ABSTRACT

Title of Dissertation:	UNDERREPRESENTATION OF BLACK STUDENTS IN HIGHER LEVEL SECONDARY MATHEMATICS COURSES: AN ANALYSIS OF THE IMPACT OF REMOVING QUALITATIVELY INFERIOR MATHEMATICS COURSES ON STUDENT ENROLLMENT, COMPLETION, AND ACHIEVEMENT
	Joseph A. Sutton, Doctor of Education, 2025
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This dissertation investigates the underrepresentation of Black students in higher-level secondary mathematics courses within Calvert County Public Schools (CCPS). The study addresses the persistent opportunity gap between Black and White secondary students, a disparity historically perpetuated by district practices that tracked Black students into lower-level mathematics courses. In response, a district initiative—guided by principles from the National Council of Teachers of Mathematics (NCTM) and supported by a small group of committed district staff—sought to increase Black student enrollment in advanced mathematics courses. The initiative aimed to enhance mathematical achievement and literacy, both of which are critical for future academic and career success.

Employing a quantitative descriptive, ex post facto design, the study analyzed administrative data from CCPS on course enrollment, completion, and achievement (primarily SAT Mathematics scores) for freshman cohorts from 2006, 2011, 2016, and 2021. Additionally, an online survey was administered to all high school mathematics teachers to gather their perspectives on the district's decision to eliminate certain lower-level high school mathematics courses—Prealgebra, Intermediate Algebra,

Algebra III, and Business Math—beginning 2014. The study examined both the impact of these course eliminations and the evolution of teacher perceptions over time.

Key findings indicate that the removal of these courses was associated with increased access to Algebra II and subsequent University System of Maryland (USM)-approved post-Algebra II courses, particularly for Black students, increasing from 51% of Black students earning credit for Algebra II to 79% and increasing from 22% of Black students earning credit for a USM-approved post-Algebra II course to 69% over the two decades. Moreover, Black students demonstrated a significant increase in SAT Math scores relative to their Reading scores and to the Math scores of the overall student population, with cumulative average annual increase rates of 4.2%, 9.6%, and 13.9% respectively at the 400+, 500+, and 600+ levels, compared to 1.7%, 3.6%, and 3.3% for the full population, suggesting improved achievement outcomes linked to increased access to rigorous coursework. Teacher perceptions, initially skeptical of the course eliminations, shifted positively after reviewing data showing increased enrollment and achievement among Black students.

These findings have important implications for educational policy and leadership. They suggest that systemic course restructuring can be an effective strategy for addressing racial disparities in mathematics education. The study contributes to the broader understanding of how intentional policy changes can promote equity and expand opportunities for historically underserved student populations in CCPS, across Maryland, and potentially in other districts nationwide.

UNDERREPRESENTATION OF BLACK STUDENTS IN HIGHER LEVEL SECONDARY MATHEMATICS COURSES: AN ANALYSIS OF THE IMPACT OF REMOVING QUALITATIVELY INFERIOR MATHEMATICS COURSES ON STUDENT ENROLLMENT, COMPLETION, AND ACHIEVEMENT

by

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Preface

I entered the field of education when I realized I enjoyed helping my fellow aerospace engineering majors with their homework more than doing my own. Calculating forces and loads on trusses, bridges, or wings didn't ignite my passion the way seeing someone's face light up at a moment of understanding did. From that realization, I set out to live a life centered on being as helpful as possible to as many people as I could. I feel incredibly fortunate to have spent my career doing just that. In the beginning, I didn't realize how much I didn't know. Looking back, I may have even strongly disagreed with the knowledge I now hold about how best to support learning for the next generation before I began this mission of learning as much as I can to help as many as I can. Today, I understand how much I'll never fully know—and I find that both humbling and uplifting. It means I'll always be able to do what I love most: learn.

This dissertation and the journey toward my doctorate have mirrored that same humbling and uplifting experience. Over the past eight years, I've grown significantly in wisdom, knowledge, skill, and confidence as an educational leader. And it truly has been a journey. I've raised four children—who were between the ages of one and eleven when I began—while balancing roles as a math supervisor, church president, travel soccer parent, travel soccer coach, and doctoral student. I restarted my dissertation after the pandemic made my original study unfeasible, navigating the highs and lows of writer's block and frustration. And I became a caregiver to my wife, Cathy—previously the picture of health—after she suffered a major stroke. This chapter of my life has been extraordinary, and I will always treasure it.

The work described in this study was challenging to sustain. Working in a smaller, rural school district, there was no office of accountability telling us we needed to do this work. Federal and state accountability measures end at the Algebra I level, with no external measures revealing narratives or driving priority until the AP level. And my district was already high-performing, regularly scoring in the top five statewide on state testing proficiency rates. There was no external pressure to meddle but my team, driven by a call to improve our system to best meet the needs of all students, learned, inspected, corrected, and supported throughout. From Bush to Obama to Trump to Biden to Trump again, from NCLB to RTTT to ESSA to ESSR, and from MSA and HSA to PARCC to MCAP, and from a landscape wherein equity was a districtwide focus to a current landscape where elected officials are questioning whether diversity, equity, and inclusion (DEI) efforts are a pendulum that has swung too far, the team had to maintain a singular commitment and focus to solving a relatively-invisible problem of failing to help some of our students reach their potential.

That the results of my study affirm the work we've been striving to do fills me with joy and hope. I'm proud that this research can contribute meaningfully to the efforts of others. This work has become a defining part of my legacy as Supervisor of Secondary Mathematics for Calvert County Public Schools. As I reach the end of this journey, I do so with immense pride, deep gratitude, and a profound sense of accomplishment, and a sincere hope that it can help inform others to take on similar challenges in their own districts.

Dedication

This dissertation is dedicated to the most fun, courageous, fun-loving, justice-oriented person I've ever met, my love, inspiration, and best friend, Cathy Sutton.

Acknowledgements

The work of this dissertation would not have been possible without the support of my critical friends, who include Julie Morrison, Sarah Noland, Sheila Rohde, Margo Gross, Dawn Caine, Jen Ontko, Bridget Dunbar, Debbie Ward, Andrew Paulson, Abby Neumeyer, my Quaranteam of Caitlin Fregelette, Dave Fregelette, Charles Morgan (who supported me most and was most excited to read the final copy), Cathy Sutton, my four children Aubrey, Eliza, Cate, and Ryan, and all of the others who have pushed and challenged me to think, learn, and grow. My doctorate and dissertation could not have happened without my many peers and teachers doing this work alongside me. I would not be in a position to do my work without the guidance and support of my professors throughout my academic journey—earning a B.S. in Mathematics, an M.A. in Curriculum and Instruction, a graduate certificate in Assessment and Evaluation, and now a doctorate in Educational Leadership and Policy Studies, all from the University of Maryland, College Park, as well as a graduate certificate in Educational Administration from McDaniel College. And this work would not be what it is by any stretch of the imagination without my advisory committee at the University of Maryland: Douglas Anthony, David Imig, Christine Neumerski, Andrew Brantlinger, and especially my very patient and supportive advisor, Margaret J McLaughlin.

I would not be who I am today without the supervision and mentorship of Helena Nobles Jones, Susan Johnson, Jackie Jacobs, Mike Watson, and Scott McComb. I would not have considered teaching math in the first place if not for my teacher, supervisor, and role model, Mark Wilding. And I wouldn't be here today without the sacrifice, dedication, and love of Mom and Dad. I love you all for the impact you've had on helping me get here and I can't wait to find out what's next!

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List of Abbreviations

Abbreviation	Full Term
AP	Advanced Placement
CCPS	Calvert County Public Schools
CCSSO	Council of Chief State School Officers
CCSSI	Common Core State Standards Initiative
CRT	Culturally Responsive Teaching
CSA	Causal System Analysis
ESSA	Every Student Succeeds Act
HSA	High School Assessment
IRB	Institutional Review Board
IT	Information Technology
MCAP	Maryland Comprehensive Assessment Program
MLT	Mathematics Leadership Team
MSDE	Maryland State Department of Education
NAEP	National Assessment of Educational Progress
NCES	National Center for Education Statistics
NCSM	National Council of Supervisors of Mathematics
NCTM	National Council of Teachers of Mathematics
NGA	National Governors Association
NRC	National Research Council
PARCC	Partnership for Assessment of Readiness for College and Careers
PII	Personally Identifiable Information
PISA	Programme for International Student Assessment
PtA	Principles to Action
SMP	Standards for Mathematical Practice
TIMMS	Trends in International Mathematics and Science Study
SEL	Social-Emotional Learning

SY	School Year

Section 1: Introduction

Introduction to the Problem

There is little disagreement that mathematical literacy is a worthwhile aim for schooling. Mathematical ability opens future career opportunities for individuals in both STEM and non-STEM fields, and a high level of mathematical literacy within a community enhances economic and global competitiveness. Mathematics is considered important enough to be one of two subjects, along with English/Language Arts, which must be assessed and reported annually for every student in the United States from 3rd to 8th grade and at least once in high school (Every Student Succeeds Act [ESSA], 2015).

Much attention has been given to improving mathematics outcomes in the United States, as ten other countries consistently have higher averages than American students. More troublingly, all but one country (Türkiye) have a smaller achievement gap between their highest and lowest performing students, as measured by the 2019 administration of the Trends in International Mathematics and Science Study (TIMSS) (National Center for Education Statistics [NCES], 2019).

Despite many efforts to eliminate achievement gaps among groups of students in the US, gaps in mathematics performance have persisted according to various measures. For example, in 2000, the average score on the math section of the Programme for International Student Assessment (PISA) for White students was 518 points, compared to 416 points for Black students in the United States. In 2022, the average score for White students was 498 points compared to 412 points for Black students. Further evidence of the math achievement gap between White and Black students in US schools comes from the National Assessment of Education Progress (NAEP), the US report card on student achievement. Though performance of both groups have improved significantly since the 1970s, over this time the average mathematics score for White students in grade 8 has been approximately 32 points higher than the average mathematics score for Black students (SD = 40) (McFarland et al., 2019). The most recent NAEP

8th grade math scores from the 2022 administration show that almost two-thirds of students in the Black student subgroup scored Below Basic (see Table 1). Maryland, the state in which the proposed study will be conducted, showed similar results for Black 8th grade students.

Table 1

2022 NAEP Math National Results by Race

Jurisdiction	Race/ethnicity	Average Scale Score	Below Basic	Basic	Proficient	Advanced
National	White	285	26%	38%	26%	9%
	Black	253	62%	29%	8%	1%
Maryland	White	289	24%	35%	29%	12%
	Black	250	64%	27%	7%	1%

National Center for Education Statistics. (n.d.). NAEP Data Explorer. Retrieved from https://nces.ed.gov/nationsreportcard/naepdata/ On January 30, 2023

Disaggregation of math assessment data at local, state, and national levels continues to reveal that Black students are consistently overrepresented among lower scoring student groups. This dissertation will focus on the longstanding math achievement gap between high school Black students and their White peers in one school system in Maryland. Specifically, it will examine the impacts of changing the mathematics course pathway in four high schools as a partial solution to address the math underachievement problem. This initiative was prompted by the school system's efforts to improve the achievement of Black secondary students by enhancing their educational experience.

The focus on Black students does not imply that math achievement gaps do not exist for other student groups within the school system. It is likely that the initial data and the impact of changes made on students who are Hispanic, Multi-racial, economically disadvantaged, multilingual, or have disabilities will be similar. However, the emphasis on Black students stems from the initial conversations and priorities set by our school district, which identified this group as a critical area of concern.

The Problem of Low Math Achievement and Lack of Opportunity among Black Students

In the following sections, I present national, state, and local data supporting the scope of the problem of lower math achievement and course enrollment data highlighting the lack of opportunity. Research has identified multiple factors contributing to lower math achievement overall, as well as potential solutions. These factors include the quality of curriculum, quality of teachers, quality of instruction, and student factors such as prior success in mathematics and dispositions like mathematical efficacy and identity.

Moreover, additional factors specifically impact Black students. One significant area is access to advanced courses. It has become common to refer to students from historically underachieving groups, including Black students, as “underserved students,” reflecting the notion that the achievement gap is largely a function of an opportunity gap (TNTP, 2018). The National Council of Teachers of Mathematics (NCTM) defines an opportunity gap as differential access to high-quality teachers, instructional opportunities, grade-level content, and high expectations for mathematics achievement (NCTM, 2011). The NCTM and others (Corcoran & Evans, 2010) recognize that the opportunity gap disproportionately impacts Black students, is a major factor contributing to achievement disparities, and is something schools can and must address. Additionally, research indicates that schools serving predominantly Black students often offer fewer advanced mathematics courses. This disparity is attributed to systemic issues such as underfunding and educator bias (Darling-Hammond, 2004). In an influential piece, Ladson-Billings argues that the focus on "achievement gaps" is too narrow and fails to account for the broader, systemic inequities—what she terms the "education debt"—that have accumulated over generations due to historical, economic, sociopolitical, and moral injustices (Ladson-Billings, 2006).

Teacher and educational stakeholder bias and cultural competence also disproportionately affect Black students. With a general awareness that students from underserved groups are more likely to struggle, stakeholders sometimes lower expectations in well-intentioned efforts to reduce the burden on students, inadvertently lowering their competence and achievement. This lack of understanding, along with a lack of culturally responsive teaching practices such as elevating relevance, discourse, and critical thinking, can lead to educational experiences that are off-putting and dehumanizing. These practices are more likely to be missing from classes perceived as designed for struggling students.

Another factor is students' mathematics identity, which can be negatively influenced by societal stereotypes and classroom experiences (Roberts & Almeida, 2023). These stereotypes can lead to stereotype threat, where the fear of confirming negative stereotypes about their racial group adversely impacts their performance in mathematics (Johnson, 2023). Additionally, differences in instructional practices and teacher expectations further exacerbate these challenges, as Black students often do not receive the same quality of instruction as their peers (Johnson, 2023). Addressing these issues requires a comprehensive approach that includes culturally responsive teaching—such as incorporating students' cultural backgrounds into mathematical problem contexts, validating multiple ways of thinking and problem-solving, and fostering classroom environments where all students feel seen, respected, and capable—and efforts to build positive mathematics identities among Black students (Roberts & Almeida, 2023).

Scope of the Math Achievement and Course Enrollment Problem

In the following sections, I present national, state, and local district math achievement and enrollment data.

Evidence Through National Achievement Data

As noted earlier, mathematical proficiency in the United States, or the relative lack thereof, has been a much-discussed educational topic. The National Assessment of Educational Progress (NAEP)—a set of subject matter assessments administered periodically in the United States since 1969—provides valuable data on student achievement across various groups. There are many encouraging signs of progress over time, including improvements in Black student performance (NCTM, 2014; NCTM, 2024), even with the pandemic-related declines seen in recent assessments.

For example, the percentage of fourth-grade students demonstrating proficiency on the NAEP rose from 13% in 1990 to 36% in 2022, while the percentage of eighth-grade students demonstrating proficiency increased from 15% to 26% over the same period (NCES, 2024). In the most recent administration in 2022, only 32% of American eighth-grade students performed at or above the Proficient level. The overall average score among all eighth-grade students was 274, compared to the Black average score of 246. This 28-point gap—approximately a standard deviation—has been a consistent trend since 1990 (NAEP, 2017).

From 1990 to 2022, the mean SAT Math score increased from 501 to 521, representing a 20% standard deviation increase (College Board, 2022). The number of students taking Advanced Placement Calculus examinations increased fivefold from fewer than 80,000 in 1982 to over 375,000 in 2021. Similarly, the number of students taking Advanced Placement Statistics examinations increased more than twentyfold, from 7,667 in 1997 to 184,111 in 2021, with many more students now earning the highest possible scores than once took the test (College Board, 2013b; College Board, 2021a).

However, despite this progress, the average NAEP mathematics scores for White 9- and 13-year-olds remain approximately one full standard deviation higher than the average scores for their Black counterparts. Moreover, the overall average mathematics NAEP scores for 17-year-olds have remained stagnant from 1973 to 2012 (NCES, 2013). Among 15-year-olds from 79 countries that participated in the 2022 Programme for International Student Assessment (PISA), the United States ranked 31st. Only 20% of American students reached the top two scoring levels, compared to 28% worldwide and 24% in Canada (NCES, 2022c; OECD, 2022).

The Trends in International Mathematics and Science Study (TIMSS) is an international assessment that allows comparisons of student progress across countries. Administered every four years since 1995, TIMSS has a scoring range of 0–1000, scaled with 500 established as the average score during the first administration and 100 points as the standard deviation. In 2019, the average score among eighth-grade students was 511 points, while Black students averaged 466 points, half a standard deviation below the aggregate.

Evidence Through National Math Course Enrollment Data

Black student math achievement scores have consistently been lower than the aggregate on multiple assessments throughout this data review, and Black enrollment in advanced math courses has also been lower. The NAEP assessment, in addition to reporting achievement levels, publishes transcript data. In the 2022 NAEP administration, 79% of Black graduates completed an Algebra II course, compared to 85% of White and 87% of Asian students. These differences are more pronounced later in the math sequence, with only 5% of Black graduates completing Calculus, compared to 16% of White and 44% of Asian students (NCES, 2022d).

A 2013 longitudinal analysis conducted by the National Center for Educational Statistics disaggregated the highest math COURSE achieved during high school by race. The categories included 'No Math', 'Below Algebra I', 'Algebra I', 'Geometry', 'Algebra II', 'Other Math', 'Precalculus', and 'Calculus'. Black students had the highest proportion among all races in three course types: 'No Math', 'Below Algebra I', and 'Other Math' (NCES, 2024a; de Brey et al., 2019). According to a 2016 report by the U.S. Department of Education's Office for Civil Rights, Black students were nearly two-and-a-half times more likely to be placed in remedial math courses than their white peers (U.S. Department of Education, 2016).

Evidence Through State Achievement Data

The problem of low math academic proficiency, particularly among Black students, is evident in Maryland through multiple assessments. In the most recent (2022) administration of NAEP, with a mean of 274 and standard deviation of 33, the average score for White students was 289, compared to 250 for Black students (NCES, 2022a; NCES, 2022b). This 39-point difference was the fifth highest in the nation, as shown in the last column of Table 2, which shows the persistence of this gap over time. Maryland routinely ranks among the states with the highest Black-White achievement gap on this assessment, also shown in Table 2 (NCES, 2022a; NCES, 2007).

Table 2

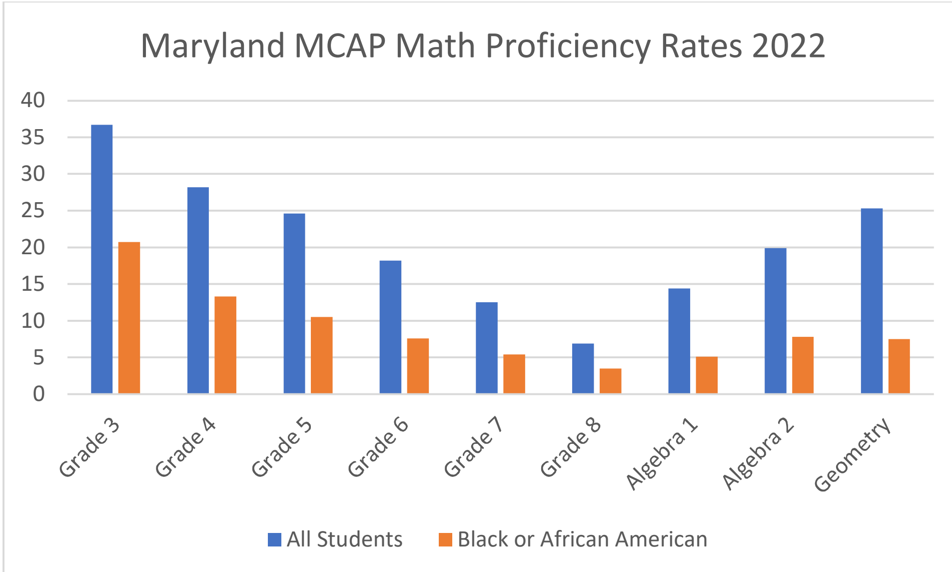
2022 NAEP Maryland Results by Race

	2007	**2009**	**2011**	**2013**	**2015**	**2017**	**2019**	**2022**
White	300	303	303	299	297	295	300	289
Black	265	266	267	268	263	262	261	250
MD State Rank (1 is the highest gap)	9	6	5	19	13	20	8	5

In addition to NAEP, all school systems in Maryland annually administer the Maryland Comprehensive Assessment Program (MCAP) math assessments for federal accountability purposes. In 2022, The percent of Black students scoring proficient or higher was below the overall average for every test at the state level, as shown in Figure 1.

Figure 1

2022 MCAP Math Proficiency by Race



In fact, an unpublished internal state document indicated that the percentage of students scoring proficient or higher on the 2022 administration was below the percentage of all students proficient for every test with data from 3rd grade through Algebra II (data are suppressed if either fewer than 5% of a group are proficient or if the student group size is ten or fewer) in 22 of the 24 districts in Maryland.

Evidence Through State Enrollment Data

The traditional core mathematics sequence in use in Maryland high schools starts with Algebra I and typically progresses through Geometry, Algebra II, Precalculus, and the Calculus courses. In 2017 - 2018, Black students represented 34.2% of enrollment in grades 9-12 but only 14.5% of the students enrolled in Calculus and 18.7% of those enrolled in AP mathematics. Meanwhile, these students represented 46.1% of all students enrolled in Algebra I in 11th or 12th grade. Black students are over-represented amongst the 11th and 12th graders taking or retaking Algebra 1.

Evidence Through Local Achievement Data

CCPS is a comparatively rural, affluent school district on a narrow peninsula in southern Maryland, located 35 miles southeast of Washington D.C. The county is the smallest by area in the state, and the 13th largest out of 24 districts by student enrollment, with approximately 16,000 students throughout the period of this study. In School Year (SY) 2024 Approximately 9% of students received special education services, 20% of students received free or reduced-price meals, and fewer than 5% of students participated in English for Speakers of Other Languages. The majority (71%) of students identified as White, 13% Black, 9% are two or more races, 6% are Hispanic, and 1% are of other racial groups. Of the nearly 1,100 teachers, 64% have at least a master's degree and 31% have 20 or more years of experience, while 2% are in their first year of teaching. CCPS also had the 7th highest starting teacher salary in the state in SY 2024, at $45,496.

According to internal data systems, in 2022, there were 1209 students enrolled in grade 12 and over 40% of these students were enrolled in at least one Advanced Placement course in CCPS. According to a 2022 look at longitudinal data, 72% of graduates enroll in college within two years of graduation. Students in the county have performed relatively well on the most recent state MCAP assessment, mostly scoring in the top third of the 24 districts in the state even for student groups with the largest gaps in the county. Table 3 summarizes the CCPS rank among 24 districts, by race:

Table 3

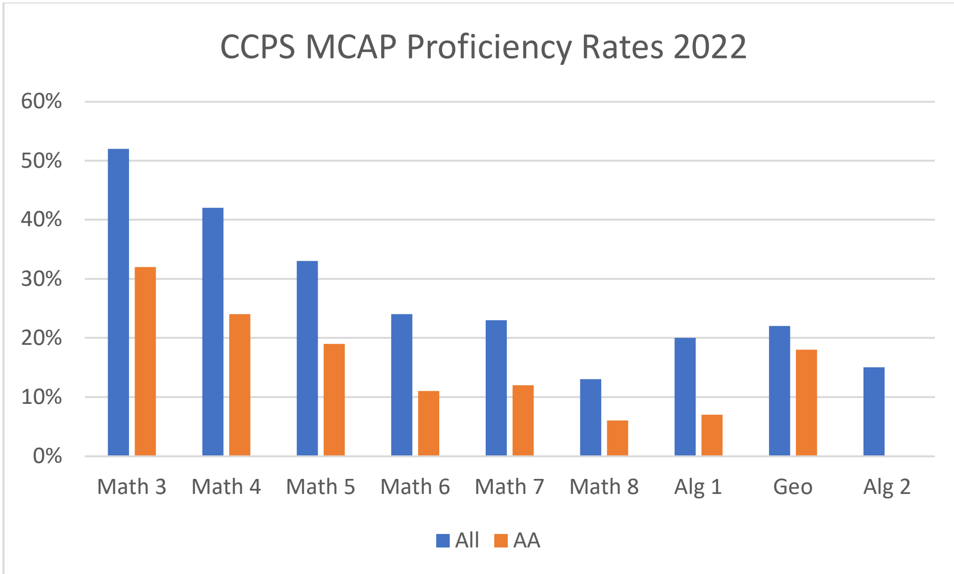
CCPS Rank Among 24 Maryland Districts, Math MCAP 2022

	Math 3	Math 4	Math 5	Math 6	Math 7	Math 8	Alg 1	Geo	Alg 2
All	4	5	8	5	6	8	7	5	9
AA	5	5	6	5	4	6	7	1	6

Upon closer examination, the problem of underachievement for Black students in CCPS persists in these data for every assessment as shown in Figure 2.

Figure 2

CCPS Math MCAP Proficiency Rates 2022



These gaps were also evident in the previous state standardized assessment, PARCC, administered from 2015 to 2019, with Black students less likely to score proficient or above on the math assessment (Maryland State Department of Education [MSDE], n.d.).

Evidence Through CCPS Math Course Enrollment Data

The underrepresentation of Black students' enrollment in more rigorous math courses was evident in virtually every CCPS high school that offered two versions of the course. See Table 4 below:

Table 4

CCPS Black Enrollment by School 2024

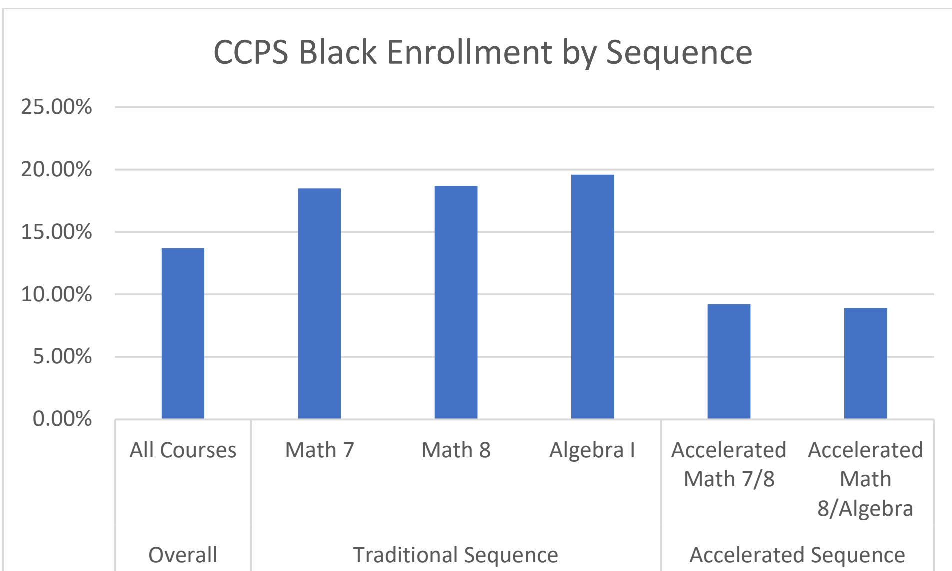
	Overall	Algebra II	Honors Algebra II	Geometry	Honors Geometry	Precalculus	Honors Precalculus
CHS Black Enrollment	21.5%	N/A*	24.3%	N/A*	20.7%	N/A*	11.0%
HHS Black Enrollment	10.2%	45.5%	12.4%	N/A*	7.9%	3.6%	8.3%
NHS Black Enrollment	10.8%	13.6%	5.1%	17.1%	5.9%	11.5%	7.2%
PHS Black Enrollment	16.5%	N/A*	19.3%	27.4%	12.0%	10.0%	3.2%

Note: *Knowing and understanding repercussions of underrepresentation of underserved student groups within their own honors level courses, some high schools have begun the process of "detracking" or reducing courses to one (honors) level.

In addition, there are some accelerated courses offered within the district that allow students to complete multiple years of mathematics coursework into one school year. Examples include Accelerated Math 7/8 and Accelerated Math 8/Algebra, a two-course sequence that includes three years of content. Black students are less likely to enroll in these accelerated math courses as shown in Figure 3. In SY 2024 Black students made up 13.7% of the enrollment of courses at this middle school level, with 18% to 20% of the enrollment in the traditional sequence and approximately 9% of the enrollment in the accelerated sequence.

Figure 3

CCPS Black *Enrollment by Course Sequence*



A similar course acceleration option exists at the Algebra II level, with some students recommended to complete Algebra II and Precalculus within one year of study. Black students are less likely to enroll in this accelerated pathway as well. The Black student enrollment in CCPS of Algebra II courses is 16%, compared to 4.6% for the Accelerated version of the course.

In addition to lack of access to previous accelerated math options, access to more advanced courses is restricted by placement decisions made by teachers, students, counselors, and parents after Algebra II credit has been earned. Options for most students are to take either a Precalculus option, a Statistics option, or a Quantitative Literacy option. In the district, Precalculus is considered the most rigorous option at this level and the Quantitative Literacy option is considered the least rigorous. Again, Black students are underrepresented in the courses perceived to have more rigor. For instance, in the 2025 school year, 13.8% of the high school population identifies as Black but enrollment within Quantitative Literacy was 24.8% Black, 13.0% in Statistics and only 7.4% in Precalculus.

Finally, there are courses that are difficult to achieve by nature of being at the end of a course pathway that not every student completes. There are three advanced placement (AP) math courses offered in CCPS. In SY 2025, 13.8% of the high school population identified as Black but only 7.1% of those enrolled in AP Statistics identified as Black, 3.1% in AP Calculus I, and 2.3% in AP Calculus II.

In summary, national, state, and local data confirm the persisting underachievement in math among Black secondary students. In addition, data also confirm the opportunity gap between these students and their peers by the extent to which Black students are not accessing more advanced math coursework.

The evidence presented above indicates a systemic problem of under enrollment of Black students in more challenging math course work. This is an example of tracking in which different versions of the same math course are created with various levels of rigors to meet the presumed ability level of incoming students. This curriculum organization result in barriers of opportunity for many students, particularly Black students. Referred to as “tracking”, the research will be explored in more depth later under causal factors. These courses typically have been developed as well-intentioned support structures for struggling students and are often created with the assumption that students need to “get ready” for more rigorous courses by spending a year strengthening and relearning prior concepts and foundational skills needed in the more advanced coursework (Berry, 2018). However, these courses, often remedial in nature, can steer students away from the very academic experiences that would inspire effort, raise achievement, and promote higher learning. Proponents of the opportunity gap argue that such courses are characterized by lowered expectations and below-grade-level work and fail to provide the kinds of experiences that would prepare students to meet expectations of higher-level coursework (Berry, 2018). Further, as shown in the data, these courses enroll a disproportionate number of students from underserved groups. The result is that the students overrepresented in lower-level courses are the very students for whom there is the greatest urgency to raise mathematics achievement.

Consequences of Not Increasing Math Performance of Black Students

In an increasingly global, computerized world, achievement in mathematics is a gateway to post-secondary success and economic mobility. A consistent theme in the writings of various advisory commissions over recent decades is that the future success of our nation and its people depend heavily on math education (Gardner, 1983; NEGP, 1991; NMAP, 2008; NCM, 2000; NCTM, 2000; Ward, Nacik, Perkins, & Kennedy, 2024; Vanderbilt University IRIS Center, 2025). According to these organizations and researchers, there are at least three reasons why mathematics is seen as a critical component of education that prepares young people for the world they will inherit.

