

Department of Mathematics K-12 Program Review Guide

Revised January 2019

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Introduction

It is the goal of the Bridgewater-Raritan Office of Curriculum and Instruction to develop and implement a thorough, data-based process for analyzing curriculum, instruction, assessment, student performance, professional development, and resources in all curricular areas ensuring that professional practice is always current, relevant, and aligned to the most updated standards. Each curricular area will be reviewed on a five-year timeline. The results of each process will be presented publicly.

Acknowledgements

The following individuals were directly involved in gathering information/data and contributed to the completion of the Mathematics Department's program review, which is presented in this document.

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Goals and Purpose

In this document, it is the goal of the Mathematics Department to present the following:

- A description of the physical program
- Current course offerings including enrollment data
- A review of the curriculum, instruction, assessment, resources and professional development
- Student Performance Data
- Recommendations leading into the Curriculum Revision Process

Program Description

Grades K-4 Mathematics

The K-4 mathematics program emphasizes the Mathematics Content Domains as outlined in the the New Jersey Student Learning Standards (NJSLS). The content is presented using a concrete - pictorial - abstract (CPA) approach designed to develop critical thinking skills while embedding the New Jersey Standards for Mathematical Practice into the daily teaching and learning. Practice of basic skills is ongoing through a variety of routines and activities. Topics are revisited regularly and practice is distributed over time to facilitate full concept development. Grades 1 through 4 employ a small group instructional model that allows for differentiated instruction, enrichment, reinforcement, and remediation based on individual student need. Grades 1-4 typically receive 75 minutes daily of mathematics instruction; kindergarten students receive 35 minutes of daily math instruction. The K-4 mathematics program helps prepare students to take the grade appropriate Partnership for Assessment of Readiness of College and Careers (PARCC) assessment.

In addition to grade level classes, students entering grades 2 through 4 can apply and qualify for the Academically Independent (AI) program. Students qualifying receive math instruction at an accelerated pace. This program is housed at Hamilton Primary School. Students entering grade 4

can also qualify for placement in 4A Mathematics. Unlike the AI program, students only receive accelerated instruction in mathematics and remain at their home school.

<u>Appendix H</u> shows enrollment and class size data for grades K-8.

Grades 5-8 Mathematics

The 5-8 mathematics program emphasizes the Mathematics Content Domains as outlined in the the NJSLS. The Math in Focus (MIF) K-5 series continues and concludes in fifth grade which provides an emphasis on problem solving, skill consolidation, and a deep understanding in preparation for algebra while utilizing a CPA approach. A CPA learning progression is embedded throughout instruction and teaches concepts with bar models that are developed and extended from the early grades through 6th grade with MIF Course 1, the first year of the MIF Middle Grades Program.

Fifth grade students have class seven periods a week for 43 minutes. Teachers have two cohorts of students that they work with for math, science, and social studies. Students have math for 43 minutes, three days per week and 86 minutes on alternating days twice a week for a total of 301 minutes. A sample 5th grade teacher schedule can be found in <u>Appendix F</u>.

Grades 6-8 typically receive a single period of mathematics each day with 43 minutes in 6th grade and 42 minutes in 7th and 8th grade. The 5-8 math program prepares students for high school math courses and allows for students to access these courses one or two years early.

Students entering 5th grade are in one of two leveled courses for mathematics, Math 5 and 5AI/E Math. The Math 5 course uses the Grade 5 NJSLS for Mathematics whereas the 5AI/E Math uses the Grade 6 NJSLS. Students who qualify for the 5AI/E math course have qualifying grades from previous courses along with other testing criteria and teacher recommendations. Although the curricula of the 5AI and 5E sections of advanced math courses are the same, it is the cohort of students that differs. Student in the AI program have qualified for advanced courses in English language arts, science, and social studies and are part of the district's Gifted and Talented AI program and students in 5E math have qualified for advanced mathematics but not in the other areas. By the end of the 5AI/E math course, students are accelerated by one grade level.

Grade 6 Math students are in one of two courses for mathematics, Math 6 or Math 6E. The Math 6 course uses the Grade 6 NJSLS for Mathematics whereas the 6E Math course uses the Grade 7 and Grade 8 NJSLS for mathematics. Students in 6E mathematics are accelerated 2 years above grade level upon course completion.

Students entering the middle school in grade 7 are scheduled for one of three courses for mathematics: Math 7, Math 7E, and Algebra I. All 6th grade students are screened for placement for 7th grade mathematics to determine placement. Students from these courses continue to Math 8, Algebra I, and Geometry respectively.

Course descriptions for 5-8 Mathematics and K-12 course sequencing can be found in <u>Appendix</u> <u>G</u>.

Students are required to take 15 credits of high school mathematics, including Algebra I and Geometry, or the content equivalent, and a third year of math that builds on the concepts and skills of algebra and geometry and prepares students for college and 21st century careers.

All high school mathematics courses receive instruction for 40 minutes each day. Students identified as in need of mathematics intervention are assigned a supplemental mathematics course to support Algebra I, Geometry, and Algebra II. All students can also choose to be enrolled in multiple mathematics courses at the same time, such as Calculus and Probability & Statistics, as well as computer science courses. The full list of high school mathematics offerings and course descriptions can be found in the high school Program of Studies found here: <u>9-12</u> <u>Math Course Descriptions and Progressions</u>

In the high school, there are currently 27.4 general education mathematics teachers, 8.6 special education mathematics teachers, and one math intervention specialist.

Enrollment data for mathematics in grades K-12 can be found in <u>Appendix H</u>.

The initial data analysis of the enrollment did not yield any significant trends regarding the current math program. We decided to look more closely at grades 4 and 7 enrollment data as these are known points of acceleration within the math program for students. Grade 4 is the first time there are three math courses. Grade 7 is the first offering of Algebra I. The percent of the students in the courses have been relatively consistent during the past four years as shown in the tables below. Differences in the 4A Math class sizes compared to the Math 4 and 4AI Math class sizes do not offer parallel student learning experiences.

	2015-16			2016-17			2017-18			2018-19		
	Total	Avg class size	%									
Math 4	475	19	78.3	529	18	83.3	477	18	78.1	482	18	76.5
4A Math	69	10	11.4	62	10	9.8	67	10	11.0	75	11	11.9
4AI Math	63	21	10.4	44	22	6.9	67	22	11.0	73	24	11.6

	2015-16			2016-17			2017-18			2018-19		
	Total	Avg class size	%									
Math 7	285	19	44.9	314	21	50.2	306	19	50.5	330	21	50.5
7E	176	25	27.7	165	24	26.4	135	19	22.3	156	26	23.9

Math												
Algebra I (7)	174	22	27.4	147	18	23.5	165	24	27.2	167	21	25.6

The difference in class sizes noted in the previous tables between grades 4 and 7 prompted the examination of the progression of a cohort of these students. The following table examines the percent of students enrolled in grade level and above grade level courses as a cohort from grade 4 through grade 8. While 19% of this student cohort was accelerated in grade 4, 53% of this cohort was accelerated by grade 7. It is noted that student acceleration is greatest when moving from grade 6 to grade 7.

		4	4A	4AI	5	5E	5AI	6	6E	7	7E	7 Alg	8	Alg	Geo
Academic	Student														
Year	Count														
13-14	n=516	419	61	36											
		81%	12%	7%											
14-15	n=501				377	66	58								
					75%	13%	12%								
15-16	n=486							353	133						
								73%	27%						
16-17	n=481									224	135	122			
										47%	28%	25%			
17-18	n=481												233	129	119
													48%	27%	25%

While the enrollment data in grade 4A Math is consistent district-wide, it varies among individual primary schools from year to year.

4A Course Enrollment by School	2015-16	2016-17	2017-18	2018-19
Adamsville Primary School	15	12	6	7
Bradley Gardens Primary School	10	0	8	7
Crim Primary School	10	12	10	12
Hamilton Primary School	4	7	13	13
John F. Kennedy Primary School	6	8	4	8
Milltown Primary School	11	15	12	17
Van Holten Primary School	13	8	14	11
TOTAL	69	62	67	75

The following graphs show the distribution of demographic groups within the different grade 4 courses. The same demographic distribution is then shown for the different levels of high school mathematics courses. The demographic data of the 4th grade and high school math courses can be found in <u>Appendix H</u>. The red horizontal line on each of the following graphs represents the percent of the total population for the category. If the math courses were perfectly equitable across demographic groups, all of the bars would be the same height and hit the red line. Bars that are under the line represent an under-representation of the group in the category. The analysis of the course demographics reveal disproportionate race enrollment in many of our math courses.

