiered systems of support (MTSS) and response to intervention (RTI) generally have these elements: multi-level, tiered prevention system that provides increasingly intense levels of instruction, a universal screener used at the first tier of MTSS to identify students at risk, data-based decision making, culturally relevant evidence-based supports, on-going progress monitoring to determine the effectiveness of the implemented supports (National Center on Response to Intervention, 2010). Current MTSS frameworks provide academic and social and behavioral supports through RTI and Positive Behavioral Interventions and Supports (PBIS), but these approaches were initially developed as behavioral initiatives for elementary schools (Morningstar et al., 2018).

Pitfalls in implementation at the secondary level are evident in current research when the efforts to duplicate the elementary design are initiated without consideration of the differences in elementary and secondary systems (Morningstar et al., 2018). Factors necessary for secondary implementation of support systems should consider necessary transformation of school climate, reorganization of secondary infrastructures to embed collaborative opportunities for students and staff, time for planning and professional development, and the need to align support efforts within existing district initiatives (Morningstar et al., 2018).

ESSA, CCR, and AVID promote clear transition pathways for career or college for all students. Goals for youths with disabilities also align with the CCR and AVID intentions. Under the Individuals with Disabilities Education Act (IDEA) (2017), transition plans for students:

> are designed to be within a results-oriented process, that is focused on improving the academic and functional achievement of the child with a disability to facilitate the child's movement from school to post-school activities, including postsecondary education, vocational education, integrated employment (including supported employment), continuing and adult education, adult services, independent living, or community participation. (Sec. 300.43a)

Although the average high school dropout rate decreased from 4.4% from 2006 to 2018, the dropout status for White students (from 6.4 to 4.2%) was lower than that of every other ethnic group except Asian (U.S. Department of Education, 2020).

A combined framework is necessary to increase access to quality educational opportunities for all students by leveraging the existing goals of ESSA, Perkins V, AVID, and IDEA. This framework emerged from efforts to embed CCR elements into an existing MTSS framework (Morningstar et al., 2018). The recommended support framework utilized six domains that emerged from current research in secondary school reform (Morningstar et al., 2018). Although the CCR-MTSS framework developed by Morningstar et al. (2018) identifies supports to address student needs, a missing component of this framework is the role of adults in the MTSS process.

AVID Center researchers developed a CCR framework with the intent of informing district and school leaders' actions to ensure college and career readiness is available and happening for all students (2020). This framework is unique in that the three domains previously identified by the researchers at the College and Career Readiness and Success Center (Cushing, et al., 2019) were merged with four adult behaviors which (a) insist on rigor, (b) break down barriers, (c) align the work, and (d) advocate for students (AVID Center, 2020). The work of improving student educational experiences cannot be addressed without connection to adult actions. Academic concerns such as those identified through this program evaluation are symptomatic of necessary reform work in school culture, instructional leadership and systems of infrastructure to support a well-rounded education that goes beyond the focus on core academic content (English et al., 2016).

Schmoker (2016) contended that effective instructional leadership requires leaders to limit and align the focus of the organization and then continually and relentlessly apply pressure to work toward the common focus. My vision to align systems in the district under study is illustrated in the combined CCR-MTSS framework (see Appendix B) that emerged through a review of research and analysis of the findings of this program evaluation and is intended to provide clear focus to instructional leaders in the district under study (AVID Center, 2020; Morningside et al., 2018). The CCR-MTSS framework blended the concepts addressed by Morningside et al. (2018) and AVID Center (2020) with already established district initiatives to align the work.

Context

In the district under study, the practice of increasing student enrollment in advanced courses with the intent of increasing the school grade resulted in limited access for middle school students in accelerated mathematics courses. As I mentioned earlier in this section, open access to college and career pathways for students was supported through historical educational policy reform. The middle school years were identified by the researchers at the CCRS Center as the formative years for a student to explore post-secondary options and determine a potential CCR pathway, and eighth grade algebra was identified as an indicator of readiness (Glessner et al., 2016). As student enrollment in middle school algebra increases in the district under study, advanced course offerings at the high schools will be expanded to accommodate the increased need as students matriculate to high school.

To provide strategies for student success in post-secondary opportunity knowledge and rigorous academic preparedness, middle schools in the district under study will provide students with opportunities to engage in rigorous coursework by utilizing a series of strategies outlined on the MTSS-CCR Framework (see Appendix B). Because culture and climate are unique to individual schools, strategies selected by one school leadership team may not be identical to strategies selected by another school leadership team. District leaders will coach school personnel to identify students by using a variety of academic and non-academic supports for interventions across the three domains while maintaining a focus on individual student desire and need. Educators in each school will collaborate to assess their own progress toward the goal of increasing opportunities for students to meet the eighth grade algebra CCR pathway indicator.

Culture

Middle schools in the district under study each serve unique geographic regions and communities. Because of the uniqueness of each school, it would not be beneficial for the district office to regulate how individual schools should address inequities in middle school algebra placement. School leaders and their leadership teams need to be the driving force in changing the culture of the school from one in which select students have opportunities to a well-rounded CCR education to one in which all students have access to CCR pathways through multi-tiered systems of rigor and support as is intended by ESSA, IDEA, and CCR guidelines. Fullan (2010) explained that new change starts with trusting relationships and with small adjustments in current behaviors before belief systems will change (p. 25). Schools will select the equity and access strategies with which their stakeholders will be most comfortable to provide new experiences in a relatively non-threatening environment. One school may choose to modify the master schedule by scheduling all sixth grade students into at least one advanced section while another school may elect to revise student course groupings to a more heterogeneous model in which students are grouped based on foundational skill sets, not by standards-based test scores. Both options allow for the school and community to feel a sense of ownership over the change.

Teachers have daily interactions with their school administrators. The administrators from the district office are distanced from the school environment, which limits opportunities to develop congenial and collegial relationships with teachers (Barth, 2006). Therefore, the school leadership team will be the driving force in aligning initiatives to identify strategies for student success with coaching support from the district office. A trusted individual from the district office will serve as an accountability partner for the school administrators, not in the sense of evaluation but in the role of a collaborative, instructional coach. Because the district administrator serves as a guide on the side, the school leaders and community stakeholders will experience the change and successes as their own and will communicate their learning and growth process to their peers. Principals will present their work to other principals, teachers will collaborate with other teachers, parents will also talk about what is happening at their school throughout the community and thus, buy-in will be achieved among stakeholders. Fullan (2010) explained that top-down change removes autonomy and grass roots change allows some to flourish and others to perish.

Conditions

Identifying students for middle school algebra occurred historically in the spring of the school year prior to placement in the district under study. Mok et al. (2015) found that mathematics growth decelerates over time and the rate of growth from grades 6-9 is slower than in grades 3-6. Because of this trend in growth, strategies to enhance foundational algebra skills should be introduced in the early grades to provide the opportunity to learn algebra by eighth grade to as many students as possible. Schools will utilize a leadership team or committee structure as described in the MTSS-CCR Framework to identify potential strategies to maximize student success and to provide intentional systems of support to aid in strategic acceleration through multiple math pathways.

Since algebra by eighth grade is a CCR pathway indicator, acceleration of more students to algebra will increase options for employment, enrollment, and enlistment (3E) after high school. The 3E pathway is student selected, but educator guided and supported. Educators will provide aligned, enriched, accelerated educational experiences in Tier I of the MTSS structure. Multi-measure assessment systems will be used to guide educators, community members, and families in modifying practice to maximize resources and supports.

Competencies

Change theorists and instructional leaders agree that communicating a clear focus and sense of urgency is instrumental when initiating change (Fullan, 2010; Kotter, 2012; Schmoker, 2016). Aligning federal and state initiatives to support CCR requires significant changes in educator and instructional leader actions. Building capacity in instructional leadership and pedagogical practices starts with trust and builds with coaching relationships and collaborative inquiry (Fullan, 2010). To break down barriers and advocate for all students, administrators and teachers will need support to understand that algebra is a CCR pathway indicator in the same capacity that third grade literacy is a CCR pathway indicator. Professional development will be provided in the three career pathways to illustrate how algebra in middle school provides access to a variety of career options. Educators, administrators, and the community will need to develop and strengthen a common cultural belief that all students deserve access to rigorous academics, student agency support, and instruction in post-secondary opportunities. Equal opportunity access to a well-rounded education is a civil right for all students regardless of race, ethnicity, or economic status (Cushing et al., 2019). Administrators and teachers will also need support to debunk the common myth that it is not appropriate to accelerate students when a student's basic mathematical skills are weak. Acceleration while remediating basic skills through repetition with rigorous content is acceptable and most appropriate (NCTM, 2014). Such changes require a school culture that celebrates change for the greater good and values diverse viewpoints (Heifetz et al., 2009).

Conclusion

Wagner et al. (2006) stated that as instructional leaders, "our core business is teaching, and our product is student learning. The only way to get better at our product is to get better at our core business" (p. 23). Isolating initiatives into separate entities is counterproductive to the goal of improving our collective practice. Middle school algebra acceleration practices in the district under study are a factor that is isolated from all other initiatives. The historical goal of middle school Algebra I acceleration has been to increase the school pass rate on the Algebra I EOC examination in order to increase the points earned on the state school accountability metrics. Student non-academic skills, college and career opportunity knowledge, and academic preparedness are not considered in a system that focuses on test scores and school grade results. Heifetz et al. (2009) contended that every system is perfectly designed to get the results that it does (p. 33). We must change the system to align initiatives if the goal of education is to provide all students with well-rounded educational opportunities to prepare them for future college and career pathways.

CHAPTER SIX

Strategies and Actions

In 1983, a commission to report on the quality of the nation's education system released a report titled, *A Nation at Risk: The Imperative for Educational Reform,* which described the apparent catastrophic state of the nation's schools. Although the report pushed the education platform to the top of the political agenda, very few reform movements that emerged had a lasting impact on public education like this report had, even after almost four decades since its release. Heifetz et al. (2009) described organizational and political changes as those that require persistence in developing the capacity of stakeholders to blend new norms and processes. These "adaptive changes can only be addressed through changes in people's priorities, beliefs, habits and loyalties" (Heifetz et al., 2009, p. 19). Kotter (2012) outlined an eight-step process for successfully implementing adaptive changes. I applied this process to my recommendation for alignment of educational initiatives to support middle school mathematics acceleration in the district under study.