The first reason is that mathematics underpins STEM careers. Engineers, statisticians, software developers, analysts, programmers, scientists, and economists all regularly apply mathematical content and reasoning in their work. Mathematics is the “heart of most innovations in the information economy" (NCTM, 2018, p. 6). In the 21st-century workplace, mathematical capability is a key determinant of productivity. According to the American Community Surveys (U.S. Census Bureau, 2009; U.S. Census Bureau, 2010), college graduates who majored in subjects such as math, engineering, and the physical sciences earn an average of 19 percent more than those who specialized in other fields. In addition to benefiting individuals, experts agree that the workplace of the twenty-first century—especially in an AI-driven economy—will require students to combine conceptual and procedural mathematical processes to "solve problems that they have never seen before or that may not even exist today" (National Research Council [NRC], 2012). Recent research echoes this urgency, noting that "more effective STEM education and workforce development are necessary" to equip Americans with the skills needed for innovation, cybersecurity, and data analytics in a rapidly evolving digital economy (West, 2023).

Policymakers see a critical mass of mathematically talented individuals as essential for an economy that can innovate, compete, attract talent, and defend itself from other nations (NRC, 2001; NCTM, 2018). This is especially true in the age of data science and artificial intelligence, where mathematical literacy is foundational to understanding and working with algorithms, data modeling, and machine learning. As AI becomes more embedded in everyday life—from healthcare to finance to education—students who lack strong quantitative reasoning skills risk being left behind in both employment and civic participation (Stanford Graduate School of Education, 2024; Cornell University, 2023).

The second reason is for students who do not pursue STEM careers. For the 93.8% of students who do not plan to use mathematical skills directly in a STEM field (U.S. Bureau of Labor Statistics, 2017), quantitative skills, data analysis, reasoning, and problem-solving are in high demand in disciplines where technical skills were previously not required (NCTM, 2018). Workers in many fields who have skills in solving problems involving patterns, displaying data, and optimizing resources are much more valuable to employers and have access to more upward mobility than those who lack an aptitude for solving problems involving numbers.

The third reason for prioritizing mathematics education is not directly tied to careers or the workplace. Rather, it concerns the essential role of mathematical literacy in modern civic life. In today's data-driven society, Americans must navigate complex financial products, interpret statistical claims from media and political figures, and make informed decisions on issues such as climate change, healthcare, and economic policy. As the National Council of Teachers of Mathematics (NCTM) emphasized, mathematical competence is increasingly a prerequisite for responsible citizenship (NCTM, 2000). More recently, educators and researchers have echoed this view, noting that mathematical literacy involves the ability to interpret, critique, and communicate quantitative information in various forms—skills that are essential for full participation in democratic society (Janes, 2023).

Given the strong link between education and adult outcomes such as higher employment rates, wages, and civic engagement, it is deeply concerning that math education continues to underserve Black students. "We are bequeathing failure to our children" (National Commission on Mathematics [NCM], 2000), and by allowing persistent opportunity gaps, we perpetuate systemic inequities that undermine both individual potential and societal progress.

Moreover, as Rochelle Gutiérrez (2002) argues, the issue is not simply that Black (and Latinx) students need more access to mathematics—it is that mathematics itself needs them. When entire groups are excluded or underserved, it is not only those students who lose out; the field of mathematics, and society at large, are deprived of the diverse perspectives, talents, and innovations that could emerge. In this sense, failing to support the mathematical development of all students weakens the collective potential of our communities, our economy, and our democracy.

The Problem Addressed in this Study

The core problem of practice in CCPS addressed by this study is the achievement gaps fueled by opportunity gaps in math course enrollments among Black high school students which were theorized to lead to underachievement of Black students in upper-level math achievement measures. The specific purpose of the investigation was to examine the impacts of a change initiative developed within the school system over the period from 2014 to present that was designed to increase Black students' course enrollments, completions, and math achievement as measured by district and state assessments. An additional purpose of the study was to explore the perceptions of the math teachers in the high schools who were involved in implementing the course changes. This evaluation further investigated the best practices implemented to support these changes and explore organizational readiness for potential future steps of reducing levels of Math 6, Geometry, Algebra II, and Precalculus.

I have been the Supervisor of Secondary Mathematics for CCPS since July 2014. My program responsibilities beyond central office tasks that are divided among members of the Department of Instruction include the hiring of teachers, training and professional learning of teachers and leaders, observation and evaluation of teachers, and selection, creation, and implementation of district-wide assessments and curriculum. I work collaboratively with central office and building leaders to implement district vision, mission, and priorities. My work included the stewardship of the course sequence, including this change initiative which was already broadly under way when I began in this position.

To provide some context for the change initiative, I first provide a brief overview of the impetus of the change initiative. The initiative is fully described later under my theory of improvement. Following the overview, I identify and discuss four major causal factors I have identified related to Black students' math underachievement including the research literature supporting these factors. I then discuss my theory of improvement, which is grounded in the experiences in improving math achievement by increasing access to opportunities for enrollment in and completion of more rigorous math coursework.

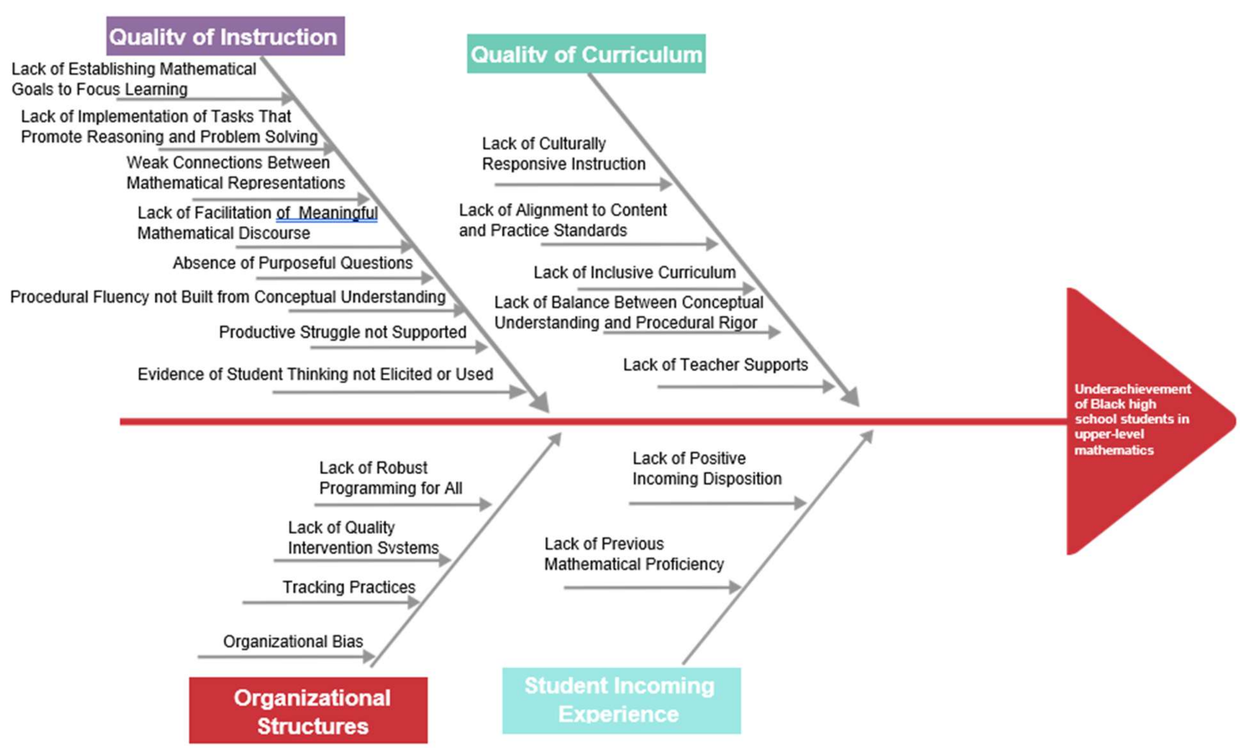
Causal System Analysis

In my ongoing efforts to improve mathematical achievement among Black students, I conducted a review of research on factors influencing mathematical achievement and identified the following: organizational structures, quality of instruction, quality of curriculum, and students' prior/incoming experience. My review focused on factors impacting Black students' access to rigorous math coursework and their achievement in these courses.

To delve deeper into these factors, I performed a Causal System Analysis (CSA) to understand the underlying causes and relationships. Based on my experience supervising the math program, I observed firsthand the challenges and opportunities within our educational system. This insight informed my fishbone diagram and literature review, which grew out of my ongoing leadership in the change initiative as well as my doctoral work. Figure 4 below presents my analysis of causes.

Figure 4

Analysis of Factors that Impact the Problem



Research supporting the three causal factors: students' incoming experience, quality of curriculum, and quality of instruction follows. This section will conclude with a deeper review of a fourth causal factor, my primary focus—organizational structures—and how course enrollment can vary for underserved students, impacting their opportunity to learn and ultimately their achievement in mathematics.

Student Incoming Experience

Research on student learning has identified key student-level factors that impact mathematical achievement. These factors can be organized into two main categories: mathematical proficiency and disposition. These factors are interrelated; achieving a certain level of proficiency can affect a student's disposition, and vice versa, which in turn impacts future acquisition of mathematics.

Mathematical Proficiency. There is broad consensus that that prior knowledge is one of the strongest and most reliable predictors of future academic achievement (Ausubel, 1968, 2000; Bloom, 1976; Dochy, 1992; Dochy et al., 2002; Thompson & Zamboanga, 2004). In mathematics, domain-specific knowledge—knowledge directly related to mathematical content—is particularly influential (Dochy, 1992; Hailikari, Nevgi, & Komulainen, 2008). However, the predictive power of prior knowledge is not uniform across all types of mathematical content or instructional contexts. Recent research confirms that enhancing students' topic-specific prior mathematical knowledge significantly improves their conceptual and procedural understanding, especially in delayed assessments, highlighting the importance of targeted preparation before introducing new content (Alreshidi, 2023).

Research from the United States supports the idea that early mastery of specific mathematical concepts, such as fractions and division, is a strong predictor of later success in algebra and overall mathematics achievement. For example, Siegler et al. (2012) analyzed large, nationally representative longitudinal datasets and found that knowledge of fractions and division in elementary school uniquely predicted high school mathematics achievement, even after controlling for general cognitive ability and socioeconomic factors.

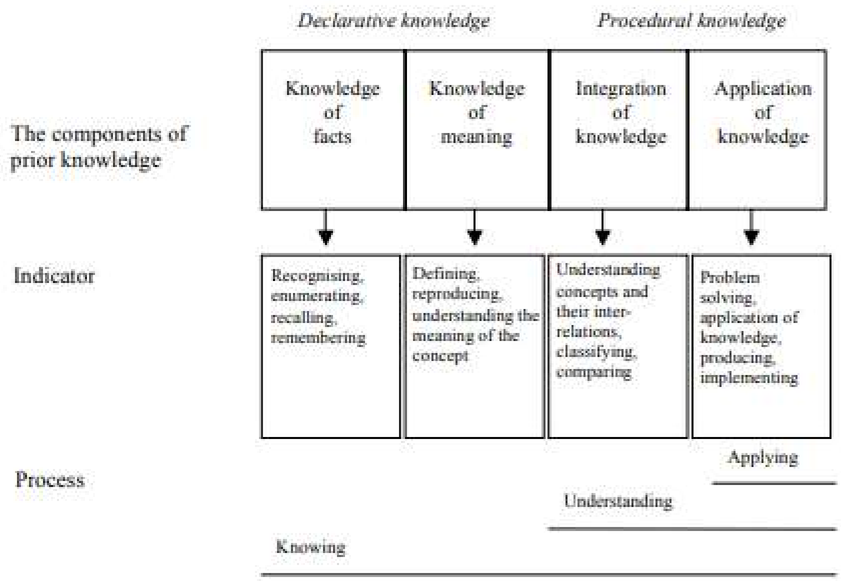
While international studies, such as Hailikari et al. (2008), suggest that students who begin a course with the ability to perform higher-order tasks (e.g., applying, analyzing, evaluating) are more likely to succeed, these findings should be interpreted with caution. The instructional methods, curricular structures, and assessment practices in those contexts may differ significantly from those in U.S. classrooms. For instance, how integration and application are defined and measured can vary widely, and such differences may influence the strength of the observed relationships.

Moreover, the relationship between prior knowledge and future achievement is moderated by factors such as teacher knowledge, instructional quality, and classroom practices. Ekmekci et al. (2015) found that the predictive value of prior achievement was stronger in classrooms where teachers had higher mathematical knowledge for teaching and more years of experience.

Taken together, these findings suggest that while prior domain-specific knowledge is a critical component of mathematical proficiency, its impact is shaped by the broader instructional and contextual environment. Therefore, efforts to improve mathematics outcomes must consider not only what students know when they enter a course, but also how that knowledge is built upon through effective teaching and curriculum design.

Figure 5

Correlations Between Types of Prior Knowledge and Final Grade



Average correlation between prior knowledge type and final grade	.07	.25	.42	.39

Multiple studies have found that while prior knowledge and prior success are strongly correlated, and both are strongly linked to academic self-beliefs, previous success in an academic domain has a “direct and independent contribution to student achievement” (Hailikari, Nevgi, & Komulainen, 2008). A student may achieve relative success in a course without acquiring as much knowledge as others, just as a student may retain knowledge better than peers without scoring as well in the course. It is widely agreed that a combination of these two variables is a stronger predictor of future success than either factor alone (Carstens & Beck, 1986; Dochy et al., 1999; Griggs & Jackson, 1988; Hailikari, Nevgi & Lindblom–Ylänne, 2007).

Disposition. A student's beliefs and attitudes about their competence and worthiness in mathematics significantly impact their acquisition of skills and proficiencies in a mathematics course. Various frameworks describe how student mindset affects performance. Expectancy-value theory suggests that individuals' performance can largely be explained by their belief in their own ability, their success on specific tasks, and the value they place on those tasks (Atkinson, 1957; Bandura, 1997; Eccles et al., 1983; Wigfield, 1994; Wigfield & Eccles, 1992). A person with high self-efficacy believes in their ability, expects success with effort, and is more likely to engage in learning. Recent research confirms that students' self-efficacy has a significant positive impact on mathematics achievement, reinforcing the importance of fostering confidence and positive perceptions in math classrooms (Appiah et al., 2022).

Self-efficacy, unlike other self-beliefs such as self-concept and self-esteem, focuses on executing specific tasks (Hailikari, Nevgi, & Komulainen, 2008). Bandura (1997) describes self-efficacy as "an individual's belief in their ability to organize and implement actions to achieve desired results." According to Bandura's social cognitive theory (1986), individuals with self-efficacy are more likely to believe they can master tasks and recover quickly from setbacks, leading to higher performance. Bandura states that self-efficacy beliefs develop from four sources: mastery experience (achieving simple tasks leading to more complex ones), social modeling (observing others succeed), verbal and social persuasions (encouragement from parents, teachers, and peers), and emotional and physiological states (mental well-being when entering a task) (Usher & Pajares, 2008).

While self-efficacy is a powerful general construct, mathematics education researchers have emphasized the importance of *productive disposition*—a math-specific belief system. Defined by the National Research Council (2001) as "the tendency to see sense in mathematics, to perceive it as both useful and worthwhile, to believe that steady effort in learning mathematics pays off, and to see oneself as an effective learner and doer of mathematics," productive disposition is one of five interwoven strands of mathematical proficiency.

It reflects not only confidence but also a student’s habitual orientation toward mathematics as meaningful and achievable. Students with a strong productive disposition are more likely to persist through challenges, engage deeply with content, and develop long-term mathematical resilience.

In addition to individual beliefs, the collective efficacy of a school’s teaching staff can significantly influence student outcomes. Roger Goddard and colleagues define collective teacher efficacy as the shared belief among educators that, through their combined efforts, they can positively affect student learning. This construct, grounded in Bandura’s social cognitive theory, has been shown to be a powerful predictor of student achievement—even more so than socioeconomic status or prior achievement (Goddard, Hoy, & Woolfolk Hoy, 2000; Goddard, 2001). More recent research confirms that collective teacher efficacy is strongly associated with student achievement and is positively related to teacher commitment, job satisfaction, and institutional belonging (Sánchez-Rosas et al., 2022). In schools where teachers believe in their collective ability to support all students, students are more likely to develop positive academic dispositions and persist through challenges.

Eccles and colleagues (1983) proposed four key components of an individual's value for a task: attainment value (importance of a task to a person's identity), intrinsic value (enjoyment of an activity), utility or extrinsic value (future reward anticipated for a task), and cost (what must be given up to perform a task). The net value, or value minus cost, is computed differently for each individual and significantly influences task success (Wigfield, Tonks, & Eccles, 2004; Eccles et al., 1983).

In summary, student prior experience and disposition are closely related. Success or lack of success in a mathematics course influences a student's belief in future success, affecting the effort they are willing to commit to mathematical tasks and ultimately, their proficiency in these tasks. When combined with a school culture that fosters collective efficacy among educators and nurtures productive disposition in students, learners are more likely to experience the encouragement, modeling, and high expectations necessary to thrive.

Support Programs. There is promising research at both the high school and college levels on the impact of intentional support programs, particularly for students of color. These programs—often referred to as *transitional support programs*—typically include a combination of academic tutoring, mentoring, orientation sessions, social-emotional learning supports, and structured opportunities to build a sense of belonging and community. They are designed to ease students' transitions into new academic environments, such as the shift from high school to college or from one academic track to another.

For example, Walton et al. (2011), in a multi-institutional study involving 37 collaborators from 24 universities, demonstrated that fostering a sense of belonging among incoming college students can significantly improve academic outcomes. Their work led to the development of free, research-based modules that institutions can use to support students' psychological adjustment during critical transitions. Similarly, Schuyler, Childs, and Poynton (2021) synthesized peer-reviewed literature to highlight how academic supports, transitional adjustment services, and mental health resources can enhance the college experience for first-generation students of color.

At the high school level, support programs often include mentoring initiatives, family engagement strategies, and targeted behavioral interventions. These are designed not only to improve academic outcomes but also to address social and emotional development, which is particularly important for historically marginalized students (Springer & Phillips, 2021; Same et al., 2018).

It is important to distinguish these support services from broader *instructional reform efforts*, such as curriculum redesign, pedagogical shifts, or changes in assessment practices. While instructional reforms can raise overall student performance, they do not automatically reduce achievement gaps—

and in some cases, may even exacerbate them if not implemented with equity in mind. Therefore, while instructional reforms are essential, they must be paired with targeted supports that address the specific barriers faced by students of color to ensure equitable outcomes.

Quality of Curriculum

Two influential works at the turn of the century reframed mathematics curriculum not merely as a set of content standards, but as the dynamic interaction between teachers, students, and mathematics. The first is the *Principles and Standards for School Mathematics* (National Council of Teachers of Mathematics [NCTM], 2000), which emphasizes six interrelated processes essential for mathematical learning: problem solving, reasoning and proof, communication, representation, and connections.

At the same time, the National Research Council (2001) published *Adding It Up: Helping Children Learn Mathematics*, a synthesis of research that articulated a comprehensive vision of mathematical proficiency. The report identified five interwoven and interdependent strands: conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition. Productive disposition is defined as “a habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one’s own efficacy” (National Research Council, 2001, p. 131).

Recent research continues to affirm the importance of these strands, particularly in how they are reflected in classroom instruction. A 2021 study found that preservice teachers often struggle to demonstrate proficiency across all five strands, especially in procedural fluency and strategic competence, highlighting the need for curriculum and training that explicitly supports these dimensions (Altarawneh & Marei, 2021). This reinforces the idea that mathematical proficiency is not a static set of skills, but a dynamic and evolving set of competencies that must be cultivated through high-quality curriculum and instruction.

Common Core State Standards. Fueled by international assessments and key research such as the NRC report, the Council of Chief State School Officers (CCSSO) and the National Governor's Association (NGA) developed K-12 standards in reading and mathematics to define what every student in US schools needed to learn to be college and career ready. The Common Core State Standards Initiative (CCSSI) was released to the public in 2010.

Along with content standards, the CCSSI produced eight standards of mathematical practice (SMP) derived from the NCTM process standards and NRC strands. These standards guide teachers in incorporating practice standards into lesson planning and instruction, focusing not just on content but on the processes and practices used while learning. These practices—making sense, persevering, reasoning, constructing and critiquing reasoning, modeling, using tools, attending to precision, looking for and making use of structure, and expressing repeated reasoning—are intended to be integrated into instruction at all levels to explore content standards effectively.

These standards were monumental for several reasons. First, they had the potential to unify mathematics curricula across the nation to a rigorous, internationally benchmarked level. Second, they incorporated findings from the NRC and NCTM, introducing a balanced approach to mathematics curricula that included procedural fluency, conceptual understanding, and problem-solving/application within the content standards (Student Achievement Partners, n.d.). Third, they represented a step forward in challenging content by focusing skills and topics on the major work of each grade and building coherence and explicit connections within and across grade levels. For example, quadratic and exponential functions, often introduced in Algebra II, became major content expectations in Algebra I.

With widespread support, the Common Core State Standards were quickly adopted by 45 states and the District of Columbia by 2012. However, as testing requirements reached students, teachers, and families, opposition began to form. Parents who had learned mostly procedural mathematics struggled to help their children with new conceptual work. Teachers, too, faced significant challenges: many were expected to shift their instructional practices without sufficient professional development or curricular resources. The emphasis on conceptual understanding and mathematical reasoning required a rethinking of pedagogy, which some educators found empowering, while others felt unprepared or constrained by high-stakes testing environments. Meanwhile, various groups with different concerns—suspicion of government overreach, frustration with standardized testing, and distrust of funding sources and corporate interests—united in resistance to the new standards (Harvard Graduate School of Education, 2014). Despite the controversy, by 2018, 47 of the 50 states were implementing curricula derived from this initiative, and as of 2023, 40 states and Washington D.C. still implement the Common Core standards (World Population Review, n.d.).

Inclusive Curriculum

Recent research highlights the profound impact of inclusive curricula on students of color. An inclusive curriculum is one that intentionally integrates the histories, perspectives, contributions, and lived experiences of diverse cultural, racial, and ethnic groups into both the content and pedagogy of instruction. In mathematics, this does not mean altering the core concepts of algebra or calculus, but rather contextualizing problems, highlighting diverse mathematicians, and fostering classroom norms that affirm all students' identities and ways of thinking. Inclusive curricula have been shown to improve academic engagement and outcomes by making learning more relevant and affirming for historically marginalized students, particularly when paired with evidence-based instructional practices and data-informed decision-making (Student Achievement Partners, 2021).

In a course like precalculus, inclusive practices might include using real-world data sets that reflect issues relevant to students' communities (e.g., income inequality, environmental justice, or voting patterns), discussing the contributions of mathematicians from underrepresented backgrounds (such as Katherine Johnson or Euphemia Lofton Haynes), and encouraging multiple problem-solving strategies that validate different ways of reasoning. While White and Asian students may not always see themselves “represented” in the same cultural sense, they often benefit from a curriculum that aligns with dominant norms and expectations. Inclusive curricula aim to extend that sense of belonging and relevance to all students, especially those historically marginalized in mathematics education.

Dixon (2021) emphasizes that inclusive curricula can improve academic outcomes by making learning more relevant and engaging for Black students. When students see themselves reflected in the curriculum—not just in content, but in the classroom culture and expectations—it enhances their motivation and connection to the material.

In addition, Social-Emotional Learning (SEL) has been shown to significantly benefit students of color by addressing their emotional and social needs. SEL programs help students develop skills such as self-awareness, self-management, social awareness, relationship skills, and responsible decision-making. Turner (2018) discusses how SEL can improve college and career readiness for Black students by fostering a supportive and responsive learning environment. SEL not only enhances academic performance but also supports students' overall well-being, helping them navigate the challenges they may face both inside and outside the classroom.

Quality of Instruction: The Importance of Teaching

According to the National Commission on Mathematics (2000), America’s students must improve in mathematics and science to succeed in today’s world, and the most direct route to achieving this is by increasing the quality of teaching. This perspective echoes an earlier insight from mathematician and educator E. G. Begle, who stated that “the problem is no longer so much teaching better mathematics as it is teaching mathematics better” (as cited in National Research Council, 2001, p. xiv). Although Begle made this observation decades ago during the New Math movement, it remains relevant in contemporary discussions about instructional quality and equity in mathematics education.

In 2014, NCTM released a companion document to guide the implementation of the new Common Core Standards, Principles to Action (PtA). Its authors observe "Over the past twenty-five years, we have learned that standards alone—no matter their origins, authorship, or the process by which they are developed—will not realize the goal of high levels of mathematical understanding by all students. More is needed than standards" (NCTM, 2014, p. vii). The document highlights standardized testing data and emphasizes the need to "move from 'pockets of excellence' to 'systemic excellence' by providing mathematics education that supports the learning of all students at the highest possible level" (NCTM, 2014, p. 3).

Principles to Action updates assumptions and principles based on research from 2000 to 2014. It presents a framework of eight research-informed teaching practices that represent high-leverage teacher moves to promote deeper mathematical learning for all students, such as posing purposeful questions and supporting productive struggle in learning mathematics. A full list of these practices is presented in Appendix A.

Additionally, the document includes a list of unproductive beliefs and practices that serve as obstacles to effective reform, corroborating and expanding upon a list previously assembled by the National Research Council (NRC, 2005).

Figure 6

Beliefs About Teaching and Learning Mathematics

Beliefs about teaching and learning mathematics	
Unproductive beliefs	**Productive beliefs**
Mathematics learning should focus on practicing procedures and memorizing basic number combinations.	Mathematics learning should focus on developing understanding of concepts and procedures through problem solving, reasoning, and discourse.
Students need only to learn and use the same standard computational algorithms and the same prescribed methods to solve algebraic problems.	All students need to have a range of strategies and approaches from which to choose in solving problems, including, but not limited to, general methods, standard algorithms, and procedures.
Students can learn to apply mathematics only after they have mastered the basic skills.	Students can learn mathematics through exploring and solving contextual and mathematical problems.
The role of the teacher is to tell students exactly what definitions, formulas, and rules they should know and demonstrate how to use this information to solve mathematics problems.	The role of the teacher is to engage students in tasks that promote reasoning and problem solving and facilitate discourse that moves students toward shared understanding of mathematics.
The role of the student is to memorize information that is presented and then use it to solve routine problems on homework, quizzes, and tests.	The role of the student is to be actively involved in making sense of mathematics tasks by using varied strategies and representations, justifying solutions, making connections to prior knowledge or familiar contexts and experiences, and considering the reasoning of others.
An effective teacher makes the mathematics easy for students by guiding them step by step through problem solving to ensure that they are not frustrated or confused.	An effective teacher provides students with appropriate challenge, encourages perseverance in solving problems, and supports productive struggle in learning mathematics.

(NCTM 2014, p. 11)

Culturally Responsive Teaching. Culturally responsive teaching (CRT) is a pedagogical approach that affirms students' cultural identities and seeks to make learning more relevant by connecting instruction to students' lived experiences. While CRT has been widely discussed in general education, its application in mathematics—particularly at the high school level—remains an evolving area of research and practice. Recent frameworks emphasize that CRT in mathematics involves not only content relevance but also instructional practices that affirm students' identities, promote agency, and maintain high expectations (Zavala & Aguirre, 2023).

In mathematics classrooms, CRT may not always involve changing the curriculum itself, but rather reshaping the classroom culture. This includes building strong relationships with students, fostering a sense of belonging, encouraging collaboration over competition, and creating an environment where students feel seen, respected, and supported. These relational and cultural dimensions are especially important for students of color, who may otherwise experience mathematics classrooms as isolating or disconnected from their identities (Thomas & Berry, 2021).

Although some educators have explored ways to incorporate culturally relevant contexts into math problems or highlight contributions of mathematicians from diverse backgrounds, there is limited empirical evidence demonstrating that such curricular changes alone lead to improved academic outcomes. Instead, the most promising aspects of CRT in math may lie in how teachers engage with students, structure participation, and cultivate inclusive norms that support persistence and confidence (Hernandez, 2022).

Thus, while CRT holds potential for improving student engagement and identity development in mathematics, more research is needed to understand how these practices translate into measurable academic gains—particularly in high school settings.

Implicit Bias Training. Implicit bias training aims to help educators recognize and mitigate unconscious biases that can negatively impact their expectations and interactions with students. Same et al. (2018) highlight that implicit biases can lead to unequal educational outcomes for Black students. By undergoing implicit bias training, teachers can become more aware of their biases and learn strategies to counteract them, leading to a more equitable and supportive classroom environment.

In mathematics education specifically, research has shown that teachers may underestimate the mathematical ability of Black, Hispanic, and female students, even when their performance is equivalent to that of their White or male peers. In a randomized controlled study, Copur-Gencturk, Cimpian, Lubienski, and Thacker (2020) found that teachers exhibited significant bias in their judgments of students' mathematical ability based on race and gender, with the strongest biases observed against Black and Hispanic girls. These findings underscore the importance of addressing implicit bias in math classrooms, where teacher expectations can shape student engagement, confidence, and achievement.

When teachers hold high expectations and provide equitable support, Black students are more likely to engage with the material and perform better academically (Same et al., 2018).

Organizational Structures: Systemic Tracking

Jeannie Oakes (2005) defines tracking as the practice of grouping students for instruction based on educators' judgments about their perceived ability to learn. These judgments are often informed by standardized test scores, prior academic performance, and subjective assessments of student potential. While intended to tailor instruction to student needs, tracking frequently results in the stratification of students into hierarchical groups that reflect and reinforce existing racial and socioeconomic disparities. Students placed in lower tracks—disproportionately Black, Latino, and low-income—tend to receive less rigorous instruction, fewer resources, and reduced access to experienced teachers and advanced coursework (Oakes, 2005).

Research has shown that tracking not only reflects but also exacerbates achievement gaps. These gaps are rooted not only in instructional practices but also in broader systemic issues such as biased assessments, unequal access to early learning opportunities, and structural inequalities beyond the control of individual schools. In response, detracking—the practice of placing students in mixed-ability classrooms—has emerged as a strategy to promote equity.

Large-scale studies, including those by Adam Gamoran and colleagues, have found that detracking can improve the academic performance of students who were previously placed in lower tracks, without negatively affecting the achievement of higher-performing students (Gamoran, 1992). However, the benefits of detracking are not uniform. Students who perform well below grade level may require additional supports to thrive in mixed-ability settings, and the success of detracking often depends on the quality of instruction and the use of inclusive, differentiated teaching strategies. Rubin and Noguera (2021) emphasize that effective detracking requires more than simply removing ability groups; it involves rethinking classroom practices to ensure that all students are challenged and supported. This includes differentiated instruction, collaborative learning structures, and intentional efforts to prevent re-segregation within classrooms. Despite ongoing debates, detracking remains a promising approach to reducing educational inequities—particularly in mathematics, where access to advanced coursework can shape students' long-term academic and career trajectories.

The National Council of Teachers of Mathematics (NCTM, 2018) echoes this concern in *Catalyzing Change*, arguing that structural barriers—such as the diversion of students into lower-quality math pathways—undermine efforts to improve mathematics achievement. Even well-intentioned interventions for struggling students can perpetuate inequities if they result in qualitatively different and less rigorous learning experiences.

Tracking Course Pathways and the Opportunity Gap. High school mathematics graduation requirements vary between states and even between districts within a state, ranging from two to four credits. Virtually all states require Algebra I and Geometry (or Math 1/Math 2 in the Integrated Pathway), and many require Algebra II (Education Commission of the States, 2019). As of 2018-2019, 86% of American students completed these and all other requirements (NCES, n.d.). However, 32.6% of American students attending 4-year colleges and 59.2% of those attending 2-year colleges are underprepared for college mathematics and must first take non-credit, remedial classes (NCES, 2016). These students often need more time to graduate (Lewis & Farris, 1996) and graduate at lower rates than their better-prepared peers, as many fail to complete these prerequisite courses and never advance to college-level work (Rutschow et al., 2019).

Rutschow et al. (2019) argue that there is encouraging research and shifting policy at the college level aimed at removing this barrier through the development and use of multiple mathematics pathways. Often, the college mathematics requirement and prerequisite remediation courses are not truly needed for success in a student's chosen major and career pathway. However, these attempts to align programs with learners' needs are in the initial stages. The question remains: if 86% of students meet high school math requirements designed to lead into credit-bearing math, why are so many students underprepared?