The 4th grade math graph below shows that in 2017-18, 78% of fourth graders were enrolled in Grade 4 Math, 11% were enrolled in 4A Math and 11% were enrolled in 4AI Math, all noted by the red lines. It is noted that although 11% of the fourth grade population is enrolled in 4AI Math, approximately 29% of all fourth grade Asians were enrolled in 4AI Math compared to approximately 2% of the fourth grade White population and none of the Hispanic population. Also notice that there were no Black students enrolled in 4A Math and 13% of Blacks are enrolled in Math 4AI. To summarize, Asians are more likely to be in advanced courses in fourth grade while Hispanics are the least likely. The data reveals that Asians are three times more likely to be in advanced mathematics course in grade 4 compared to Whites and Blacks and seven times more likely than Hispanics.



2017-18 4th Grade Mathematics Percent of Subgroup Enrolled in Each Level

The 4th grade graph below shows that the district's 2017-18 4th grade population is 32% Asian, yet the 4AI Math program enrollment is 85% Asian. The district's 2017-18 4th grade population is 46% White, yet the 4AI Math program enrollment is 9% White. Hispanics make up 15% of the population in grade 4, yet only 7% are enrolled in 4A Math and none are enrolled in the 4AI

Math. Blacks make up 2% of the population in grade 4, yet none are enrolled in 4A Math and 3% of this population isin 4AI Math. This reveals demographic inequities among the different levels of math courses.



Percent of Each Level Made up of Each Subgroup

2017-18 4th Grade Mathematics

*Note: Horizontal Bar for Black is 2% which was not placed since it obscured some of the bars.

The high school graph below shows that in 2018-19, 29% of all high school students are enrolled in Advanced Placement (AP) level courses, 12% of students are enrolled in honors level courses, 48% are enrolled in academic level courses, and 5% are enrolled in essentials level classes, all noted by the red lines.

Although 29% of all high school students are in AP math courses, 54% of Asians are enrolled in AP courses compared to 18% of Whites, 8% of Blacks and 6% of Hispanics. Similarly, 12% of all high school students are in honors math courses, 22% of Asians are enrolled in honors courses compared to 7% of Whites, 4% of Blacks and 3% of Hispanics. Also noted, 48% of all high school students are in academic math courses, 22% of Asians are enrolled in academic courses compared to 61% of Whites, 63% of Blacks and 64% of Hispanics. Lastly, 5% of all high school students are in essentials math courses, 1% of Asians are enrolled in essentials courses compared to 6% of Whites, 9% of Blacks and 13% of Hispanics.

To summarize, Asians are more likely to be in AP or honors level courses in high school while Hispanics are the least likely. The data reveals that Asians are three times more likely to be in advance mathematics course in high school compared to Whites, six time more likely than Blacks and eight times more likely than Hispanics. Whites are six times more likely to be

enrolled in an essentials level course compared to Asians, Blacks are nine times more likely, and Hispanics are 13 times more likely.



2018-19 BRHS Percent of Race Enrolled in each Math Level

The graph below shows that the district's 2018-19 high school population is 34% Asian, yet the AP and honors program enrollment is 62% Asian compared to the academic level being 15% Asian and the essentials level being 6% Asian. The district's 2018-19 high school population is 51% White, yet the AP and honors program enrollment is a little over 30% White compared to the academic level being 64% White and the essentials level being 57% White. Hispanics make up 10% of the population in the high school, yet they make up only 3% of AP enrollment compared to 15% of academic enrollment and 28% of essentials enrollment. Blacks make up 2% of the population in the high school, and approximately 1% of AP enrollment, 3% of academic enrollment and 4% of essentials enrollment. Notice the different trends between the Asian enrollment going from larger to smaller as you move from AP to resource and the Black and Hispanics going from smaller to larger moving in the same direction.



2018-19 BRHS Percent of Math Levels Made up of each Race

*Note: Horizontal Bar for Black is 2% which was not placed since it obscured some of the bars.

Computer Science Course Enrollment

Computer science courses are offered as electives within the Mathematics Department. The following table shows the enrollment of students in the high school computer science program for the past four years. It is noted that the the number of students enrolled has increased in each year.

	2015-16	2016-17	2017-18	2018-19
HS Students Enrolled in a Computer Science Course	202	248	301	317

Data Collection, Teacher Feedback, and Reviews

The following information was gathered through surveys. Questions for the survey were developed by a committee of K-12 teachers. Surveys were developed for three target audiences: parents, students, and staff. Responses to surveys included 277 teacher responses; 5,956 grade 3-12 student responses, and 488 parent responses.

Each survey audience was asked questions in the following categories: mathematical beliefs, curriculum, instruction, instructional resources, assessments, and professional development.

A listing of survey questions and responses for each of these audiences can be found in <u>Appendix C</u>.

Mathematical Mindset

Parents, teachers, and students were surveyed regarding their mathematical beliefs. Dominant beliefs about teaching and learning of mathematics can be an obstacle to the consistent implementation of the Mathematics Teaching Practices identified as best practices by the National Council of Teachers of Mathematics (NCTM). Teacher beliefs impact decisions they make regarding how they teach mathematics, and student beliefs impact their disposition and perceptions of learning mathematics. Frequently, parent and teacher beliefs about math instruction are formed by the experiences they had when they were learning mathematics when memorizing facts, formulas, and procedures were more commonplace in the math classroom. This perspective perpetuates a traditional lesson structure in which math instruction features review and demonstration by the teacher and repeated practice by the students and is not always aligned with current best practices.

Principles to Action (2014) states that these beliefs are neither good nor bad, but may be unproductive "when they hinder the implementation of effective instructional practice or limit student access to important mathematics content and practices" (11). Having dominant unproductive beliefs about teaching and learning can be an obstacle to effective teaching and learning practices. We surveyed teachers, students, and parents about their dominant beliefs.

The results are as follows:

Mathematical Learning Beliefs

Most teachers (93%) demonstrate a productive belief about mathematics learning. An unproductive belief is most prevalent among teachers of high school essentials and resource room teachers.

Overall, 86% of students demonstrate a productive belief about mathematical learning. Overall, 85% of parents demonstrate a productive belief about mathematical learning. An unproductive belief is most prevalent among parents of special education students.



Teacher question NCTM 1: Select the statement with which you most strongly agree.



Student question NCTM 1: Select the statement with which you most strongly agree.

Parent question NCTM 1: Select the statement with which you most strongly agree.



Effective Teaching

A greater difference was noted between teachers and students in the belief questions regarding the description of an effective teacher. Most teachers (94%) demonstrate a productive belief about effective teachers. There is an exception to this is among teachers of resource room courses.

In contrast to the teachers, 52% of students demonstrate a productive belief about effective teachers. More students in accelerated courses (AI and honors/AP) demonstrate a productive belief about effective teachers than their peers in grade level courses.



Teacher question NCTM 4: Select the statement with which you most strongly agree.





Role of the Teacher

Most teachers (94%) demonstrate a productive belief about the role of the teacher. An unproductive mindset is more prevalent among teachers of resource room courses. Overall, 66% of students demonstrate a productive belief about the role of the teacher. This productive belief is most prevalent among students in AI/E and honors/ AP courses. Overall, 74% of parents demonstrate a productive belief about the role of the teacher. An unproductive belief is most prevalent among parents of special education students.



Teacher question NCTM 3: Select the statement with which you most strongly agree.





Parent question NCTM 2: Select the statement with which you most strongly agree.



Role of the Student

Most teachers (94%) demonstrate a productive belief about the role of the student. An unproductive belief is more prevalent among teachers of resource room courses. Overall, 76% of students demonstrate a growth belief about the role of the student. This productive belief is most prevalent among students in AI/E and honors/AP courses.



Teacher question NCTM 4: Select the statement with which you most strongly agree.



Student question NCTM 4: Select the statement with which you most strongly agree.

The findings from the belief statements show the greatest disparity between the number of teachers having productive beliefs and the students having productive beliefs about the role and of the teacher and effective teaching. When teacher and student beliefs do not align, it is more difficult to deliver effective instruction that students feel is purposeful.

Review of Curriculum

Pacing calendars and scope and sequences are outlined in curricula documents. Scope and sequence documents outline instructional resources that are used for instruction, remediation, assessment and enrichment. Hyperlinks provide teachers access to additional online recommended resources, such as NJSLS Framework recommended activities that enhance instruction, provide additional supports for struggling learners and formatively assess student understanding. Through review of lesson plans and both formal and informal classroom observations, teachers are consistently observed using curricular resources as required.

Teachers also have a clear and common understanding of the NJSLS that guides their instruction. NJSLS content and skills are outlined in the curricula and this understanding is evident in their survey response.