Strategies and Actions

Change theorists often agree that the emerging phase of effective change involves clarity in focus and in establishing urgency (Collins, 2005; Kotter, 2012; Schmoker, 2016; Wagner et al., 2006). There is an ebb and flow quality to any change because of the social connections of those involved in the organization (Heifetz et al., 2009). Too often, leaders roll out new initiatives as solutions to problems without diagnosing the system as a whole or considering that adaptive change is not a linear process of inputs and outputs (Heifetz et al., 2009). Schools adopt the practice of analyzing inputs and outputs through state end of course examination results and state assigned school grade calculations. The sense of urgency in which this practice results is one of short term, unsustainable gains that focuses on increasing student achievement and enrollment in rigorous courses without considering the unintended consequences. In the process of establishing a sense of urgency, personalities and relationships within the organization should be carefully considered (Kotter, 2012). One of the greatest challenges in instituting change is navigating the external loyalties of stakeholders (Heifetz et al., 2009).

Establishing a Sense of Urgency to Align College and Career Initiatives

A sense of urgency is strongest when leadership has sufficient autonomy to develop passion and conviction surrounding a strong purpose for change (Sinek, 2009). Sinek (2009) explained that the “why” is purpose, the “how” is a description of how one thing is better than another, and the “what” is the process for the work. Leaders focus on the “how” when they provide data to highlight poor quality or lack of growth and expect that change will be welcome (Kotter, 2012). Sinek argued that the brain interprets such information as a threat to belonging which is counterproductive to developing urgency. The purpose for change must be concise and clearly communicated in a persistent manner by trusted individuals (Fullan, 2010).

District leaders who have established relationships with individual principals will initiate personal conversations with school administrators to communicate the “why” for implementing the college and career readiness-multi tiered systems of support (CCR-MTSS) framework. The purpose for change is (a) to align initiatives, (b) to identify and implement potential strategies for student success, (c) to assess indicators of CCR pathway readiness of enroll, enlist or employ the 3Es, which includes algebra completion in middle school, and (d) to provide the necessary supports to ensure resources are used to their fullest potential (English et al., 2016). Throughout at least one school year, district instructional leaders will visit classrooms throughout the school campus and assist with school functions and events regularly to develop trusting relationships with the teachers and staff. Fullan (2009) explained that when leaders have a strong moral purpose, the initial phases must be slow in order to accelerate the change later (p. 19).

According to the AVID Components of Excellence (AVID Center, 2020), developing school-level urgency must start with the principal of the school as the principal manages resources and is the first provider of systems of support, but it is imperative that teachers are included from the very beginning. District instructional leaders will collaborate with the school to establish school-level urgency through an inspirational training that addresses the purpose of focusing on 3E pathways, which asserts that every student deserves a 3E pathway to success, whether that path is employ, enlist, or enroll (English et al., 2016; Every Student Succeeds Act, 2015).

Students without a clear pathway or access to resources to select a pathway are more likely to drop out (Murnane, 2013; Rumberger, 2001). Sinek (2009) was clear that to develop authentic urgency at the grassroots level, the message must inspire and not simply motivate (p. 134). “Charisma has nothing to do with energy; it comes from a clarity of WHY. It comes from absolute conviction in an ideal bigger than oneself. Energy, in contrast, comes from a good night’s sleep or lots of caffeine” (Sinek, 2009, p. 134).

Creating a Guiding Coalition for Transforming School Cultures

People perform best in a culture that reflects their values and beliefs (Sinek, 2009). Kotter's (2012) second phase is a recommendation to put together a guiding coalition of individuals who possess four key characteristics: position power, expertise, credibility, and leadership (p. 59). The process of building a community of followers to develop and spread the initiative is described by Everett M. Rogers as the Law of Diffusion of Innovations (as cited in Sinek, 2009, p. 116). Rogers explained that 2.5% of any population will adopt a belief almost immediately if there is a strong enough purpose. After the innovators adopt a belief, 13.5% will follow shortly. The culture of an organization will shift to support the initiative when the 34% of the population who make up the early majority believe in the purpose of the initiative as illustrated below in Figure 28.

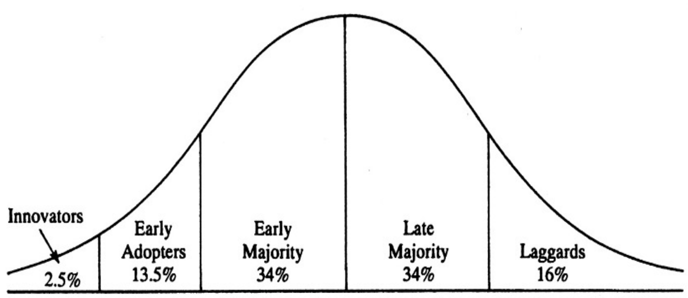

Figure 28. Rogers' Law of Diffusion of Innovations (as cited in Sinek, 2009, p. 116).

After the school-based training to communicate the "why" of preparing all students for a 3E pathway, the school and district administrators will establish a process for recruiting teacher volunteers who are not only innovators and early adopters, but also fit the profile of Kotter's guiding coalition. The AVID Center (2019) described this grade-level and horizontal interdisciplinary team of teachers and administrators as the AVID Site Team, which is charged with advocating for students by collaborating "on planning, logistics, and student access, and influenc[ing] school policy concerning access to rigorous curriculum and advanced courses at each grade level" (p. 101). However, the historical culture of the non-profit organization has led schools to support college readiness for a select group of students enrolled in the AVID Elective course as a Tier II support. While the authors of the recently published "AVID Components of Excellence" (AVID Center, 2020) outlined school-wide access to rigor and intentional systems of support for all students, the cultural trend of the AVID Center has been one of bolstering Tier II student skillsets to increase access to college. The guiding coalitions of each school will collaborate with their district instructional leaders to utilize the structural recommendations of AVID for the development of an interdisciplinary site team but will focus initial efforts on school-wide, Tier I capacity to prepare all students for college and career.

Hierarchical leadership tends to feel like a directive or micromanagement and grassroots, organic growth of an initiative creates a frustrating structure for some members of the organization to flourish while others perish (Fullan, 2010). "Peer interaction is the social glue of focus and cohesion" (Fullan, 2010, p. 36). Swanson, Mehan and Hubbard (1993) described a peer leader within the site team as a teacher who is academically knowledgeable, possesses the qualities of a coach, is well respected by the faculty, and has enough experience in the educational system to understand the structure and rationale for policies and initiatives (p. 10). Each school-based team will also select a teacher to serve as the site coordinator with the advice and consent of the school administrators. Fullan (2010) contended that systemic reform movements are successful when efforts to strengthen collective efficacy are employed. The intended result of moving toward initiative alignment is a cohesive school culture that is intently focused on preparing all students for a 3E pathway.

Developing a Vision and Strategy for Aligning Initiatives to Support CCR

Kotter's (2012) third step in leading change, developing a vision and strategy, requires the collaboration of the guiding coalition. The mission of the district under study is "Developing Successful Citizens – Every Student, Every Day" (citation withheld to preserve the confidentiality of the district). The most recent iteration of the AVID mission statement is "AVID's mission is to close the opportunity gap to prepare all students for college readiness and success in a global society" (AVID Center, 2020).

Mary Catherine Swanson was the teacher who founded AVID in 1980 in a California high school as a Tier II support for underprepared, ethnically diverse students who were enrolled in her school that year as a result of court ordered desegregation (Swanson et al., 1993). While her initial mission was to provide support to a select group of students, Swanson (1993) envisioned AVID as a system that merged the multitude of initiatives and their related plans for implementation into one cohesive site plan that guides schools toward "an excellent education for all children" (p. 12). I revisited Swanson's vision of initiative alignment while expanding the goal of college readiness for students to any one of the 3E pathways.

Sinek (2009) recommended starting with a clear, concise "why" to set expectations and to inspire, but the "how" of the work is planned and implemented by the guiding coalition. I serve the district under study through a variety of roles and one of those involves AVID. In this capacity, I conduct a training with the site coordinators from each school and district instructional leaders to instruct them on the three CCR skill domains identified by the College and Career Readiness and Success Center with definitions of the domains as described by AVID Center. I also provide the rationale for MTSS and Response to Intervention (RTI) as these systems were historically viewed as pathways to exceptional student education in the district under study.

The purpose of this training is to explain that the school site plan is the "how" and it is developed collectively by the site team with guidance from the coordinator and school administrators during the annual three-day AVID Summer Institute (SI) (AVID Center, 2020). The site team goals are revised throughout the year during monthly site team meetings. The AVID Coaching and Certification Instrument (CCI) is used as a guiding tool to develop the site plan vision with three clear goals and steps to operationalize the goals based on longitudinal school CCR and ESSA data. I provide data folders for each of the participants for the SI to guide them in their site plan creation.

The first AVID SI was a week-long collaborative professional learning and planning conference that was held at the University of San Diego in 1989 (AVID Center, 2020). Fullan (2010) described traditional one-day workshop trainings and site visits to other organizations as valuable, but "you can't get depth by visitation" (2010, p. 53). Swanson et al. (1993) described the ideal professional development as immersive, focused, and continual (p. 11). AVID SI is no longer a week-long institute.

The now, three-day immersive, focused professional learning, and structured creation of a school site vision and plan continues each summer. During SI, site team members participate in structured activities to create a vision for their school that is grounded in the four goals for a well-rounded educational experience as described by the College and Career Readiness and Success Center: (a) align initiatives, (b) identify and implement potential strategies for student success, (c) assess indicators of CCR readiness pathways, and (d) provide the necessary supports to ensure resources are used to the fullest potential.

Schmoker (2016) outlined five steps toward successful instructional leadership, which are (a) research, (b) reduction, (c) clarification, (d) repeated practice, and (e) monitoring (p. 15). After creating a common vision, site teams analyze their longitudinal CCR and ESSA data to strategically select three meaningful and manageable goals for their individual schools. As schools create their goals, I guide them to identify strategies that support students in completing algebra in middle school.

Since algebra is an indicator of CCR readiness, the site team must consider the educator actions that need to be developed to assist students in gaining CCR opportunity knowledge. Site team members should also consider educator actions that need strengthening to reinforce basic mathematics skills through repetition with rigorous content. Educators at the NCTM (2014) explained that tracking students by ability limits their potential for CCR pathway readiness and differences in student ability, background, and interest can be overcome with rigorous, effective instruction and differentiated supports (p. 65).

Heterogeneously grouped students based on specific skill needs instead of by state test scores allows teachers to maximize the instructional differentiated support systems they employ in their individual classes. Because schools maintain autonomy throughout this change process, some schools may elect to adjust their advanced course placement protocols sooner than others. Site teams utilize this information in conjunction with their school data to create the three goals within one or more of the AVID domains of instruction, systems, leadership, and culture during SI that aligns with and can be monitored throughout the school year via the AVID CCI.