Part of the answer lies in the structures used in many schools intended to help struggling students and reduce failure. *Catalyzing Change* (NCTM, 2018) calls for multiple high school mathematics pathways to be chosen based on students' future goals rather than past readiness. They recommend that all students complete core-required courses (usually some combination of Algebra and Geometry) in the first two years of high school, then select from one of three pathway options: traditional algebra/precalculus, statistics, and quantitative analysis. They specifically criticize the current practice in many schools of offering redundant “bridge” classes to strengthen skills, which instead of leading to increasingly rigorous and relevant mathematics, delay progress.

Examples of such courses within the CCPS sequence at the beginning of this study include a Prealgebra class in 9th grade before Algebra, an Intermediate Algebra class between Algebra I and Algebra II, an Algebra III class designed to give students time to work on Algebra skills before Precalculus, and a Business Math option that does not build upon previous rigorous math standards.

Ironically, the existence of alternative course sequences can make widespread failure in prerequisite courses appear acceptable. When students who are not prepared for Algebra II are instead placed into courses like Intermediate Algebra or Business Math, it creates the impression that the system is functioning as intended—offering options for all learners. However, this structure can mask deeper instructional issues. If 50% of students leave Algebra I unprepared for Algebra II, the availability of alternative pathways may reduce the urgency to address problems in teaching, curriculum, or student support.

While courses like Business Math are often designed to support career readiness, their effectiveness depends on how they are positioned within the broader curriculum. In some cases, these courses may overlap with other offerings, such as financial literacy, or serve as endpoints that limit students' access to more advanced mathematics. As a result, students may complete four years of high school math—such as Prealgebra, Algebra IA, Algebra IB, and Business Math—without acquiring the mathematical foundation needed for college-level coursework in Algebra or Precalculus.

This layered system of course options, while well-intentioned, can inadvertently lower expectations and reinforce inequities. Without careful alignment and support, these pathways may divert students from opportunities rather than prepare them for postsecondary success.

Tracking and the Opportunity Gap. Organizational structures within schools, particularly the practice of tracking, have long been identified as significant barriers to equitable educational outcomes. Jeannie Oakes defines tracking as grouping students based on educators' perceptions of their ability, often resulting in hierarchical groups and an uneven distribution of learning experiences and resources (Oakes, 1992). In her later work, Oakes emphasized that tracking remains widespread and continues to reflect adult judgments about students' current and future abilities, often reinforcing racial and socioeconomic hierarchies. These grouping decisions—based on perceived IQ, past performance, or potential—frequently lead to educational inequities along race and class lines (Gamoran et al., 1997; Welner, 2001; Rubin & Noguera, 2021).

More recently, attention has turned to the opportunity gap as a major factor in explaining persistent achievement disparities. The opportunity gap is defined as differential access to high-quality teachers, instructional opportunities, grade-level content, and high expectations for mathematics achievement (TNTP, n.d.). Research, such as that presented by TNTP (2018) in *The Opportunity Myth*, makes a compelling case that the achievement gap is largely a function of this opportunity gap, where students from historically underserved groups, including Black students, spend significantly less time engaging with rigorous, engaging, grade-level content compared to their White peers (TNTP, 2018). Experts emphasize that students achieving below grade level need more time accessing instruction that requires deep thinking with challenging material, rather than being placed in remedial or skill-building courses (TNTP, n.d.).

Contemporary research continues to highlight how these structural issues specifically deny students from historically underserved groups access to crucial academic knowledge. A 2023 report by EdTrust and Just Equations found that Black and Latino/a students, despite showing aptitude, are disproportionately denied access to advanced mathematics courses (EdTrust, 2023a). This denial of opportunity is not new; as early as 2016, a U.S. Department of Education report indicated Black students were nearly two-and-a-half times more likely to be placed in remedial math courses than their White peers (U.S. Department of Education, Office for Civil Rights, 2016). These access issues are recognized by organizations like the National Council of Teachers of Mathematics (NCTM), which notes that the opportunity gap disproportionately impacts Black students and is a major contributing factor to achievement disparities that schools must address (NCTM, 2011; NCTM, 2018). Schools serving predominantly Black students often offer fewer advanced courses, a disparity linked to systemic issues like underfunding and educator bias (Johnson, 2023).

While often developed with the well-intentioned goal of supporting struggling students and preparing them for more rigorous work, courses designed as "bridge" or "remedial" can paradoxically hurt the very students they intend to help (NCSM, 2019; Long & Boatman, 2013). These courses are often characterized by lowered expectations and below-grade-level content, failing to provide the necessary experiences to prepare students for higher-level coursework (NCSM, 2019; TNTP, 2018). The National Council of Supervisors of Mathematics (NCSM) argues that tracking, including steering students into qualitatively different or dead-end pathways, does not improve achievement but increases educational inequality (NCSM, 2019). Instead of providing a safety net, these structures can mask problems of curriculum and instruction in prior courses and effectively steer students away from the academic experiences that promote higher learning and proficiency (NCSM, 2019).

Furthermore, placement into lower tracks disproportionately affects low-income and minority students (Slavin, 1990). Studies have shown that struggling students were more successful in college-level math when placed in higher tracks compared to lower, needs-tailored ones (White et al., 1996). This dynamic is particularly significant for historically underserved groups, as placement decisions can rely more on subjective teacher perceptions than objective student ability (Cogan et al., 2001). Research indicates that differences in instructional practices and teacher expectations, possibly influenced by implicit bias, can further exacerbate challenges for Black students in these settings (Same et al., 2018; Roberts & Almeida, 2023). Gloria Ladson-Billings's work on culturally relevant pedagogy underscores that equity in education requires not only access to rigorous content but also instruction that affirms students' identities and empowers them to think critically about their world .

Detracking aims to counter these inequities by placing students in mixed-ability classes (Rubin & Noguera, 2021). While controversial and facing resistance due to perceived lack of empirical evidence (Loveless, 2021), successful detracking practices have shown promise in reducing racial and socioeconomic disparities in educational outcomes (Jardinez & Natividad, 2024). Detracking can lead to improved academic achievement and increased opportunities for students of color by providing challenging and stimulating learning environments (Jardinez & Natividad, 2024). Educational researcher John Hattie's meta-analysis indicated that while the direct academic effect size of detracking is limited, its impact on equity is significant, as it removes the unintentional bias that tracking can operationalize (Hattie, 2016). Other research corroborates the negative effects on certain groups from this unintentional denial of access to rigor (NCSM, 2019; TNTP, 2018; EdTrust, 2023a).

For these reasons, professional organizations like the NCSM call for the elimination of tracking in mathematics to close the opportunity gap, advocating for detracked, heterogeneous instruction through early high school, followed by goal-aligned pathways (NCSM, 2019). The NCTM's *Catalyzing Change* argues that structural issues like diverting students to lower-quality courses hinder overall improvement efforts and calls for the removal of such courses (NCTM, 2018). Ensuring detracked pathways provides all students with access to rigorous coursework and high-quality instruction, regardless of prior academic performance, which is essential for achieving educational equity (NCSM, 2019; NCTM, 2018; Jardinez & Natividad, 2024).

Causal System Analysis Summary

As discussed earlier, a major focus in education over recent decades has been on closing achievement gaps. A search of the ERIC database (06/11/22) for the term “achievement gap” returned over 7,700 results, the vast majority published in the last 20 years. However, scholars such as Gloria Ladson-Billings (2006) have long argued that this framing is incomplete. Rather than focusing solely on disparities in test scores, Ladson-Billings urges educators and policymakers to consider the broader *educational debt* owed to Black and Brown students—a debt accumulated through historical, economic, sociopolitical, and moral injustices. She contends that what is often labeled as an “achievement gap” is in fact a reflection of systemic opportunity gaps that have persisted for generations.

Building on this foundation, *The Opportunity Myth* (TNTP, 2018) presents a contemporary analysis of how these opportunity gaps manifest in classrooms today. The report finds that students of color, particularly Black high schoolers, spend significantly less time engaged in rigorous, grade-level instruction compared to their White peers. TNTP emphasizes that students performing below grade level are often placed in remedial or skill-building courses that limit their access to challenging material—despite evidence that they benefit most from instruction that asks them to think deeply and engage with complex content. In this way, TNTP echoes and extends the argument made by Ladson-Billings and other scholars of color: that educational inequities are not simply the result of student performance, but of systemic failures to provide equitable learning opportunities.

According to Balka et al. (2009):

> Mathematics leaders need to ensure equitable access to courses by carefully monitoring barriers to participation…Barriers may reside in a district or school without consciously being seen as preventing students from participating in higher mathematics …. mathematics leaders should work with other instructional leaders and administrators to reduce the number of remedial mathematics courses. In the United States a trend in mathematics has been to create less-demanding courses for students who struggle with the traditional approach of teaching…Mathematics leaders need to obtain districtwide agreement—from superintendent to teacher—to reduce remedial courses in a timely manner. Students will never catch up academically in an education that continually slows them down" (Balka, Hull, & Miles, 2009, p. 45).

In previous sections, I briefly reviewed four key factors that contribute to student achievement in mathematics. Three of those factors – quality of primary instruction, quality of curriculum, and student incoming experience – are critical components in raising student proficiency in mathematics, and much of the ongoing work in CCPS focuses on incrementally improving these factors. However, these factors are not the primary focus of this study. Instead, as noted in the introduction, this study will analyze the impact of recent changes in math course structures in CCPS intended to address the opportunity gap for Black students and provide challenging math instruction to all students. The following sections will describe the CCPS initiative, including what is known and unknown about its effectiveness in addressing the opportunity gap.

Theory of Improvement

Addressing the opportunity gap in CCPS requires a comprehensive understanding of the district's context and the initiatives undertaken to foster change. This section outlines the steps and strategies implemented to enhance Black students' access to rigorous math coursework and improve their achievement.

Beginning to address the Opportunity Gap in CCPS

The initiative was implemented in CCPS which has four high schools (grades 9-12) located generally in a straight-line North to South down the county which is a peninsula. Between 2005 and now, enrollments ranged from 1,000 to 1,100 in the two southern county high schools and from 1,300 to 1,500 in the two northern schools. Black students represented approximately 20% of the student population in the two southern schools and approximately 11% in the two northern schools throughout this period. Historically, the system's failure to improve the performance of Black students in mathematics went relatively unnoticed, partly due to the small enrollments of these students and their minimal impact on the strong overall average assessment scores.

In the early 2000s, a group of teachers and leaders in the two southern high schools identified a problem: Black students were not consistently reaching their potential. Recognizing the need for action, this group, in collaboration with student groups, began by organizing student clubs such as MAC Scholars and A Place at the Table. These clubs aimed to empower nonwhite students and provide opportunities for them to share their voices with other students, teachers, and leaders.

As a district leader, I witnessed firsthand the powerful impact of student voice in shaping equity conversations. In one instance, Black students shared personal stories of being the only person of color in advanced courses or realizing as early as fourth grade that they were in the “dumb class” based on the racial composition of their peers. These testimonials were not part of a formal study or publication, but emerged during district-led equity initiatives and listening sessions. Teachers, counselors, and administrators were often surprised by the students’ awareness of these patterns and the inferences they drew about their placement and treatment. What struck many adult stakeholders was the consistency of these experiences across schools and grade levels.

These conversations prompted district leaders to reflect more deeply on how implicit systemic expectations—such as assumptions about who belongs in advanced coursework—might be shaping student experiences. In response, the district began exploring ways to better integrate underrepresented student groups into learning environments that reflect the community's broader vision for inclusive, high-quality education.

Around the same time, CCPS leadership began to expand organizational knowledge and understanding of equity across the system. In 2016, the district created a new Department of Equity and appointed a Supervisor of Equity to increase organizational awareness and the importance of engaging communities of learners through shared partnerships. A teacher in each school building was assigned additional duties as Equity Liaisons, leading book studies, difficult conversations, data analyses, and community events. These efforts aimed to help teachers and leaders discover where barriers to equity existed within the instructional environment, structures, and systems of CCPS. This work was challenging and sometimes emotional, but it was crucial in providing opportunities for leaders to inspect and address equity issues within their programs and buildings, including secondary mathematics.

Historically, the secondary math course sequence in CCPS has included tracked courses such as Basic, General, Academic, and Honors Geometry. These courses were created to group students with similar skill levels into different versions of required high school math courses, aiming to differentiate instruction based on assumed needs. The courses were developed in response to pressures to ensure more students demonstrate proficiency on increasingly challenging standardized state tests from the late 1990s into the early 2010s. The assumption was that grouping students would increase math achievement by providing instruction tailored to their skill levels.

The courses had virtually the same curricular standards as Algebra I, Geometry, and Algebra II but were separated into as many as four levels per course (Basic, General, Academic, and Honors). The courses covered different amounts of content, and students enrolled in lower levels did not receive the same amount of content as those in higher levels, making it very difficult for them to progress and be ready to enroll in higher-level math courses in future years due to gaps in the curriculum. In other cases, these courses were created to allow students to repeat one or more years of previously experienced content to catch up and succeed in later coursework. Examples include Prealgebra (a high school repeat of Math 8) and Intermediate Algebra (a course following Algebra that repeated most of the Algebra content to prepare students who had not mastered it).

The MLT and IPACC. All of the courses were formally inspected by the CCPS Mathematics Leadership Team (MLT) and approved by the High School Instructional Program and Curriculum Committee (IPACC). The MLT includes me as a math supervisor, a general education math specialist, a special education teacher specialist, and four high school core math leads. The core leads teach two or three math classes and use the rest of their day to design and implement interventions, lead collaborative team meetings, analyze data, and foster change.

At the beginning of the initiative, the MLT considered the persistent low achievement of Black students. Prompted by research addressing the causes of low math achievement (discussed later in this section), the team requested an analysis of the demographic makeup of course enrollments and the subsequent outcomes for students who successfully completed various courses. The analysis revealed that, despite their intent, there was no evidence that the courses under inspection—Prealgebra, Intermediate Algebra, Business Math, and Algebra III—led to the intended improved outcomes in subsequent coursework. The only significant impact was that enrollment in these courses delayed students' progression through the math academic standards and limited their enrollment in higher-level math coursework.

This analysis revealed that the enrollment of Black students in various high school math courses was inversely related to the presumed difficulty of the course. Black students were overrepresented in courses such as High School Prealgebra and Intermediate Algebra and underrepresented in courses such as Honors Precalculus and the three AP math options, even when their achievement scores were equal to or higher than those of White students enrolled in the more rigorous options. The MLT recommended that these specific courses be systematically removed from the math curriculum.

In CCPS, changes to the instructional program cannot be made in isolation; a proposal must be submitted to the High School Instructional Program and Curriculum Committee (IPACC), discussed, and voted upon. The IPACC was instrumental in the process of changing the mathematics courses. The High School IPACC is a committee in CCPS that includes approximately ten high school general education instructional supervisors and specialists, the four principals, a counselor from each high school, and the head of the Instruction Department. This team, which meets approximately six times annually, exists to consider and discuss proposed course or programmatic changes. The committee analyzes data and asks questions of the group bringing a proposal, aiming to understand context, root causes, opportunities, threats, possible unintended consequences, and potential solutions. In a typical 2-hour meeting, principals or supervisors present a problem, explain various ways they've explored to solve it, and present a proposed solution, often sharing qualitative and quantitative data. Members of the committee bring the idea back to their teams between meetings to discuss and return to subsequent meetings to share findings. At the end of the discussion, members of IPACC vote to approve or deny changes.

In 2013, as part of its ongoing tasks and responsibilities, the CCPS Mathematics Leadership Team (MLT) analyzed enrollments in all grade 9 – 12 math courses, disaggregated by race. This analysis was prompted by recommendations from NCTM and NCSM to examine courses within the sequence that are not proportionally enrolled according to the school system's demographic makeup (TNPT, 2018; NCSM, 2019). The MLT aimed to reduce opportunity gaps in the high school math curriculum, which they believed contributed to persistent lower math achievement among Black and other underrepresented students. Their goal was to increase the proportion of Black students scoring Proficient and above, as measured by district and state assessments and other outcome measures.

To achieve this goal, the MLT adopted a theory of improvement, asserting that no number of enhancements in pedagogy, curriculum, or student disposition will be fully effective if students are stalled in remedial courses or steered away from rigorous mathematical pathways. This theory was informed by our experiences implementing the initiative, conducting a Causal System Analysis (CSA), and reviewing relevant literature.

Through the CSA, we identified that remedial courses—though designed to support struggling students—often function as a form of internal tracking. These courses can delay students' progress through academic standards, limit their access to higher-level coursework, and reinforce perceptions of fixed ability. Students placed in these tracks often internalize negative messages about their mathematical potential, which can erode their confidence, reduce their willingness to engage productively with challenging material, and ultimately harm their mathematical identity.

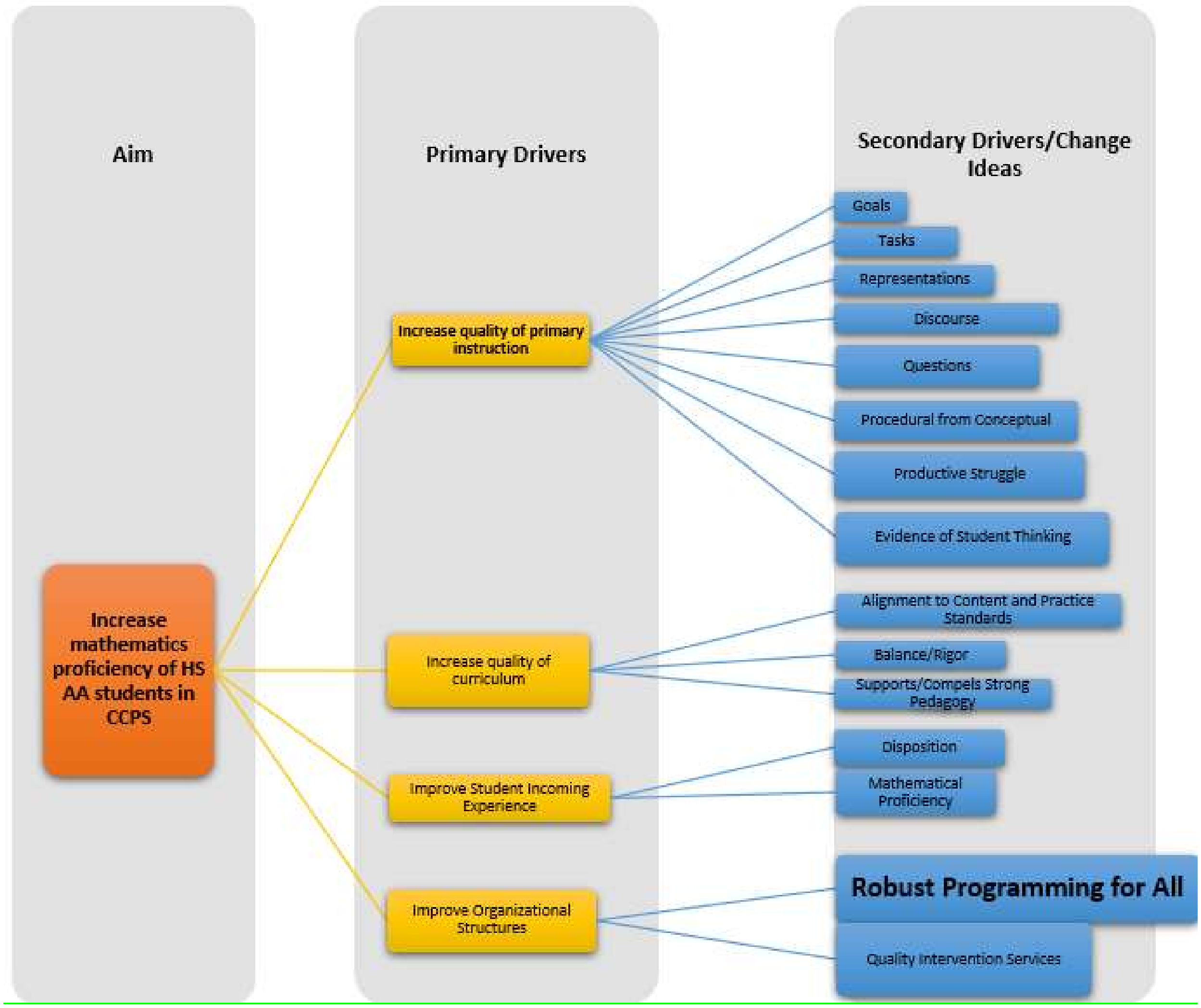
This insight aligns with research showing that tracking structures, including remedial pathways, can mask deeper issues in curriculum and instruction rather than addressing them directly. The literature review emphasized the importance of providing all students with access to rigorous, grade-level content and highlighted the long-term negative effects of tracking on student achievement and equity. By recognizing remedial courses as part of a larger tracked system, we better understood how systemic structures—not just individual interventions—shape students' opportunities and outcomes in mathematics.

Recognizing these challenges, the MLT decided that a comprehensive theory of improvement was necessary to guide our efforts. We needed a structured approach to ensure that all students, particularly Black students, had the opportunity to succeed in rigorous math courses. This theory provided a framework for identifying and addressing the root causes of low achievement and inequitable access.

Based on this theory, the MLT developed a driver diagram (Figure 7) representing the improvement areas adopted by the team. This led to a systematic process of eliminating specific courses—Prealgebra, Intermediate Algebra, Algebra III, and Business Math—from the math course sequence. By removing these courses, we aimed to create a more streamlined and equitable pathway for all students to access higher-level math coursework and achieve their full potential.

Figure 7

Driver Diagram



The Change Initiative Process

Earlier in this introduction, I described a change initiative designed to improve the Black students' opportunities to enroll in rigorous high school math coursework. As noted in the earlier section, the specific improvement activities examined in this study began in 2013. Prior to 2013, CCPS attempted to improve math performance among secondary students by creating classes intended to help struggling students strengthen specific prerequisite skills for the next level math course in the sequence. These courses aimed to build foundational math skills and introduce topics from the upcoming course sequence. However, remedial courses designed to help students catch up can counterintuitively lower student proficiency in math (TNTP, 2018) by exposing students to less rigorous and often less engaging content. Research indicates that remedial courses are more likely to be recommended to high school students of color, creating systemic barriers to their academic progress (EdTrust, 2023a; NCES, 2023).

In this section, I describe the change initiative that began in 2014. Before describing the process of implementing curriculum changes, it is important for the reader to understand the administrative process for curriculum changes in CCPS. The CCPS MLT has continuously worked to improve all identified key drivers impacting student success in secondary mathematics. Teachers attend regular professional learning activities designed to help them incorporate high-leverage instructional strategies into their lesson plans. They work to instill productive dispositions towards math in students as they progress through the program, build strong curricular resources, and engage in collaborative planning to increase lesson effectiveness. CCPS leadership focuses on improving the quality of the teaching staff through hiring strategies and instructional coaching. They also analyze performance data to identify classrooms, content teams, schools, or courses that are not delivering desired results and develop improvement plans, which may include eliminating or redesigning courses.

One of the responsibilities of the MLT is to continuously update their understanding of research and best practice in the field of secondary math instruction. One topic that was emerging to the team at the time was the concept that bridge and remedial courses, while intended to help students can paradoxically hurt the very students they're intended to support while masking problems of curriculum and instruction elsewhere in the program (Long & Boatman, 2013).

If a previous course in the math sequence produces increasing numbers of students who finish underprepared for the next course, it is not immediately obvious that the previous course is producing unfinished learning if students can move into a remedial course to prepare for the next math course. Conversely, if no bridge course exists, the lack of preparation is noticed by teachers and leaders, prompting efforts to correct the underperforming course through curricular, pedagogical, or structural solutions. The existence of remedial courses obscures problems in previous coursework from stakeholders, as students failing to meet expectations in the next course are more readily noticed and addressed than those meeting lowered expectations in a remedial course.

Given this understanding, the CCPS MLT decided to initiate changes in course sequences by eliminating specific bridge or remedial courses through small cycles. In the following sections, I will describe each cycle in the initiative and the data collected to justify the elimination of a course. However, a thorough evaluation of the impacts of these course changes on Black students has never been conducted. The absence of both quantifiable and qualitative data affects future decisions about curriculum or instructional changes, including any unintended consequences. For example, some teachers, counselors, and system leaders remain skeptical about whether the changes are benefiting students. Stakeholders deserve to know the impact of the changes to understand the merit of future related change initiatives.

Summary of Changes: 2013 – 2023

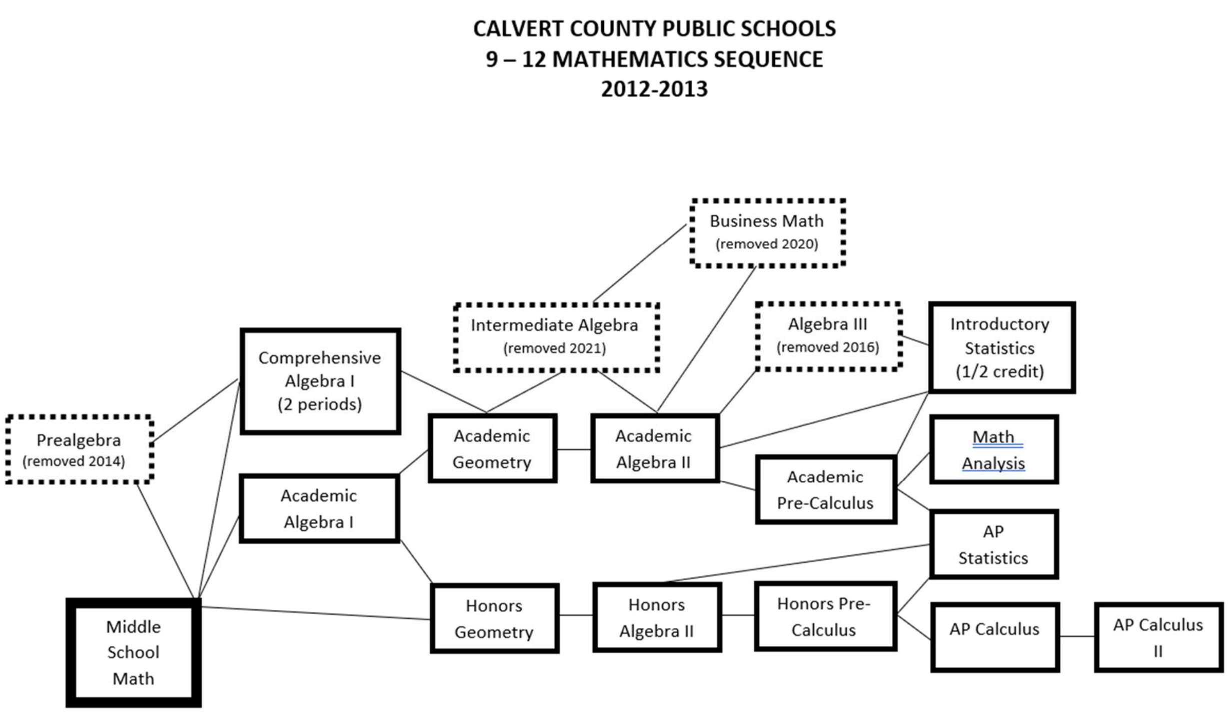
As previously discussed, a change idea implemented in small cycles since 2013 has been to remove courses that contribute to the opportunity gap for students, particularly Black students, in CCPS. In the following section, I will briefly detail the reasoning behind the removal of four courses—Prealgebra, Intermediate Algebra, Algebra III, and Business Math—from the high school math course sequence. The CCPS Mathematics Leadership Team (MLT) was aware of the research leading to the key NCTM recommendation to “discontinue…the practice of tracking students into qualitatively different or dead-end course pathways” (NCTM, 2018, p. 15). This prompted the MLT to examine these courses more closely.

Figure 8 below shows the CCPS grade 9-12 math course sequence in place during 2012-2013, just before the change initiative began. At that time, CCPS required students to earn four credits of mathematics and provided course options that allowed some students to be steered away from

challenging math courses. In the course sequence shown below, a student could take a three-course progression of Prealgebra, Comprehensive Algebra (2 credits), and Geometry, or alternatively Comprehensive Algebra, Geometry, and Intermediate Algebra, earn four credits, and never reach the Algebra II level. This was not the intended outcome when the system (and later, the state) decided that students needed to earn four credits of mathematics to graduate.

Figure 8

CCPS 9 – 12 Mathematics Sequence 2012 – 2013

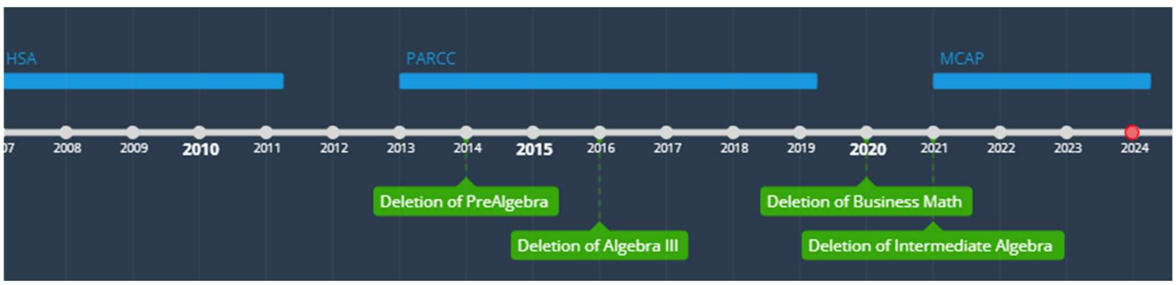


The courses that would be identified as candidates for deletion have been given a dashed border in the figure to help the reader more easily see the courses that steer some students from the core progression.

Figure 9 previews the changes made amidst a landscape in which the state-required testing was evolving.

Figure 9

Timeline of Events



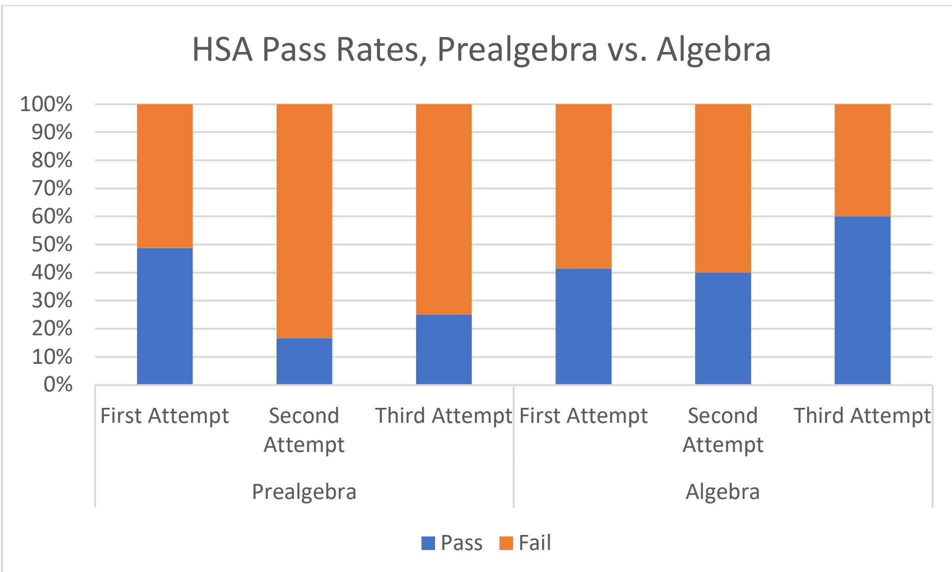
The First Course Eliminated: Prealgebra, 2014

The first course that IPACC examined was Prealgebra. CCPS had two options for diploma-bound students with disabilities who entered high school with very low math readiness levels: a self-contained Algebra I course and a self-contained Prealgebra course. The Prealgebra course was designed for students with disabilities who had little success in middle school mathematics, allowing them to spend a year strengthening previous skills. Some schools in CCPS used the Prealgebra course, while others did not, enabling a comparative study between students who took Prealgebra and those who would have taken it if available at their schools. This allowed the MLT to determine whether enrollment in Prealgebra made a measurable difference in student outcomes.