In Kindergarten through grade 6, including AI, E and 4A math, students are assessed using common chapter and computational fluency assessments throughout the year. Students in grades 1 through 4 are administered a beginning-of-year and end-of-year formative assessment that covers culminating benchmark standards.Grades 7-12 students are administered common mid-year and final assessments. Students entering grades 7 and above are also administered a common course assessment after completing their summer assignments.

Needs of learners are met using a multitude of strategies across the grade levels. ELL students and students with IEPS or 504 plans are supported according to identified recommendations and accommodations. Students are identified for Response to Intervention (RTI) services using NWEA MAP and teachers recommendation. In the primary grades, common assessments and NWEA MAP assessments are used to form small instructional groups. These groups are fluid

and regularly adjusted to allow for differentiated instruction Students can test to accelerate into the Academically Independent (AI) track as early as grade 1 for placement in grade 2. AI students must meet requirements for Math and ELA. In grade 3, all students are assessed using NWEA MAP for acceleration into the 4A Math track. These students receive the same curriculum as 4AI math students. In grades 5-12, students are tracked based academic performance. Please see K-8 Math Progression and High School Math Progressions in <u>Appendix</u> I. At the end of grade 8, additional opportunities exist for students to accelerate through Option II.

The NJSLS framework is based in research and sequences math standards from Kindergarten through Algebra II. All applicable BRRSD Math curricula are aligned to the NJSLS. Vertical articulation of the math content domains across the NJSLS from grades K-8 ensure well-sequenced, vertically-aligned content. <u>Appendix J</u> shows the Grade K-8 NJSLS Math domains.

The NJ Curricular Framework is a suggested sequence of standards for each course/grade level from Kindergarten through Algebra II. All applicable BRRSD Math curricula address the standards listed in the NJ Curricular Framework.

The PARCC Evidence Statement Analysis Reports show a consistent pattern that students outperform the state in the majority of standards in each course/grade level. This is evidence that the curriculum contains the necessary standards for the course/grade level. The following statements summarize the performance data from PARCC Evidence Statement Analysis Reports in which more than 10% of the students had attempted the question.

- Grade 3 students scored above the state average on 88% of the PARCC questions
- Grade 4 students scored above the state average on 98% of the PARCC questions.
- Grade 5 students scored above the state average on 98% of the PARCC questions.
- Grade 6 students scored above the state average on 96% of the PARCC questions.
- Grade 7 students scored above the state average on 82% of the Grade 7 PARCC questions. (In grade 7, 78% of students took the Grade 7 PARCC.)
- Grade 8 students scored above the state average on 77% of the Grade 8 PARCC. (In grade 8, 55% of students took Grade 8 PARCC.)
- Algebra I students scored above the state average on 95% of the PARCC questions.
- Geometry students scored above the state average on 100% of the PARCC questions.
- Algebra II students scored above the state average on 96% of the PARCC questions.

PARCC Evidence Statement Analysis Reports are confidential and cannot be distributed, and therefore are not included as an appendix.

Survey questions were asked to students, staff and parents regarding the current math curriculum. Highlights of the survey results are as follows.

In the teacher survey, over 91% of teachers agree or strongly agree that their course curriculum meets the NJSLS. This is evidence that the curriculum contains the necessary standards for the course/grade level.

Overall, 82.6% of teachers believe that students have met the expectations of the state standards when they complete the course. Teachers of high school essentials, workshop and resource courses disagree with this statement more so than teachers of other courses as is seen in the graph below.



Teacher question 22: By the end of the year, students have met the expectations of the State Standards for the course.

Approximately 80% students feel well-prepared for current courses based on student survey feedback. Most notable is that students in Math 7, Math 8, and high school essentials and academic courses feel less supported than other students in the district as shown in the graph below.



Student question 23: My previous math classes have prepared me well for this class.

Parents responded that they are less comfortable supporting their child with homework as students progress through the mathematical curricula.

Review of Instruction

Survey questions were asked to students, staff and parents regarding the current math instruction. Below are highlights of the survey results.

Based on survey results, 89% of BRRSD students feel appropriately supported in their math classes. Looking more specifically at subgroups and grade levels, exceptions to this exist at high school academic math classes where 76% of students feel appropriately supported.

Overall 78% of parents feel their child is receiving appropriate support in their math class. It was noted, however, that 53% of parents of grade 10 students and 63% of parents of grade 6 students feel their child received appropriate math support.

Overall, 72 % of teachers agree daily math instructional time is adequate. This figure drops to about 50% when looking at Math 7, Math 8 and high school academic courses. Only 26% of teachers instructing high school essentials and workshop classes feel there is adequate instructional time. At the primary level, kindergarten (62%) and grade 3 (66%) teachers feel there is enough instructional time. This contrast with grades 1, 2 and 4, all showing between 83% and 89% of teachers feeling there is adequate time for instruction.



Teacher question 11: Daily math instructional time is adequate for me to deliver content in this math course.

Pacing for student understanding data shows grade 3 teachers significantly differ from other primary grades. In grades 3, 29 % of teachers strongly disagree, with 53% of grade 3 teachers disagreeing overall that pacing does not allow for student understanding. No other primary grade level was above 26% disagreement overall. Grade 3 is the only primary grade level where any teacher strongly disagrees.

There are significant differences among the primary schools and the intermediate schools in regard to the pace of the curriculum allowing for student understanding. Math 7, Math 8, high school academic, essentials and resource classes all show high levels of disagreement.



Teacher question 18. Curriculum pacing for this grade/course allows for student understanding.







Teacher question 18. Curriculum pacing for this grade/course allows for student understanding.

Teachers employ a variety of instructional strategies across all grade levels. Primary grades 1 through 4 are required to employ the small group instructional model. In high contrast to the primary schools, whole class instruction and lecture are most prevalent at the intermediate through high school levels.

Student survey data shows that 91.0% of students are aware of the daily instructional objective in their math class.

Student survey data shows most students agree that they better understand content when it is presented in multiple ways.

Student survey data shows that the greatest perceived meaningful problem-solving occurs in grades 3-6, and the least amount of perceived meaningful problem-solving occurs in high school essentials, workshop and academics classes.

Along with mathematical content, modeling and reasoning are components of math instruction. The teacher survey shows over 80% of teachers incorporate modeling and reasoning into instruction at least multiple days a week. Most lacking in this area is the high schools essentials and workshop classes, where only 38% of teachers incorporate modeling and reasoning multiple days a week.



Teacher question 10: How often do you incorporate mathematical reasoning and modeling into instruction for this math course?

Students data shows that 67.5% of students sometimes or frequently use hands on manipulatives in class. This is most prevalent in grades 3-6 and decreases as students move to the MS and HS.



Student question 8: How often do you use hands-on manipulatives in your math class?

Overall 75.2% of teachers believe the grades earned by students adequately reflect their understanding of course content. Notice that more than half of the high school essentials and workshop teachers do not believe that the grades earned by students reflect their understanding of the course content.



Teacher question 24: Grades earned by students in this course adequately reflect their understanding of the course content.

Standardized assessments begin in grade 3 with the administration of the PARCC. Overall, 70% of teachers feel the rigor of the course prepares students for standardized assessments. Teachers of resource and essentials classes feel the rigor of their course least prepares them for standardized assessments.



Teacher question 23. I feel that the rigor of this course adequately prepares students for standardized assessments.

Students agree at a higher rate than teachers that they are prepared for the standardized assessments. Overall, 79.9% of students feel they are prepared. Resource students feel as prepared as honors and AP students for standardized assessments.



Student question 24. This math class has prepared me well for standardized math assessments (PARCC, AP, SAT, etc.)

Teachers report the curriculum offers limited opportunities to integrate with other course/disciplines.Only 37. 5 % of teachers report opportunities to integrate with other disciplines.

Instructional technology varies based on grade levels. All primary classrooms are outfitted with Smart Boards, and Grade 5-12 math classrooms have LCD projectors and document cameras. Document cameras were introduced in September 2018 so usage is not in survey data. There are no Smart Boards in any middle or high school general education classrooms.

Teacher survey data shows teachers have access to technology when needed, although there are discrepancies in access to different technologies across schools. Intermediate schools are least satisfied with access to chromebooks.

Over 91% of students report that they have computer and internet access at home.



Student question 16: I have access to the following resources at home. Check all that apply.

Instructional Software

As stated by NCTM (2015), instructional software in mathematics, when used by students and teachers in thoughtfully designed ways and at carefully determined times, allows the capabilities of the technology to enhance how students and educators learn, experience, communicate, and do mathematics.

The following software and online resources are used to aid mathematics instruction.