Communicating the Change Vision Relentlessly and Consistently

The fourth step in Kotter's (2012) change model is to communicate the change vision. Because education is a uniquely personal and social profession, transformational leaders must take great care to continually assess and adjust strategy based on observable feedback and reaction without losing trust (Fullan, 2010, p. 66-67). Kotter explained that communication of the vision is most effective when the message is clear, concise and a variety of communication methods are utilized (p. 95). I coach site teams to spread the common vision of systems alignment to enhance college and career readiness pathways by reminding them to increase visibility of the 3Es for every student in all communication. I have used this strategy of guiding a school to brand themselves with their vision for the past two school years. One middle school adopted the phrase, "All means ALL." The principal allocated funds to purchase signs with the phrase and school mascot and hung them in visible areas throughout the school. The site coordinator worked with the site team members to post examples of employment, enrollment and enlistment in hallways, classrooms, on classroom door signs, and they converted trophy cases into 3E showcases. Student volunteers painted hallways with motivational messages and administrators posted achievement data and goals in central locations. The AVID elective class and site team members collaborated to create school t-shirts with the "All means ALL" phrase and the administrators updated the school website and all written communication to include the phrase. The school administrators actively encouraged faculty to post examples of opportunity knowledge, rigorous academic preparedness, and student agency on social media with the tag, #AllMeansALL. After only one school year, district leaders and community members could easily identify the school by name when I mentioned their key phrase. The transparency, repetition, and common language of the mission and vision helped the school leaders gain momentum towards system alignment.

Empowering Employees for Broad-Based Action Through Site Team Selected Educator Actions

Empowering employees for broad-based action is Kotter's (2012) fifth strategy in his eight-stage process for leading change. I use the Middle School CCR-MTSS Framework (see Appendix B), which was introduced in the previous chapter, to outline a template to guide site teams and their district instructional leadership support through this step in the process for leading change. In the section at the bottom of the framework, I included the Educator Actions outlined by the researchers at AVID Center (2020). Site teams use the Educator Actions to guide their work by breaking down barriers, insisting on rigor, aligning work, and advocating for students. The Potential Strategies for Student Success at the top of the framework provide suggestions for supporting student needs at the various tiers and categories in the multi-tiered system of support.

Site teams begin the work of breaking down barriers by meeting at least monthly to "collaborate and advocate on planning, logistics and student access, and influences to school policy concerning access to rigorous curriculum and advanced courses at each grade level" (AVID Center, 2019, p. 58). As site teams communicate the mission of equitable access to rigorous courses and the CCR pathway indicators are assessed, the site team determines whether more students should have access to algebra if their selected 3E pathway and student agency skills necessitate algebra course enrollment. Common suggestions for breaking down barriers to student access to algebra in middle school tend to follow the trends in historical literature regarding less successful algebra for all initiatives. Universal enrollment policies increase student enrollment without considering student agency, student post-secondary pathway awareness or mathematical foundational skill strength.

The curriculum and instruction leaders in the district office provide a differentiated template for mathematics acceleration with multiple pathways for student tracking to be adjusted throughout the middle school years. The traditional method for tracking students in the district under study required school administrators to identify students for the accelerated track prior to seventh grade. Based on the sixth grade math state assessment, a teacher-created placement test and teacher evaluation, students enrolled in sixth grade advanced math were either enrolled in seventh grade algebra or seventh grade advanced math.

The following year, the same cohort of students were enrolled in geometry or algebra. Students were frequently moved to a lower track but were not moved up to a higher track. Students on the regular math track could only take sixth grade regular math, seventh grade regular math, and eighth grade pre-algebra. Figure 29 illustrates the traditional mathematics acceleration tracks in the district under study.

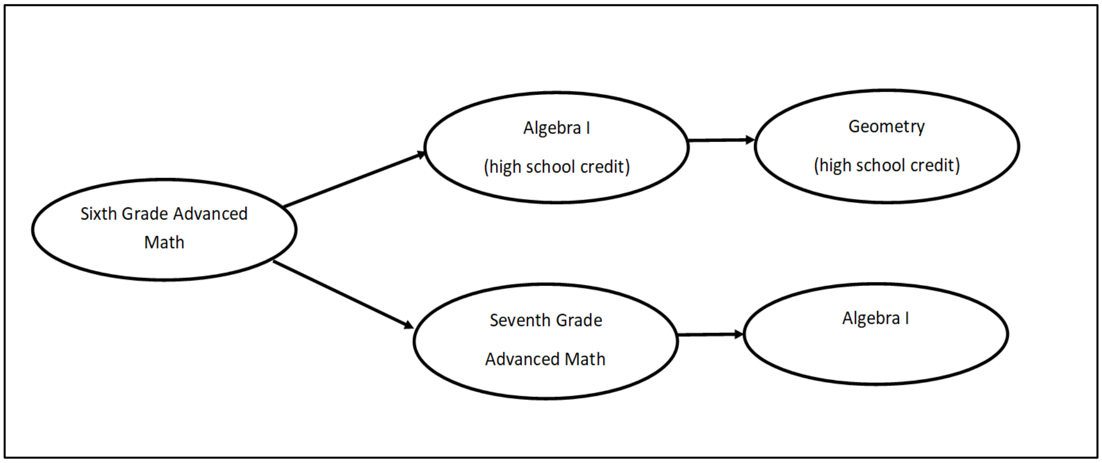

Figure 29. Traditional acceleration pathway in the district under study.

An alternate math track, demonstrated in Figure 30, allows students to have multiple pathways for acceleration. This track allows for acceleration based not only on academic preparedness, but also allows school leaders to consider student agency and opportunity knowledge. The pathway allows for additional supports through virtual instruction and brick and mortar classroom environments. Additionally, the alternate pathway allows for students and families to select a more rigorous math track initially and alter the pathway later without penalty of having students tracked into the lowest pathway for the duration of their secondary schooling experiences.

The new, accelerated tracking option requires school leaders to first create and establish a site team with a vision of eliminating obstacles to CCR for all students. Should the alternate math path be introduced before the culture of the school reflects a desire to help all students experience student agency, opportunity knowledge, and rigorous academic preparedness, the initiative to increase access to algebra may be interpreted as accelerating students beyond their ability levels.

On the alternate math pathway, sixth grade students who have a desire to accelerate, present evidence of strong student agency, and are knowledgeable of college and career opportunities may elect to accelerate if math academic skills in algebra gateway categories are sufficient enough to support concurrent enrollment in math courses. Depending on the structure and fiscal resources available at the school, students on this path will take sixth grade advanced math in the traditional classroom and seventh grade advanced math in another traditional classroom, through virtual instruction during the school day or outside of school.

Students will be monitored and counseled by a support professional such as an instructional coach, district virtual teacher, guidance counselor, or other adult mentor throughout the sixth grade concurrent enrollment. If a student, family, or mentor determines that the pathway is not an appropriate fit for the student's needs, the student will drop the seventh grade math course and continue with the sixth grade advanced math course without penalty. The following year, the student will be enrolled in seventh grade advanced math as is outlined on the traditional math pathway. If the student completes both math courses, the student will take the sixth grade state math assessment. The results of that test, student agency strength, and CCR opportunity knowledge will be used to determine appropriate course placement for the student's seventh grade year.

Two options exist on the seventh grade alternate math acceleration pathway: Algebra I, which is a high school course, or Pre-Algebra, which has been traditionally viewed as an eighth grade remedial course. Additional support in algebra readiness skills such as functions and Expressions and Equations are embedded in the eighth grade Pre-Algebra course. As is illustrated in Figure 30, the inclusion of Pre-Algebra as an accelerated option for seventh grade students slows down the math acceleration to best meet the needs of students and may also have an effect on school culture related to the perception of students enrolled in Pre-Algebra. No longer will the Pre-Algebra course represent remediation only. It will also be an option for acceleration.

Those seventh grade students enrolled in Algebra I will continue to Geometry in eighth grade, while seventh grade students enrolled in Pre-Algebra will progress to Algebra I in eighth grade. Any seventh grade students on the traditional math acceleration pathway course of seventh grade advanced math will also have the option to progress to Algebra I in eighth grade. The expansion of multiple accelerated pathways and inclusion of student agency strength and CCR opportunity knowledge as factors in determining acceleration allow for transparency of student needs and strengths. The school site team will be able to devise intentional systems of support to aid in strategic acceleration for the majority of middle school students when they are presented with information from pathway analysis. School leaders' use of this process will also support students in meeting a key indicator of CCR pathway readiness, which is algebra completion by eighth grade. Leaders of AVID Center also charge the site team and leadership team with assessing student access to rigor through analysis of the master schedule. "The master schedule reflects alignment of AVID and the school's mission and vision as evidenced by site policies and procedures that ensure all students access courses of high rigor" (AVID Center, 2019, p. 64). An alternate mathematics acceleration pathway is illustrated in Figure 30.

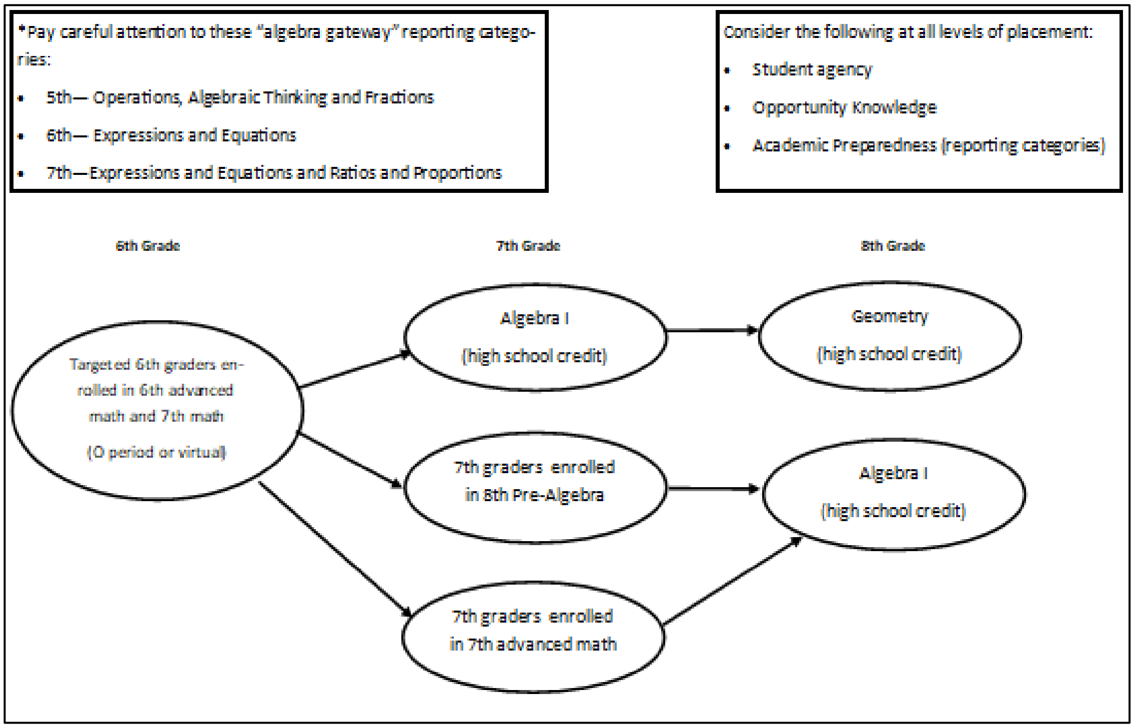

Figure 30. Alternate acceleration pathway.