IPACC first examined which of the two courses led to the highest scores on the High School Assessment (HSA), the graduation requirement for mathematics at the time. They also analyzed whether the percentage of students passing the HSA was higher among those who had taken Prealgebra. Figure 10 was shared and discussed, where 0312 represented the self-contained high school Prealgebra option and 0314 represented the self-contained Algebra option.

Figure 10

Highest Score Attained by Course



Students passed the Algebra test at a 42% rate if they went straight into Algebra I and took the test that year, compared to a 48% rate if they took the Prealgebra course first and then took the Algebra I test and course the following year. This small difference in pass rate was considered insufficient to justify slowing down students' opportunities to build more advanced math skills for an additional year, especially given the much lower pass rates on subsequent attempts. The Prealgebra course was intended to provide students with an extra year of preparation before taking the Algebra I assessment to increase pass rates. However, this did not happen at a rate that justified spending an additional year filling in gaps and catching up. Additionally, course pass rates and overall grades were similar between students in the Prealgebra and Algebra I courses.

To summarize, some schools offered a Prealgebra course for low-performing incoming 9th grade students, but this course did not significantly boost HSA pass rates, HSA average scores, course pass rates, or course average grades. These findings were discussed within IPACC, and despite the data showing no advantage, there were concerns that underprepared students would have nowhere to go without a Prealgebra option. The argument for eliminating the Prealgebra course was that although entering 9th graders had not learned the necessary procedures, facts, skills, and concepts for success in Algebra I, the data did not support enrolling them in a remedial course for a year to relearn middle school material. The data demonstrated that providing Prealgebra was not more effective than maintaining high expectations and embedding support and prerequisite practice into existing Algebra I courses, as schools without Prealgebra had done.

Stakeholders had concerns about removing a support structure from the course sequence, but by the end of the conversation, members of IPACC were persuaded by the data and unanimously voted to eliminate the Prealgebra course from the math sequence.

Elimination of Algebra III: 2016

In 2016, CCPS created a new math acceleration course option, where students were taught the content of Algebra II and Precalculus in one fast-paced, compacted year. Students now had four Algebra-based course options after completing Algebra II: the new Accelerated Algebra II/Precalculus, Honors Precalculus, Academic Precalculus, and Algebra III. The latter course covered approximately 60% of the Precalculus content that did not involve Trigonometry.

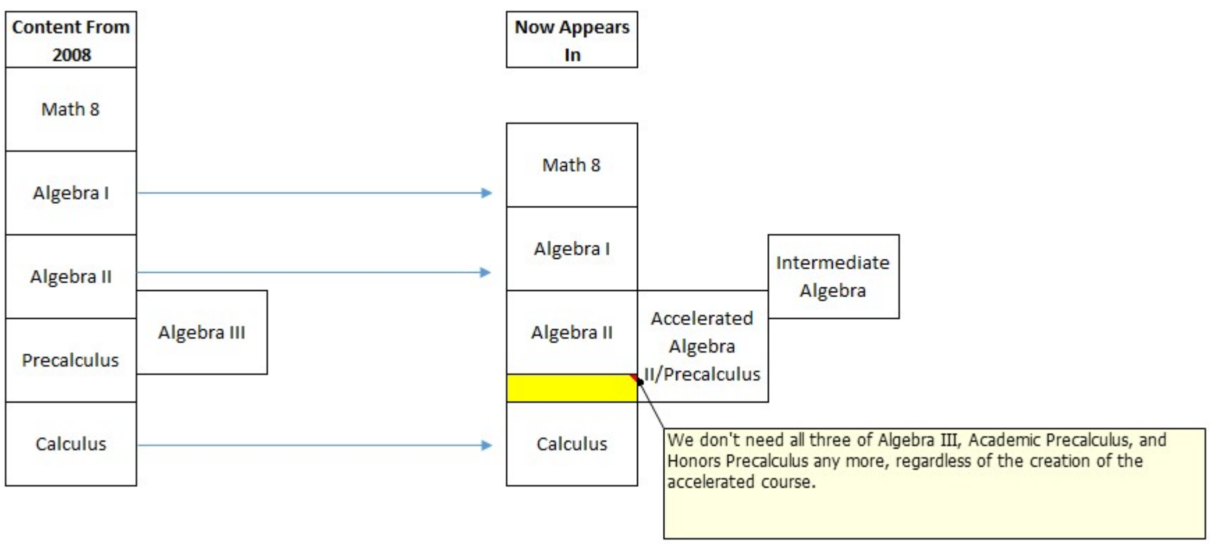
For context, the introduction and adoption of the Common Core State Standards in CCPS from 2012-2015, along with the transition from the HSA to the Partnership for Assessment of Readiness for

College and Careers (PARCC) assessment, increased the difficulty and scope of Algebra I and Algebra II. Meanwhile, the College Board's curriculum for AP Calculus remained the same, reducing the curriculum content gap between Algebra II and Calculus courses. The MLT recognized that Algebra III might be an unnecessary, qualitatively inferior option and investigated further.

In anticipation of the results of this investigation, IPACC discussed the systemic tendency of school systems to create less-demanding courses for struggling students rather than improving instructional practices in more demanding courses. Members of the committee reflected on their collective responsibility to ensure that changes in state guidance and policy are implemented with integrity so that students experience the intended outcomes.

Figure 11

Illustration of Curricular Content Shift Upon Implementation of Common Core State Standards



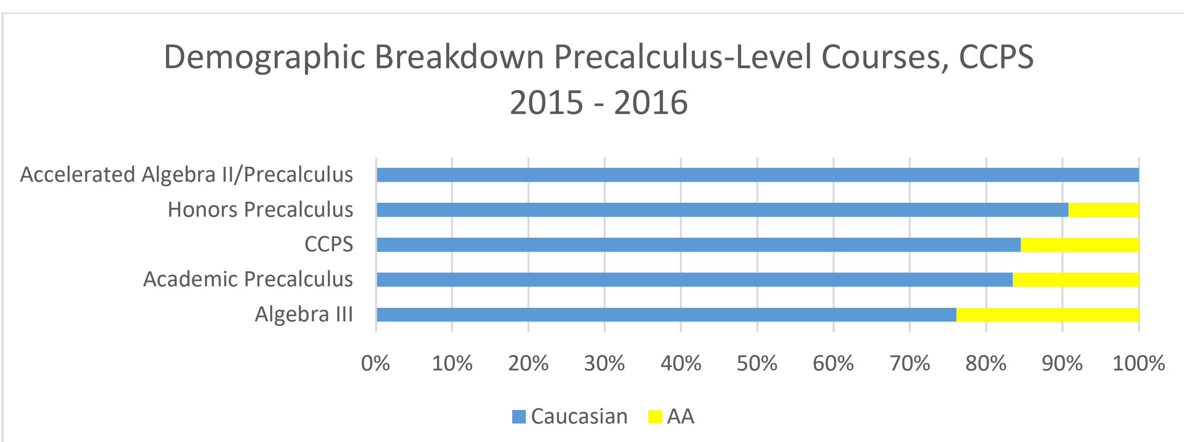
The conversation was heated, as some stakeholders couldn't imagine current or future students of Algebra III succeeding in future math coursework without the course as an option. The MLT argued in IPACC that there did not need to be three levels of courses to bridge the now-reduced skills gap between Algebra II and Calculus. The IPACC review indicated that the content of Algebra III was not inherently easier; the course was designed to cover 60% of what the Precalculus options included, but in more depth. The differences between Algebra III and the Precalculus courses were two-fold: perceptions among parents and school staff regarding the rigor of the class content (leading to discrepancies between the actual and intended curriculum) and the demographic makeup of the courses.

Figure 12, showing the racial makeup of the four course options preceding Calculus, was presented and discussed with IPACC. It was argued that with the increased expectations of the new math standards, Algebra III, whose necessity was already dubious, was completely unnecessary and potentially harmful to the program. The MLT discussed that there was no curricular reason to have so many levels of courses at this stage. With disparities in racial makeup across the levels, IPACC began to suspect that implicit bias was affecting student placement and course completion.

Based on these analyses, IPACC and the MLT agreed on the need for multiple types of post-Algebra II pathways in mathematics rather than multiple levels of the same content. Rather than maintaining four levels of similar algebra-based options, the decision was made to remove Algebra III after the 2016-2017 school year and develop a new, rigorous statistics course to be first offered in 2019-2020.

Figure 12

Demographic Breakdown Precalculus-Level Courses, CCPS 2015 – 2016



Elimination of Business Math: 2020

In 2020, IPACC began discussing the Business Math course, which was not considered a math course but could be taken for one credit of mathematics. By 2020, this course was somewhat of a relic in CCPS; it once had value as an option for students to learn various aspects of personal finance. However, in 2010, a new required half-credit course, Financial Literacy, was introduced by CCPS in response to the 2008 international financial recession. An analysis revealed that the learning objectives of Business Math overlapped significantly with the new Financial Literacy course, with over 80% surface-level overlap and over 50% identical information.

Historically, Business Math was considered a place for students deemed “bad at math” to avoid the challenge of learning new mathematics standards. Although mathematically proficient students had previously enrolled in Business Math as an elective, once the Financial Literacy requirement was introduced, only students considered “bad at math” were recommended for the course. Colloquially called a “dump class” by teachers and counselors in CCPS, this course had little new content and became associated with low expectations among students, parents, counselors, teachers, and administrators.

Recognizing this legacy, IPACC unanimously agreed to remove the Business Math credit in 2020. When the course no longer counted as a math credit and students did not elect to take it, enrollment disappeared, and the course was deleted in 2021.

Elimination of Intermediate Algebra: 2021

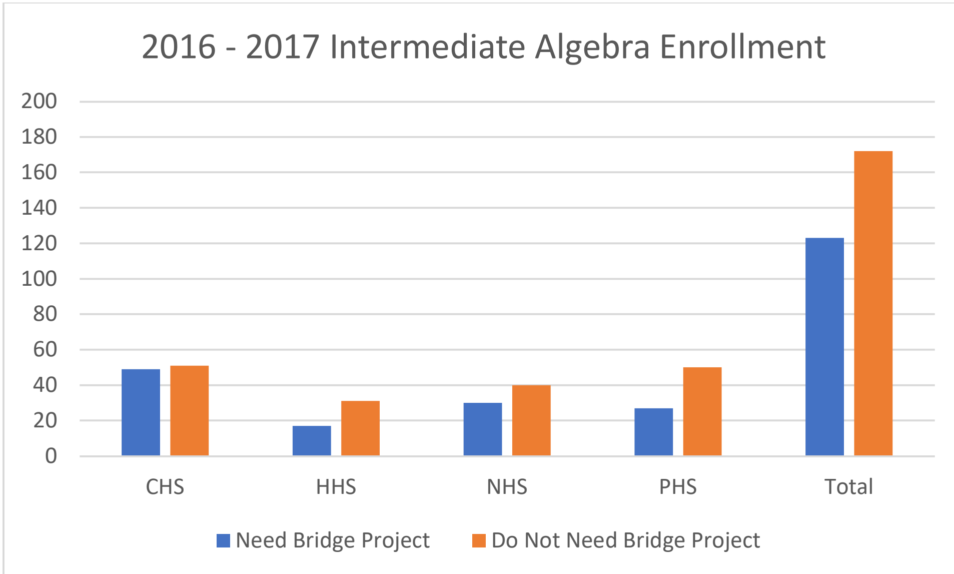
In 2014, the Maryland State Department of Education was preparing districts to transition from the HSA to the new PARCC assessment. Students would be required to either pass the end-of-year standardized assessment with a minimum score or, after at least one failed attempt, complete a Bridge Project—a 20- to 40-page packet of real-world situations requiring knowledge of Algebra standards. Intermediate Algebra was created in 2015 for students struggling with Algebra, intended to build skills and preparedness for Algebra II. It also aimed to give students who had not passed the PARCC Algebra assessment extra time and support within their scheduled math course to complete a state-required Bridge Plan project as an alternative to passing the end-of-year Algebra I assessment. The previous model had students pulled out of other courses to complete these projects, which worked for the number of students who didn't pass the HSA but wouldn't work for the anticipated number of students failing to meet proficiency on the new PARCC test.

When the Intermediate Algebra course was proposed in 2015, IPACC approved to allow it to be used remedially to strengthen math skills for students considered less able but who had already passed the state Algebra assessment. IPACC viewed Intermediate Algebra as additional support since it included material from both Algebra I and Algebra II, preparing students who passed the Algebra assessment but still had concerns about succeeding in the more challenging Algebra II course. Principals, supervisors, and counselors reluctantly agreed that Intermediate Algebra could be appropriate for a limited number of students who did not need to complete a Bridge Project for graduation.

However, when high schools began scheduling students, initial enrollments in Intermediate Algebra were much higher than agreed upon, with significantly more students enrolled who did not need a Bridge Project than those who did. According to an agreement within IPACC, approximately 15 students not needing a Bridge Project should have been enrolled in Intermediate Algebra across all four high schools. However, in its first year as a course option, 172 students—more than ten times the agreed number—were enrolled, supposedly to obtain extra support and instruction before enrolling in Algebra II the following year. See Figure 13 below for the enrollment data shared with IPACC.

Figure 13

2016 – 2017 Intermediate Algebra Enrollment



The NCAA maintains a database of courses they have approved as meeting appropriate criteria for high school student-athletes. These approvals influence some student course placement decisions, as courses without approval would not count towards high school requirements for student-athletes who wish to continue with athletics in college. In 2017, the NCAA rejected accrediting the Intermediate Algebra course, considering it a "transition course" that builds an unnecessary bridge between two courses that already have a coherent transition from one to the other. The NCAA concluded that there were no new skills or standards covered in Intermediate Algebra that were not already addressed in Algebra I and Algebra II.

Stakeholders insisted that the course was valuable and necessary, appealed the decision to the NCAA, and were again denied certification. This was seen as a blow to the arguments for keeping the course, as student athletes would no longer be able to earn eligible credit for it. More importantly, the IPACC concluded that the NCAA's reasons for withholding accreditation were likely similar to those the group had been using to eliminate other courses.

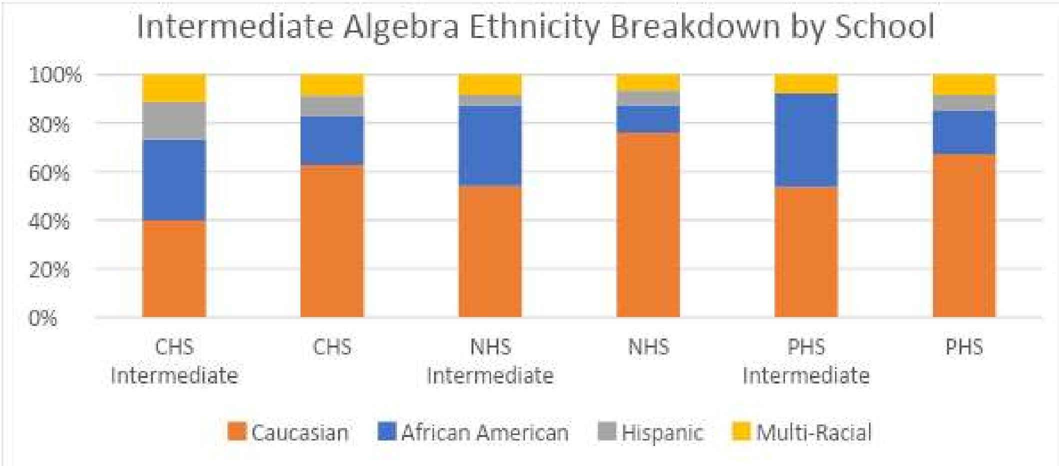
Coronavirus. In the spring of 2020, the Coronavirus pandemic began, and schools across the country closed. In Maryland, school systems requested waivers for various high school graduation requirements, eliminating the need for Bridge Projects. Consequently, the MLT unanimously agreed not to offer the Intermediate Algebra course in the 2020-2021 school year. However, with schools overwhelmed by higher priorities related to transitioning to virtual instruction and meeting basic student and teacher needs during closures, the agreement to not schedule the course was overlooked. As a result, three of the four high schools offered the course and enrolled students.

This provided CCPS leadership with an opportunity to observe the impact of a non-essential transition or support course without the requirement of Bridge Project completion. During the 2020-2021 school year, Intermediate Algebra enrollments in the three high schools consisted entirely of students who had earned credit for Algebra I two years prior but were considered by school staff as unable to succeed in Algebra II.

When comparing the demographic makeup of each school's enrollment in Intermediate Algebra during the 2020-2021 school year, a common finding emerged, as discussed in IPACC, and shown in Figure 14. Students of color represented 50% to 90% of enrollments in this course at each school, significantly overrepresented compared to the population of students potentially eligible for the course, which was 35% students of color.

Figure 14

Intermediate Algebra Enrollments by Race and High School

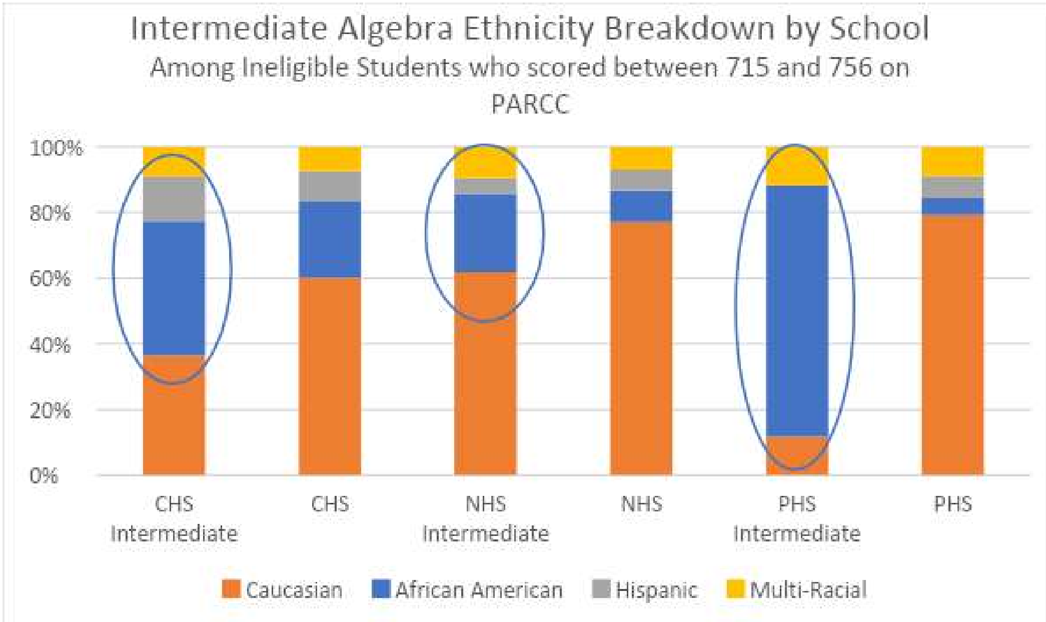


IPACC had specified that students who scored at least 715, within ten points of the minimum graduation requirement score (725) on the PARCC Algebra assessment, demonstrated the minimal required proficiency and readiness to enroll in Algebra II. However, in this instance, teachers, counselors, and building administrators made exceptions for students they perceived to be unready, regardless of their state test scores. Although these students had demonstrated the proficiency level that IPACC had established for success in Algebra II, well-intentioned teachers and counselors erred on the side of caution and recommended Intermediate Algebra, thereby delaying student acquisition of Algebra II standards by one year.

When the MLT analyzed the data for students who had scored at the IPACC threshold of 715 but were still incorrectly enrolled in Intermediate Algebra, the discrepancies between enrollments of students of color in each high school and the enrollments in Intermediate Algebra courses were even greater. Students of color within the group who scored at least 715 on the PARCC made up a significantly higher representation in Intermediate Algebra courses compared to the overall school population, as discussed in IPACC, and shown in Figure 15.

Figure 15

Intermediate Algebra Enrollment by Race Among Students with 715+ PARCC Scores



When these discrepancies were discovered, the MLT asked teachers, counselors, and building administrators why they had made placement recommendations so dramatically different from what was agreed upon in IPACC. A common response was concern that students would have lower or failing grades if they went directly into Algebra II. To investigate this argument, the MLT examined the average final grades for Algebra II and Intermediate Algebra for the 2018-2019 school year, disaggregated by incoming PARCC Algebra performance level to compare students of similar ability. Table 5 presents those results.

Table 5

Average Final Course Grades by Incoming PARCC Score

Algebra II Average Grade by Incoming PARCC Score		Intermediate Algebra Average Grade by Incoming PARCC Score	
Incoming PARCC Performance Level	Average Grade	Incoming PARCC Performance Level	Average Grade
1: Did Not Yet Meet	72.3	1: Did Not Yet Meet	69.0
2: Partially Met	73.9	2: Partially Met	73.8
3: Approached	75.1	3: Approached	77.7
Overall Average	75.7	Overall Average	74.3

The average final grades were almost identical across the two courses and PARCC levels. Admittedly, grades can be subjective and impacted by bias, but they were the stated reason for overidentifying students of color into Intermediate Algebra, warranting investigation. It appears that students with similar knowledge of Algebra I were routed into a lower, transitional course option, Intermediate Algebra. Regardless of whether PARCC scores are an appropriate measure of course readiness, the salient point is that there did not appear to be any increase in lower grades or failure rates among students with the lowest incoming PARCC scores who were enrolled in Algebra II. However, there was a significant increase in access to rigor and learning for students in Algebra II.

To summarize, for Intermediate Algebra placement, the district set parameters to prevent the slowing down of mathematics acquisition, particularly for underserved groups. Stakeholders violated these parameters, recommending this remedial course significantly more often for students of color than White students.

The argument that taking Intermediate Algebra before Algebra II boosts student readiness and leads to higher grades in Algebra II was also examined by the MLT. The final Algebra II grades of students who completed Intermediate Algebra and later enrolled in Algebra II were compared to those who went directly to Algebra II. The data shown in Table 6 do not support this argument, as students at performance levels of 2 or 3 had lower final grades in Algebra II compared to their peers who did not spend a year in Intermediate Algebra.

Table 6

Final Algebra II Grades for Students Who Did and Did Not Take an Extra Preparation Year in Intermediate Algebra

PARCC Performance Level	Went Directly into Algebra II	Took Intermediate Algebra First
2: Partially Met	73.8 (n = 49)	69.9 (n = 52)
3: Approached	76.1 (n = 30)	73.2 (n = 60)

Two claims had been made about the necessity of Intermediate Algebra for some students: first, that going straight into Algebra II would lead to lower student grades, and second, that taking Intermediate Algebra to prepare for Algebra II would increase grades in Algebra II. The MLT demonstrated that neither of these claims could be backed by evidence. The MLT concluded that enrolling in Intermediate Algebra did not provide any benefits to student grades and only served to slow down student progression through the mathematics sequence, denying students the opportunity to enroll in higher levels of math coursework. Additionally, students of color were being enrolled in the course more often than White students. Following a review of the data, IPACC recognized and acknowledged this systematic sorting of students and its implications for the opportunity gap and unanimously approved the deletion of the course.

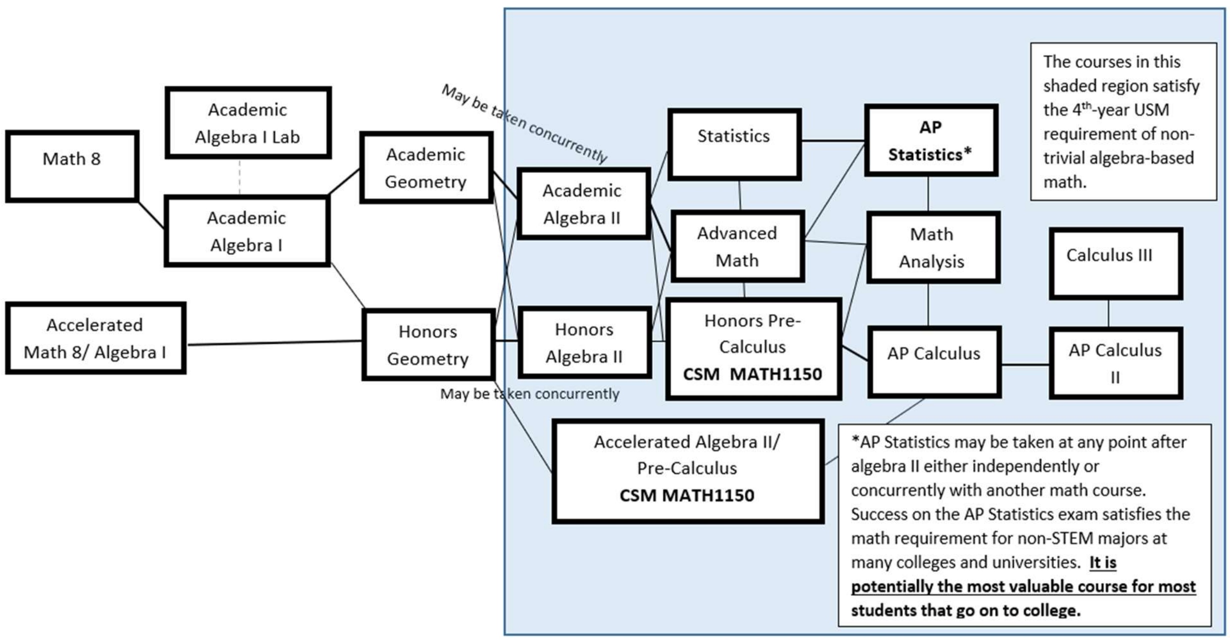
Current Status of the Change Initiative

As a result of the course changes made by IPACC to the math sequence, in school year 2024 there were fewer less-rigorous course offerings in the mathematics program. The CCPS mathematics course sequence for the 2024 school year is shown below in Figure 16. To date, an evaluation has not been conducted to ascertain the impacts on students, particularly Black students, such as whether they are enrolling in higher-level math courses and completing high school with higher mathematics proficiency as measured by available data sources. Additionally, a review of teacher perceptions of the challenges they face without remedial courses for unfinished learning has not been conducted.

Figure 16

CCPS 9 – 12 Mathematics Sequence 2023 - 2024

CALVERT COUNTY PUBLIC SCHOOLS
8 – 12 MATHEMATICS SEQUENCE
2024-2025



The CCPS MLT is considering changes in math coursework for the 2025 – 2026 school year and beyond. The first proposed step is to consolidate Academic and Honors Precalculus into a single course at the Honors level. This proposal is similar to the one that led to the elimination of the Algebra III course. Currently, CCPS offers three Advanced Mathematics courses: Statistics and Precalculus. There is no need to provide different levels of the same Precalculus course. Students who are not prepared for Honors Precalculus can choose other courses that align with their desired major or career.

The second proposed step is to create a single level for both Geometry and Algebra II courses. Currently, these courses have Honors and Academic levels, but three of the four high schools have been piloting a detracking initiative since 2021. This initiative consolidates the courses into one level that meets state standards. CCPS detracking efforts have been implemented across the four core content areas, and their evaluation goes beyond the scope of the current study.

Summary of the Theory of Improvement

The work to eliminate certain math courses over time aimed to improve the math outcomes of Black students. However, this aim has not yet been investigated. The working theory was that by removing redundant, lower-rigor options from the math course sequence, students would engage in rigorous, higher-level mathematics coursework. Consequently, these students would demonstrate higher proficiency in mathematics.

Over the course of the work on course changes, The CCPS MLT examined data as discussed earlier and found evidence of systemic opportunity gaps in some math courses based on incorrect assumptions. Data-driven conversations within IPACC led to the elimination of some courses. These changes align with recommendations from the National Council for Teachers of Mathematics and other organizations. There has been concern from some stakeholders, particularly teachers and counselors, who feared that removing certain course options would significantly increase student failures.

It is important to note that the removal of these courses was one of many strategies implemented to improve Black student achievement within classrooms in CCPS. Professional development on culturally responsive instruction was provided for all teachers and leaders in CCPS. Teachers and leaders engaged in courageous conversations about equity and discussed instructional practices known to make learning more accessible for all students (Singleton, 2021). Black students likely would have successfully completed Algebra II at higher rates over time with or without the course eliminations due to these additional strategies. However, the series of course removals may have acted as an accelerant, as most students had no other choice but to progress through the Algebra II course.

There are limitations in the available data that impact our ability to draw causal conclusions about the change initiative. The initiative was not initially designed to be studied, and ethical concerns regarding experimenting with students' education meant that comparisons between study and control groups could only be made retrospectively due to circumstances that led to the course being implemented in some buildings but not others.

Additionally, the required state testing program underwent two major shifts: from HSA to PARCC in 2013, and from PARCC to MCAP in 2021, as illustrated in Figure 17. The COVID-19 pandemic further disrupted typical schooling for nearly two years, resulting in missing assessment data and other complications in comparing student cohorts.

Given these data issues, the MLT does not have a comprehensive analysis of some key student achievement and course enrollment outcomes. Therefore, it is not possible to make definitive causal statements about the impact of the initiative.

Figure 17:

Timeline of Course Changes

The MLT has not conducted a comprehensive assessment of teacher and counselor opinions about the course eliminations. Many teachers and counselors have expressed in meetings or anecdotally that they would like to see some of the previous courses reinstated. They believe that students need course options that meet them at their level and allow them to be successful. These stakeholders have faced difficulties during the transition, particularly because they now see students in courses with lower acquisition of math knowledge than in prior years. Previously, when a student failed to learn content in a math course, they could be enrolled in a lower-level course as a safety net. Now, teachers and counselors are noticing a lack of preparedness in some students enrolled in more rigorous courses and are faced with the urgency to address these gaps as part of their usual course content because struggling students do not have "someplace else to go."

The MLT's stance continues to be that the solution to struggling students in mathematics classrooms is to improve the quality of instruction, student factors such as incoming preparedness and mindset, curriculum, and all other drivers of mathematics proficiency to ensure all students are prepared for success in each course in the math sequence. The existence of lower-level courses previously reduced the urgency to address inadequate learning within a course. The elimination of such courses can lead to real problems for teachers, counselors, and parents, including finding ways to provide more intensive instruction as part of an advanced course, as well as issues with grading and impact on some students' GPA. Teachers and counselors express that they are doing everything they can to help all students succeed. To these advocates, removing the lower-level courses can feel like a wrong decision because there are now students in the higher-level courses with more gaps in knowledge.

Purpose of the Investigation

Given the lack of comprehensive analyses of student data and teachers' perceptions of the course changes, the purpose of my investigation was to formally examine the impacts of the mathematics course changes implemented in CCPS on the math achievement and course enrollment of Black secondary students. Specifically, I investigated the effects on enrollments and completions in higher-level math coursework, as well as achievement on various standardized measures. Additionally, I gathered the perceptions of all secondary math teachers in the four CCPS high schools who participated in the course elimination initiative.

The results of the investigation are intended to assist the MLT to determine whether changes need to be made to the existing course sequence and/or whether additional supports are required. The findings will also be used to inform stakeholders within and beyond CCPS about the effectiveness and impact of the systematic course eliminations in CCPS.

Section 2: Study Methods.

As noted at the end of Section 1, the purpose of my proposed investigation was to systematically examine the impacts of the change efforts on Black secondary students in CCPS. Specifically, I investigated the effects on enrollments and completions in higher-level math coursework, as well as achievement on the math section of the SAT. Additionally, I surveyed all CCPS math teachers who participated in the math coursework changes to obtain their perceptions of the process of removing lower-rigor courses as well as the impacts of the changes and the changes they made in practice to accommodate these structural changes and the supports they found helpful and/or would have liked to have had.