Grades K-6

- ThinkCentral provides access to online textbooks, all teacher resources, and virtual manipulatives. Students in grades 1- 4 have access to the student textbook, manipulatives and parent videos through ThinkCentral. The ThinkCentral usage reports shows that this is not a widely used resource by students.
- Smart Notebook software is used to create interactive lessons.
- TenMarks is a curriculum supplement used for formative assessment, skills enrichment and to reinforce math content and skills in grades 3, 4, and 5 as well as RtI tier 3 students in grade 2 and 6 and special education resource room classes at grade 6. Small group instruction provides opportunities for students to work with TenMarks a couple of times each week.
- Illustrative Mathematics is a website that teachers use to access standards-based activities that are used for instruction and formative assessment. These activities are linked to the grade level scope and sequence documents.
- XtraMath is used by students for skills and fact practice.
- Kuta Pre-Algebra Software is available for 5th and 6th grade teachers to create customizable practice for students.

Grades 7-12:

- TI-Smartview is a graphing calculator that can be projected for the class to see. TI-84 Smartview software allows teachers to emulate the TI-84 Graphing Calculators used by students in Algebra I and subsequent courses.
- MathType allows teachers to type mathematical equations and symbols into Microsoft Word.
- Albert.io is used by AP and SAT teachers as an online bank of AP questions that can be assigned to students and get assessment reports.
- Digital resources for Algebra I and Math 8 provide access to online textbook and other digital content.
- Kuta Software is a resource for creation of mathematical activities for Pre-Algebra, Algebra I, Geometry, and Algebra II. This resource is used to produce customized additional practice for students.
- Desmos is a free online program used as an interactive graphing calculator and for mathematical activities.
- Geogebra is a free online dynamic geometry software that can be used by teachers and students.

- Google Classroom is used to communicate with students and parents and assign students work. Classrooms are also used by teachers at the building and team levels to share resources and collaborate.
- Google Forms is sometimes used for online assessments and surveys
- Google Drive is used for sharing of documents between staff
- TenMarks is used for RtI and special education resource room classes in grades seven and eight.

Many teachers incorporate additional online resources into their classrooms for lessons and assessments.

Review of Assessment

Teacher survey data shows tests and quizzes are the most common forms of assessment. Assessment data is most commonly used for lesson planning, differentiating instruction, grouping students and remediation. Teachers report that they use their assessment results to inform instruction, with 91.4% of teachers doing so at least weekly.

The graphs below show that teachers across the grade levels and schools are relatively consistent in their use of student data for future lesson planning; however, they are inconsistent in their use of student data for differentiating instruction, with less frequency in grades 5-12 than grades K-4. Teachers responded that they were more likely to use assessment data for remediation purposes than enrichment purposes.



Teacher question 27: Please indicate the frequency in which you use assessment data for the following purposes in this math course.



Student Extra Help, Homework and Summer Work

Extra Help

Students getting support outside the math classroom time are most likely to utilize parental support, teacher extra help, and online resources. Tutoring and tutorial periods are the least likely supports used by students. Tutoring trends are relatively consistent across grade levels, and 82% of students district-wide report never utilizing a tutor. Student survey results show 6% of the students responded that they receive frequent tutoring.

Approximately seven out of every ten teachers report having students attend outside support sessions on a weekly basis. Most often, one to three students per week seek extra help from their teacher.

Homework

Homework should be assigned as reinforcement of the class instruction or to prepare for an upcoming class topic. It shall be of quality and relevance to the subject matter and further the student's comprehension.

Homework in mathematics is assigned to reinforce class instruction or prepare students for upcoming math content.

District-wide, over 81% of students report that homework helps them better understand math content. This was consistent across all programs except for honors and AP courses where this number jumps to 93%.

Approximately 94% of teachers anticipate that students will complete their homework in less than 30 minutes, and 84.6% of students report spending less than 30 minutes completing math homework.

In grades 6-12, 83% of students complete their homework within the Board Policy time guidelines for out of class study.

Survey data shows that 9.7% of district-wide teachers report that less than 75% of their students regularly complete homework; however, all teachers of high school essentials courses report that less than 75% of their students are completing homework on a consistent basis.



Teacher question 15: How many of your students in this math course complete homework on a consistent basis?

Summer Work

Summer packets are assigned to all students entering 6E Math and all middle school and high school courses. The purpose of the summer packet is to reinforce skills and improve retention of previously learned math content that will be extended in the subsequent course. The summer packets provide teachers with early information about the student's prerequisite knowledge entering the course.

Lower grades have recommended, but not required, practice assigned by teachers through TenMarks in grades 3 -5. Workbooks are provided for students who are accelerated for the first time into AI classes, Math 4A, and Math 5E/AI.

The graph below shows teacher beliefs about summer assignments broken down by school. Notice the inconsistencies among the primary schools, although summer work is not currently required at that level. Teachers at Eisenhower, Hillside and the Middle School overwhelmingly believe the summer packets are beneficial to students while teachers at the high school see less benefit.



Teacher question 12: I believe a summer assignment for this course is beneficial for students.

Slightly more than half of students agreed that summer assignments helped them maintain their mathematical knowledge while almost three out of four parents agreed that summer packets helped their children maintain mathematical skills.

Review of Resources

In grades K-4, the Math in Focus (MIF) Program is the primary instructional resource. The MIF program places solving at the center of the curriculum. To build conceptual understanding, strong emphasis is placed on instruction using the CPA progression of representations.

The Math in Focus Grade 5 textbook is the capstone course for the K-5 series. The Math in Focus textbook for grade 6 is the first course of a three-year middle grades program. Math 7, 7E, and 6E each use a Pre-Algebra book by Glencoe which predates the CCSS/NJSLS and the online resources have since expired. Math 8 utilizes a Glencoe Course 3 book which is the capstone course for the 6-8 middle grades program and is common core aligned and includes a online access and resources. Students in the grade level math courses from 6th grade through Algebra II will have had 6 different text series.

In grades 9-12, copyright dates range from 1994 to 2015. The Algebra I textbook is CCSS aligned and includes online access and resources. No other high school textbooks include online access or resources. The Algebra II textbook was written prior to Common Core State Standards and New Jersey Student Learning Standards.

The <u>District Textbook Adoption Cycle</u> document on the district web page contains the current list of approved textbooks and adoption dates.

Teacher survey data shows textbook usage is highest at the primary and intermediate schools, while textbook usage drops at the middle school and high school levels where teachers exclusively teach mathematics. Longer instructional periods up to grade 5 allows for more in class use of textbooks for instruction and independent work. The textbooks in grades 7-12 are frequently used as instructional resources rather than a page by page curriculum. Teachers, particularly at the middle school, utilize other textbooks and related resources.



Teacher question 31: How often do you utilize the following resources in this math course?

Survey data shows 76.4% of teachers agree that the textbook and accompanying resources made available by the district adequately addresses the concepts and standards for the course. Further examination of data shows that there are individual courses that differ from this trend. Disagreement is mostly noted from teachers of resource room courses and honors, academics Algebra II courses and Probability and Statistics.

Expanding upon our resource questions, 79% of teachers agree they have adequate manipulative resources to support instruction and 61.5% of teachers agree there are adequate resources for remediation and enrichment for students in their math course. Resource room teachers are more likely to disagree on having adequate manipulative and remediation or enrichment resources than teachers in other areas. Use of manipulatives, both physical and virtual, is greatest in the early primary grades and decreases in later grades.

Grades 6E, 7 and all high school classes with the exception of Algebra I are the only grade levels without access to an online textbook and related resources. Teachers that have access to online teacher textbooks and/or related resources report that they frequently access it.

Teacher question 37: How often do you access the online teacher textbook and/or related online resources for this math course?



Students prefer a hardcover to online textbooks for their math course with most students indicating a preference to having both hardcover and online textbook.

Professional Development

September inservice days provide opportunities for content supervisors to meet with their staff. In Grades K-5, this is time shared with other content supervisors.

The January in-service day offers opportunities for additional math content professional development for interested teachers. Workshops are offered across all grade levels. Workshops are presented by supervisors and teachers.

Eight Monday supervisor meeting are scheduled at each grade level. In grades K-5, this is time shared with three content areas.

Grades K-4

Team meetings are scheduled at the building level. Information related to math curriculum and instruction is shared with ETSs at their monthly supervisor meeting and then relayed by the building ETSs at each primary team meeting. Supervisors attend these meetings by invitation, or by the supervisor's request if there are building related topics to be addressed. When necessary, full day and half day sessions for professional development are scheduled to introduce and/or reinforce new resources and initiatives.

Grades 5-8

The Middle School teachers have team time each day with their guidance counselor and teachers on their team. There is one math teacher on each team and this time does not lend itself to curriculum collaborations. Teachers will occasionally have common prep time with their co-teacher when the schedule allows.