School leaders' use of the MTSS-CRR framework allows for potential strategies for student success to be identified and implemented as educators on the site team work to insist on rigor for all students. School site teams create their school vision statement and site plan over the summer and continually meet to assess and revise the plan at least monthly throughout the school year. District instructional leaders guide school site teams toward selection of at least one instructional and one professional development goal. Professional development is designed to increase educator capacity in rigorous instruction techniques, social and emotional strategies, or cultural competencies such as increasing student knowledge of CCR pathways. Instructional goals are written with clarity to ensure teacher observers, administrators, coaches, and district instructional leaders can easily monitor and document the progress of the goal. District instructional leaders conduct classroom walk-throughs with school-based leaders and instructional coaches to calibrate on identifying quality instruction related to the site team goal. District leaders and instructional coaches also conduct instructional rounds at least once a semester in which small groups of teachers identify a focus goal, create a problem of practice related to that goal, and then observe volunteer classrooms with a trusted leader or coach facilitator (City, Elmore, Fiarman, & Teitel, 2009). The teacher observers identify trends related to the problem of practice and then present their findings to the site team. Individual teacher observation data is not discussed. The purpose of the rounds is simply to identify trends and discuss a plan of action for addressing the identified problem of practice. The site team analyzes documentation of progress during monthly meetings.

Stakeholders must consider strategies for supporting academic preparedness for all tiers in the MTSS-CRR framework. The strategies to support the academic achievement of students identified as needing interventions emerged from decades of research that highlighted differences in student populations and characteristics that contribute to the achievement gap (AVID Center, 2020). This perspective led instructional leaders nationally, as well as in the district under study, to focus on Tier II and III academic interventions within MTSS. "When the focus turns from learning 'outputs' (student achievement scores) to teaching 'inputs' (resources, experiences, and opportunities), one is forced to seek an explanation for our lack of progress in the system of schooling" (AVID Center, 2020, p. 2). The CCR-MTSS framework provides a structure for engaging in gap analysis exercises with the site team. Four site teams in the district under study recently analyzed their use of academic and non-academic supports in their schools and determined that Tier I practices should be bolstered across all three categories of CCR.

Each school site team plans, implements, and adjusts professional learning structures to support school-wide academic goals as outlined in the site team plan. Because a district instructional leader serves as one member of each school site team, the support from the Curriculum and Instruction Department is timely and authentic. District leaders collaborate monthly to discuss and employ strategies and structures for administrator and educator support in schools. School administrators receive on-going professional learning through monthly administrative meetings and targeted school walk-throughs. Site team coordinators also receive on-going professional development through monthly collaboration and training days held at host schools instead of at a district training site. Collaborative coordinator trainings are held at schools so the host site can share CCR celebrations with other schools in the district and to provide an authentic learning environment for the coordinators. The full day coordinator trainings consist of the host school collaborative CCR celebration presentation by the administrator and coordinator, communication of a problem of practice identified from school-based evidence collection, structured coordinator classroom visits followed by guided coaching conversations to provide new ideas for addressing the problem of practice, and an hour-long training module facilitated by district leaders.

Professional learning for rigorous academic preparedness is guided by the needs of the school and the strategic goals and on-going monitoring of those goals by the site team. District leaders provide guided support to teachers and administrators through lesson modeling and coaching, instructional planning collaboration, and discussion supported by current academic research. To support Tier I academic preparedness structures, the district curriculum and instruction team members initially focus efforts on rigorous literacy and critical thinking strategies embedded in all academic content areas. The team concentrates efforts on high impact instructional practices that reinforce foundational literacy and mathematics skills through repetition with rigorous content, rather than in isolation. The practice of isolation of skills leads to gatekeeper strategies that impede student enrollment into rigorous courses.

The CCR-MTSS framework is a school-wide, evidenced-based approach to align academic measures with the set of skills and dispositions students need for post-secondary success. In the district under study, departments at the district level operate in isolation of each other. Curriculum and Instruction, School Counseling and Assessment, Career and Technical Education (CTE), Exceptional Student Education (ESE), School Choice and Student Services each have strategic goals and expectations that school leaders and educators must navigate. The illusion of competing initiatives leaves school leaders in a position to address many goals with minimal impact on overall college and career readiness.

Schools utilize the CCR-MTSS framework and AVID site plan to develop annual goals to support student success. The alignment of systems is visible to school teams since each of the departments at the district office is represented in the tiered strategies for success and through the educator actions. Garnering support from the various departments in the district presents a challenge. Aligning systems and streamlining initiatives is logical, but to force alignment without considering the individuals who work in the departments could be detrimental. Heifetz et al. (2009) explained that adaptive changes, such as the alignment of department initiatives, have the greatest potential to threaten the success of a system but impact the organization the most. District departments have the potential to lose some autonomy when merging goals and initiatives with other departments. Therefore, the movement to align initiatives at the district level must be carefully considered and strategically planned.

Just as creating a guiding coalition at the school level requires starting with "the why," building support among district departments requires the same dedication to communicating purpose. The district department alignment will take time and care to develop as the district leaders may lose independent authority by collaborating. Political alliances at the district office are also defined and developed over an extended period of time. Heifetz et al. (2009) explained that "no stakeholders operate solo. They have external loyalties to people outside their group and to the people behind the ideas that matter to them" (p. 93). For these reasons, it is imperative that the school site teams with teacher-initiated vision and goals are established prior to developing a district site team that extends beyond the reach of the Curriculum and Instruction Department.

As school site teams strengthen with district instructional leaders' support, goals on the site plans expand beyond strategies for rigorous academic preparedness and include strategies to develop students' skills in opportunity knowledge and student agency. Opportunity knowledge strategies include initiatives that are central to the CTE, School Counseling, and School Choice departments. Student agency strategies include initiatives that are central to the work of School Counseling, CTE, ESE and Student Services. As strategies are included and implemented in the schools, district instructional leaders from the Curriculum and Instruction department continue guiding site teams to communicate the vision while highlighting CCR celebrations on their campuses.

A school in the district under study that was successful with this approach invited well-respected community business partners to speak to the student body about career opportunities and the importance of soft skills. Members of the school site team took pictures and videos during the event and posted them to their school social media sites with their vision #AllMeansAll. During school celebrations, community members, parents, and district leaders from the related departments were invited to the events, which were also publicized on social media and highlighted through the district Public Relations Department. The authentic *why* was communicated, not from a district standpoint, but from the school level, which eliminated some of the perception of stepping on toes or traveling outside one's lane.

As initiatives are aligned organically, district leaders in the Curriculum and Instruction Department will begin to share CCR-MTSS framework and site plan strategies with connected departments and invite leaders in those departments to professional learning experiences including the annual AVID SI. Constant communication of purpose in a non-threatening format will blend the departments to work towards the same goal of college and career readiness for all students. Effective lasting change will emerge from purposeful peer interaction, non-judgmental capacity building, and transparency of data and practice (Fullan, 2010).

Through implementation of the CCR-MTSS framework, the site team meets monthly to monitor CCR structures and school policies and advocate for all students. As the site team assesses indicators of CCR defined by the College and Career Readiness and Success Center, they identify specific strategies for their school that provide necessary supports for success if Tier I strategies are not sufficient enough to support a student's college and career readiness. Potential Tier II strategies should support the student's needs within the CCR-MTSS framework and continue to be monitored by the site team. Suggested strategies to support the middle school CCR readiness indicator of middle school algebra completion include, but are not limited to, providing students with opportunities to learn about career pathways that require math knowledge to increase student opportunity knowledge, enrollment in the AVID academic elective, or adjusting the master schedule to allow for a double-math intervention to support academic preparedness, and increasing structures of collaboration in mathematics classrooms to support student agency skills.

Finally, empowerment of employees requires transparency in funding sources to assist site-teams in streamlining conversations with district departments. Cushing et al. (2019) described the complementary roles of federal policies and programs in providing students with a well-rounded education to prepare them for the workforce. Each federal program serves a specific purpose but is designed to align with the college and career readiness categories of student agency, opportunity knowledge, and academic preparedness (Cushing et al., 2019).

The ESSA requires states to implement academic standards and to support CTE learning for in-demand jobs and to create systems to measure progress toward those requirements. State leaders monitor progress towards ESSA requirements via the state school grade calculation models for the district under study. Title I, Part A does not require career awareness activities, but school leaders can allocate Title I funds to assist students in awareness of pathway options by developing individualized pathways for students through career counseling programs or other postsecondary transitional interventions.

Since Title I is focused on improving the achievement of disadvantaged students, funds can also be allocated to provide academic intervention supports such as credit recovery, funding the AVID elective, or providing additional academic intervention programs. Title II funds are intended to be used for recruiting and training high-quality teachers, principals, and other school leaders. Therefore, the federal grants manager can allocate Title II funds for professional learning experiences designed to improve instructional strategies as well as integration of CTE content into academic practices. Professional learning experiences funded through Title II can also include training on local workforce needs and postsecondary transition strategies (Cushing et al., 2019). Title IV supports content-rich programs to enhance student learning during and beyond the regular school day. Content can be science, technology, engineering, and mathematics (STEM) based, include CTE integration, and can be utilized to build career competencies and career readiness (Cushing et al., 2019).