The results of the analysis will be crucial in informing leadership within Calvert County Public Schools (CCPS), particularly the Mathematics Leadership Team (MLT) and other content supervisors, about future directions. These may include efforts to make other subject-area courses more inclusive and to expand supports for all students who struggle, ensuring they have equitable access to higher-level coursework. The findings will also help the MLT evaluate whether changes are needed to existing math courses to better support both students and their teachers.

Beyond the district level, the insights gained from this work may also be valuable to state and national education leaders who are grappling with similar challenges around equity, access, and course placement. By documenting how systemic structures influence student outcomes and identifying strategies for improvement, this analysis can contribute to broader conversations about policy, curriculum design, and support systems aimed at closing opportunity gaps in mathematics education.

Research Questions

The following research questions guided my study. For clarity, I refer to the set of courses that were removed—*Prealgebra*, *Intermediate Algebra, Business Math, and Algebra III*—as non-advancing mathematics courses. These courses were typically designed for students who struggled in earlier math classes but often did not lead directly to college-preparatory pathways such as Precalculus, or Statistics.

1. What evidence exists that the removal of non-advancing mathematics courses has led to increased access to higher-level mathematics for Black students in CCPS?
2. What evidence exists that the removal of non-advancing mathematics courses has led to increased achievement in higher-level mathematics for Black students in CCPS?
3. How do math teachers who participated in the course changes perceive the change effort of eliminating non-advancing mathematics courses?

Methodology

In this section I will first describe the study design and rationale. I will then explain the data sources used to answer each of the research questions. I will then describe the procedures for obtaining and analyzing the data and conclude by summarizing my study.

Study Design

In this section I detail the framework employed in this study, which used a quantitative descriptive approach and cohort analysis to explore enrollment/completion of Algebra II and subsequent coursework, as well as achievement measures on the mathematics section of the SAT among Black students enrolled in one of the four high schools in CCPS. I then analyzed descriptive statistics measuring teacher opinion of the change effort before and after seeing data discovered while attempting to answer the first two research questions. The section provides a comprehensive overview of methods used to collect and analyze data.

Quantitative Descriptive Approach. For my first two research questions, I performed a quantitative descriptive cohort analysis of existing record data. This method is well-suited to objectively describe a set of outcomes for each successive cohort of students (Scribber, n.d.). This method results in summaries by cohort, allowing statistical summaries and patterns to emerge while reducing potential researcher bias. It enables me to quantify differences between groups over time and identify the significance of my findings, serving as a replicable study for future research. For the first research question I examined the proportion of Black CCPS students that successfully completed Algebra II and a USM-approved post-Algebra II course over time. And for the second research question I examined how many Black students were able to score slightly below average, average, and slightly above average on the mathematics section of the SAT as will be later detailed.

For the third research question, I surveyed teachers after sharing informal results of the first two research questions with them using a twelve-question online survey. I conducted quantitative analysis on the results and synthesized emerging patterns in teacher response. Because this was an ex post facto study, there was no experimental design, and I did not attempt to draw causal conclusions from the data.

Data Sources

This study used extant record data from the CCPS data warehouse, which includes comprehensive enrollment, credit, transcript, and assessment records for all high school courses. These data are audited regularly by members of the CCPS IT department to ensure accuracy and completeness, providing reliable data for analysis and are routinely used to generate reports.

The study also used survey data from a Google Form that I maintain. The survey results were anonymized. At the end of a professional learning day, my learning specialist gave all present teachers fifteen minutes to answer the survey questions which gave teachers opportunity to give their thoughts on the change project from 2014 to present. I used a blend of closed- and open-ended questions, as shown in Appendix C. I then forwarded the survey to my building leads and asked them to administer the survey to anyone not present on that day during future professional learning time. When I obtained the survey data I removed responses from the final two demographic questions, realizing that a respondent may no longer be anonymous if they're the only teacher in the district with those demographics.

Types of Records. The primary data sources for this study included course completion records, SAT assessment scores, and demographic information. Key variables included student race, enrollment dates for Algebra II and other upper-level mathematics courses, course completion status, and SAT Mathematics and Reading scores. These data were extracted from the Calvert County Public Schools (CCPS) data warehouse through formal requests to the CCPS IT department.

To address the first research question, I used existing enrollment and course completion data from 6,320 students who entered ninth grade in CCPS between 2006 and 2021. I requested transcript-level data beginning in 2006, the earliest year available in the district's electronic data system. The dataset included course enrollment and completion information for the incoming 9th grade cohorts of 2006, 2011, 2016, and 2021. This allowed me to examine the proportion of students from three student groups who successfully completed Algebra II, as well as those who completed a USM-approved post-Algebra II course. Although the primary focus of this study is on Black students, students with disabilities were included in the analysis. This decision reflects the district's broader responsibility to all students and acknowledges the relevance of other district initiatives—such as inclusive practices and flexible co-teaching models—that may intersect with the course removal policy.

To address the second research question, I requested all available SAT Mathematics and Reading scores for students in the same cohorts. I also requested internal course final exam data from

2006 to the present; however, the IT department was only able to provide data from 2017 onward. Due to the disruptions caused by the COVID-19 pandemic (which eliminated 2020 and 2021 exam data) and two major revisions to the district's final exam structure between 2017 and 2024, I determined that the internal benchmarking data lacked the consistency necessary for meaningful analysis and excluded it from the study.

Importantly, the SAT and course transcript data were provided in a single report that included both assessment and course history for each student. Upon receiving the dataset, I immediately removed all personally identifiable information (PII) in accordance with the Institutional Review Board (IRB)-approved data management plan. This allowed me to link SAT scores with course completion data while maintaining student confidentiality.

Students who dropped out, did not complete the relevant courses, or did not take the SAT were included in the dataset but were counted as not having reached the corresponding benchmarks. Their absence from upper-level coursework or SAT participation was treated as meaningful data, reflecting the broader patterns of access and achievement that this study aimed to examine.

study.

Relevance to Research Questions. The enrollment/completion data are directly relevant to the research question of determining the year-over-year increase in the number of Black students completing Algebra II and subsequent coursework. The assessment data are directly relevant to the research question of determining the year-over-year increase in the number of Black students able to score at various levels on SAT, a test that includes upper-level mathematics. The teacher survey data are directly relevant to the research question of determining the teachers' perception of the course deletions. The comparisons to data in other subject areas will serve to context growth rates, attempting to account for differences in completion and achievement data that were present in mathematics that did not occur in other subject areas. The teacher informal and formal survey data are directly relevant to the research question of teacher perception of the course removals.

Data Collection

This section outlines the procedures for collecting data from the CCPS data warehouse to establish a systematic and comprehensive approach. Data collection was conducted over a month-long period, with me making data requests and follow-ups to the CCPS IT department as appropriate.

Data Extraction Process. Access to administrative records was obtained through formal approval from the CCPS IT department and the IRB. Data were primarily extracted using database queries. When available, data points were cross-referenced with already-available data to confirm completeness and accuracy of these new data requests. The key variables extracted included race, enrollment/completion dates for Algebra II and other upper-level courses, course completion status, and SAT scores. Extracted data were stored onto my password-protected computer. Data were always anonymized to protect student privacy.

Teacher Survey Data. I already had access to the informal version of teacher survey results that I ask on each year's annual survey (Appendix B) before I decided to formalize this study as research. These results are anonymous and stored in my Google Drive. For this study I administered a more formal, IRB-approved version of these survey questions (Appendix C) with anonymous responses and stored them in my Google Drive. This is a password-protected account and no one else has access to these data sources.

Ethical Considerations. All data were anonymized to remove any personally identifiable information. Access to the data has been restricted to me and the CCPS IT department member that extracts the data. Since the study involves the use of extant records, informed consent from individual students is not required. However, approvals from CCPS and the IRB were obtained to ensure ethical compliance. Though I already had access to all data required for this study as a responsibility of my work as supervisor of the program, personally identifiable information was deleted from the data and excluded from the analysis by me to maintain ethical standards for the purpose of this study.

Data Analyses

For my first research question on enrollment/completion, I first determined the percentage of CCPS students who have earned a credit in Algebra II throughout their academic career from the freshman cohorts of 2006, 2011, 2016, and 2021 and disaggregated by race. I also determined the number of students from the same cohorts who have earned a credit in a USM-approved post-Algebra II course throughout their academic career, disaggregated by race. I reported the change over time of Black students compared to the full population.

For my second research question on achievement, I looked at SAT data to determine the number of Black students who have achieved scores of 400 and above, 500 and above, and 600 and above on the mathematics portion of the SAT. These numbers were selected as proxies for one standard deviation below average, average, and one standard deviation above average, as the average and standard deviation of SAT subject area scores were approximately 500 and 100 for the period (College Board, 2024). I then conducted a similar analysis for the Reading portion of the SAT. I calculated the rate of increase for SAT taking, scoring 400+, 500+, and 600+ for CCPS students on the math and reading sections for the periods and calculated the annual rates of increase, by first finding a linear regression model to smooth the year-to-year fluctuations that can arise from small sample size and then using the formula, Cumulative Annual Growth Rate = $\frac{Ending\ Value}{Beginning\ Value}^{1/t} - 1$, where t is the number of years (UN ESCAP, 2015). Because there was a redesign of the SAT in 2015 that qualitatively shifted the Reading portion, I limited my study of reading scores to the period from 2006 – 2015. The

Mathematics portion of the SAT remained stable beyond 2015, so I included Math SAT data from 2006 until the pandemic greatly shifted SAT-taking practices in the district after 2019.

Cohort Analysis. Using transcript and assessment data, for my first and second research questions, I analyzed the rates at which Black students enrolled in and completed coursework from Algebra II and beyond. For this study, I used the earliest available data in the CCPS data warehouse from 2006 as a baseline and included data to the present. Due to the organization and availability of the data, this study focused on students who entered 9th grade in the years under consideration. Students who transferred out of CCPS were excluded from this analysis. The distinction between transfers and dropouts was determined based on specific codes associated with students when transcript requests were received from the receiving districts. Course completion and test score data were extracted from the CCPS data warehouse through data requests to the CCPS Information Technology (IT) department. The data were always anonymized immediately upon receipt.

For my third research question, I aimed to understand how teacher perceptions evolved after being presented with data on the impact of course removals. Prior to sharing any findings, CCPS math teachers had completed an annual survey in June 2024 that included questions similar to those used in my formal dissertation survey (see Appendix B for the initial informal survey questions). After analyzing the results from Research Questions 1 and 2, I shared these preliminary findings with the teachers. I then administered a formal survey to the same group to assess whether their views had shifted in response to the new information. This approach allowed me to examine changes in teacher perceptions before and after they were informed of the enrollment, completion, and achievement trends associated with the course removals.

Data Analysis

This section outlines the procedures for analyzing the data collected from the CCPS data warehouse to identify trends and patterns in course completion and achievement rates. Analysis of teacher survey data will also be discussed.

Administrative Record Data Analysis. Descriptive statistics were used to summarize the completion and achievement rates for Algebra II and other upper-level courses, as well as teacher perception before and after teachers learned the impact on completion and achievement. Trend analyses were conducted to examine year-over-year changes in the proportion of Black students completing Algebra II and subsequent coursework. They were also conducted to examine year-over-year changes in the proportion of Black students able to score 400+, 500+, and 600+ on the SAT math and reading assessments. This involved using regression analysis and calculating annual growth rates using the formula discussed earlier.

Teacher Survey Data. The results of some of the questions on the survey were histograms representing the number of responses in each of 5 categories on a Likert scale in a Google Form responses summary screen, from 1 representing "very bad decision" to 5 representing "excellent decision". Descriptive statistics were used to compare teacher perception before and after learning the results of the first two research questions.

Software Tools. Data analysis was conducted using Microsoft Excel for regression analysis and the Microsoft Excel Analysis ToolPak for t-tests. The Analysis ToolPak was chosen because it is free, available, familiar to me, robust, and used widely in a variety of fields. These tools facilitated the calculation of descriptive and inferential statistics and helped me visualize the data trends.

Limitations

This study was limited to the data that I were able to access. I previously discussed difficulty in obtaining internal benchmark data prior to the 2017 school year. The COVID-19 pandemic significantly disrupted the use of SAT in CCPS, so I had usable data only through the 2019 school year. The SAT test saw a change in structure for the reading/language arts assessment in 2016, so I was only able to use scores until 2016 for the reading portion. Because of the way data are stored in CCPS, I only have access to students that entered a 9th grade cohort and graduated or dropped out from CCPS; the data do not include students who transferred out of the district. Because students previously took the courses studied by this analysis in various years, it was difficult to assign exact dates of impact for removal of courses when reviewing transcript data, which is why long-term trend data is the focus of this study. Because transcript data in CCPS only include completion and not enrollment data, ignoring the very few students that attempted and later dropped a course without completing, completion data are used as a proxy to represent the numbers of students *successfully* enrolled into courses.

I did not anticipate difficulties with the teacher survey data because, as an instructional leader, I regularly survey teachers to understand their opinions, successes, and frustrations to be responsive to emerging needs. I typically have very high response rates. However, with a recent CCPS change in professional learning model that gives me access to only general educators in math and not special educators, I only had 24 out of 51 high school teachers of math respond to the survey.

Protection of Human Subjects

The University of Maryland Institutional Review Board (IRB) within the Division of Research determined that this research was exempt from IRB review. See Appendix F for the exemption letter.

Summary of Methodology

Great lengths were taken to ensure the integrity and appropriateness of this research. The confidentiality of all students and teachers involved was rigorously preserved. Personally identifiable information was immediately removed from the datasets, and the survey was anonymized from the outset to safeguard the confidentiality of study subjects. These measures were implemented to uphold ethical standards and protect the privacy of participants throughout the research process.

Summary of the Study

This study examined the impact that removing courses from the CCPS course sequence had on enrollment/completion in Algebra II and subsequent courses for cohorts of Black secondary students in CCPS between 2006 and 2024. I also examined whether there was an associated increase in achievement scores between these cohorts of students over time. The study also obtained math teachers' opinions of the course changes.

I conducted a quantitative descriptive cohort analysis of extant record data for the enrollment/completion and achievement data. I conducted an analysis to examine teacher perception, before and after their learning of the completion and achievement data. It included regression analysis through Excel's Analysis ToolPak to determine the significance of differences in growth rate found. These methods were chosen to maximize the power of inference that can be made about the impact of the removal of the courses, given the ex post facto nature of the study and some potential data limitations related to a relative dearth of data in upper-level math courses. All personally identifiable information was removed from the data and prior permission was obtained from both CCPS and the IRB.

Section 3: Study Findings, Conclusions and Recommendations

Introduction

The purpose of this study was to formally investigate the impacts of the change efforts on Black secondary students in CCPS. I examined the effects on enrollments and completions in higher-level math coursework, as well as achievement on various standardized measures, including internal benchmarks and the math section of the SAT. Additionally, I aimed to determine how CCPS teachers who participated in the math coursework deletions perceive the process of removing lower-rigor courses.

The results of the analyses can be crucial in informing CCPS leadership about possible future efforts to reduce lower-level coursework in other subject matter courses and to identify supports for all struggling secondary students in the system. The findings will also enable the MLT to determine if and what changes may need to be made to existing math courses to better support students and teachers. Finally, I hope the results of this study informs other change efforts around the state and nation at a time when leaders in the math education field are calling for districts to undertake this work of identifying and removing courses that allow students to be steered around the core mathematics sequence (NCTM, 2018) and states are beginning to enact it into policy (Maryland State Department of Education, 2025).

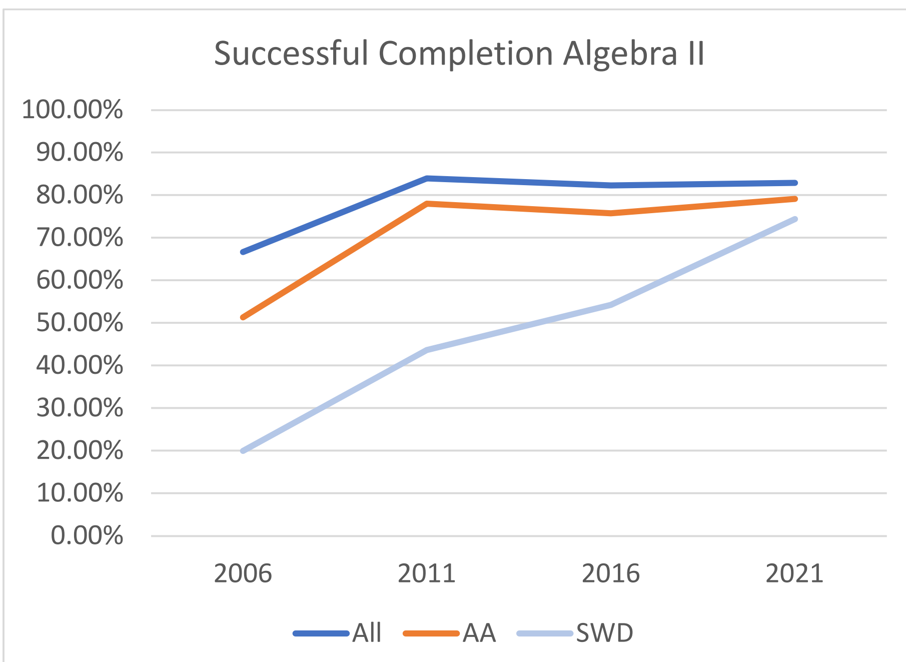
Three research questions guided my study. In the following sections I first present the results of my analyses by each question. This will be followed by a synthesis of the results and a discussion of the implications.

Research Question 1: Removing Lower-Level Math Courses and Black Student Access and Outcomes

The first question investigated what evidence exists that removing lower-rigor courses has led to increased access to higher-level mathematics for Black students in CCPS. Figure 18 below indicates that Black students (as well as students with disabilities) showed notable increase in successful completion of Algebra II over the period from 2006 to 2021. The freshman cohort of 2006 had approximately 50% of Black, and 65% of all students earning credits of Algebra 2 by the time they graduated. The proportion of students from the Black and the full groups increased by 28% and 16% respectively, to 79% and 83%. The gaps between proportions of Black students and the full group have now reduced from 15% to 4%.

Figure 18

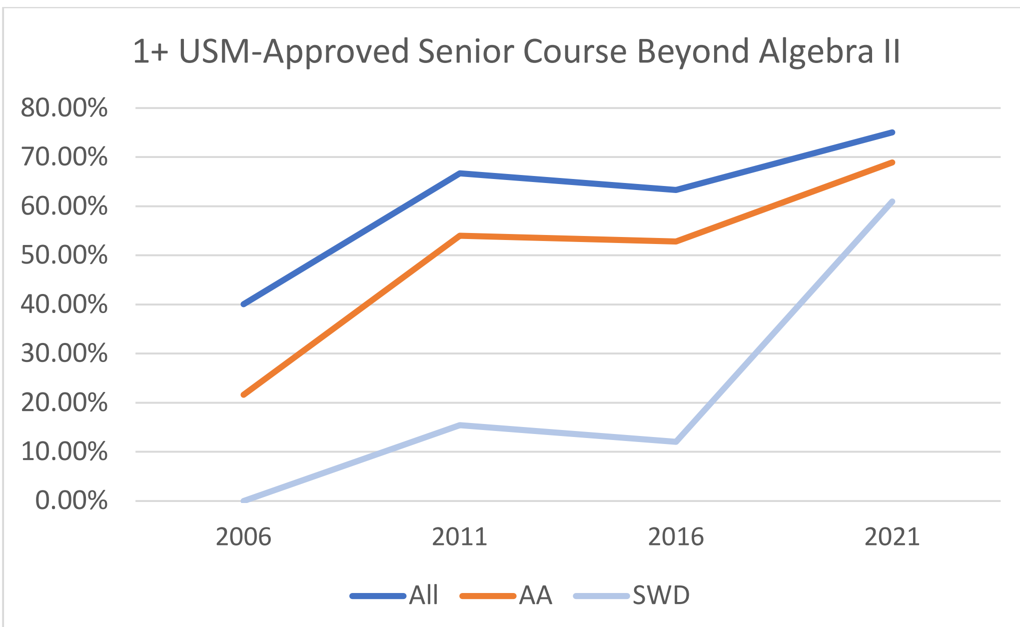
Successful Completion of Algebra II by Student Group



I next looked at enrollment in and successful completion of at least one USM-approved post-Algebra II course. Figure 19 below indicates that Black students (as well as students with disabilities) showed a significant increase in successful completion of at least one USM-approved post-Algebra II course over the period from 2006 to 2021. The freshman cohort of 2006 had approximately 22% of Black, and 40% of all students earning credits of Algebra 2. The proportion of students from the Black and the full groups increased by 47%, and 35% respectively, to 69% and 75%. The gaps between proportions of Black students and the full group have now reduced from 18% to 6%.

Figure 19

Successful Completion of USM-Approved Post-Algebra II Course by Student Group



The data indicate significant progress in closing the opportunity gaps in Algebra 2 credits among special education, Black, and all students. The reduction in gaps from 47% to 9% for students with disabilities and from 16% to 4% for Black students demonstrates a substantial improvement in equity and access to higher-level mathematics courses. This suggests that the interventions and policies implemented over the years have been effective in promoting academic success across diverse student groups.

As previously claimed, access to Algebra II would likely have happened without the course closings. It's unclear whether this is true after 2011, as the freshman cohort from 2016 stagnated, decreasing slightly in the proportion among Black students for both course types. However, there was rapid improvement from the 2016 to the 2021 cohort, during which the percentage of students that completed a USM-approved post-Algebra II course increased among Black students and all students from approximately 53%, and 63% to approximately 69%, and 75%. As a function of percent change among proportions of these student groups taking these courses, this amounts to 30% increase among Black students, and 19% increase among all students across a five-year period.

Research Question 2: Evidence of Increased Achievement in Higher-Level Math for Black Students After Course Removals

The second, and arguably more important question investigated was what evidence exists that removing courses has led to increased achievement in mathematics for Black students in CCPS. The theory behind this change effort was that one key driver of achievement gaps has been opportunity gaps driven by a systemic tendency for stakeholders to know that Black and other students from historically underserved groups have had disparate outcomes, and with best intentions, steer these students away from the most challenging and rigorous opportunities in attempt to help these students' grade point averages and graduation rates, not realizing the impact these actions have on students' post-secondary preparedness that has been discussed in the literature review. It was my hope as supervisor that if I were able to close access gaps to higher-level mathematics for Black students, we would see corresponding increases in mathematical proficiency.

This has been a relatively less-noticed level of mathematics proficiency, as pushes for standardized testing, designed to ensure districts focus on achievement of an established minimal proficiency for all students, have largely focused on student achievement at the 9th grade, Algebra I level. Maryland has recently stretched this accountability to higher levels with recent legislature (College and Career Readiness and College Completion Act, 2013), but as they continue to work to define what exactly constitutes college and career preparedness moving into the 2025 – 2026 school year, public attention will not shift to these increases in proficiency beyond Algebra I for some time yet.

A widely recognized measure of upper-level mathematical proficiency is the Scholastic Assessment Test (SAT), a standardized exam commonly used for college admissions in the United States. The SAT includes content aligned with Algebra II, making it a relevant indicator of student achievement at this level. Improvements in SAT performance among Black students would therefore represent the types of proficiency gains targeted by this change initiative. It is important to acknowledge that SAT participation rates fluctuated across the study period. To account for this variability, changes in performance across different achievement levels were analyzed relative to the overall growth in test participation.

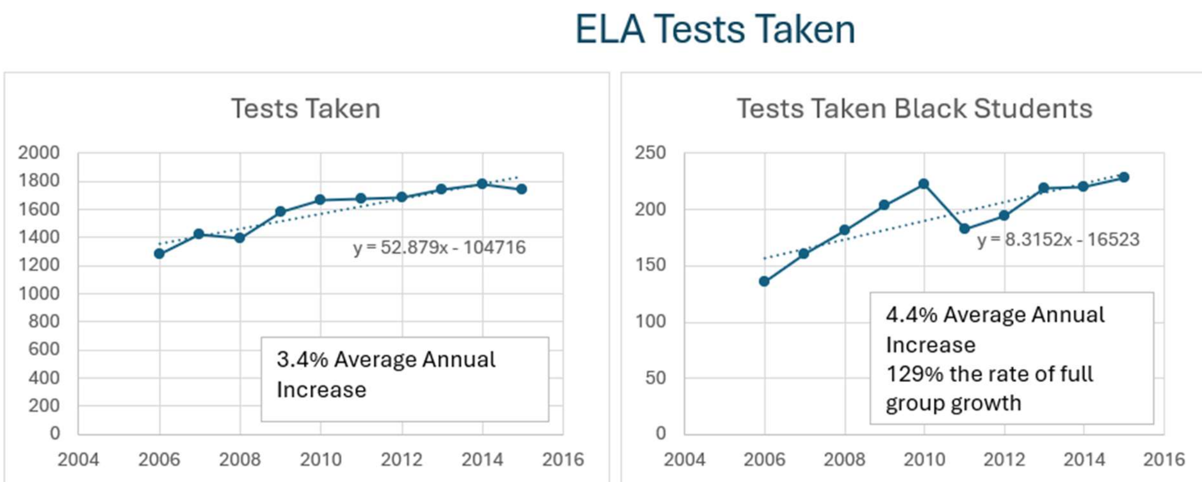
Reading SAT Results

Because CCPS had additional strategies to improve its inclusivity and equity for all students across all subjects that operate as confounding variables in this study, I will start with a discussion of CCPS data on the Reading section of the SAT as a control of what should be expected with growth of Black student performance if the course closures being studied had not happened. I argue that the course closures had additional impact on math achievement in the district that would not have been experienced in other subjects because the other subjects never had course options that allowed students to be steered around the core sequence, as existed in mathematics.

I use the Reading scores to be a representation of the growth in achievement made through improvements in the CCPS English/Language arts (ELA) department. I first examine the number of tests taken by year. The overall tests taken increased districtwide by an average of approximately 3% each year, while the tests taken by Black students increased by 4% each year, as shown in Figure 20. This was approximately 1.3 times the growth rate in tests taken for Black students during this period.

Figure 20

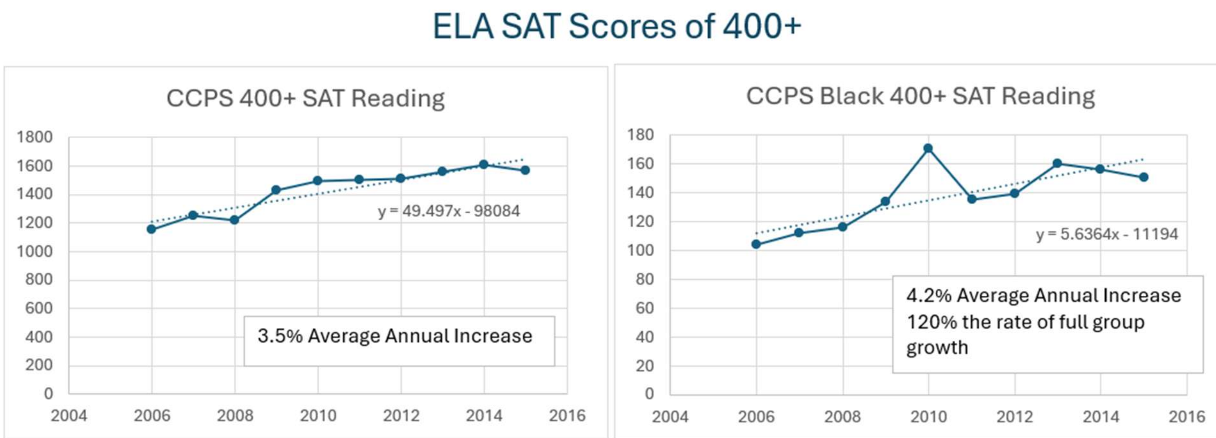
ELA SAT Tests Taken



We had similar increases at the 400+ level, with again an average of 3.5% each year for the full group, and 4.2% increase each year for Black students. This was approximately 1.2 times the growth for Black students during this period, as shown in Figure 21.

Figure 21

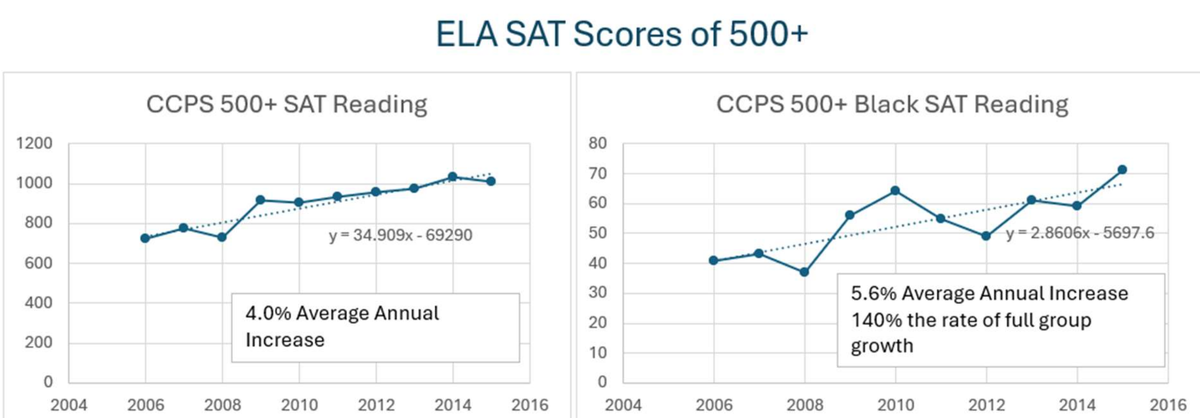
ELA Scores of 400+



We also had similar increases at the 500+ level, with now 4% gain each year for the full group, and 5.6% increase each year for Black students, as shown in Figure 22. This was approximately 1.4 times the growth for Black students during this period.

Figure 22

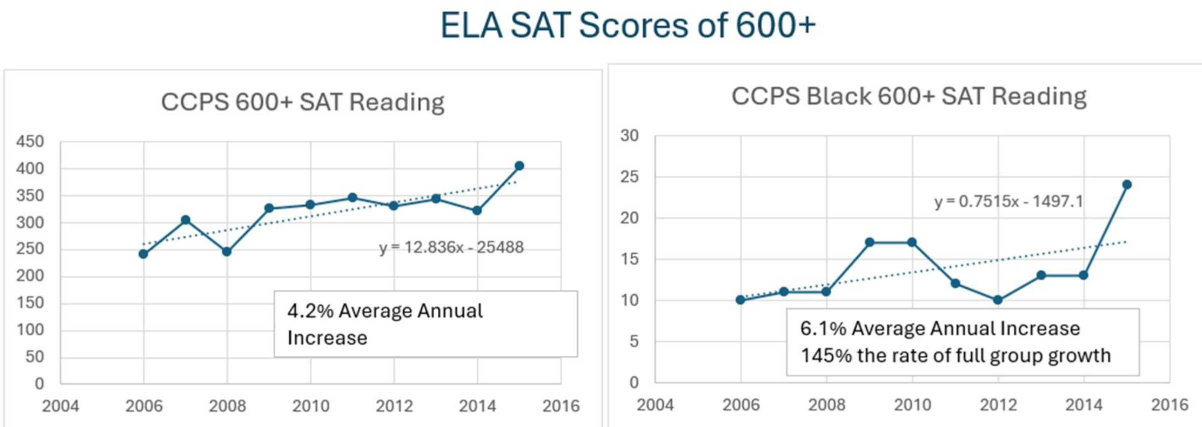
ELA SAT Scores of 500+



Finally, We had similar increases at the 600+ level, with now 4.2% gain each year for the full group, and 6.1% increase each year for Black students, as shown in Figure 23. This was approximately 1.45 times the growth for Black students during this period.

Figure 23

ELA Scores of 600+



If our gain in test taking had no association with increased proficiency, we might expect the annual increase at each score point to be approximately the same as a function of percent change of test taking. We didn't see that, though, as our rates of increase appeared to be consistently slightly higher for the higher scoring levels of 500+ and 600+. And we were generally able to see these increasing gains more pronounced for our Black students. So, this gives a baseline of what we might expect to see in our math numbers because of the work we've been doing to make our programming more inclusive, with increased use of high impact instruction that is effective for all, if we had not deleted the courses under study.