Intermediate school teachers have meeting time in their schedules to meet as a team for planning. PLC groups, as a subject area department, or with the guidance counselor. The structure of the meetings and type varies by building. While this time permits collaboration between teachers, not all teachers share common planning time. Time for teacher collaboration between the two intermediate schools or between teams of teachers at the same school occur during building and supervisor meetings, during a common lunch or prep period, or before or after school.

Grades 9-12

There are no team meetings at the high school level. The only structured time available for teachers to collaborate with colleagues would be during the eight Monday Supervisor meetings if collaborative time is needed to achieve the objective of the meeting. Although there is no structured collaborative time during the school day, teachers often informally collaborate with others who share the same prep or lunch period.

Professional development is valued in a variety of forms by the teachers and staff. Evidence shows that teachers value professional development in any new content or resources and value choice in selecting professional development sessions. Peer observation was the least valued form of professional development by staff, although it is interesting to note that almost all teachers (94.5%) said that they would be willing to visit a colleague's classroom for a form of professional development, and 82.2% of teachers said that they would be willing to have colleagues visit their classroom.



Teacher question 25: I have adequate time to meet with my colleagues to discuss math curriculum related issues in this course.

<u>Assessment</u>

K-4 Assessments:

Kindergarten Assessments: Kindergarten students are formally assessed five times a year using the Kindergarten Individual Profile of Progress (KIPP). The KIPP is aligned to NJSLS-Math, and students are assessed as beginning, developing or secure based on activity rubrics.

Grades 1-4 mathematics, grades 2-4 AI mathematics, and grade 4A mathematics have common chapter assessments. Assessments align to appropriate NJSLS-Math as outlined in Stage 1 of their curricula.

Starting in grade 2, benchmark fact fluency assessments are administered each marking period, aligning with grade level NJSLS-Math. These assessments start in marking period 3 for grade 1. In grades 3 and 4, benchmark algorithm assessments are administered each marking period, aligning with the grade level standards.

In grades 1-4, common beginning-of-year (BOY) formative assessments are administered to help determine small groups for differentiated instruction at the start of the year. End-of-year common assessments are administered to assess culminating standards for the grade level and provide additional data to inform the next year's BOY instruction.

All grade 3 students are administered the Northwest Evaluation Association Measures of Academic Progress (NWEA MAP) assessment in marking period 3. This data is part of the student portfolio that informs eligibility for 4A mathematics.

Grades 5 - 6 Assessments:

Grades 5-6, 5E, and 5AI mathematics have common chapter assessments in which each question has been aligned to the relevant NJSLS. Model Eliciting Activities (MEAs) are implemented in marking periods 1, 2, and 4. Marking period 3 includes a mid-year cumulative assessment, which is standard aligned and developed from released model curriculum and PARCC problems. A sample of an MEA can be found in <u>Appendix D</u>.

Grades 7 - 12 Assessments:

Grades 7-12 and 6E math classes have a beginning-of-year formative assessment based on the summer packet comprised of the previous years mathematics. There is also a midyear cumulative assessment along with a final exam which are common assessments. Chapter assessments and quizzes are created by individual teachers and are typically developed collaboratively.

The beginning of the year formative assessment is utilized by teachers along with other data such as MAP and PARCC scores, if available, to differentiate targets for the midyear cumulative assessment. These early data points provide a baseline of information for teachers to inform their instruction and support individual students with growth in mathematics.

Each year, student PARCC scores from the previous year are reviewed as well as the evidence statement reports regarding the district's performance on individual standards.

Student Performance Analysis

An analysis of our PARCC scores through the middle grades reveals some interesting results. A significant decline in the percent of students who pass the Math PARCC exam with a score of 4 (met expectations) and 5 (exceed expectations), decline at a greater rate through the middle school compared to the State of New Jersey. The decline in the district's PARCC scores from grade 6 to grade 7 corresponds with the decline in the number of students taking the grade level PARCC exam. The decrease in the number of students taking the grade level exam is due to the students in 7th grade that are in an Algebra I course and take the corresponding Algebra I PARCC Exam. Similarly, there is another decrease in the the number of students taking the grade 8 PARCC due to the number of 8th grade students taking Geometry and Algebra I. The number of students scoring a 4 or 5 on the Algebra I PARCC in grades 7 and 8 was nearly 98% during the 2017-18 school year. Similarly, the number of students scoring a 4 or 5 on the Geometry PARCC in grade 8 was 100%.

Year = 2018	Grade 5	Grade 6	Grade 7	Grade 8
BRRSD % of Students PARCC Score = 4 or 5	68.2%	63.4 %	53.6%	36.7%
Number of Valid Test Scores	673	666	472	384
NJ % of Students PARCC Score = 4 or 5	48.8%	43.5%	43.4%	28.2%

Following the 2015 grade 5 cohort through the middle grades reveals a cohort group that consistently underperformed when compared to past and future cohorts at the same grade level. Grade level trends show modest gains with the exception of the 2015 grade 5 cohort. By 8th grade, the cohort scores more closely resembles the previous year's performance. This cohort of students is currently in Algebra I at the High School.

2015, 2016, 2017, 2018 PARCC Comparison Grade 5 Mathematics Level 4+



2015, 2016, 2017, 2018 PARCC Comparison Grade 6 Mathematics Level 4+



2015, 2016, 2017, 2018 PARCC Comparison Grade 7 Mathematics Level 4+

80

10





The distribution of the 2017-2018 6th grade PARCC scores for students currently enrolled in Algebra I, 7E Math, and Math 7 can be found below. The 6th Grade PARCC is the last common PARCC assessment prior to students taking Algebra I in 7th grade, when they will no longer take the same PARCC assessment as their grade level peers. Although placement decisions were made based on MAP testing, unit test averages, marking period grades, and teacher recommendation, no students had a PARCC score of a 5 (exceeding expectations).


	Blue - Algebra I (7)	Orange - 7E Math	Grey - Math 7
Maximum	850	809	779
3rd Quartile	813	777	754
Median	797	769	741
1st Quartile	785	761	728
Minimum	762	737	689
Outliers	-	809, 727	685, 682, 650
Average	798	769	739
Range	88	72	90

2017-18 High School Algebra I PARCC Analysis

There are noticeable differences between the PARCC performance of students enrolled in Algebra I Academic compared to Essentials of Algebra I.

Data from Algebra I Academic:

- 65% (170/262) of Academic Algebra I students passed Algebra I PARCC
 - 93% (96/103) of Academic Algebra I students who passed Grade 8 PARCC also passed in Algebra I PARCC
 - 55% (57/103) of Academic Algebra I students who scored Approaching in Grade 8 PARCC passed Algebra I PARCC
 - 47% (65/139) of Academic Algebra I students who did not pass Grade 8 PARCC passed Algebra I PARCC

Data from Essentials of Algebra I:

- 7% (4/55) of Essentials of Algebra I students passed Algebra I PARCC
 - 3/4 Essentials of Algebra I students who passed Grade 8 PARCC also passed Algebra I PARCC
 - 1/43 Essentials of Algebra I students moved from Not Passing on Grade 8
 PARCC to Passing on Algebra I PARCC
 - 0/14 Essentials of Algebra I moved from Approaching on Grade 8 PARCC to Passing on Algebra I PARCC

2017-18 High School PARCC Results by Level

There are noticeable differences between the PARCC performance of students in the different levels of mathematics courses.

Honors Level (Geometry, Algebra II) - 99% (201/203) passed PARCC Academic Level (Algebra I, Geometry, Algebra II) - 54% (440/813) passed PARCC Essentials Level (Algebra I, Geometry, Algebra II) - 4% (6/170) passed PARCC

The following scatter plot shows a strong correlation (r=0.70) between student PARCC scores and grades earned in their mathematics courses. Students who do well on PARCC tend to earn higher grades in their math course, This includes all students in grades 5 through Algebra II who took a PARCC exam in the 2017-18 school year.



The district PARCC results in Mathematics grades 3-8, Algebra I, Geometry and Algebra II can be found in <u>Appendix E</u>.

The following graph shows the results on the AP Calculus BC Exam in 2017-18. The results are broken down by the two prerequisite courses that lead into AP Calculus BC: Precalculus Honors and AP Calculus AB. Note that all results are similar except the scores on the BC exam for students coming from AP Calculus AB. This is most likely due to the AP Calculus BC course reviewing all concepts of AP Calculus AB before moving on to the new BC material.



Model Programs Descriptions

The BRRSD math supervisors met with the math supervisors and/or director of curriculum of the following districts: West Windsor - Plainsboro Regional School District, Hillsborough Township Public School District, Freehold Regional High School, and Montgomery School District.