The goals and expectations of Perkins V require integration of employability, academic, and technical skills throughout CTE, as well as within core academics. Perkins V promotes the inclusion of rigorous academic coursework in CTE programs and instruction (Cushing et al., 2019, p. 4). The Individuals with Disabilities Education Act (IDEA) requires a free, appropriate education with full opportunity in the least restrictive environment be provided to students with disabilities. Students with disabilities have an Individualized Education Program (IEP) that parallels to CCR indicators with the inclusion of post-secondary transition planning and employability skills goals to support economic self-sufficiency for students at the secondary level. As schools and districts grapple with competing initiatives, transparency in policy goals and funding sources will align efforts for college and career readiness to maximum efficiency.

Generating Short-Term Wins Through Cycles of Continuous Improvement

The sixth strategy for leading change is generating short term wins (Kotter, 2012). Each school site team creates their three high-impact goals and plans for implementation for the school year. Data is collected to measure progress toward each of the goals, and the site team meets at least monthly to assess progress and determine a plan of action. Coordinators are coached to start all site team meetings and whole faculty meetings with public celebrations related to the school goals. Celebrations for schools may include increased student attendance, increased student enrollment in rigorous coursework, equitable demographic representation in rigorous courses, CTE completion, or evidence of student authentic use of notetaking or study strategies in classrooms.

District leaders support their school site teams by celebrating successes during classroom walk-throughs. The leaders leave notes with positive praise related to the school site team goals for classroom teachers as they exit each classroom. Checking progress of and celebrating site team created goals allow the team to determine if their initial goal was meaningful and attainable. Teams can revise the goal, if necessary, and adjust supports and data collection measures. Each summer, the site team analyzes goals and data from the previous year to celebrate successes and creates new site plans for the upcoming year.

Consolidating Gains and Producing More Change Through Long Term Goals

The seventh stage in the change process is consolidating change and producing more change (Kotter, 2012). Kotter (2012) describes outstanding leaders as those willing to think long term (p. 150). Celebration of short-term wins provides momentum but should not cause change to stall. In this stage, the site team celebrates and then revises goals to create more change. The AVID CCI is a guiding document that is used to create site goals during the summer institute and is revisited throughout the year as a continuous improvement reflective document during monthly site teams. The site team and leadership team communicate the CCI indicator ratings to the faculty and site team throughout the school year. Additionally, the school coordinator, school-based leaders, and district leaders collaborate annually to complete a three-year goal for each of the three categories of the MTSS-CCR framework.

The site team analyzes goals through a gap analysis activity to develop short term checkpoints for each of the goals. The site team and leadership team collaborate to use the gap analysis document to provide longitudinal focus on strategies to increase academic preparedness, opportunity knowledge and student agency for all students. The short term annual goals of the site team extend into a long-term plan as schools strive to earn CCI indicator ratings within the highest levels of the rubric for each of the four domains—instruction, systems, leadership, and culture.

Anchoring New Approaches in the Culture of Trust

The eighth strategy for leading change is anchoring new approaches in the culture (Kotter, 2012). Aligning initiatives to provide access to students for opportunities to learn through systems of rigor and support are only effective if the culture of the school shifts to prioritize student access to CCR readiness pathways. In the district under study, school leaders have been transferred between schools each spring. Principals are reluctant to take on change projects because of the uncertainty of their positions. The school district leaders will no longer transfer school-based leadership teams until the team has had the opportunity to serve at a school for at least five years. After five years, district leaders can determine if the school community would benefit from a change in leadership, but at no point will an entire leadership team be transferred in the same school year. Principals cannot establish credibility and trust with a faculty if leadership transitions occur too quickly (Melnyczenko, 2014). Lasting cultural change is grounded in trust (Covey, 2006).

Conclusion

Decades of research have done little to move the needle on equitable access and college and career readiness success for students. Efforts to close the achievement gap have focused on student learning attributes and in bolstering academic measures of success, but college and career readiness extends beyond core academics. The strategies and actions that should be employed to expand advanced course enrollment require the district and schools to share a common vision that is grounded in the four goals of college and career readiness: to align initiatives, identify and implement strategies for student success, assess indicators of college and career readiness pathway indicators, and to provide the necessary supports to ensure resources are used to the fullest potential. School leaders, district leaders, educators, and community members should work collaboratively toward the goal of providing tiered supports to students in the areas of student agency, post-secondary opportunity knowledge and rigorous academics.

Aligning college and career readiness initiatives to identify and implement strategies for student success is a social, legal, and moral imperative.

CHAPTER SEVEN

Implications and Policy Recommendations

In the district under study, the practice of limiting students' opportunities to learn middle school algebra was culturally ingrained as acceptable practice since the course was initially offered at the middle grades level. In the 2015-2016 school year, only 19% of middle school students in the district successfully completed a middle school algebra course compared to 32% of middle school students in the state who completed the course (citation withheld to protect the confidentiality of the district under study). The rationale was that not all students were prepared for algebra nor was it necessary to take the course in middle school. That belief was reflected as a trend in teacher and administrator interview responses for this study.

The national educational priority has traditionally been to prepare students for high school graduation. In the past two decades, the target has extended beyond graduation to prepare students for post-secondary education and workforce success (Carnevale, Smith, & Strohl, 2013). Culturally, districts and schools have faced challenges in adjusting to the shift in focused efforts on bolstering the education to workforce pipeline. The district under study has an established Career and Technical Education (CTE) department that rivals those of comparable districts in course offerings and community visibility and support. However, the CTE staff has operated as a parallel department to traditionally academic departments such as Secondary Curriculum and Instruction and Exceptional Student Education. This division of the work led to disconnected district initiatives and strained resources.

Policy Statement

At the core of any district improvement policy should be concerted efforts to leverage opportunities within ESSA for a well-rounded education, multiple strategies of support and embedded college and career readiness (CCR) indicator checks. The policy I recommend is to leverage the Every Student Succeeds Act (ESSA) guidelines to support the Individuals with Disabilities Act (IDEA) and Perkins V by aligning federal policy through the combined implementation of the AVID school-wide model and the college and career readiness-multi tiered systems of support (CCR-MTSS) Framework (see Appendix B). Because of the political implications of a widespread change initiative to align district systems, I recommend that the implementation of the Advancement Via Individual Determination (AVID) school-wide model with the CCR-MTSS Framework be initiated cautiously and strategically. Not all middle schools will begin the process at the same time. The change process will start slowly, with four carefully selected schools attempting to align school systems through a modified implementation of the AVID system. AVID, as a system to align the work between 6-12 education and college for students in the elective course should be expanded in the district under study to align systems of support for all students to be college and career ready. The AVID elective is communicated and implemented as a Tier II support in the district under study to avoid competing with CTE courses and to insure strategic placement in the master schedule at schools. All other aspects of the AVID system, such as Response to Intervention (RTI) and Positive Behavioral and Intervention Supports (PBIS), are implemented school-wide and are communicated through the CCR-MTSS framework. In the district under study, school leaders should not have the option to initiate AVID as only an elective course initiative.

Change of this magnitude must start at the school level and organically spread to the district office and community as a shift in culture, not as a mandated change. As school site teams strengthen and short-term results are realized, additional schools will likely request to be part of the change. Four middle schools were initially selected to implement AVID school-wide in their schools. In the second year of this study, two additional middle schools requested to include the CCR-MTSS framework and AVID system in their schools. Alignment between ESSA and CCR policies will inform and align systems to strengthen the education to workforce pipeline. The result of such alignment will be visible longitudinally through ESSA assessment measures and K-12 CCR accountability indicator results, one of which is middle school algebra success.

Analysis of Needs

This program evaluation started as an investigation into advanced mathematics course placement policies at the middle school level. The focus on course enrollment and related assessment results was in line with the focus at the state level to analyze educational quality through student test results. Through an analysis of the findings and current literature, I realized that the foundation of tracking protocols emerged from isolated interpretation of federal educational policies when each policy was written with the intent of complementing the others. Additional literature strongly supported an alignment of systems to identify and support student needs in three areas: student agency, opportunity knowledge, and rigorous academic preparedness. The role of educators in supporting the needs of students was mentioned in recent AVID Center publications

(2020) but the identification of potential strategies and connection to MTSS have not been addressed in the literature. My study fills a gap in the literature by recommending a policy to leverage ESSA guidelines to support CTE, IDEA, and AVID through an MTSS framework.

Educational analysis. ESSA requires states to annually assess school progress based on several indicators: percentage of students proficient in math and reading on statewide assessments, achievement growth from year to year on statewide assessments, four-year adjusted cohort graduation rate, percentage of students making progress toward English language proficiency, and an additional indicator of student success (U.S. Department of Education, 2016). The flexibility in selection of additional indicators of student success granted to states under ESSA was not available under the No Child Left Behind (NCLB) act.

The shift to accountability systems that are relevant to individual states allowed for inclusion of purposeful assessment systems that have the potential to provide meaningful results toward tracking progress related to postsecondary student success. Hein, Smerdon and Sambolt (2013) identified the following academic indicators of post-secondary success in the middle grades: passing all English Language Arts (ELA) and mathematics courses and meeting proficiency benchmarks on state examinations, taking rigorous coursework throughout the middle grades, and completion of Algebra I by the completion of eighth grade (p. 6). The following non-academic indicators were also identified: having less than 20% absenteeism throughout the middle grades, receiving no unsatisfactory behavior grades in the sixth grade, showing evidence of social and emotional decision making skills, and remaining in the same school through the middle grades (Hein et al., 2013, p. 6).

Prior to implementing the recommended policy to align systems, student predictor indicators were reported and addressed by individual district departments. An alignment of systems through the combination of AVID school-wide and the CCR-MTSS framework would streamline the focus of strategies to support students in all academic and non-academic readiness indicators. Educator actions across all academic and non-academic proficiencies could be identified to better support students.

Economic analysis. By aligning district initiatives to streamline CCR pathways, additional supports should be provided to students to increase middle school access to rigorous coursework. When schools utilize the CCR-MTSS framework in conjunction with the AVID system, gaps in student academic and non-academic needs would be visible, allowing school site teams to leverage support strategies more efficiently. The alignment of systems and collaboration of teachers and administrators to work toward common goals would lead to increased student agency, post-secondary opportunity knowledge and rigorous academic preparedness. Subsequently, more students would have sufficient mathematics foundational skills and self-efficacy to have the opportunity to learn algebra by eighth grade. Carnevale, Smith and Stohl (2013) explained that while the knowledge domains of communication, coordination, and analysis are reported as the most valued employment skills, mathematics knowledge is rated as “very important or extremely important to success” in 70% of all occupations (p. 9).