Table 7

Summary of ELA Growth Rates

	Tests	400+	500+	600+
ELA Expected Annual Growth	N/A	3.4%*	3.4%*	3.4%*
ELA Annual Growth	3.4%	3.5%	4.0%	4.2%
ELA Black Annual Growth	4.4%	4.2%	5.6%	6.1%

Note. * indicates the expected growth rate if achievement numbers grew at the same rate as the test taking numbers.

As described in my methodology, I used the ELA growth rates as a baseline for comparing achievement on the math section of the SAT. The ELA baseline growth rate was near 4% for the full group and 5% for Black students for each of the measures of tests taken, 400+, 500+, and 600+.

Mathematics SAT Results

Figure 24 indicates about a 1% overall annual increase in SAT math test taken, while the tests taken by Black students increased by 1.8% each year.

Figure 24

Math SAT Tests Taken

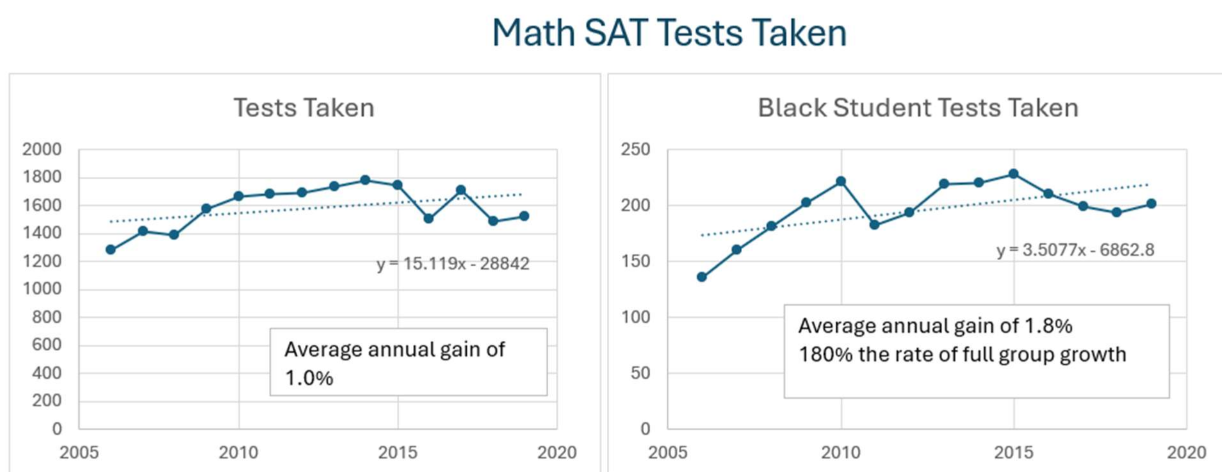
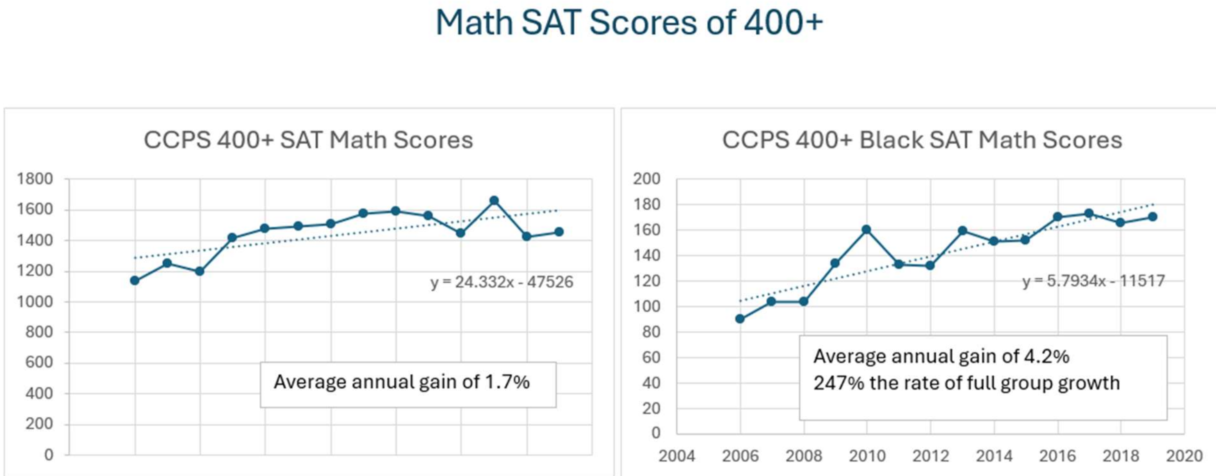


Figure 25 shows somewhat higher increases in math achievement when tests taken is compared to the number of students able to score approximately one standard deviation below the national mean or higher (400). Whereas the number of Black test takers had just a 1.7% annual increase, the number of Black students who took the test and scored 400 or above increased by 4.2% annually, nearly doubling over this period from 90 to 170.

Figure 25

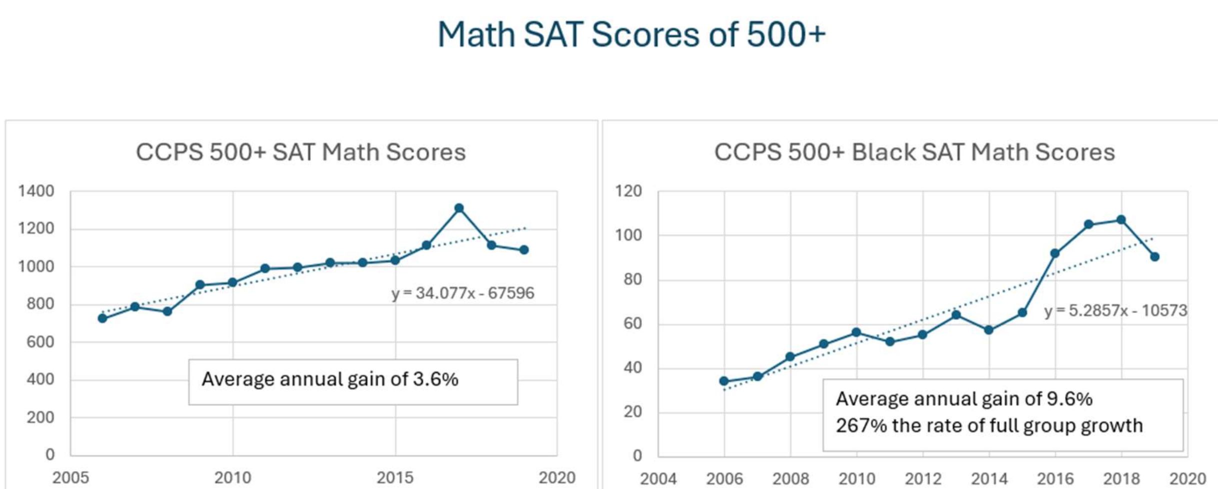
Math SAT Scores of 400+



Furthermore, as shown in Figure 26, the number of CCPS students scoring at or near the national average of 500 has been increasing by 3.6% year over year. In contrast, the number of Black test takers scoring at the national average increased at an average annual rate of 9.6%, more than doubling the number doing this annually over the period, from 34 to 90.

Figure 26

Math SAT Scores of 500+



And finally, ELA math scores of CCPS's more advanced students are shown in Figures 27 and 28. Data show that the percent growth in numbers of students scoring at 600 or above on the test is 3.3% for the full group but 13.9% each year for Black students. This was approximately a quadrupled growth rate when compared to the full group, and more than doubled from 8 to a peak of 33, before dropping in the final year of the study to 19.

Figure 27

Math SAT Scores of 600+

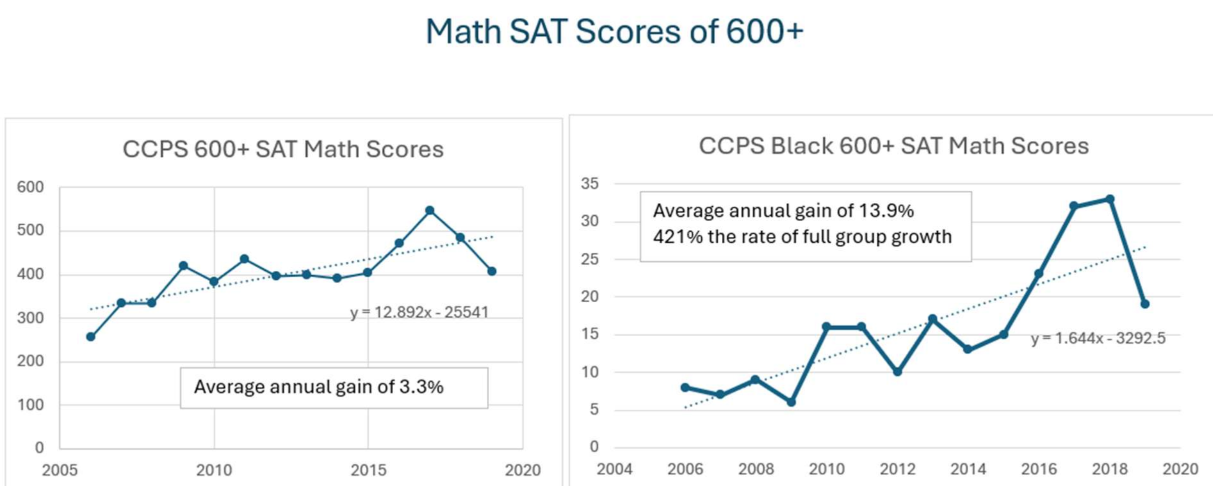


Table 8 below presents average *annual* increases in percent of students scoring at different levels on ELA and math tests. Generally, increasing scores of 500+ and 600+ by Black students by 9% and by 13% respectively over a multiple-year period would be enough to meet typical success criteria for a change initiative. Having those numbers as average annual increases supports the case for the impact of the course eliminations coupled with district support on increasing achievement. And comparing those numbers to the average annual increases of Black students able to reach similar benchmarks on the Reading section of the SAT allows us to infer that something happened in the CCPS Mathematics Program that led to gains beyond those captured in students' reading achievement results.

Table 8

Summary of SAT Tests Taken and Achievement by Subject

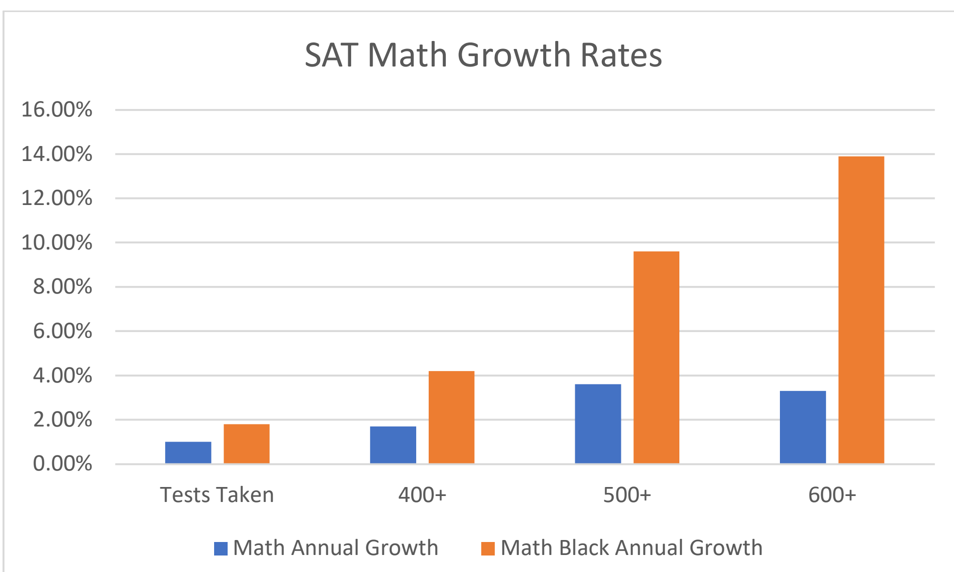
	Tests	400+	500+	600+
ELA Expected Annual Growth	N/A	3.4%*	3.4%*	3.4%*
ELA Annual Growth	3.4%	3.5%	4.0%	4.2%
ELA Black Annual Growth	4.4%	4.2%	5.6%	6.1%
	Tests	**400+**	**500+**	**600+**
Math Expected Annual Growth	N/A	1.0%*	1.0%*	1.0%*
Math Annual Growth	1.0%	1.7%	3.6%	3.3%
Math Black Annual Growth	1.8%	4.2%	9.6%	13.9%

Note. * indicates the expected growth rate if achievement numbers grew at the same rate as the test taking numbers.

The Black students' achievement growth rates far outpaced both the increase in test taking and the growth rates for all CCPS students during this period, as shown in Figure 28.

Figure 28

SAT Math Growth Rates



Research Question 3: Teacher Perceptions of the Effort to Eliminate Non-Advancing Math Courses

To answer the third question, I used data from a survey administered to the 51 high school mathematics teachers potentially impacted by these change efforts. As discussed earlier, the MLT had previously been informally polling teachers annually on various thoughts and opinions for what was and was not working in the CCPS program. In those informal polls, administered before this study was conducted, all four of the course removals were consistently unpopular among teachers. The key findings for research questions 1 and 2 were presented to teachers at a professional learning session and the teachers were more formally polled with a Likert scale with 1 representing “very bad decision” and 5 representing “excellent decision”.

Figure 28 below shows that 12.5% of 24 teachers answering the question had a negative opinion of the removal of Prealgebra, down from 66.6% earlier in the process.

Figure 29

Teacher Perception of the Removal of High School Prealgebra

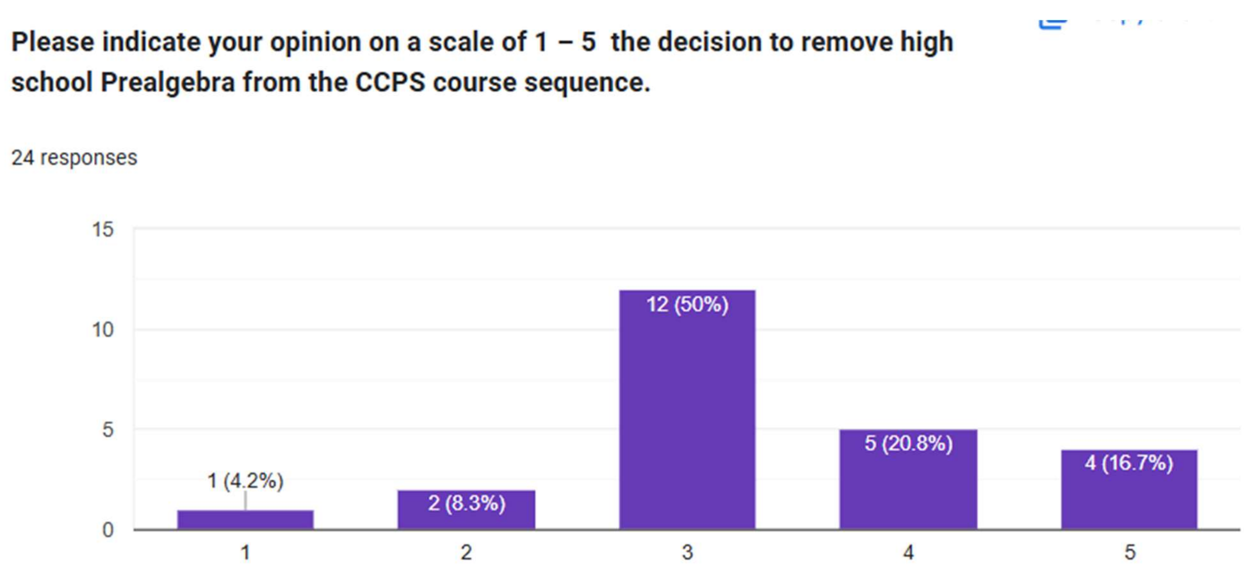


Figure 29 below shows that 33% of 24 teachers answering the question had a negative opinion of the removal of Intermediate Algebra, down from 72.8% earlier in the process.

Figure 30

Teacher Perception of the Removal of Intermediate Algebra

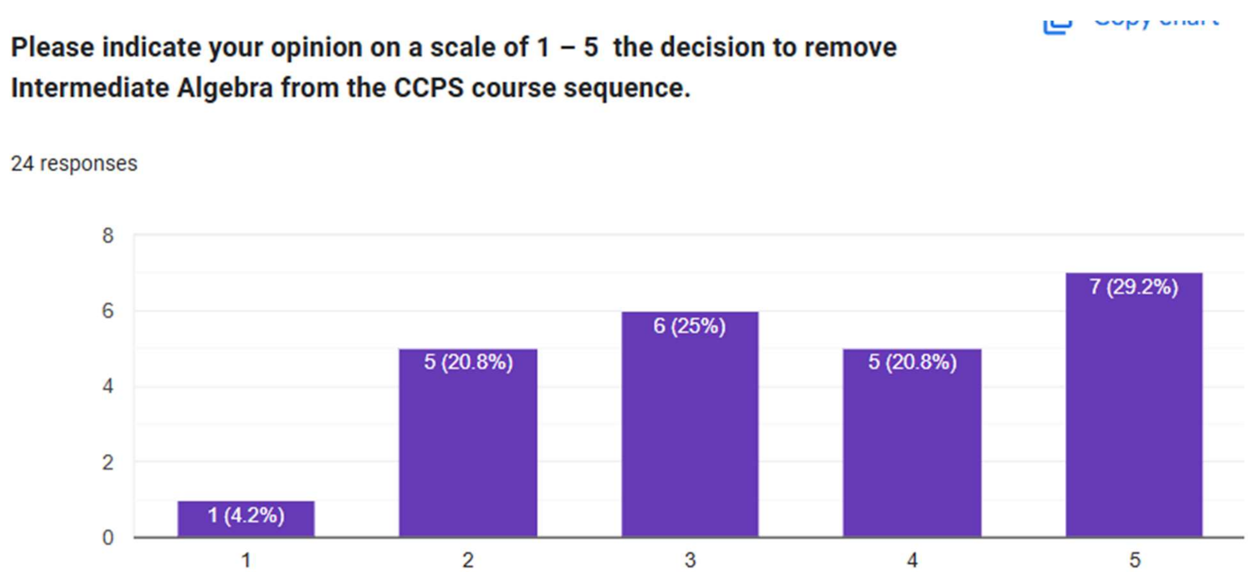


Figure 30 below shows that 20.9% of 24 teachers answering the question had a negative opinion of the removal of Business Math, down from 73.1% earlier in the process.

Figure 31

Teacher Perception of the Removal of Business Math

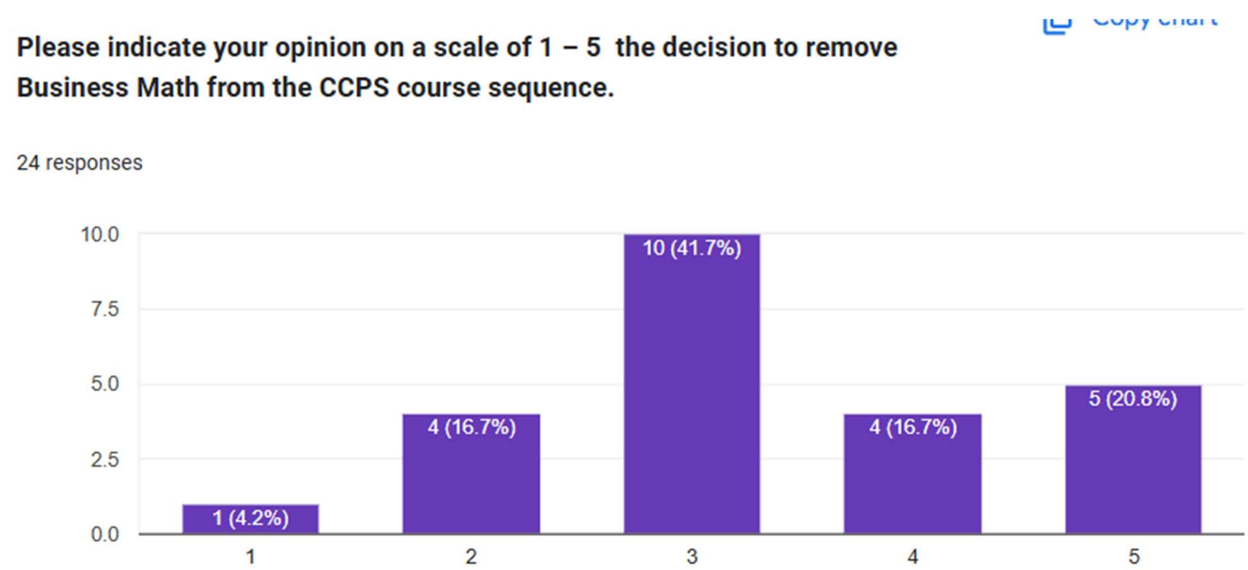
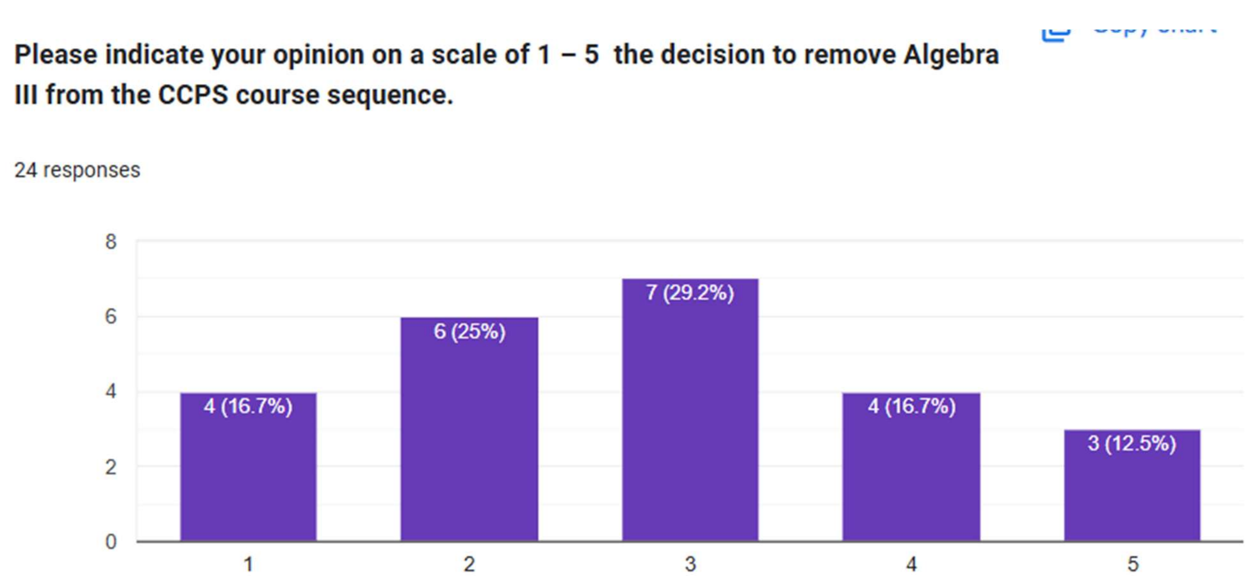


Figure 31 below shows that 41.7% of 24 teachers answering the question had a negative opinion of the removal of Prealgebra, down from 85% earlier in the process.

Figure 32

Teacher Perception of the Removal of Algebra III



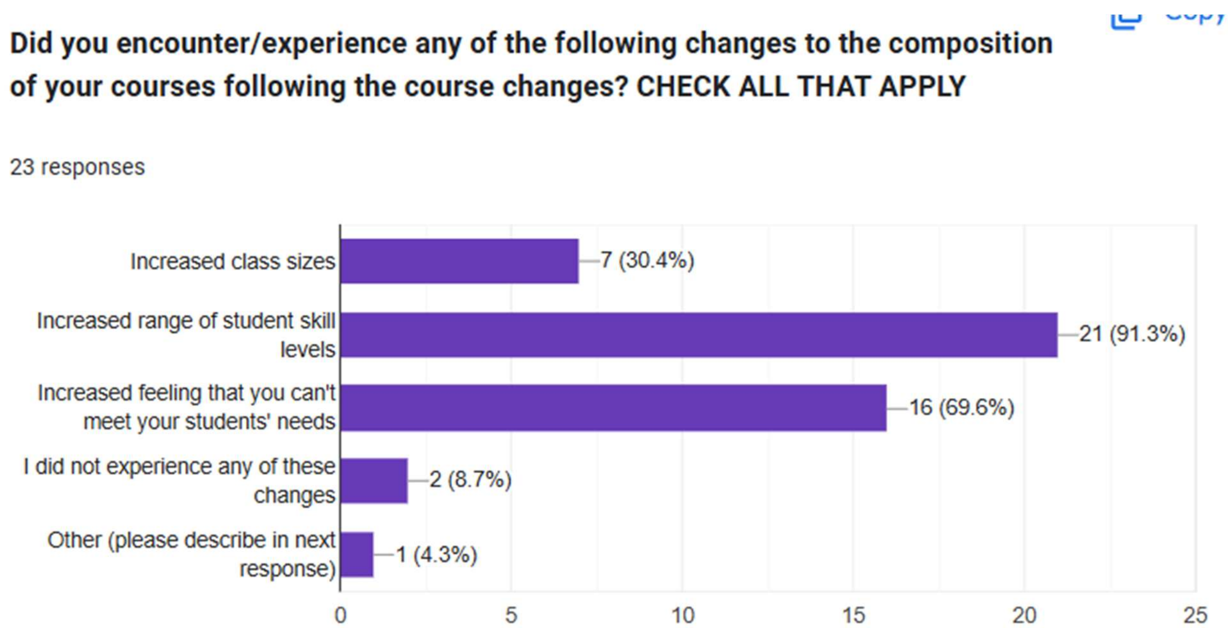
This course removal was the most unpopular among teachers, as it was a dual-enrollment course with the local community college and served as a USM-approved post-Algebra II option. Based on conversations with CCPS math teachers, it became clear that this course was valued for its rigor and alignment with college expectations. Although the course held merit within the CCPS mathematics pathway, guidance from the Maryland State Department of Education (MSDE) recommended discontinuing multiple versions of College Algebra/Precalculus in favor of offering distinct pathway options, such as Data Science, Coding, and Quantitative Analysis. As a result, the course was ultimately replaced by offerings in Statistics, Advanced Mathematics, and Data Science—representing different fields of mathematics rather than different levels of the same content.

The previous survey data weren't one-time questions. I've routinely asked these questions at the end of every year, and these four questions have been the ones that most consistently frustrate teachers. To have these results receive unfavorable scores near 70% for multiple years and then immediately decrease significantly is an important indication that these data needed to have been analyzed, found, and communicated earlier.

Questions 2 – 8 of the survey asked teachers to indicate the challenges they experienced because of course eliminations, which solution ideas they adopted, and how successful they've felt. Each of these questions provided a list of options with an additional "other" open-ended response choice and a chance to explain in a follow-up open-ended question. Figure 31 shows the range of challenges teachers experienced.

Figure 33

Changes Experienced by CCPS Teachers as a Result of Course Closures



Responses to the question indicated that the two most prevalent challenges were the increase in the range of student skill levels in courses and teachers' feeling unable to address the students' needs. The following challenges were identified in the free response follow-up.

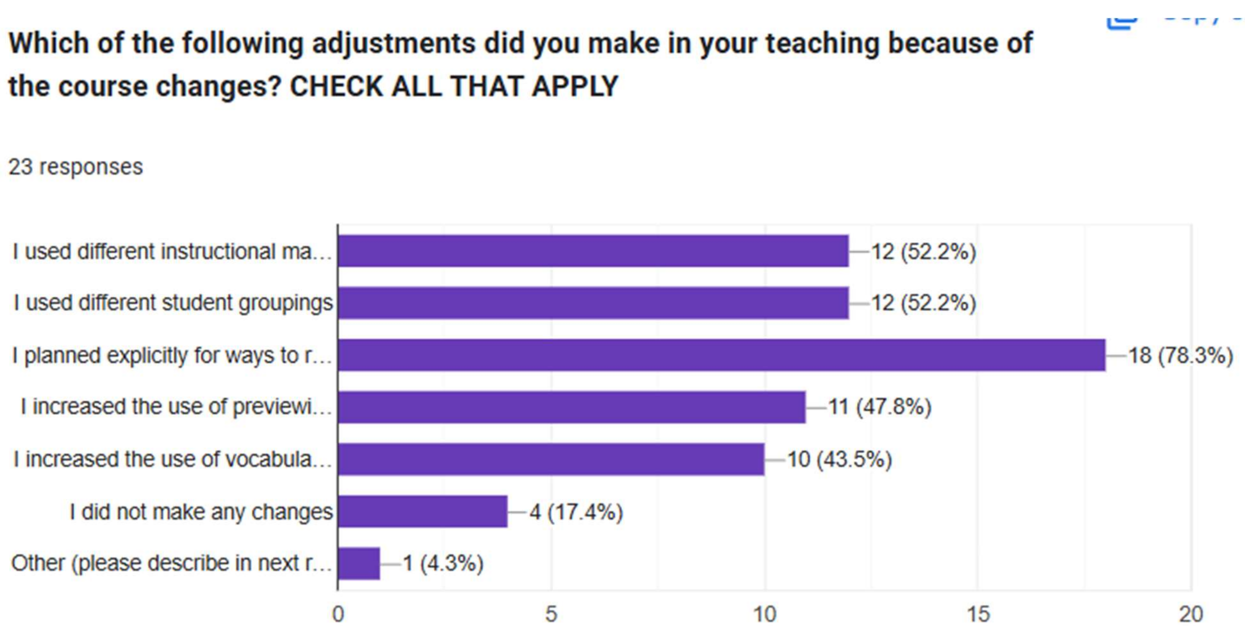
As described earlier, I analyzed the open-ended responses, which are listed in Appendix G, for patterns in response among the 23 teachers who answered this question. One theme that emerged was that pushing students into higher-level math courses without sufficient foundational understanding led to a lack of confidence and feelings of success for the teachers. There was the sentiment that efforts to cater to all student levels often resulted in meeting none effectively, due to the heterogeneous student population. Larger class sizes were mentioned, though this wouldn't have been a direct result of the course closures. Perceived variability of ability levels now being recommended into their courses complicated planning and increased classroom management issues, doubling the planning time for differentiation, according to the responses. Teachers mentioned increased apathy and poor work ethic among students transitioning from lower to upper-level classes, where expectations are higher, affecting their performance. There was reported frustration among teachers and counselors due to the lack of appropriate algebra-based courses after Algebra 2 besides Honors Pre-calculus to support continued learning and college preparation.

Some responses indicated that some teachers did not notice negative impacts. Strategies like small group learning, self-paced learning, and vertical whiteboards were reported to be implemented to address diverse learner needs. Overall, the survey called out significant challenges in supporting the needs of a diverse new student population in upper-level courses to ensure students are adequately prepared for courses that they may not have accessed in the past.

The survey then asked what adjustments teachers needed to make in their practice to adjust to the new clientele in upper-level math courses.

Figure 34

Changes in Teaching Resultant from Removal of Courses



I again analyzed the open-ended responses, listed in Appendix G, for patterns in response among the 23 teachers who answered this question. The following solutions were identified in the follow-up open-ended response. Teachers emphasized planning intentionally and utilizing co-teachers, focusing on what is best for students rather than what is easiest for themselves. Various grouping strategies were employed, including mixed, same level, and random groupings, to cater to different situations. Increased use of word walls and topic graphic organizers was said to enhance student understanding. More language development was explicitly used in delivering material, and extra opportunities were provided for students to practice and deepen their understanding. Small group instruction, self-paced learning, and vertical whiteboards were used to address diverse learner needs.