	BRRSD	West Windsor - Plainsboro Regional School District	Hillsborough Township Public School District	Freehold Regional High School District	Somerset Hills	Montgomery
District Enrollment	8,549	9,670	7,316	10,790	1,965	4,799
Student Teacher Ratio	11:1	13:1	11:1	13:1	12:1	12:1
Grade that Math Acceleration Begins	Grade 2	Grade 6	Grade 6	NA - HS Only District	Grade 6	Grade 6
HS Academic Levels Offered	Essentials Academic Honors AP	College Prep Honors Hon & Accelerated AP	College Prep Honors AP	College Prep Honors AP	Academic Accelerated Honors AP	Did not visit HS
Criteria for Level Placement	Must maintain B- to remain in AP/Honors or A to move up from Academic	Must maintain C to remain in AP/Honors or B to move up from College Prep AP Statistics was open for anyone	Criteria based on standardized test results, academic performance and teacher recommendations	Open access for all honors and AP courses	Criteria for AP/honors but allow anyone access with a waiver form signed by teacher, supervisor, parent and counselor	Did not visit HS
Frequency of Instruction	K-4: 75 min daily 5: 43 min daily plus two additional each week 6: 43 min daily 7-8: 42 min daily 9-12: 40 min daily	<u>K-5</u> : 60 min daily <u>6-8</u> : 52 minutes per day plus 30 minute flex each day <u>9-12</u> : 60 minutes 3 of 4 days (rotating drop)	<u>K-4</u> : 50-75 min daily <u>5-6</u> : 80 min daily <u>7-8</u> : 40 min daily <u>9-12</u> : 48 min daily	<u>9-12</u> : 67 min 5 out of every 7 days	K-4: 60 min daily 5-8: 43 min daily (Math 7 has additional cycle for Probability and Statistics for 45 days) 9-12: 42 min daily	<u>5-6</u> : 59 min daily <u>7-8</u> : 82 min every other day
Average Class Size	<u>K-4</u> : 20 <u>5-6</u> : 22	27-28	<u>K-2</u> : 20-22 <u>3-4</u> : 25 <u>5-12</u> : Varies	29-30	20-21	

Primary Instructional resources	K-6 Math in Focus	Math In Practice Differentiated Math Menus	K-5 Everyday Math 6-8 Connected Math 3	NA	Did not visit	K-4 Math In Focus
Technology		<u>5-9:</u> Has one-to-one chromebooks, adding a grade level each year	One to one devices across district			<u>5-8:</u> Classrooms are 1 to 1 with chromebooks
Assessments	K-6: common chapter/unit assessment <u>7-8</u> : beginning of year formative assessment, mid year, and final exam common assessment	K-5: Common unit assessments <u>6-8</u> : Quarterly Cumulative Exams except 3rd marking period which is a performance task	K-12: Common unit assessments		<u>5-8</u> :Common midyear and end-of-year assessments	<u>5-8</u> : Common unit assessments and quizzes created during common planning time
	<u>9-12</u> : common midterm and final exam	<u>9-12</u> : Quarterly common assessments		<u>9-12</u> : Quarterly common assessments	<u>9-12</u> : Common final assessment	
Option II	All courses except Algebra I	Allowed one per summer and one per department over high school career	Not allowed in Algebra I, Geometry or Algebra II		No restrictions, do not approve Educere for advancement	

K-4 Site Visit Comparisons

West-Windsor-Plainsboro:

- Math coach at each primary building.
- Provided one-week summer institute to provide small group implementation support; teachers paid to attend. Teachers who were unable to attend were offered pull out days during the school year. Resources: <u>Math Workshop</u>, Lempp, Jennifer, 2017.
- Classroom furniture: tables instead of desks, flexible seating.
- Anchor charts support student independence
- Curriculum resources: <u>Math in Practice</u> as primary resource, secondary, <u>Differentiated</u> <u>Math Menus</u>
- Heterogeneous grouping
- No early acceleration, in class differentiation.

Hillsborough:

- Small group model being used in most classes and effectively run. Stations included work with teacher, technology game, and Math Boxes which was spiral review. Well run routines performed by the students.
- Small class sizes 13 20 for math instruction
- Heterogeneous grouping
- Extra teacher in all the classes observed
- Math boxes as a resource for spiral review
- Writing in math
- Technology site related to textbook
- Students have strong number sense
- Strategy support as opposed to getting student to right answer
- Use of number line models across grade levels
- Conceptual understanding reinforced through discussions
- Established math routines by students who were productively engaged and worked well independently
- Closely follows Every Day Math program sequence and resources

5-8 Site Visit Comparisons

West Windsor-Plainsboro:

- Math Coach Grade 6 to support workshop model and new textbook
- Workshop Model currently implemented in grades 5-6, rolling out to grade 7 next year Resources: <u>Math Workshop</u>, Lempp, Jennifer, 2017.
- Number Sense, Number Talk as a focus activity for each class designed to build and improve number sense in students.
- Ed Gems is used as their middle grades text resource, accelerated group uses Big Ideas Accelerated for compacting 7th and 8th grade standards.
- Incorporation of Growth Mindsets which was evident in student perseverance and problem solving while working on challenging mathematical tasks.

Montgomery:

- Flex period at the Upper Middle School (UMS) grades 7-8 and Lower Middle School (LMS) grades 5-6 allow for students to get additional help in mathematics from their math teacher 4 days per week as needed. Other flex time opportunities included outside activities, inside gym, media center, and other subject areas.
- A/B block schedule at the UMS with 80 minutes of math instruction every other day. Teachers had shared with our visiting committee that the change to the block schedule was good for the students having only 4 classes each day.

- Instructional pacing and activities observed allowed for conceptual development of concepts and deeper dive into problems through teacher questioning
- All teachers of like subject areas had common planning time throughout the district. Professional Learning Communities (PLCs) of teachers are used to plan units of instruction twice a week. Curricular pacing and common assessments are developed during PLCs. Twice a week teachers meet at grade level teams to discuss students and cross curricular instruction.
- Program resources were consistent K-4 which used Math in Focus (MIF), 5-6 Envision Math, 7-8 Holt McDougal Larson Mathematics. Teachers were observed utilizing resources and instruction from these instructional resources during the visit.

9-12 Site Visit Comparisons

Mathematics course offerings in all of the high schools were fairly consistent with each other and with BRHS. Noted differences are described below.

- West Windsor-Plainsboro and Hillsborough offer Algebra III/Trigonometry course as an alternative to Precalculus after completion of Algebra II.
- Data Structures is offered as a computer science course after AP CSA in West Windsor-Plainsboro.
- West Windsor-Plainsboro offers a full-year Intro to CS/Game and App design course.
- Hillsborough offers two semesters of Intro to Computer Science.
- Freehold and Hillsborough do not offer AP Computer Science Principles or Multivariable Calculus (Calculus III).
- None of the districts offer Differential Equations or Advanced Mathematics of Engineering.
- None of the districts visited had any high school levels of algebra I, geometry or algebra II below Academic (College Prep). West Windsor-Plainsboro and Somerset Hills offer three levels of each of those courses. Hillsborough and Freehold both over two levels. Freehold has recently phased out their essentials level courses for algebra I, geometry and algebra II and did not see a difference in failure rate when students were placed in academic level classes. Hillsborough eliminated their essentials level courses years ago.
- Freehold offers open access for students to choose if they want to enroll in honors or AP courses. In conversations with their administration, they have experienced a doubling in the amount of students taking AP exams and have not seen a decrease in their overall AP exam results.
- West Windsor-Plainsboro and Hillsborough provide more time for math instruction in grade 6.
- West Windsor Plainsboro also has more time for instruction in grades 7 and 8.
- West-Windsor Plainsboro, Hillsborough and Freehold all have more time for math instruction in the high school.

• Professional development is utilized for teachers in West Windsor-Plainsboro and Freehold, both during the school year and over the summer.

Current Research and Best Practices in Mathematics Education

A hallmark of a quality math program includes opportunities for students to receive high-quality mathematics instruction, learn challenging grade-level content, and be supported as needed to meet with success. Achievement gaps can be the result of students being tracked into fixed sequences of courses that are different levels of the same course and having a qualitatively different educational experience. These differences include but are not limited to opportunities to learn high-quality mathematics, access to high-quality teachers, opportunities to learn grade-level mathematics content, and high expectations for mathematics achievement. Additional research and support can be found in <u>Appendix K</u>.

Appropriate acceleration should be distinguished from tracking for students who demonstrate a deep understanding of the course-based content. As student accelerations are considered, opportunities must be available for each and every prepared student and no critical concepts should be rushed or skipped.