Increasing student access to the CCR success predictor of Algebra I course completion in middle school will inevitably increase the ability of the students in the district to select one of the 3Es: employ, enlist, or enroll, which will positively impact the local economy. More of the population will be employed in stable careers, which will decrease the crime rate and the need for county services to support those in poverty. If access to CCR pathways for students are unavailable because supports for developing student agency, rigorous academic preparedness and opportunity knowledge are limited, students are more likely to drop out of school and experience the reality of the school to prison pipeline (AVID, 2017; Heitzeg, 2009; National Association for the Advancement of Colored People, 2005).

An alignment of district initiatives will positively impact professional development opportunities and community engagement through the integrated use of federal funds available through ESSA, Perkins V, and IDEA. Each of these three federal laws identifies alignment opportunities to support student development in rigorous academic preparedness, student agency, and post-secondary opportunity knowledge. ESSA (2015) funds may be utilized to support collaborative instructional professional development on the integration of academic, technical, and employability skills for CTE and general education instructors. ESSA funds may also be used to instruct counselors and educators on local workforce needs, to provide STEM integrated instruction, to help students develop relational capacity, and to develop rigorous, interdisciplinary content supports for general academics and CTE courses.

Perkins V (2018) funding must be used to train educators, administrators, or guidance counselors in strategies to integrate academic and CTE content. Perkins V also allows for the use of funds to train educators on local workforce needs and career pathways. Funds are based on local needs, which must be reassessed every two years.

IDEA funds support services in the general education classroom as well as in specialized facilities. Funds can be used to provide supports for transitional strategies and to provide professional development to teachers on how to facilitate successful workforce transitions for students. At the district office, fiscal responsibility requires effective communication between and alignment of departments to maximize human capital, financial and learning resources.

Social analysis. The egalitarian belief of schooling has been long debated in the public education sector. State-sponsored "separate but equal" policies that were initially upheld by Plessy v. Ferguson (1896) were overturned by the landmark Brown v. Board of Education of Topeka (1954) with a unanimous decision that segregation of students based solely on race was in violation of equal protection under the law provided by the 14th Amendment to the Constitution (1868). Public school districts across the nation implemented desegregation of schools with varying degrees of compliance which resulted in federal involvement in those instances. According to the state Advisory Committee to the U.S. Commission on Civil Rights (citation withheld to protect confidentiality of the district under study), the district under study operated under a federal court order to integrate schools from 1978 until unitary status was granted less than 15 years ago (citation withheld to protect confidentiality of the district under study).

Since efforts to integrate schools in the district under study were forced, equity and access disparities naturally transferred from school building access to course of rigor access. Domina et al. (2017) argued that schools act as social mirrors of the communities in which they serve by employing sorting mechanisms that maintain racial categories and privilege barriers without explicit reference to race. Ayieko (2018) stated that high quality mathematics instruction should be viewed as a civil right for all students because of the role math serves as a gatekeeper for enrollment in advanced courses in high school. This rationale also applies to student success on college entry examinations such as the Scholastic Aptitude Test (SAT) and the American College Testing Assessment (ACT), the probability of success on technical industry certifications for CTE and the Armed Services Vocational Aptitude Battery (ASVAB) high category scores necessary for highly sought after career fields in the armed forces. The implementation of policy to align systems and provide multiple layers of support for student academic and non-academic needs holds promise for students with racial and socioeconomic gaps. Students from disadvantaged backgrounds and those who face structures of racial inequality benefit more from exposure to additional support structures than their relatively advantaged peers (Domina et al., 2017).

Political analysis. Systems alignment in the district under study would require all departments to actively collaborate and operationalize a common mission and vision: to prepare all students for college and career readiness. The CTE department has garnered the support of various community organizations and is a well-established and uniquely active partner with the local chamber of commerce. Perkins V funding for the district rivals that of other comparable districts in the state. The allocation for the district under study was approximately $125,000 more than one comparable district in size and demographic and approximately $250,000 more than another district (citation withheld to protect confidentiality). CTE department staff members frequently address the school board with CTE celebrations, and the local media lauds the CTE director's efforts to publicize career pathways with the well-known, local question to students, "What's your E?" (citation withheld to protect confidentiality).

The work of the department is congruent with the mission of a systems alignment policy; however, support systems to capture all students are lacking in the current CTE initiative. Academic and student agency indicators were not addressed in the work of the CTE staff at the time of this study. Additionally, high school students were targeted to identify their 3E pathway, according to the department Career Planning Guide. Because foundational skills are explicitly taught well before a student's entry into high school, providing career counseling and support at the high school level is too late. The CTE director has expended much effort to develop workforce committees in the district office and within the community. Efforts to align systems to include the beneficial work the CTE department has initiated must be continued with great caution to balance academic opportunities for students.

Legal analysis. The reauthorized federal legislation, ESSA and Perkins V and IDEA, have been revised to align goal descriptions and funding to support the common goal of preparing students for workforce readiness through student agency, opportunity knowledge, and rigorous academic preparedness. The goals highlighted in the state Department of Education Strategic Plan (2015-2020) were: "Goal 1, Metric 3: Closing the Achievement Gap" and "Goal 2, Metric 3: Access to High-Quality K-12 Educational Options" (citation withheld to protect confidentiality). These goals support the rigorous academic preparedness aspect of CCR initiatives, but opportunity knowledge and student agency categories are not addressed. The state strategic plan goals were designed to reward school districts for accountability measures that focused on only academic achievement. To a large degree, high school and college outcomes are predictable results of decisions made for students when their first academic assessment is taken when they are nine years old. The linear focus on academic outputs is the very system that perpetuates the tracking mechanisms that may be more detrimental to the very students the policy was intended to help.

According to the state Principal Leadership Standards for the district under study, an instructional leadership priority for school leaders is to:

> initiate and support continuous improvement processes focused on the students' opportunities for success and wellbeing; and, engage faculty in recognizing and understanding cultural and developmental issues related to student learning by identifying and addressing strategies to minimize and/or eliminate achievement gaps. (citation withheld to protect confidentiality)

School leaders are charged with not only attending to academic needs of students but are also to engage in a cycle of inquiry for all aspects of student success and well-being. The state leadership standard is reflective of the overarching goals of my systems alignment policy.

Moral and ethical analysis. The ethic of justice is usually the center of court opinions and legal principles. In the school, the ethic of justice means that "every parent, teacher, student, administrator must be treated with the same equality, dignity and fair play" (Shapiro & Stefkovich, 2005, p. 13). Although the ethic of justice played an important role in overturning "separate but equal" legislation, systems for maintaining an imbalance in educational opportunities were created and readily accepted. Critiquing the ethic of justice allows for discourse that challenges social inequities such as the practice of tracking students (Shapiro & Stefkovich, 2005). The blend of student agency, opportunity knowledge, and rigorous academic preparedness in the CCR framework focuses on the needs of the whole child. The inclusion of educator actions to align work, break down barriers, insist on rigor and advocate for students in the CCR-MTSS framework highlights the role of adults in making student CCR pathways straight.

Implications for Staff and Community Relationships

The policy to align district initiatives through a CCR-MTSS framework is an adaptive change that requires members of the organization to experience some sense of loss (Heifetz et al., 2009). Since school districts are social systems where culture is tenacious and the status quo is naturally preserved, empathy, care, and flexibility must be employed to operationalize my recommended policy to align systems. This particular policy has the potential to impact multiple departments at the district level and to significantly restructure the way of work for secondary schools. Managerial strategies to implement new policies are guaranteed to be ineffective; therefore, time must be spent on building trust, then in building the capacity of the site teams at the schools. Recruitment of additional district leaders to support schools will be through casual conversation about site plans and results will initially and gradually evolve to solicit assistance in a more supportive role for the schools.

I will recruit additional departments at the district office through gradual, repeated conversation and through sharing experiences with the schools. Trainings and meetings will only result in surface level understanding and increase the potential for a feeling of loss (Heifetz et al., 2009). Site teams and school leaders should recruit key community members and parents to join the school site teams. Strong site teams comprised of a variety of stakeholders will be able to communicate the goals and short-term wins of the policy change to other district personnel, the school board and the community. Flexibility in communication and implementation at the school level is also important. Since each school is unique in culture, strategies for supporting schools and in communicating the urgency of the goals must also be unique to their needs.

Conclusion

The CCR-MTSS framework is a social justice policy that provides a systemic approach to engage in continuous analysis and improvement of fair and equitable instructional opportunities, non-academic skills support, and post-secondary pathway knowledge for students. American schools have structured social inequalities by sorting students into tracking mechanisms that have intergenerational effects. School leaders also have the potential to redistribute resources, social and emotional support, and quality educational experiences. Community culture plays a significant role in the opportunities afforded to students, and cultural beliefs and actions are tenacious and serve to maintain the status quo. Implementation of my policy requires district leaders to demonstrate a culture of care and develop trusting relationships with school leaders, educators and staff. District leaders must exercise patience and flexibility with school leaders and site teams to align district initiatives and systems to prepare all students for college and career success.

CHAPTER EIGHT

Conclusion

The purpose of this program evaluation emerged from observation and personal experience that student access to algebra in the middle grades was limited. I focused on quantitative and qualitative measures to investigate student characteristic trends in middle school algebra courses. The disparities in student demographic composition and similarities of teacher and administrator perspectives on student enrollment practices were congruent with historical trends in educational social justice research.

Educational equal access and opportunity have been at the forefront of political policy and litigation since glaring disparities in equal opportunities to learn were argued first in Mendez v. Westminster (1946) and eight years later in Brown v. Board (1954). Since then, policy and equity initiatives have resulted in integrated opportunities to learn in the physical school building which have often been accomplished as a result of federal intervention. Deeply rooted, culturally engrained ideals aid in maintaining educational inequities and disparities in educational access transferred to course access enrollment which is most notable in advanced math course access in middle school. Such tenacious beliefs require more than policy and accountability. They require persistent cultural supports for educators to debunk deficit views of students. All students deserve well-rounded educational opportunities that prepare them for college and career readiness and success.

Discussion

The purpose of this study was to investigate the characteristics of students selected for enrollment in middle school algebra over three academic years. Additionally, through this study I compared administrator and educator perceptions of students' progress toward advanced mathematics foundational skills and state assessment results. I completed investigations by using the state EOC assessment reporting category results (2017-2019), administrator and teacher interviews and student course enrollment and completion demographic data.