Some teachers said they were not directly affected by changes, but others said they faced challenges due to lack of training and time to create new instructional materials. This led to negative feelings about the course recommendation process and students' perceived lack of belonging in courses. Some teachers mentioned a need for creation of new materials and re-grouping students based on levels and skills address gaps in student knowledge, with previewing upcoming skills helping with these gaps. They increased use of assessment techniques such as exit tickets. There was emphasis on maintaining high expectations, with teachers saying it is crucial to avoid lower results with new clientele in upper-level coursework.

Overall, the responses called out the importance of intentional planning, effective grouping strategies, and the use of various teaching tools to support student learning, while also addressing the challenges of differentiation and maintaining high expectations.

When asked which professional learning opportunities better situated teachers to meet the needs of students following course deletions, they offered a variety of ideas. Teachers reported that it was helpful to have vertical board training and book studies to enhance their instructional strategies. Some said that engaging in book studies with colleagues has fostered a collaborative learning environment, allowing teachers to share insights and practices, which was helpful. Recent Multi-Tiered

System of Supports (MTSS) training was reported to better equip teachers to address diverse student needs. Emphasis on collaborative planning has helped some teachers share strategies and improve instructional practices. County-provided professional development planning time has been said to be beneficial, allowing teachers to learn new strategies and implement them effectively. Finally, the implementation of strategies from the "7 Steps to a Language-Rich Classroom" was identified to improve language instruction.

When asked what additional support should have been provided, teachers identified several suggestions. I again analyzed and synthesized their open-ended responses to this question, which can be found in Appendix G. First, teachers expressed a need for more consistent handling of disciplinary referrals at the building level to maintain classroom order with a new blend of students that was less academically focused than in the past. Additionally, there was a call for more mandatory training earlier in the process, with varied presentations including lesson planning, book studies, and class observations. Teachers also highlighted the need for increased planning time and opportunities to collaborate with other teachers to enhance instructional strategies. Some teachers noted that providing professional development beyond Agile Mind's is essential, especially to accommodate students with Individualized Education Plans and diverse learning needs (Agile Mind is the district’s primary curricular resource, which not all teachers like, particularly when professional learning focuses on more effective implementation of the resource). Teachers noted that teachers of Honors Pre-calculus require support in adapting to a more inclusive curriculum, sharing resources, and meeting regularly to discuss strategies. There was also a note of desire for assessments that are not solely based on Agile Mind's framework. Finally, co-teaching sections were proposed to provide additional support and improve instructional effectiveness.

When asked what additional measures could be taken to enhance the success of students, teachers offered several ideas. I again analyzed and synthesized their open-ended responses to this question, which are included in Appendix G. First, teachers suggest returning to offering academic courses separately from honors to better address different student needs (this is in response to previously mentioned building initiatives to detrack Geometry and Algebra II courses). Interestingly, there was a call from some that supported recent changes for stricter measures against staff who refuse to comply or sabotage efforts. More training was said to be needed, including specific numeracy interventions for struggling students. Some teachers called out the importance of leadership seeking their feedback prior to making changes to ensure the changes are effective and well-received. Some said that more training in instructional strategies is needed, particularly in reading and addressing diverse student needs. Finally, some said that revising the district's retake policy (current CCPS procedures require teachers to allow students to have a second attempt on at least two assignments during each nine-week marking period and not everyone agrees this is helpful for students) and holding students accountable for attendance is necessary, as current policies allow students to miss too many days and come into assessments underprepared, with the intention of using the first try as a baseline and only then focusing their study for a final attempt.

Summary of Teacher Survey

In retrospect, one of the key threats to the success of course eliminations was a loss of faith among teachers, particularly early in the process. There was real concern that these shifts were going to hurt students. Teachers reported that they saw less-prepared students in their courses and were required to make adaptations to their practice or risk seeing students fail. Once I was able to find evidence that the work we were doing was having a positive impact, and once teachers were given time to adjust their practice to feel successful with their students, negative opinion softened, and many teachers started to show more positive and fewer negative opinions toward the course deletions than in the informal annual polling.

Synthesis and Implications of Findings

The synthesis of findings aims to integrate and consider the results obtained from the three research questions addressed in this study, to what degree Black student access to upper-level math coursework changed over this period, to what degree Black student performance improved during this period, and to what degree teachers were impacted throughout. By examining the data collectively, this section seeks to uncover overarching themes, identify patterns, and draw connections that provide a comprehensive understanding of the educational experiences of Black students, as well as teachers, in CCPS. The following subsections will delve into a cross-question analysis and assess and the overall impact on teachers and Black students in CCPS

Cross-Question Analysis

One of the key reasons for examining this work for my dissertation was the discomfort my teachers were expressing to me. I tend to make 50 to 70 school visits each school year, and spread across my ten main buildings, this amounts to approximately one visit each month for each building. A subset of my teachers in a given building would see me on each visit, which means each teacher would only see me a few times each year. When I would stop and talk to them about how things are going, one thing that would often be chosen by them as a topic of conversation was how we really needed to bring back the removed courses because some students now had nowhere to go. Because of the nature of the conversation, maybe three minutes in the hallway during class exchange, I felt frustrated to not be able to explain the intent and impact we were having for our students. I could acknowledge their challenges and vow to support, but the time was just insufficient to talk about equity gaps, and I didn't yet have hard data to justify the work we were doing. It was clear to me that I owed teachers that explanation because if they know it's leading to positive results, they are willing to do the extra learning and working that it takes to be more inclusive as a program.

The first piece of the theory of action for this initiative was that if we removed the so-called "qualitatively inferior" courses from the secondary math sequence in CCPS, more of its students and particularly, more of its Black students (as well as students from other historically underserved student groups), would successfully complete Algebra II and USM-approved post-Algebra II coursework. As discussed earlier, this did, in fact happen. Other district initiatives had been in place from 2006 to 2016 that had already been improving Black students' completion rates in these courses from 51% to 76% in Algebra II and from 22% to 53% in a USM-approved post-Algebra II course over this time. But a closer look reveals stagnation during this period. From 2011 to 2016, these numbers fell from 78% to 76% for Algebra II and from 54% to 53% for the USM-approved higher coursework among Black students in CCPS. Then from 2014 to 2020, we closed certain courses and observed an increase in upper-level course completion rates. Specifically, Algebra II completion rates rose from 76% to 79%, and from 2016 to 2021, completion rates increased from 53% to 69% in the USM-approved higher options. Notably, these improvements were not seen in upper-level course enrollments for other subject areas, as none of them had previously-existing course options designed to divert students from rigorous coursework for a year to better support their future preparedness. These enrollment increases were unique to the upper-level math courses in CCPS.

The second, perhaps more crucial piece of the theory of action was that if we increase enrollment in upper-level coursework, we will increase achievement for students in CCPS, particularly for Black students (as well as students from other historically underserved student groups). Being inclusive has long been one of the stated aims of CCPS, but being inclusive is not an aim if it comes at the expense of student achievement. Initial resistance to course closures happened because teachers and counselors were worried that student failure and non-graduation would increase. As discussed earlier, this did not happen because of the efforts of teachers and counselors to provide increased support to the students that they feared would not succeed. But this increased effort begged the question of whether it was all worth it. Stakeholders wondered whether this initiative was leading to increased math achievement outcomes for students in CCPS.

As discussed earlier and summarized in Table 8, CCPS did see increases in scores of 400+, 500+, and 600+ on both the Reading and Math sections of the SAT that outpaced increases in test-taking. And these rates of increase were more pronounced among Black students for Reading, but dramatically more for Black students' Math performance, statistically significantly at the 500+ and 600+ level. These findings suggest that the existence of the courses had been, in fact, negatively impacting students, particularly Black students in math outcomes in CCPS. And the subsequent increased enrollment in upper-level math coursework was in fact associated with increased math achievement in the district.

The third research question was about teacher perception of these actions and the additional effort they had to expend to help their students succeed. It was not part of the original theory of action but emerged naturally as teachers shared concerns with me and others about the initiative. As discussed earlier, teachers did have negative initial feelings about the course removals, with an average of 74% answering that they disagreed with the course closures. After sharing the findings from the first two research questions with teachers and formally surveying them, only an average of 27% reported that they disagreed with the closures. Many teachers, equipped with the findings of this research, changed their minds, and agreed that the course closures were having a positive impact for students in CCPS, or at the very least, were not leading to the negative results that they had feared. Still, over a quarter of teachers disagreeing with this initiative prompts further investigation.

The biggest theme of challenge noted in the teacher survey was that of an increase in what they considered underprepared students of all races for their courses, which was an anticipated dynamic: the underlying theory of action espoused by the field (NCTM, 2014; TNTP, 2018) was that school systems are requiring an unnecessary prerequisite ability to access upper-level coursework, and that instead of restricting their access, districts should enroll and support students through the challenge.

The CCPS teachers' response to this new challenge was very much supported by research explored in the first section of this dissertation, as they both employed and asked for more collaborative planning, small group instruction, formative assessment, and professional learning on effective instructional practice, coteaching strategies, and techniques for fostering language development. Essentially, the teachers called out that the professional learning experiences that the district provided alongside these course removals should have happened earlier, with increased dosage or intensity, and with more immediate transparency of the results associated with the course deletions.

There are still some teachers that philosophically disagree with this work, as evidenced by requests to retrack courses emerging from the survey responses. However, the adoption of Math Policy at the state level that requires implementation of many of the previously-discussed research-supported strategies, including efforts to eliminate tracking structures, moves local conversations forward from whether we should make these changes to how we should make these changes and what support will be needed.

Overall Impact on Teachers and Black Students in CCPS

As discussed in the first section of this paper, society recognizes that mathematical literacy is crucial for the competitiveness of nations, as well as for the earnings, employability, and promotability of individuals. This holds true regardless of whether a career is STEM-related or not. In an increasingly data-driven world, it has become an expectation of citizenship that all people can navigate the myriad probabilities, statistics, formulas, proportions, percentages, and reasoning that permeate daily life. Furthermore, society acknowledges that not all individuals leave schooling with the same advantages in mathematics. People from various demographic groups, including Black individuals, consistently score lower on mathematics achievement measures, such as local, state-wide, and national academic tests.

What initially interested me in this project was the emerging-to-me concept that achievement gaps are at least partially attributable to opportunity gaps, and that math leaders have the responsibility to identify and address qualitatively inferior math courses (TNTP, 2018; NCTM, 2014). The data earlier in this section reveal that course closures, along with other district initiatives, can improve outcomes for all students, disproportionately benefiting Black students. The accelerated improvement during the period of course closures, and the significantly higher rates of improvement in SAT Math scores compared to SAT Reading scores for Black students, provide strong evidence that this initiative positively impacted both opportunity and achievement for all students over the past decade, particularly for Black students. Students who scored higher on the SAT because of taking more rigorous coursework likely experienced subtly increased college choices, scholarships, and confidence and motivation. Although these benefits are challenging to detect at the individual level, what excites me is the conversations and the work that will follow the findings of this study.

To have these numbers – 4.2%, 9.6%, and 13.9% – as average annual increase is incredible, hugely affirming, and worth celebration. For context, I typically hope for 2% or 3% growth year over year with our own internal benchmark averages. These are textbook example graphs of responsibly closing opportunity and achievement gaps by increasing outcomes for all while increasing outcomes for students from historically underserved student groups more rapidly by eliminating systemic barriers and opportunities for bias to affect enrollment and consequently, achievement. The impressive growth rates found in this study demonstrate the power of intentionally addressing the opportunity gap by eliminating systemic barriers. These findings underscore a core tenet highlighted by educational scholars such as John Goodlad (1990) and EdTrust and Just Equations (2023) who emphasized that ensuring equitable access to knowledge is fundamental to achieving educational equity and improving outcomes for all students.

When I shared the findings of this study with my teachers, there was a feeling of awe and pride at what we had accomplished together. I presented the data in a session that explored our efforts to be more inclusive, not just in our upper-level math courses, but in the other areas discussed in the first section that had similar theories of action: that if we want to raise outcomes we need to find where we can be more inclusive in structure and do the required work to make our instructional practice more inclusive. CCPS math teachers discussed connections between data from this study, recent efforts to detrack core classes, and efforts to reduce exclusionary placement of students with disabilities. We acknowledged that the required work is challenging, and the aim is lofty, but the teachers shared that it was energizing and affirming to see the impact the work had had behind the scenes of their day-to-day work with students.

I next shared the findings with IPACC, the curriculum council responsible for approving these course deletions and let them have similar conversations about the impact this initiative had, the possibility that other initiatives may be invisibly helping students while visibly making teachers' jobs more challenging, and the need to conduct evaluations to inform and propel this work.

This is what I hope to be the impact and legacy of this work for Black and other students in CCPS. To my knowledge, it is the only current attempt to evaluate and quantify the results of a change initiative aimed at inclusivity in the district. As discussed earlier, the course closures were unpopular; the core of the change theory was that students with relatively less math knowledge than their peers could succeed in rigorous upper-level mathematics. Including students that were below previous prerequisite thresholds has led to lower average incoming ability and a wider spread of ability levels among students of all races in the upper-level courses of CCPS, two separate challenges for teachers. Initiatives to be more inclusive can be difficult to sustain due to similar mechanisms, particularly with a lack of confirmatory data.

Limitations

In this section, I discuss the limitations of the study and their impact on the findings and conclusions. Recognizing the limitations is essential for understanding the scope and applicability of the research results.

Methodological Constraints

A significant limitation to this study stems from the sequence of actions. I began this initiative as a brand-new supervisor, with limited understanding of program evaluation and no intent to later study it as the foundation of a dissertation. As such, proactive components I would include if I were to do it again, such as success criteria, evaluation plans, communication and marketing timelines, were absent. For ethical reasons I'm not sure I would have designed a control and experimental group of schools to get more toward causation than the association I was able to report. I felt, following the research and guidance I had come across, that these course deletions were positive changes for all students, and with no original intent to design a study, believed that the changes should be implemented immediately for all students. Furthermore, there are enough confounding variables within each of the schools and a small sample size of four schools, so I don't know that I would have been able to attribute differences across schools any more to the course deletions than a whole host of factors, such as changing school leadership, tenure and expertise of teachers, socioeconomic factors, and others.

An additional limitation was the data that were available for this study. I had originally wanted to include an analysis of the number of Black students able to beat the district average on internal CCPS end-of-year assessments in Algebra II and USM-approved post-Algebra II courses from 2006 to the present. However, the CCPS IT department informed me that our data system only had those data back until 2017, and wasn't able to recover scores from before then. The pandemic eliminated meaningful end-of-year results for 2020 and 2021, leaving a big hole in the data. Additionally, the assessment was revised twice in the period. Though the number of Black students completing these end-of-year increased by an average of 9 a year and the number of Black students beating the district average increased by an average of 3 a year over the 2017 – 2024 period, I ultimately decided those data were too unreliable to add value to this study.

An additional limitation of this analysis involves the interpretation of statistical significance at higher SAT score thresholds, particularly at the 600+ level in math. While growth in the number and proportion of Black students achieving 600+ math scores was notable, the difference was not statistically significant when compared to growth in ELA scores. This outcome may be partially attributed to the small sample size at high score levels. As score thresholds increase, the number of students reaching those levels typically decreases. This reduction in sample size can lead to greater variability and reduced statistical power, making it more difficult to detect significant differences even when meaningful trends exist. In this case, the relatively small number of students scoring 600+ in both math and ELA likely limited the ability of the two-sample t test to detect a statistically significant difference. This suggests that the absence of statistical significance at the highest score tier should not be interpreted as a lack of progress in math, but rather as a reflection of statistical limitations and concurrent gains in ELA performance.

A final methodological limitation to discuss is that of the absence of census subject testing in the upper-level pre-AP courses. Maryland does currently have an end-of-year MCAP test for Algebra II, but with the passing of the More Learning, Less Testing Act of 2017 (Maryland General Assembly, 2017), many districts tested only as much as was federally required, which would have been primarily students that already took their Algebra I test in middle school and needed to take a test while in high school, and this subset of students that typically do enroll in upper-level math coursework before graduation was not the focus of this study.

Limits to Validity

As previously discussed, these course closures were one of many sets of initiatives the district implemented over this period. Internally, teachers and leaders had been trained in equity, culturally responsive strategies, restorative practices, and high impact instructional strategies. Though I did my best to show that something different happened with Black students' math scores in CCPS than their Reading scores, there are many confounding factors that alternatively could have produced the results. Still, it was affirming to not see negative impacts in grades, course completions, or graduation rates, as making a program more inclusive without seeing negative consequences is a decidedly good thing.

It's unclear that these results would have been seen in other settings. CCPS is a relatively affluent school district with 100% of its secondary math teachers certified throughout this period. The teaching staff overall has talent, experience, high expectations of themselves, and high expectations and beliefs for students. It's not clear if these gains would be realized in a district without these privileges. It should be mentioned that it is unknown what confounding impact the pandemic had on students throughout this initiative. Finally, as was discussed in the synthesis, states will be starting to put requirements to eliminate or improve qualitatively inferior courses into policy. Initiatives that are done for compliance rather than a shared higher purpose may have varying levels of success.

Impact on Findings and Conclusions

Researchers tend to hope their work will be impactful and built upon by others. Because of the limitations discussed above, this work won't be as influential in the field as I would have liked. I can't demonstrate that the course closures caused increases in enrollment and achievement in upper-level math courses for Black students, only that the closures were associated with these increases. Still, it corroborates findings from research done by well-resourced groups and offers an example context for local or other rural districts to consider and guide future work.

Conclusion

The purpose of this study was to investigate the impacts of the mathematics course changes implemented in CCPS on Black secondary students. This conclusion summarizes the key findings of the research, provides recommendations for future research, provides broad educational policy implications and discusses the practical implications for schools and districts. By synthesizing the results, this section aims to offer a comprehensive understanding of the study's contributions and its potential influence on educational policy and practice.

Summary

The course changes were, in fact, associated with increased student access to Algebra II and beyond, particularly for Black students in CCPS. Of the incoming 9th grade cohort in 2006, 51% of Black and 67% of all students successfully completed an Algebra II course. Of the incoming 9th grade cohort in 2021, 67% of Black and 83% of all students successfully completed that same course. Of the incoming 9th grade cohort in 2006, 22% of Black and 40% of all students successfully completed a USM-approved post-Algebra II course. Of the incoming 9th grade cohort in 2021, 69% of Black and 75% of all students successfully completed a USM-approved post-Algebra II course.

Additionally, the course changes were associated with increased student achievement in Mathematics, as measured by the SAT. Furthermore, there was a larger increase in Black student achievement on the Mathematics section than the full group that was dramatically larger than the differences seen on the Reading section of the SAT. When looking at the average annual increase rate of tests taken, scores of 400+, scores of 500+, and scores of 600+, the full group saw gains of 1.0%, 1.7%, 3.6%, and 3.3%, respectively. Black students achieved average annual increases on the Reading section of 4.4%, 4.2%, 5.6%, and 6.1%, respectively. In contrast, Black students achieved average annual increases on the Mathematics section of 1.8%, 4.2%, 9.6%, and 13.9%, respectively.

These results were validating for the work that had been done. CCPS Teachers of mathematics had previously been surveyed on their opinions of the changes to the course sequence in years past. Without having seen the enrollment or achievement data in years past, between 67% and 85% of surveyed teachers had a negative opinion of each of the changes to course sequence. After having the data shared and discussed, the number of teachers that had negative opinions fell to a range between 12% and 41%. A key takeaway of this was that the CCPS MLT should have conducted and communicated the present evaluation earlier in the process to increase teacher buy-in and reduce teacher anxiety that the CCPS program was headed in the wrong direction.

Teachers noted wider ranges of ability within their classrooms and increased feelings that they couldn't meet their students' needs because of the course changes. When asked what strategies helped them succeed despite the added challenge, they called out the importance of intentional planning, effective grouping strategies, and the use of various teaching tools to support student learning, while also addressing the challenges of differentiation and maintaining high expectations. When asked what could have been done better to position teachers for success, they largely shared that, earlier in the process, they should have received the time, tools, and training for the identified solution strategies above.

Recommendations for Future Research

This initiative and study were conceived as proof of concept. We followed recommendations from research and the field, hoping they would apply in our context. Similar analyses have been conducted and published by others (EdTrust, 2023b). My first recommendation is to continue this work in various contexts and analyze data across different demographics. The mechanism that diverted Black students from rigorous opportunities in CCPS applies to any student group for which stakeholders have increased concern and a potential to overprotect. It would be interesting and instructive to see if the positive outcomes observed in CCPS are replicable in other educational settings with different demographics and resources.

The proliferation of such research can inform and encourage more states to enact policies that help local districts remove barriers to equity within their programs. As states create policy, there will be opportunities for studies among districts required to implement changes like those examined in this study. These changes at the state level provide opportunities to conduct longitudinal studies to see the impact of required structural changes to mathematics pathways on student enrollment and performance in college math courses.

Additional research is needed on student and teacher perceptions and experiences. This study did not include student interviews to gather insights into their attitudes, challenges, and successes in adapting to the new course structure. Furthermore, this research only scratched the surface of teacher perception, stopping short of measuring the impact of training on teachers' instructional practices and student outcomes to identify areas for improvement.

Broader Implications for Educational Policy

As mentioned earlier, the Maryland State Department of Education (MSDE) recently unanimously approved a new math policy incorporating and requiring many recommendations from this study. The first recommendation is for states to work with K–16 partners to identify core math courses that all students must complete to succeed in post-schooling opportunities and include them in graduation requirements. Maryland's graduation requirements have long included Geometry and an Algebra course. However, the College and Career Readiness Act of 2013 expanded this to require students to take meaningful math courses each year in high school, stating, “It is the goal of the state that all students achieve mathematics competency in Algebra II” (MSDE, 2013). Unfortunately, the vague phrasing diminished the legislation's potential to improve math outcomes for Maryland students, as the misalignment between the law's stated goal and graduation requirements allowed districts to create various courses and structures that adhered to the letter of the law without following its intent.

MSDE has worked with its K–16 partners to accelerate what the state considers the core sequence, moving from the traditional Algebra I–Geometry–Algebra II three-year sequence to an integrated two-year sequence. This new sequence cuts out several Geometry and Algebra II standards deemed not to be the “most relevant and widely applicable content” (MSDE, 2025, p. 25), allowing students two years to complete subsequent upper-level coursework more aligned with their desired majors or careers. A draft of the proposed content for this two-course core sequence was presented to district supervisors in October 2024 and is listed in Appendix D.

The next policy recommendation is for states to expand definitions of rigorous mathematics beyond the Algebra/Precalculus sequence to other fields of mathematics. The Dana Center Mathematics Pathways (DCMP) model expands the definition of rigorous and meaningful math beyond the traditional STEM precalculus sequence to include pathways more directly related to students' desired majors or careers (Sepanik, 2023a). This model acknowledges that the traditional sequence is not necessary for all students to succeed in post-secondary education and has historically served as an unnecessary barrier. Students deemed underprepared for required mathematics have had to take and pay for zero-credit "developmental" math courses in their first year of college, which many students never completed, leading to failure and eventual dropout, particularly for students of color and students from lower-income backgrounds (Sepanik, 2023a). MSDE has provided draft guidance to leaders across the state, included in Appendix E, on how mathematics pathways may look in Maryland soon.

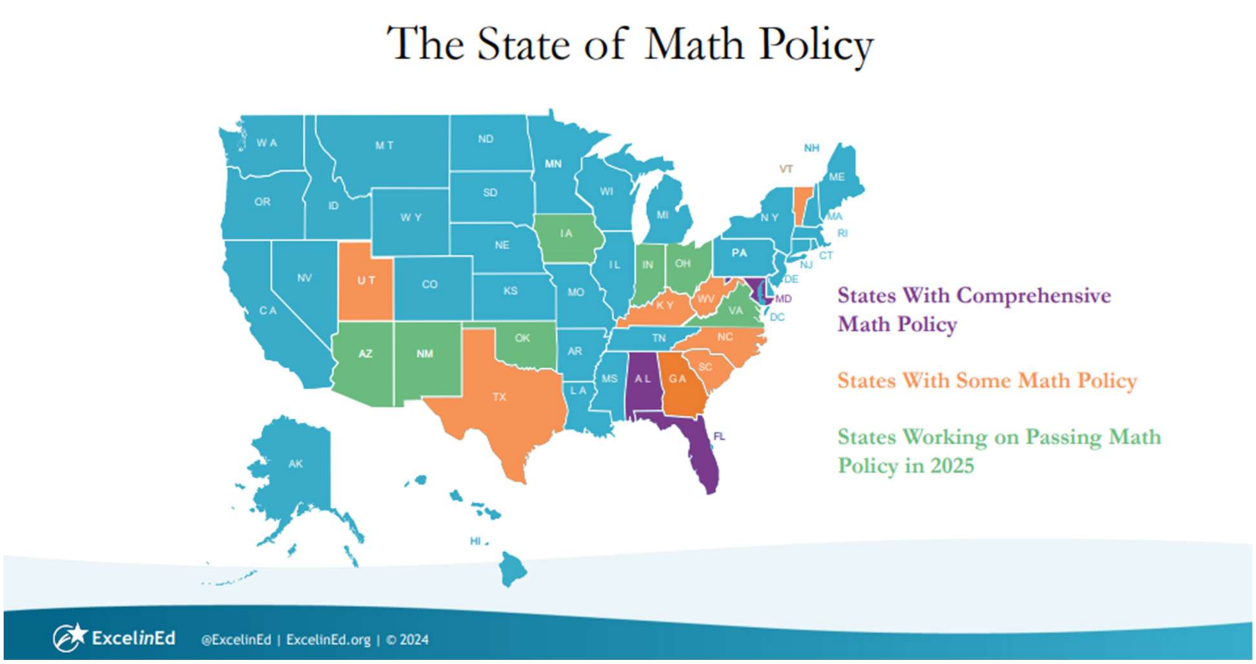
The last recommendation informed by this work is for states to implement a course approval process or audit the quality and rigor of districts' math courses, as Maryland is currently doing (MSDE, 2025). I am part of a task force working to establish, among many other policy-related shifts, criteria for appropriate levels of rigor in post-core math courses. A challenge arising from the shift to varied pathways is establishing a definition of rigor that applies to all meaningful courses. Previously, states could require a certain amount of Algebra or select minimal algebra topics or standards for a course. Now, with Geometry, Data Science, Statistics, Discrete Math, and other senior-level mathematics recognized as beneficial, it is difficult to identify common meaningful criteria for all approved options. Nevertheless, my recommendation is for leaders to establish criteria and requirements to guide districts in either strengthening or removing qualitatively inadequate courses.

Teachers and leaders in CCPS did this work without these recommendations yet being policy in Maryland. It took significant effort to uncover inequities in the enrollment and achievement of students in CCPS, communicate these findings to stakeholders including the curriculum council, argue for the removal of courses that many teachers and counselors thought necessary, and support teachers and students throughout the transition. As district supervisor, I spent considerable “relationship capital” with teachers and counselors that I had built over the years to lead these unpopular course closures. For this to succeed, I needed to analyze my own data to find narratives of inequity before anyone would approve the course deletions. I had to be tenured long enough to earn trust and either stay long enough to see the transition through or have a successor who could understand and maintain this work. I needed to evaluate and communicate success along the way, something I discussed earlier that would have made this change initiative more successful if done earlier in the process. With all the turbulence and transition inherent in educational leadership, it seems unlikely for districts to focus on this work without the support of larger policy requiring it.

At the CCSSO Legislative Conference in 2025, titled Growing a Nation of Problem-Solvers: A Summit on Math Outcomes, the summit began with welcoming remarks and an overview, followed by a session on the National Landscape on Mathematics (Henderson & Arrington, 2025). In this session, the speaker emphasized the critical importance of putting best practices into policy and praised Maryland for its recent unanimous approval of its new policy. She shared where each state is in the process of establishing math policy, as shown in Figure 33, and encouraged all states to consider similar actions, informed by the successes and lessons learned from states ahead in this work.

Figure 35

The State of Math Policy



Once Maryland's new math policy was communicated to district leaders and became a topic of conversation at the district level, I found that I had increased access and influence over the initiatives my team had been working on. I had more time with principals to discuss successful math practices and was able to conduct central MTSS training for teachers and leaders, greatly accelerating our timelines for this work. The new policy requires full implementation of MTSS by 2026 – 2027, and as a result we made more district progress this year than in the previous seven years we had been working to implement MTSS combined. Having faced challenges in prioritizing this work and then experiencing an elevation in priority due to the policy, I believe it is essential for all states to adopt similar policies. Earlier, I referenced Principles to Action's call to move from "pockets of excellence" to "systemic excellence" by providing mathematics education that supports the learning of all students at the highest possible level (NCTM, 2014, p. 3). I believe that implementing research-based recommendations at the state level will accelerate this aim.

I think, particularly for rural districts like CCPS, this state-level work is impactful. CCPS doesn't have a department of Accountability or Curriculum or Assessment or Teacher Evaluation or Professional Learning. There is, instead, a small collection of content supervisors responsible for all of those duties within their own programs, and we all do our best to keep up with emerging urgent needs. I happen to have a personal affinity for data analysis and program evaluation, and diplomas for Mathematics, Assessment and Evaluation, Curriculum and Instruction, Educational Administration, and now Educational Leadership and Policy Studies. I was a student, then teacher, then assistant principal, then content supervisor within my own district, building a great deal of relationships and trust along the way. To ask district content supervisors without these advantages to do similar work, I strongly feel that states need to exert influence and require this work.

Still, my perspective is that of a district-level leader and researcher. Though they are not my own ideas, this section would be incomplete without reviewing the following recommendations from organizations designed to inform policy.

Just Equations reconceptualizes the role of math in ensuring educational equity. Their mission is to advance evidence-based policies and strategies that ensure all students develop the quantitative foundation they need to succeed in college and beyond. They focus on creating redesigned math pathways that reflect 21st-century needs and align with students' academic and career aspirations. Additionally, Just Equations advocates for justice and racial equity, aiming to make issues around educational equity visible and address systemic racism in education (EdTrust, 2023b; National Math and Science Initiative, 2023).

EdTrust is committed to advancing policies and practices to dismantle the racial and economic barriers embedded in the American education system. Their mission is to close the gaps in opportunity and achievement that disproportionately impact students who are the most underserved, with a particular focus on Black and Latino/a students and students from low-income backgrounds. EdTrust works by analyzing local, state, and national data to understand opportunity gaps, shaping and influencing policy, and providing practical assistance to educators, policymakers, and advocates to transform schools and colleges into inclusive environments (EdTrust, 2023b).

In 2023, these two organizations teamed up to conduct research on topics related to my first and second research questions. They both host a copy of this research on their websites, though under different names: *Opportunities Denied: High-Achieving Black and Latino Students Lack Access to Advanced Math* is posted on Just Equations, and *Despite Showing Aptitude, Black, Latino, and Students from Low-Income Backgrounds Are Denied Access to Advanced Math Courses* is posted on EdTrust, though they're both the same piece of writing.

In this work, they propose at the federal level an Advanced Coursework Equity Act, which would require states to set goals, create or increase funding for preparatory programs, support higher education institutions to train teachers and school leaders of color, and support and incentivize states and districts to prioritize safe, equitable, and positive learning environments. Additionally, they maintain that the Department of Education should support knowledge building to improve equity in access to advanced coursework opportunities, increase the racial and linguistic diversity of the teacher workforce, and measure Advanced Placement course-taking and exam success.

At the state level, they recommend policymakers address institutional culture and low expectations, update math standards to make learning more relevant and engaging, reduce school counselor-to-student ratios in districts with higher enrollments of Black and Latino students, adopt automatic-enrollment policies, and support positive school climates and a student's sense of belonging in advanced classes.

Finally, for higher education, they recommend policymakers update and clarify admissions practices, provide early academic support programs, and analyze students' math courses in the context of their school's resources, all to be equitable to students whose K – 12 schooling may have included opportunity gaps of the kind discussed throughout this paper.