NCTM (2018) states:

If the demographics of students accelerated in mathematics in a school or district are not evenly distributed across racial, linguistic, cultural, and economic lines, then reflection and analysis are called for to determine why not, and actions should be taken to remove whatever biases or structural barriers led to this inequitable outcome (21).

Best practices in mathematics teaching has been researched and reported in the National Council of Teachers of Mathematics publication *Principles to Actions, Ensuring Mathematical Success for All*. The list represents a foundation of high-leverage practices and skills needed to promote learning and can be found in <u>Appendix K</u>.

Recommendations

"An excellent mathematics program requires that all students have access to a high quality mathematics curriculum, effective teaching and learning, high expectations, and support and resources needed to maximize their learning potential."

-Principles to Actions, NCTM, 2014, p. 59.

The K-12 Math Program Review Committee suggests the following recommendations be made to improve the current BRRSD K-12 Mathematics Program:

Recommendation: Improve equity and access to high level mathematics and high quality instruction by phasing out high school essentials and workshop courses.

Rationale: Results from internal surveys, assessment data, demographic inequities, research and programs in other school districts all show that placing students in lower level versions of mathematics courses does not represent best practice.

Results from internal surveys revealed inequities in program and instruction between essentials classes and academic level classes. It was noted that in the results from the surveys, teachers of essentials and workshop level classes displayed more unproductive beliefs about mathematical learning and felt more strongly that the grades earned by students did not reflect their understanding of the course content compared to teachers of academic, honors, and AP courses. Differences between the different levels were noted on the results of many of the survey questions.

Assessment results show that very few students in essentials level courses pass the PARCC exams compared to students in other levels.

Demographic data shows that essentials classes have a higher percentage of certain minorities compared to academic and honors/AP levels.

Research and best practices show that students placed in the low track tend to focus more on rote skills and procedures, with instruction devoting little attention to developing their understanding or their belief that mathematics is something they can do (Boaler, William, and Brown 2000; Oakes 1985). As a result, students in the low track do not receive the high-quality education that they deserve. The replication of this experience year after year has long-term negative effects on students' learning outcomes and their mathematical identities (NCTM 2011). Evidence suggests that students placed in less rigorous versions of algebra ultimately have lower achievement in mathematics, even if their performance in the less rigorous version of the course is stronger than that of students in more rigorous versions (Tyson and Roksa 2017).

In visiting four other high schools, none of them currently offer essentials level courses in mathematics.

Implementation Plan:

Phase-out Plan: The essentials classes and associated math workshop classes will be eliminated one course at a time starting with Essentials of Algebra I and Math Workshop I in 2019-20, Essentials of Geometry and Math Workshop II in 2020-21, and Essentials of Algebra II and Math Workshop III in 2021-22.

Student Support Plan: Research shows that effective interventions recognize that not all students learn at the same pace and provide additional time instead of removing students from grade-level instruction (Baker, Gersten, and Lee 2002). As such, students identified as in need of additional support will be placed in an additional small group support class (maximum of ten students per class) that meets the period immediately preceding their algebra I course and will be taught by the same algebra I teacher.

Curriculum: Curriculum for the algebra I small group support course will need to be written. The Algebra I Academic curriculum will remain the same with additional differentiation strategies and activities included.

Resources: N/A

Staffing: In order to support students in the small group support class model, approximately three additional sections will be needed compared to our current programming.

Professional Development: For successful implementation, all Algebra I Academic teachers who teach the algebra support class will receive ongoing professional development on differentiated instruction in the algebra classroom, starting this spring and continuing throughout next year.

Cost:

Three additional sections of staffing Curriculum Writing: \$3,600 Professional Development: \$7,500

Recommendation: Improve equity and access to high level mathematics and high quality instruction by allowing all students opportunities to enroll in honors and AP mathematics courses in high school.

Rationale: Internal surveys, assessment data, demographic inequities, research and programs in other school districts revealed the following:

Results from internal surveys show differences in productive beliefs about mathematics between AP/honors students from other levels.

Assessment data shows that almost all students enrolled in honors classes successfully pass the PARCC exam compared to a lower percentage of students passing the PARCC in academic level classes. AP students also score highly on AP exams.

Demographic data shows inequities in the ethnic makeup of honors and AP mathematics courses. Percentages of ethnicities enrolled in honors and AP courses are significantly different than percentages of the overall population of students.

Research shows that too often, as NCTM (2018) attests, placement into different tracks is based on a variety of nonacademic factors, such as perceived (but not potential) academic ability.

Other high schools in the state have recently allowed all students to have the choice of taking honors and AP classes without having a criteria based on grades. In conversations with their administration, their school experienced about twice as many students taking AP exams with no significant change in AP results.

Implementation Plan: Allow all students to enroll in honors and AP level mathematics courses based on choice instead of grade starting in the 2020-21 school year.

Curriculum: N/A

Resources: N/A

Staffing: N/A

Professional Development: All honors and AP teachers will receive ongoing professional development in differentiated instruction and the growth mindset.

Cost: Professional Development: \$7,500

Recommendation: Allow student choice in mathematics pathway based on individual goals and career aspirations (STEM or humanities).

Rationale: NCTM (2018) states:

The goal of the high school mathematics curriculum must be to ensure that each and every student, has an opportunity to learn the essential concepts of mathematics and then to continue studying mathematics beyond the essential concepts. The direction of this later high school mathematics study should be based on the student's own needs, goals, interests, and aspirations, and desire to pursue the future that the student imagines for himself or herself rather than on any difference in mathematical ability perceived by anyone else (p. 85).

To this extent, two pathways are recommended: one for students planning to pursue a career in STEM fields and another for students planning to pursue a career in humanities fields.

Implementation Plan: In the 2021-22 school year, the following course progression will be implemented.

STEM Career Pathway:



Resources: New Algebra II textbooks would be needed for all of the Algebra II courses

Staffing: N/A

Professional Development: Professional development would be needed for all Algebra II teachers focused on differentiation and the new curriculum.

Cost:

Curriculum writing for four new Algebra II courses: \$12,900 Professional development: \$7,500 Textbooks: listed under consistent program resources recommendation

Recommendation: Split AP Calculus BC into two courses, one for students coming from AP Calculus AB and one for students coming from Honors Precalculus.

Rationale: Students taking AP Calculus BC who took AP Calculus AB the prior year displayed a lower percentage of earning a 5 on the AP Calculus BC exam compared to students who took Precalculus Honors the prior year. The AB subscores between the two groups were very similar. The AP Calculus BC course teaches all concepts in AP Calculus AB before moving onto the new material in AP Calculus BC. This is necessary for students coming from Precalculus Honors who have not yet learned the AP Calculus AB content. However, this is a review for students who have already learned the AB content. These students would be better served by a full course focusing on the new content in AP Calculus BC to spend more time developing and practicing these concepts. In 2017-18, AP Calculus BC was comprised of 49 students coming from Precalculus Honors and 63 students coming from AP Calculus AB.

Implementation Plan: Two versions of AP calculus BC will be created starting in the 2019-20 school year. The current course will be available for all students coming from Honors Precalculus. A new course will be created for students coming from AP Calculus AB.

Curriculum: Curriculum writing for the new course for students coming from AP Calculus AB would be needed.

Resources: N/A

Staffing: N/A

Professional Development: N/A

Cost: Curriculum writing: \$2,400

Recommendation: Replace Math Analysis A with College Algebra/Trigonometry A course.

Rationale: Currently, students who complete Algebra II A either take Precalculus A or Math

Analysis A the following year. Although the Math Analysis course addresses similar content to Precalculus, it falls short of preparing students with the necessary skills for Calculus. Students then take Precalculus as the next course in the progression, which repeats some much of the content but goes more in depth. Adjusting the content to include more of a continuation from Algebra II will provide a more rigorous course in College Algebra/Trigonometry topics, and better prepare students for a formal Precalculus course (or placement exam) the following year, whether it be in high school or college. Other districts we visited also offer this course progression.

Implementation Plan: Math Analysis will be replaced by College Algebra/Trigonometry for the 2020-21 school year.

Curriculum: Curriculum writing for the new College Algebra/Trigonometry course would be needed

Resources: New textbooks would be needed.

Staffing: N/A

Professional Development: N/A

Cost: Curriculum writing: \$2,400; Textbooks: \$12,000

Recommendation: Eliminate Math 4A course.