The findings from this study suggest that over three school years, there was an increase in the percentage of eighth grade students enrolled in algebra, but the End of Course (EOC) examination results illustrated stronger student knowledge in one of the three reporting categories. The reporting category trends also showed that while the mean scores increased overall, the variance in distribution of those scores also increased which points to the possibility that instructional methods and quality remained the same although the student demographic was more heterogeneous than in previous years.

While aligning the findings to the literature, I found a disconnect between federal policy surrounding equal educational access and district policies for advanced mathematics enrollment. Schools in the district were granted autonomy to determine student placement protocols without district oversight. Gatekeeping policies such as placement testing and teacher recommendations for enrollment into algebra were commonplace. Students faced barriers to gain access to advanced mathematics, and they could be easily removed from the course throughout the school year if the teacher perceived that the student was not ready academically or if the teacher felt the student did not have the desire or work ethic to learn. Once students were placed in a lower academic track, they often remained there throughout their secondary school experiences where the academic climate decreased with fewer learning opportunities, less experienced teachers, and less rigorous academic expectations (Wheelock, 1992). High quality mathematics instruction can be viewed as a civil right because economic opportunities are limited when students lack the skills to gain access to college, score well on armed forces career fields assessments, or to complete vocational certification examinations (Cushing et al., 2019; Domina et al., 2017; NAACP, 2005).

Nearly two decades of research on mathematics placement suggest student success in advanced courses in middle school could be improved by considering student self-efficacy and the student's desire to attend college (Reyes & Domina, 2017). Student academic engagement has also been found to be influenced by parent educational level, parent socioeconomic status and parent ability to understand the importance of mathematics (Matthews & Farmer, 2008). A compilation of the student factors that contribute to student success in courses of rigor highlight student agency, opportunity knowledge, and rigorous academic preparedness as equally important in determining an appropriate course placement.

Leaders at AVID Center (2020) explained that decades of discussion have contributed to supports that were designed to close the achievement gap by addressing student factors, but educator perceptions and actions play a significant role in student opportunity and access. Teacher perception of student ability has a profound impact on student desire to learn and self-efficacy (Galanti, 2019). Other educator actions addressed within the research were gatekeeping processes that often lead to the exclusion of students from marginalized backgrounds (Faulkner et al., 2014) and the impact of low-quality teacher content knowledge and pedagogical practices (Telese, 2012). Educator factors that contribute to the levels of student mathematics success include creating barriers, providing less rigorous instructional practices, and denying rather than advocating for student access.

Current federal policy provides opportunities for alignment of district systems to advance equity practices holistically. I broadened the theme for this program evaluation from middle school algebra access to include social justice reform for all academic subjects and non-academic skills and dispositions. Hargreaves and Fink (2006) explained that justice in education is working toward a collective goal in schools that contributes to the common good in the community. Under the Every Student Succeeds Act (ESSA) (2015), districts and schools are provided guidance in preparing all students for college and career readiness and success. ESSA includes descriptions of well-rounded academic experiences, guidance on resource allocations, includes definitions of accountability measures and provides provisions for career ready integration of agencies to align initiatives.

Without clear focus and collegial conversation, systemic improvement cannot occur. Advancement Via Individual Determination (AVID) Center (2020) developed a career and college readiness (CCR) model that had strong foundations in the CCR organizer published through the College and Career Readiness and Success Center. AVID's (Avid Center, 2020) model combined the student CCR factors of student agency, opportunity knowledge and rigorous academic preparedness with desired educator actions of insisting on rigor, breaking down barriers, advocating for students, and aligning the work. AVID's traditional focus has been on providing academic and non-academic supports to select students within the school who are enrolled in the AVID elective. The goal for the AVID elective students is to become college ready by graduation. The stance of the non-profit organization, AVID Center, has been that as the selected students' successes are publicized throughout the school, other teachers will become interested and the cultural change will happen naturally. My experiences as an educator in three schools that had AVID classes contradicted that premise. In all three schools, AVID felt exclusionary, and after 15 years, none of the three schools have expanded to school-wide implementation.

I serve as an administrator in the central office in the district under study. When we introduced AVID to several schools in the district under study, district leaders presented a clear message that AVID school-wide was imperative to provide college and career readiness experiences and supports to all students. While AVID Center communicates that AVID elective students should work toward the goal of college enrollment, the district leaders modified this message for the schools in the district. AVID schools in the district under study support all students to gain access to one of the three Es – enroll, enlist, employ. This change in mission was strategic. Heifetz et al. (2009) explained that the longer a system has resisted change, the more difficult it will be to initiate adaptive change.

Several departments in the district under study were successful with their individual initiatives. CTE leaders were strategic in meeting the goals of Perkins V and worked to garner significant support from the community. The support for CTE ranged from human capital assistance to financial backing through the referendum passed in 2018 to expand vocational programs. CTE leaders developed the 3E initiative in high schools. To gain support for AVID at the district level, as well as with schools, I capitalized on the already established 3E message and altered the goal of helping students become college ready to include preparing students for the additional post-secondary pathways.

Leaders in the School Counseling and Psychology Services Department provided training and support to schools for youth mental health. Leaders in the Exceptional Student Education (ESE) and Student Services Department provided consistent guidance on multi-tiered systems of support (MTSS), Positive Behavior Interventions and Supports (PBIS), and increasing student opportunities by analyzing Least Restrictive Environment (LRE) data. Through this study, I realized that the relationship between AVID and CTE could be expanded to include additional departments. ESSA can be leveraged to align the goals of Perkins V and the Individuals with Disabilities Education Act (IDEA) (Cushing et al., 2019). Morningstar et al. (2018) explained that MTSS models largely address academic goals, PBIS focuses on behavioral goals, and CCR models encompass both academic and non-academic student skills. The authors suggested merging the models of MTSS, PBIS, and CCR to support student skills across several categories including transition competencies, mindset, and perseverance (Morningside et al., 2018). Since the AVID CCR model had already been communicated to schools, and it was congruent with the 3E message from CTE, I combined the skill categories described by Morningside et al. to align with the CCR categories of student agency, opportunity knowledge and rigorous academic preparedness to create the CCR-MTSS Framework (see Appendix B).

Since the initial year of the study, one of the schools in the study implemented AVID school-wide, developed a site team of no less than 20 members that meets bi-weekly to engage in collegial conversation about goals, and expanded their network of supports and professional learning to include families and the community. This school also had a CCR vision that was evident throughout the culture of the school. Students talked about college and career pathways and requested advanced, high school credit classes, and Pre-AP courses on course selection sheets.

The recommended policy to align systems through a CCR-MTSS framework in conjunction with AVID school-wide implementation does not explicitly impact the initial issues raised in the program evaluation. Through careful observation of already established district systems and relationships, strategic alignment of initiatives, and clear systems of support will address the initial issue of middle school algebra access. The system of barriers put up to combat change could be demonstrated through personal reactions, compliance behaviors or isolation (Wagner et al., 2006). My ultimate goal was not in devising a policy based on theory alone, but to strategically implement small changes in culture and behavior with persistence.

Leadership Lessons

As I reflect on the program evaluation, several leadership lessons come to mind. The first lesson involves feelings of loss when change is eminent. Cultural changes that require a shift in vision cause people to experience feelings of loss when they feel the new work does not appear to represent their values or perspectives. Educators and administrators need to trust the change agent and need to believe in the purpose for the change before any action toward implementation can take place. Covey (2006) explained that there are four cores of credibility, which are integrity, intent, capabilities, and results (pp. 56-57).

The author argued that even before establishing a sense of urgency or a guiding coalition and vision, the foundation of trust must be established. I took this lesson on establishing trust and Fullan's (2010) advice to "attend to the new relationships that have to be developed" (p. 18) to slow down the change process, develop relationships, and then applied strategies to start with the "why" (Sinek, 2009). I was strategic in selecting the change theorist as a model for conversations with schools. I observed *Start with the Why* (Sinek, 2009) and *Leading with Focus: Elevating the Essentials for School and District Development* (Schmoker, 2016) on the bookshelves of forward-thinking principals and district administrators. By using the language with which they were familiar as a starting point, I established some credibility before I attempted to implement my policy.

A strategic mission and vision are the foundation for academic focus among all stakeholders in the district. Without a mission and vision statement or goal, the direction of the district is unfocused. District office leaders implement their own initiatives without direction or collective purpose. Communication among stakeholders is non-existent or weak, and information is shared only with those who have a political or historical connection to those who make the decisions. The goals of the district were fragmented and exclusively focused on outputs. State test scores, graduation rates, and teacher evaluation scores were the primary indicators of student success. Focusing efforts for improvement on system outputs placed attention on disjointed goals. What was deemed essential in one department was not addressed in another and schools felt the burden of competing masters. These qualities resulted in a district operating under a culture of fear instead of a culture of care. Shifting the focus to be on inputs such as empathy and capacity building for educators and students changes the conversation to focus on potential strategies for meeting a variety of needs and away from a dangerously competitive one.

Another lesson I learned was that coaching requires an element of judgmentalism to build collective capacity. Through this program evaluation, I observed some leaders in the district present the message that judging practice is wrong because leaders are too quick to implement change. Other leaders I observed argued that if leaders are not honest in feedback, practice will remain stagnant. Fullan (2010) argued that both viewpoints are true. “Judgmentalism means perceiving something that is not working and wittingly or unwittingly conveying a negative or pejorative message” (p. 46). Fullan recommended collaborating with stakeholders through the change by maintaining a focused goal and through “purposeful peer interaction, capacity building and daily work with a focus and use on transparent data” (p. 52). I work with teachers and administrators by assisting and modeling strategies, providing professional development, and walking classrooms to leave positive praise daily. Trust is not maintained without constant demonstration of the four cores of credibility, which are integrity, intent, capability, and results (Covey, 2006).

Conclusion

Despite the egalitarian spirit of schools, they operate in a way that reinforces the culture of the community. In the district under study, categorical sorting mechanisms transferred from schoolhouse access to curriculum and resource barriers even after federal interventions. Policies and practices were ingrained in the cultural fabric of the community. To take steps toward socially just changes, a culture of care and empathy toward the district, as a whole, was needed to align systems of support while leveraging ESSA goals and resources. An emphasis on social justice and in improving instruction will be met with resistance if the leader initiating the change has a culturally neutral position in the district. Although hierarchical position may give a leader authority to make necessary decisions, if trusting relationships had not been previously developed, the changes would be perfunctory.