For each set of stakeholder groups, the authors don't just offer recommendations as ideas but provide specific examples of states and universities that have successfully implemented strategies to increase enrollment for Black and Latino students in upper-level mathematics (and other) coursework.

Challenges to DEI. One current related factor is the recent national political movement to eliminate all initiatives related to Diversity, Equity, and Inclusion (DEI) (Trump, 2025). This shift poses challenges to build off of this work, threatening to remove or reduce equity and inclusion work from the priority list of every district in the nation. It is critical that district leaders continue this work, driven not by broad, blunt efforts of locally elected officials to end anything related to DEI, but by the need discussed in earlier sections to have all members of the community to have a minimal proficiency of mathematically literacy.

MSDE's recent unanimous adoption of a new math policy (MSDE, 2025) is an example that leaders can follow to sustain the work that needs to continue. Perhaps importantly, this policy includes the word "equity" only once and doesn't include the words "diversity" or "inclusion" anywhere. It codifies the work of expanding from pockets of excellence to the systemic excellence that NCTM calls for (NCTM, 2014) without getting mired in political debate, explicitly requiring implementation of MTSS, professional learning, acceleration practices, common assessments, state-approved secondary pathways, and elimination of tracking structures, all strategies that increase outcomes by creating more inclusive and equitable mathematics classrooms across the state.

Practical Implications for Schools and Districts

Leaders don't have the luxury of waiting for their states to create, propose, adopt, and enact more substantive math policy. Every year these structural barriers remain is another failed opportunity to increase the number of Black students who achieve 400+, 500+, and 600+ on the Mathematics section by 4.2%, 9.6%, and 13.9%, respectively, if the results in CCPS are replicable. Amidst a landscape of local, state, and federal grants all offering large sums of money to increase outcomes, particularly for students within underserved student groups, this is an intervention that costs no money and virtually no time. Perhaps if done better than the CCPS initiative it would have some additional costs in teacher training and structures of support, but this is the sort of cost already being expended in local budgets to maximize the effectiveness of tier 1 instruction. Although my key recommendations were for states to require this kind of work, schools and districts have the responsibility to do this work with or without the backing of state policy.

An additional consideration is to reflect upon larger lessons of this study. This study focused specifically on the impact of course removals, specifically on upper-level math enrollment and achievement of Black students. The lessons learned are likely transportable to students from other historically underserved student groups, within additional well-intentioned structural attempts to better meet student needs by “dividing and conquering”. Examining the impact of tracking into honors and academic or other such routing mechanisms may prove worthwhile. Quantifying growth (not grades, but measurable academic growth) that students with disabilities make in exclusionary settings versus inclusive classrooms may also inform change initiatives. Anywhere that the theory of action seems to be to help those that are behind with “separate but equal” opportunities demand inspection, as the result of such well-intentioned attempts are often to expect less of those that are behind, quietly, along the fringes of classrooms that are under higher scrutiny.

There is always the risk of organizational drift as external factors shift priorities and leaders move on to new challenges. This risk seems more direct in today’s political climate. Locally, CCPS has elected new board members who are rightfully probing our work, identifying any wasteful practices, and exploring ways to simplify the experience for teachers and students. During their political campaign, these board members linked themselves to a larger national trend to restrict or eliminate Diversity, Equity, and Inclusion (DEI) initiatives across various sectors, including education, government, and private industry (NBC News, 2025). It is critical for leaders to be in position to discuss with stakeholders how this work and similar initiatives to include our students are measurably beneficial for all students. The elimination of tracking and other exclusionary practices represents the removal of inefficient structures within CCPS.

A final thought is that sometimes success is felt by many as negative progress. During this process, the very talented teachers of CCPS felt increased student need for support within their classes and thought that was a negative change, not realizing that by including these students into their classes, they were producing more growth than if the students had taken the qualitatively inferior course. I’d like to share an example of a similar dynamic from history.

During World War II, the Allies analyzed the bullet holes on planes that returned from combat to determine where to add more armor. Initially, they observed that the fuselages had the most bullet holes and reasoned that these areas needed reinforcement or redesign because they were being hit more often than the wings or engines. However, this analysis was flawed because it only considered the planes that made it back, not those that were shot down.

A mathematician named Abraham Wald, who was part of the Statistical Research Group, pointed out this critical oversight. He explained that the planes with bullet holes in the fuselage survived because those areas could withstand damage. The planes that didn't return likely had critical hits in the wings or engines, which prevented them from making it back. Therefore, Wald recommended reinforcing areas with no bullet holes, such as the engines and wings, as these were the parts that, when hit, led to the planes being lost (Bowman, 2023).

This insight is a classic example of survivorship bias, where the focus is on a subset being observed rather than the entire set of data, leading to incorrect conclusions. This error in reasoning holds back inclusive efforts in many other settings and is critically important for stakeholders to recognize and understand. Recently in CCPS, some teachers worried about “misplaced” students being included in the Honors Precalculus course due to changes in the course sequence. These students were struggling compared to their peers, and there were few resources for students who struggled with the curriculum. The realized problem wasn’t that the students were poorly matched for the course, but that the course was poorly matched for the students. Only the most resilient learners had ever made it to this course in the past, so instructional resources and techniques were not as inclusive as they could have been. CCPS teachers worked to develop new resources and strategies, and students who never would have made it to the course in the past grew much more than they would have if they had been recommended for an inferior version of the course.

AP teachers often focus on their students' average AP scores and are reluctant to be more inclusive in their programs because they perceive borderline students as likely to bring their average score down. However, it is well-established that even students who achieve lower scores on AP exams are more prepared for post-secondary coursework than those who don't attempt the course (College Board, 2021b; College Board, 2021c). District leaders should shift AP program focus on number of students with given scores instead of student average to naturally encourage stakeholders to target inclusion of more students.

All this work requires wisdom and experience from leaders to stay the course long enough to realize outcomes. When I first embarked on this initiative, it was as a new leader with little experience in program evaluation, implementation science, PDSA cycles, knowledge of equitable practices, or understanding of opportunity gaps. Fortunately, I happened to be in a state leading this kind of work in a district with strong teachers and leaders who understood the significance of equity issues well enough to support our students even through my missteps. It is my hope that this research can support and push future leaders, whether or not they have the support that benefitted me and the students of CCPS.

Appendix A: The Eight Mathematics Teaching Practices

1. Establish Mathematical Goals to Focus Learning: explicitly communicate learning goals and success criteria, linking to past and future learning.
2. Implement Tasks That Promote Reasoning and Problem Solving: select problems and tasks that require student thinking rather than student repetition. Leave room for ambiguity of approach and solution and allow learners at all levels to interact with the problem creatively.
3. Use and Connect Mathematical Representations: Connect visual, physical, contextual, verbal, and symbolic representations to identify and communicate new perspectives when exploring problems.
4. Facilitate Meaningful Mathematical Discourse: Create space, culture, and norms of conversational problem solving in order to develop agency and identity, as well as to build collaborative and conversational problem-solving in order to make new meaning. Anticipate, monitor, select, sequence, and connect responses in order to enhance the learning experience for all.
5. Pose Purposeful Questions: Gather information, probe thinking, make the mathematics (importantly, not the solution) visible, and encourage reflection and justification. Help to focus, not funnel, student thinking as students work toward acquisition of a learning goal.
6. Build Procedural Fluency from Conceptual Understanding: Stop the practice of showing kids how to solve problems before they've even seen the problem, as this sort of instruction robs students of sense-making. Have them develop strategies when working tasks and recognize patterns that emerge in their solutions; only then, look for generalizations or procedures.
7. Support Productive Struggle in Learning Mathematics: resist the urge to "rescue" students, as the moment they're struggling is when they have the most potential to make sense and build lasting learning. Scaffold the learning process and build growth mindsets to help students embrace these sometimes uncomfortable moments of frustration.

8. Elicit and Use Evidence of Student Thinking: strategically plan formative assessment to help student learning and misconception become evident to both the students and the teacher throughout the learning in order to inform next steps (NCTM, 2014; NCTM, 2024).

Appendix B: Previous, Informal Survey Questions

1. In the past decade we removed high school Prealgebra. How good was that move? Skip the question if you're not sure.

- 1 – Terrible. We must bring this course back.
- 2
- 3
- 4
- 5
- 6 – Wonderful. We must not bring this course back.

2. In the past decade we removed Intermediate Algebra. How good was that move? Skip the question if you're not sure.

- 1 – Terrible. We must bring this course back.
- 2
- 3
- 4
- 5
- 6 – Wonderful. We must not bring this course back.

3. In the past decade we removed Business Math. How good was that move? Skip the question if you're not sure.

- 1 – Terrible. We must bring this course back.
- 2
- 3
- 4
- 5
- 6 – Wonderful. We must not bring this course back.

4. In the past decade we removed Algebra III. How good was that move? Skip the question if you're not sure.

- 1 – Terrible. We must bring this course back.
- 2
- 3
- 4
- 5
- 6 – Wonderful. We must not bring this course back.

5. In the past decade we added a non-AP Statistics course. How good was that move? Skip the question if you're not sure.

- 1 – Terrible.
- 2
- 3
- 4
- 5

- 6 – Wonderful.

6. In the past decade we added an Advanced Math course. How good was that move? Skip the question if you're not sure.

- 1 – Terrible.
- 2
- 3
- 4
- 5
- 6 – Wonderful.

Appendix C: Updated Teacher Survey Questions

Teacher Survey

There is a link to the consent form which is located at the top of this survey, please read the consent form prior to agreeing to participate in the study. Please respond "yes" below to the following consent statements if you choose to participate in the study.

By clicking, "yes" you are:
1). At least 18 years of age
2). You have read this consent form or have had it read to you,
3). Your questions have been answered to your satisfaction and you voluntarily agree to participate in this research study.

----

1. **Please indicate your opinion on a scale of 1 – 5 the decision to remove each of the following courses (1 = Very Bad Decision to 5 = Excellent Decision)**

COURSE	1.	2.	3.	4.	5
HS Prealgebra					
Intermediate Algebra					
Business Math					
Algebra III					

2. **Did you encounter/experience any of the following changes to the composition of your courses following the course changes? CHECK ALL THAT APPLY**

   - **Increased class sizes**
   - **Increased range of student skill levels**
   - **Increased feeling that you can't meet your students' needs**
   - **I did not experience any of these changes**
   - **Other (please describe)___________________________________**

3. **Follow-up: why did you answer the previous question the way you did?**

4. **Which of the following adjustments did you make in your teaching because of the course changes? CHECK ALL THAT APPLY**

   - **I used different instructional materials**
   - **I used different student groupings**
   - **I planned explicitly for ways to remove potential barriers in lesson plans**

- **I increased the use of previewing or other acceleration strategies**
- **I increased the use of vocabulary support**
- **I did not make any changes**
- **Other: (please describe)_________________________________**

5. **Follow-up: what, specifically, did you do?**

6. **Which professional learning activities, if any, have you accessed that have helped you to make your classroom more inclusive and equitable?**

7. **How could CCPS have done a better job supporting teachers throughout this process?**

8. **What additional improvements could CCPS make to the process?**

9. **Overall, do you think that the course changes have benefited students in CCPS?**

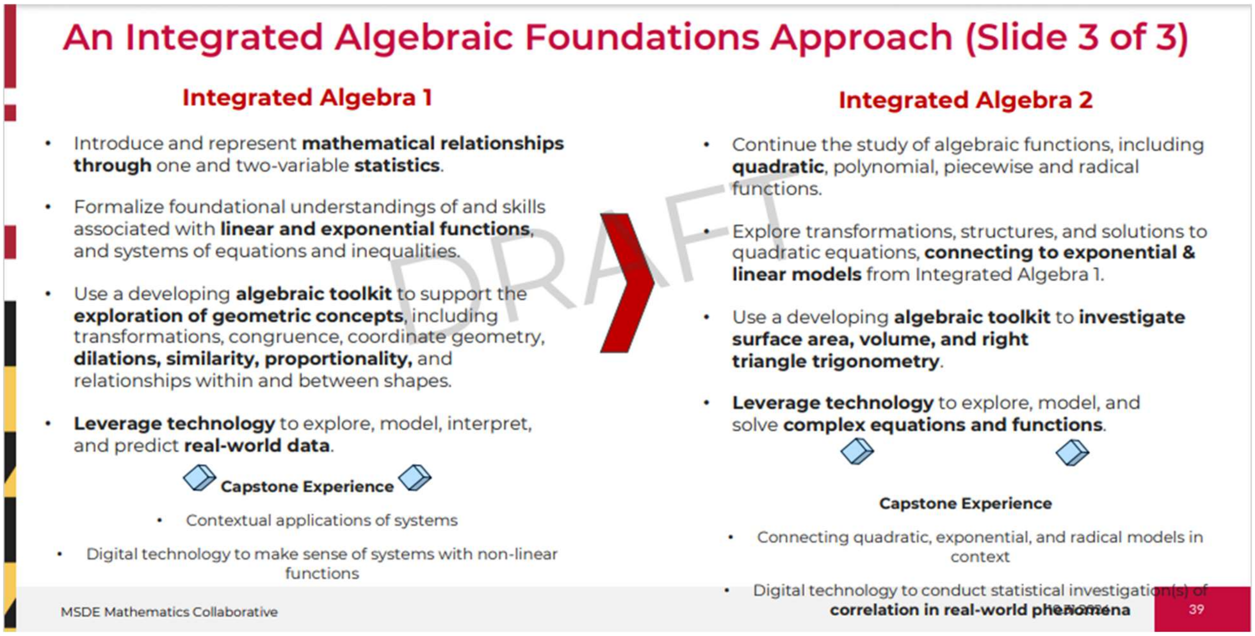
10. **Which best describes your position?**

    a. **Special Educator**
    b. **General Educator**

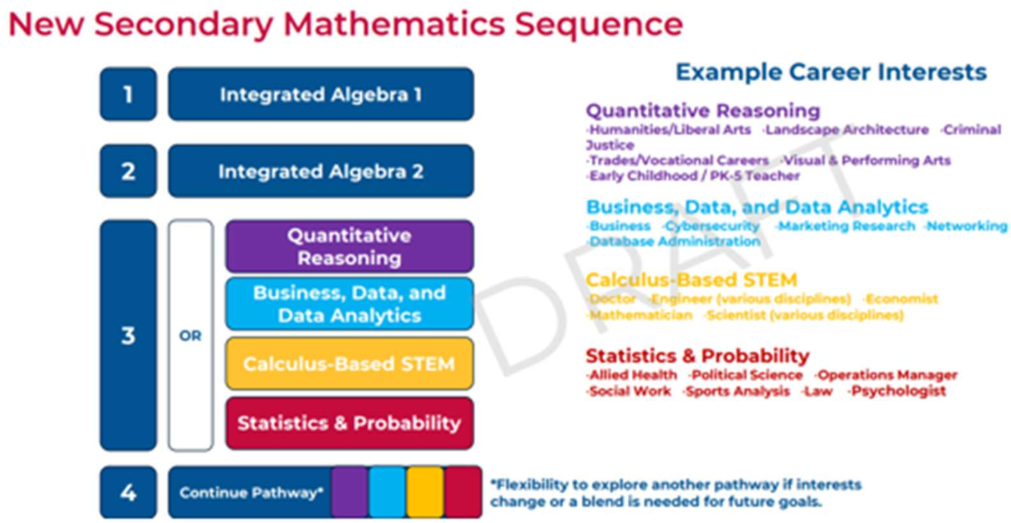
11. **Which best describes your number of years teaching high school mathematics?**
    a. **1 – 5 years**
    b. **6 – 10 years**
    c. **11 – 15 years**
    d. **16 – 20 years**
    e. **21 – 25 years**
    f. **26 – 20 years**
    g. **More than 30 years**

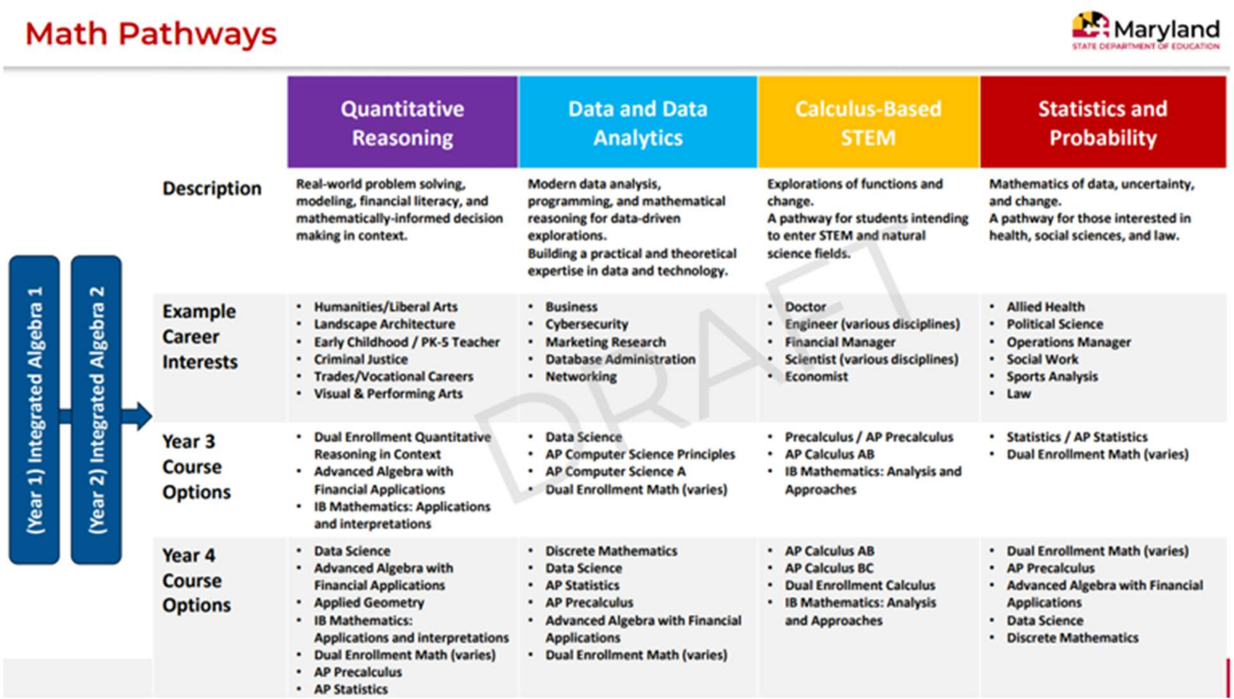
12. **Which best describes your number of years teaching high school mathematics in CCPS?**
    a. **1 – 5 years**
    b. **6 – 10 years**
    c. **11 – 15 years**
    d. **16 – 20 years**
    e. **21 – 25 years**
    f. **26 – 20 years**
    g. **More than 30 years**

Appendix D: MSDE's Proposed Integrated Algebra Framework



Appendix E: MSDE's Proposed Math Pathways





Math Pathways

Maryland STATE DEPARTMENT OF EDUCATION

(Year 1) Integrated Algebra 1 → (Year 2) Integrated Algebra 2 →

	Quantitative Reasoning	Data and Data Analytics	Calculus-Based STEM	Statistics and Probability
Description	Real-world problem solving, modeling, financial literacy, and mathematically-informed decision making in context.	Modern data analysis, programming, and mathematical reasoning for data-driven explorations. Building a practical and theoretical expertise in data and technology.	Explorations of functions and change. A pathway for students intending to enter STEM and natural science fields.	Mathematics of data, uncertainty, and change. A pathway for those interested in health, social sciences, and law.
Example Career Interests	• Humanities/Liberal Arts • Landscape Architecture • Early Childhood / PK-5 Teacher • Criminal Justice • Trades/Vocational Careers • Visual & Performing Arts	• Business • Cybersecurity • Marketing Research • Database Administration • Networking	• Doctor • Engineer (various disciplines) • Financial Manager • Scientist (various disciplines) • Economist	• Allied Health • Political Science • Operations Manager • Social Work • Sports Analysis • Law
Year 3 Course Options	• Dual Enrollment Quantitative Reasoning in Context • Advanced Algebra with Financial Applications • IB Mathematics: Applications and interpretations	• Data Science • AP Computer Science Principles • AP Computer Science A • Dual Enrollment Math (varies)	• Precalculus / AP Precalculus • AP Calculus AB • IB Mathematics: Analysis and Approaches	• Statistics / AP Statistics • Dual Enrollment Math (varies)
Year 4 Course Options	• Data Science • Advanced Algebra with Financial Applications • Applied Geometry • IB Mathematics: Applications and interpretations • Dual Enrollment Math (varies) • AP Precalculus • AP Statistics	• Discrete Mathematics • Data Science • AP Statistics • AP Precalculus • Advanced Algebra with Financial Applications • Dual Enrollment Math (varies)	• AP Calculus AB • AP Calculus BC • Dual Enrollment Calculus • IB Mathematics: Analysis and Approaches	• Dual Enrollment Math (varies) • AP Precalculus • Advanced Algebra with Financial Applications • Data Science • Discrete Mathematics

Appendix F: IRB Exemption Letter

UNIVERSITY OF MARYLAND

INSTITUTIONAL REVIEW BOARD

1204 Marie Mount Hall
College Park, MD 20742-5125
TEL 301.405.4212
FAX 301.314.1475
irb@umd.edu
www.umresearch.umd.edu/IRB

DATE:	April 3, 2025
TO:	Joe Sutton
FROM:	University of Maryland College Park (UMCP) IRB
PROJECT TITLE:	[2266940-1] UNDERREPRESENTATION OF BLACK STUDENTS IN HIGHER LEVEL SECONDARY MATHEMATICS COURSES: AN ANALYSIS OF THE IMPACT OF REMOVING QUALITATIVELY LESS-THAN MATHEMATICS COURSES ON STUDENT ENROLLMENT, COMPLETION, AND ACHIEVEMENT
SUBMISSION TYPE:	New Project
ACTION:	DETERMINATION OF EXEMPT STATUS
DECISION DATE:	April 3, 2025
REVIEW CATEGORY:	Exemption category # 45CFR46.104(d)(2)(i-ii); 45CFR46.104(d)(4)(ii).

Thank you for your submission of New Project materials for this project. The University of Maryland College Park (UMCP) IRB has determined this project is EXEMPT FROM IRB REVIEW according to federal regulations.

We will retain a copy of this correspondence within our records.

If you have any questions, please contact the IRB Office at 301-405-4212 or irb@umd.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within University of Maryland College Park (UMCP) IRB's records.

Appendix G: Study Survey Results

Question 2/3:

Did you encounter/experience any of the following changes to the composition of your courses following the course changes? CHECK ALL THAT APPLY Follow-up: why did you answer the previous question the way you did?
by trying to meet all needs and levels, we are meeting none.
Heterogeneous student population.
I am noticing a frustration from teachers and counselors with a lack of course placement for students that need an algebra-based course after Algebra 2 that is not Honors Pre-calculus. A course to support continued learning to prepare students for the math placement exam/courses in college.
I have a lot of stats students who left precalc. Our student numbers are way off. Class Sizes are all over the place and of course I get the huge ones
I have students everywhere on the scale of knowledge. I feel that I do not support my students in all areas that they need due to this.
I'm all for the changes and I did not notice any changes listed above.
Increase in student apathy and work ethic. They are coming to upper level classes from lower classes where the expectations and work are not near the level of what is required of them and then although pleasant to deal with do no work and their grade suffers accordingly. Some think that they should not have to work outside the 45 minute period because of jobs or time they need to do what they want to do and it is not a reality. All for pushing as many kids to upper level classes as possible, but the prep and work ethic has to match the initial desire to be there.
It is a struggle to meet the needs of students in a classroom with diverse learners. We are coming up with strategies that help such as small group, self paced learning, and vertical whiteboards.
Students migrate toward common experiences and ability levels too students get bored and don’t want to always help lower students
Teaching Algebra 2 last year was overwhelming. The range of ability levels in that one class was astounding. It was very challenging to meet all of the students where they were.
The range and size in the classes has made planning a more difficult process. Not only are the classes larger with more classroom management issues, but the differentiation in the instruction doubles my planning time.
Wasn't here for any of the changes beside Intermediate Math, but it didn't affect me

We are pushing students into higher level math courses, setting them up to not be successful. There isn't enough time to build a firm understanding of concepts resulting in lack of confidence.

With students being inclusive, there is more work to provide more opportunities of access for students.

Question 4/5:

Which of the following adjustments did you make in your teaching because of the course changes? CHECK ALL THAT APPLY

Follow-up: what, specifically, did you do?

I am constantly creating new materials depending on the differentiation of my classes. Constantly re-grouping students based on level and skills. Constantly bringing in pre-requisite skills because of gaps with some students. Previewing as soon as possible skills that will be used in upcoming units to help with gaps in student skills.

I have tried grouping by levels (mixed, same level, and random) for different situations. I have increased my use of my Word Wall - posting and constantly changing out the posters.

n/a

None

Plan intentionally and utilize my co-teacher, research-based teaching strategies, I thought not about what was best and easiest for me but what was the best for students.

Reiterate and use more language in my delivery of the material. Provide extra opportunities for students to practice and have a deeper understanding of the material. Give more small group instruction.

small group, self paced learning, and vertical whiteboards.

The change did not directly affect me but other teachers in the department. Changes were made without giving teachers the training/time to create different instructional materials. I think because of this, teachers are blaming the course recommendation process and students 'not belonging' in courses vs. adapting their instructional strategies to teach all students in the classroom.

The expectation cannot change for what we require of them or we will get lower results which we are on the way to doing.

Using exit tickets, providing students with an entrance to every problem.

Word walls & topic graphic organizer each topic

Question 6:

Which professional learning activities, if any, have you accessed that have helped you to make your classroom more inclusive and equitable?
?
7 step to language rich class
AP Reading
Book studies with colleagues and having like-minded colleagues to confer and practice with.
Collaborative planning
MTSS training
n/a
None
The county PD planning time has really helped. We learn something new and then are able to implement specifically that strategy by giving us planning time.
Vertical Board Training/ book study
Vertical white board activities, groups.

Question 7:

How could CCPS have done a better job supporting teachers throughout this process?
Co-teaching a section like this would have been beneficial
Focusing specifically on Honors Pre-calculus, teachers have generally not had to adapt curriculum/instructional strategies in the past years. This year, since academic pre-calculus was eliminated, I am noticing these teachers struggling with teaching students of various skills and abilities. There feels to have been a 'non-inclusive' stigma surrounding this course and now, that is obviously becoming a problem. This is a shift for many of our teachers of upper level math courses. I do not think these teachers genuinely think all students cannot learn the content, I think it is a matter of how to change instruction and teaching habits to do so. It would be nice to see Honors pre-calculus teachers within the county to be able to share resources and meet regularly. Teachers are uncomfortable with change and this time could help support this.
have more consistency with disciplinary referrals.
Increase planning time/opportunities to work with other teachers.

More collaboration time, more training
more planning
More planning time. Non-agilemind assessments.
No comment
not sure they can other than take away some of the ways for students to succeed after not doing what they are supposed to the first time.
Provide PD other than Agile Mind's perspective as there will be a variety of learners and we will need more ways to accommodate. Especially regarding students with IEPs
Providing more mandatory training earlier in the process. The mandatory training should be varied in its presentation: lesson planning, book study, class observations,
Providing more time for collaborative planning

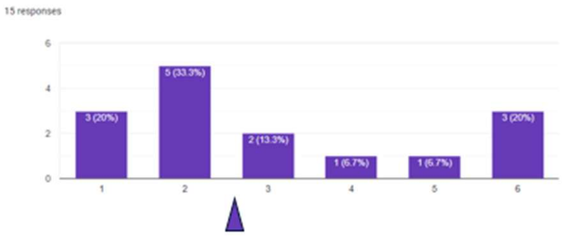
Question 8:

What additional improvements could CCPS make to the process?
Ask for teacher feedback prior to making changes
Being more strict with staff who refuse to comply or sabotage.
go back to offering academic courses separate from honors
More instructional strategies with reading and addressing student needs.
More training, incorporate specific numeracy intervention for struggling students
n/a
Non-agilemind assessments and curriculum.
Nothing specific
revise retake policy, expect more for attendance and hold them accountable as kids now miss weeks at a time or way to many days in a quarter.

Appendix H: Results of Previous, Informal Survey

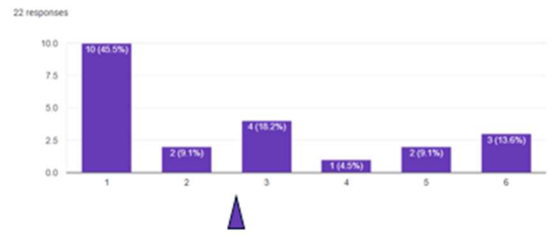
High school teachers: in the past decade we removed high school Prealgebra. How good was that move? Skip the question if you're not sure.

Terrible. We must bring this course back. 1 2 3 4 5 6 Wonderful. We must not bring this course back.



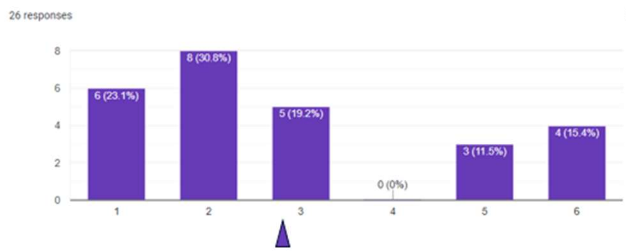
High school teachers: in the past decade we removed Intermediate Algebra. How good was that move? Skip the question if you're not sure.

Terrible. We must bring this course back. 1 2 3 4 5 6 Wonderful. We must not bring this course back.



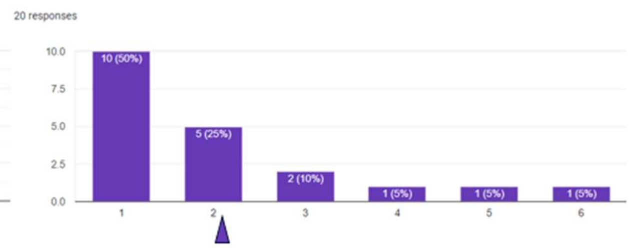
High school teachers: in the past decade we removed Business Math. How good was that move? Skip the question if you're not sure.

Terrible. We must bring this course back. 1 2 3 4 5 6 Wonderful. We must not bring this course back.



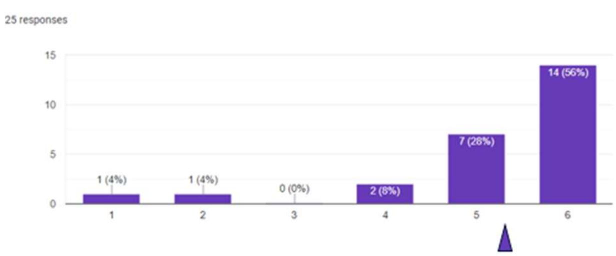
High school teachers: in the past decade we removed Algebra III. How good was that move? Skip the question if you're not sure.

Terrible. We must bring this course back. 1 2 3 4 5 6 Wonderful. We must not bring this course back.



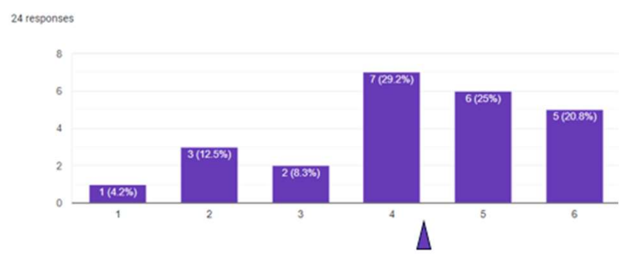
High school teachers: in the past decade we added a non-AP Statistics course. How good was that move? Skip the question if you're not sure.

Terrible. 1 2 3 4 5 6 Wonderful.



High school teachers: in the past decade we added an Advanced Math course. How good was that move? Skip the question if you're not sure.

Terrible. 1 2 3 4 5 6 Wonderful.



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