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Appendices

Appendix A: Interview Questions for District-Based Administrators, School-Based Administrators, and Teachers

Appendix B: Middle School CCR-MTSS Framework to Support a Well-Rounded Educational Experience

Appendix C: Strategies and Actions Chart

Appendix D: As-Is Chart

Appendix E: To-Be Chart

Appendix A: Interview Questions for District-Based Administrators, School-Based Administrators, and Teachers

1. What factors should be considered when enrolling students in Algebra I Honors or Geometry Honors in middle school?
2. What do you believe is the long-term academic impact on a student who is enrolled in Algebra I Honors or Geometry Honors in middle school?
3. What do you think is the long-term social or emotional impact on a middle school student who is enrolled in Algebra I Honors or Geometry Honors?
4. Do you have any other opinions regarding mathematics acceleration that you would like to share?

Appendix B: Middle School CCR-MTSS Framework to Support a Well-Rounded Educational Experience

Potential Strategies for Student Success			
	Student Agency	**Opportunity Knowledge**	**Rigorous Academic Preparedness**
Tier 1 Suggested Supports	• Individualized student learning plans • School-wide mentoring (e.g., staff, or peer mentoring) • School climate student/family and teacher perception surveys • Student participation in and tracking of extracurricular activities • Use technology resources as a collaboration tool • Use structures for collaboration engage in work with peers (e.g., Jigsaw, Four Corners, Rally Coach) • Peer critique and mentoring • Student portfolios • Rising sixth grader summer camp week	• Student-directed progress monitoring • Enroll, Enlist and Employ (3Es) pathways communicated (e.g., Future Fridays, 3E Spirit Week) • Person-Environment Fit considered to determine accelerated track placement • Service-learning opportunities • Communicate the CCR mission and vision to all stakeholders • Project based learning • STEAM • Early career assessment interest and skills inventory through (e.g., My Career Shines) • 3E pathway schedule planning with guidance counselors • Attend Career and College Expo • Attend Magnet Expo • Magnet shadow days at high schools • School-business partnerships through district Career Education Facilitators (CEF) and the Chamber and Economic Partnership (CEP) • Career Club	• PSAT for eighth graders included on district middle school assessment plan (use to create individualized student learning plans) • Collaborative Study Groups (CSGs) during Student Success Time • School-wide access to rigorous coursework and CTE courses to explore 3E pathways • Rigorous literacy and critical thinking strategies embedded within academics • Reading, writing, speaking and listening strategies embedded within all core academics • Use structures for inquiry (e.g., Socratic Seminars) • School-wide academic challenges or competitions
Tier II/III Suggested Supports	• Early warning systems • Check in/Check out with guidance • Additional academic elective to support social, emotional and study skills (e.g., AVID) • Social and emotional counseling groups • Peer mediation • Self-directed Individualized Education Program	• Outreach to hard-to-reach families • Parent liaisons advocate for students and families • Parent workshops and support during "Car Line School Advisory Council" meetings • Additional academic elective to explore careers and establish a 3E goal (e.g., AVID) • Long term tutor/mentor support (e.g., AVID tutorial volunteers to Take Stock in Children mentors for high	• Co-teaching in core academics • Instructional accommodations • Tutoring afterschool through 21st Century Program • Credit recovery with mentoring as a drop-out prevention strategy • Additional academic elective to support individual academic needs (e.g., AVID)

	(IEP) planning • Peer mentoring support for diverse social engagement (e.g., Best Buddies)	school) • Cultural liaisons for families • Peer mentoring support for social engagement (e.g., Best Buddies)	• Assistive technology for access to content • Small group instruction • Expand access to at least one rigorous course (advanced, honors, pre-AP, high school credit bearing) • Summer support (e.g., AVID Summer Bridge, Algebra Bootcamp)
Educator Actions			
Advocate	• Create a grade-level vertical and horizontal team to meet regularly to address CCRS domain work and assess progress (e.g., AVID site team) • Professional development in multiple pathways to postsecondary opportunities for students		
Align Work	• Create and utilize a strategic plan to align the work and engage in a continuous improvement cycle (e.g., School Improvement Plan, AVID site plan) • Develop partnerships with local businesses and organizations (e.g., public education foundation, local chamber and economic partnership, local business partners) • Create few, specific, high impact goals to build upon longitudinally • Professional development in cross-disciplinary connections and critical thinking application of skills		
Break Down Barriers	• Communicate the mission of equitable access to CCR repeatedly and consistently to all stakeholders (e.g., 3E's, "Scream the Theme" in the school, branding school via social media) • Ensure the master schedule supports courses of high rigor (advanced, honors, Pre-AP, AP/IB/AICE/Dual Enrollment/CTE PLTW) • Professional development on individualized learning plans to provide targeted and intensive interventions		
Insist on Rigor	• Plan, implement and adjust structures to support school-wide rigorous academic strategies • Monitor, coach and provide professional development that is tightly aligned with the strategic plan instructional focus		

Appendix C: Strategies and Action Chart

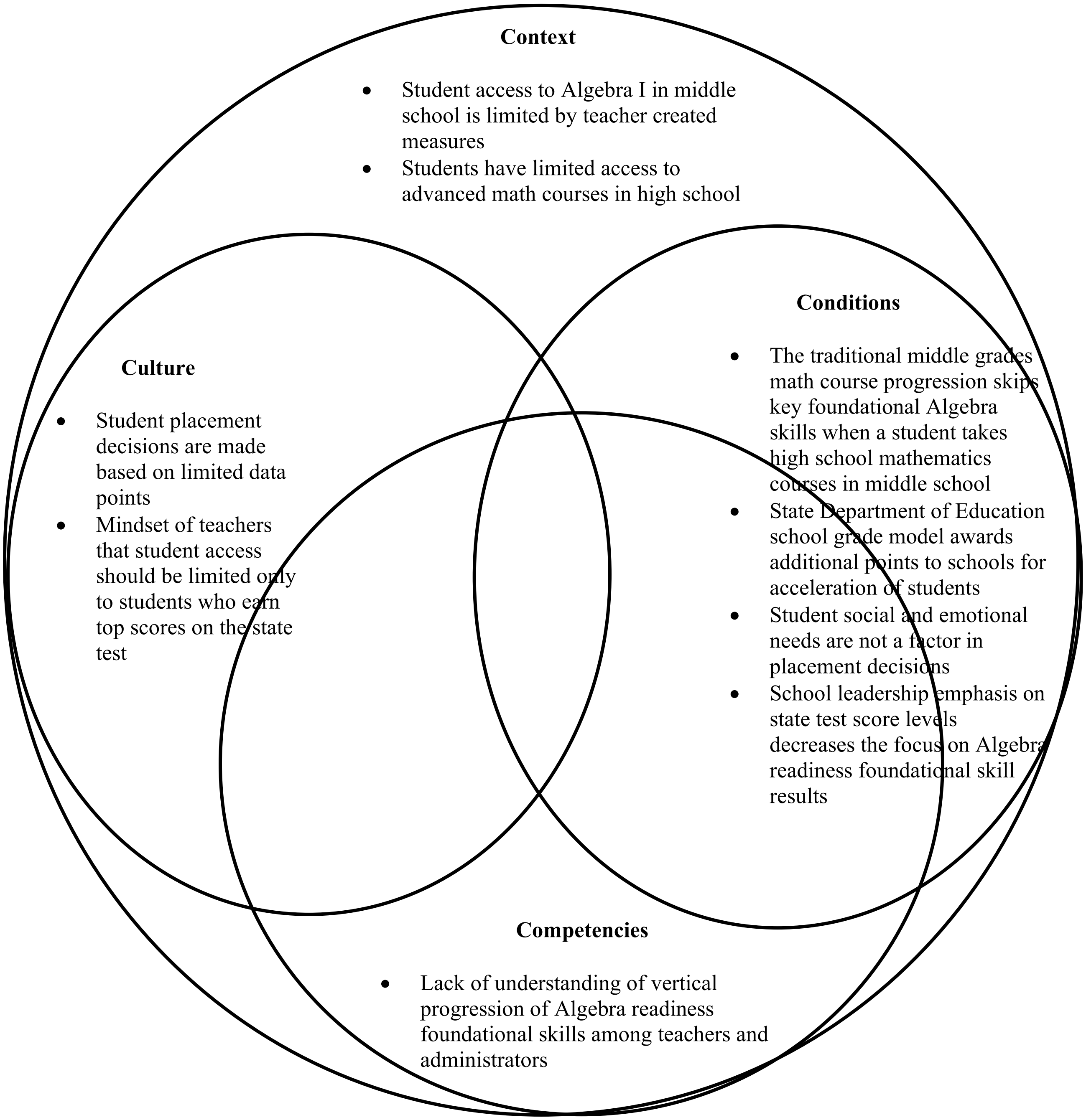
Strategies	Actions
Establishing a Sense of Urgency to Align College and Career Initiatives	• District instructional leaders build credibility and trust with school leadership and faculty • District leaders, site leaders and teachers participate in a training to establish their "why"
Creating a Guiding Coalition for Transformation of School Cultures	• Identify interdisciplinary site team participants from teacher volunteers • Selection of volunteer site coordinator • Inclusion of district instructional leader on school-based site team
Developing a Vision and Strategy for Aligning Initiatives to Support CCR	• Team creates the vision grounded in the four goals of the College and Career Readiness and Success Center • School site team creates site plan with three meaningful and measurable CCR goals at Summer Institute
Communicating the Change Vision Relentlessly and Consistently	• Transparency of vision communicated throughout the school by utilizing a branding strategy • Public transparency of vision communicated through social media, public relations, and community interactions

Empowering Employees for Broad-Based Action Through Site Team Selected Educator Actions	• Site teams identify and implement strategies to:
	  ○ Break down barriers
	  ○ Insist on rigor
	  ○ Align the work
	  ○ Advocate for students
	• Communicate transparency of federal initiative goals and aligned funding sources to inform the work

Generating Short-Term Wins Through Cycles of Continuous Improvement	• Monitor site goals via the continuous improvement cycle • Start all communication with celebrations aligned to the goals
Consolidating Gains and Producing More Change Through Long Term Goals	• AVID Coaching and Certification Instrument progress monitoring and revision of goals annually • Gap analysis activity utilized to create a long term success guide
Anchoring New Approaches in the Culture of Trust	• Establish school leadership placement longevity to maintain credibility and trust

Appendix D: As Is 4 Cs Analysis for Middle School Acceleration Models, Mathematics

"As Is" 4 Cs Analysis for Middle School Acceleration Models - Mathematics



Appendix E: To Be 4 Cs Analysis for Middle School Acceleration Models, Mathematics

"To Be" 4 C's Analysis for Middle School Acceleration Models - Mathematics