Rationale: In the recommendation to eliminate essentials and workshop courses, research regarding the benefits of de-tracking was discussed. The same theories hold true for all grade levels. Grade 4 is the first grade where students are removed from grade-level mathematics courses for acceleration outside of the AI program. Research shows that although students who are accelerated may perform well in the accelerated program, this accelerated and those who are not. Flores (2007) states that differentials in learning outcomes are significantly a function of disparities in opportunities that different groups of learners have with respect to access to grade-level (or more advanced) curriculum, teacher expectations for students and beliefs about their potential for success, exposure to effective or culturally relevant instructional strategies, and the instructional supports provided for students. In addition to these disparities, it is evident that the class sizes of the Math 4A classes are significantly less than the class sizes of Math 4 or Math 4AI, adding to the difference in learning experience.

According to NCTM (2018), best mathematics practices reminds us that we need to ensure "no critical concepts are rushed or skipped" and that "acceleration may be appropriate if a student has demonstrated deep understanding of grade-level or course-based mathematics standards beyond his or her current level." As such, it would not be appropriate to accelerate students who have not demonstrated above grade level work in order to increase the enrollment in Math 4A. Researching other programs, we have found no district that accelerates students as early as grade 4.

Instead of allocating staff to teach the Math 4A course comprised of smaller groups of students who are accelerating in mathematics, staff should be reallocated to better support and provide interventions for RtI students. Many of the intervention specialists currently teaching this accelerated math course course are trained reading specialists.

Examining the data from the 2013-14 grade 4 cohort of students shows that there are multiple opportunities for acceleration in later grade levels and that students can end up in the same course by grade 7 regardless of the opportunity for acceleration into Math 4A in grade 4.

Implementation Plan: It is recommended to universally screen all 4th grade students at the end of the year to determine possible placement into 5E Math. It is anticipated that students that would have qualified for 4A Math will qualify for 5E Math along with additional students that have had the additional time to develop a readiness for advancement in mathematics.

Additional balance and equity on the 5th grade teams could be achieved by combining students from 5AI Math with 5E Math. It is the same curriculum that serves students in 5E Math as well as 5AI Math. This would not have any impact for 6th grade since the students from both 5AI Math and 5E Math combine into the same classes of 6E Math.

Curriculum: N/A

Resources: Resources to further support differentiation. -Update *Exemplars* resource to Common Core version (K-5) to further support differentiation

Staffing: N/A

Professional Development: PD on how to best differentiate the grade 4 curriculum with growth opportunities for all students would be presented to all grade 4 teachers. This PD will have a positive effect for instruction of all students.

Cost:

Resources and PD related to differentiation in Math 4 TBD. Exemplar Costs: 73,350.36 for 5 years (\$22,500 for the first year, \$12,712.59 for each additional year)

Recommendation: Provide more consistent daily instructional time in grades 5-12.

Rationale: Best practices provide opportunities for students to learn mathematics through the development of interrelated strands that include; conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition. Additional time would support teachers efforts in implementing effective mathematics teaching practices and allow learners to engage with challenging tasks that develop conceptual understanding. Visits to other districts revealed that some district provide more time for classroom instruction in mathematics in grades 5-12. No district visited provided less math instructional time than BRRSD.

Implementation Plan: Hold a meeting with necessary stakeholders to look at ways to adjust the schedule to allow more time for mathematics instruction.

Curriculum: Curricula would be adjusted as necessary.

Resources: Resources would be included/adjusted as necessary.

Staffing: Staffing would be adjusted as necessary.

Professional Development: Professional development would be provided as necessary.

Cost: Cost would be dependent of the exact changes made.

Recommendation: Provide consistent structured time for teachers to collaborate during the school day.

Rationale: Structured time for teachers to meet during the school day would enables teachers to collaborate on important work and decision making about students and instruction. Research shows that structured time for teachers to collaborate improves teacher commitment, satisfaction, efficacy, and student outcomes. Current survey data shows that most teachers state that they do not have enough time to meet with their colleagues to discuss curriculum-related issues.

Implementation Plan: Hold a meeting with necessary stakeholders to look at ways to incorporate more structured time during the school day for teachers to collaborate.

Curriculum: N/A

Resources: N/A

Staffing: N/A

Professional Development: Professional development on how to utilize structured collaboration time would be given to staff

Cost: N/A

Recommendation: Provide additional opportunities and resources for students to engage in productive struggle and build procedural fluency from conceptual understanding by engaging students in tasks that promote reasoning and problem solving.

Rationale: Research recommends that to develop a deep understanding of mathematics, students should have experiences with tasks that actively engage them in reasoning, sense making and problem solving. These types of tasks typically allow students to explore a task without being told in avance what to expect. (NCTM 2018, p. 20-21). These opportunities

allow students to develop perseverance and problems solving strategies.

While all students will benefit from these instructional tasks, PARCC data shows over 63% of students in the ELL and IEP sub-groups to do not meet PARCC expectations (scoring 4 or 5). This population would benefit most from visually rich tasks rather than those rich in text that are not easily accessed.

"Many drawings and other visual supports are of particular importance for English language learners, learners with special needs, or struggling learners, because they allow more students to participate meaningful discourse in the classroom (Fuson and Murata 2007). The visuals assist students in following the reasoning of their classmates and in giving voice to their own explanations as they gesture to parts of their math drawings and other visual representations." (NCTM, 25-26).

ThinkCentral student accounts should be eliminated; usage reports show low usage by students. Teachers report students use it mostly for online manipulatives. Teachers are encouraged to use physical manipulatives or free online resources, for which websites can be provide.

Implementation Plan: 2019-2020

Curriculum: Update curriculum units to recommend appropriate manipulatives for conceptual development.

Resources:

Update existing *Exemplars* resource to Common Core version (K-5)

STMath Online software, Mind Research, Inc

2019-2020 school year for grades 1 and 2

2020-21 school year for grades 3 and 4

(STMath software was piloted for 60 days as a possible replacement for TenMarks which will no longer be available after June 20, 2019. It is not a recommendation for replacing TenMarks because of its focus on conceptual development and problem solving skills.)

Manipulatives for K-8 classrooms to support Concrete, Pictorial, Abstract (CPA) Approach

Professional development: Teachers are already familiar with using *Exemplars*. Workshops to model manipulative use and software training.

Staffing: N/A

Cost:

Manipulative costs: TBD by school inventories, estimated cost \$12,000 *Exemplars:* First year costs : \$22,500 (for grades 1-5, about \$5. 85 per student. This cost could be offset by the cancellation of ThinkCentral student accounts.) *STMath*: Year 1 cost \$73, 400 for grades 1-2 ,Year 2-4 costs: \$11,400 for grades 1-2. Year 1 cost includes teacher PD.

Recommendation: Create and implement more performance tasks in K-12 mathematics classrooms.

Rationale: Survey results revealed that some teachers in middle school and high school do not consistently incorporate performance tasks into instruction. By creating rich performance tasks that are differentiated for students and integrating them into the curriculum, resources will be made more available for implementation in the classroom.

Implementation Plan: As a Summer 2019 Curriculum Project, teachers will create multiple performance tasks to be used within the curricula.

Curriculum: Performance tasks will be added to the curricula

Resources: N/A

Staffing: N/A

Professional Development: All staff would be made aware of additional performance tasks during curriculum meetings with supervisors.

Cost: 41 courses x 3 teachers x 2 days x \$300 = \$73,800

Recommendation: Revise all current math curricula to include more best teaching practices and new state curricular requirements.

Rationale: Curriculum revisions are necessary to meet new QSAC requirements in all course curricula. Integration of technology standards, use of benchmarks, interdisciplinary connections will be added to current curricula. This is also an opportunity to update and improve all current curricula to better reflect desired content and instruction.

Implementation Plan: Course curricula would be revised in the spring/summer of 2019.

Curriculum: Curriculum revisions for all math courses would be needed. This includes: Kindergarten Math

Math Grade 1 Math Grade 2 Math Grade 3 Math Grade 4 Math 2AI

Math 3AI

Math 4A/AI Algebra I H. Geometry Math 5 Math 5E/AI Math 6 Math 6E Math 7 Math 7E Math 8 Math SI Math II Workshop Essentials of Geometry Geometry Academic Math III Workshop Essentials of Algebra II Algebra II Academic Algebra II Honors Precalculus Academic Precalculus Honors Calculus Academic AP Calculus AB AP Calculus BC Unified Calculus III Differential Equations Adv Math Engineering Probability & Statistics Academic AP Probability & Statistics Math IV Workshop SAT Math AP Computer Science Principles AP Computer Science A

Resources: N/A

Staffing: N/A

Professional Development: Professional development on updated curricula would be given to staff through grade level meetings and Monday Meetings.

Cost: 39 courses x 3 teachers x 3 days x \$300 = \$105,300

Recommendation: Create and implement quarterly common assessments in all math classes in grades 7-12.

Rationale: Currently, there are common assessments in the beginning of the year, mid-year, and end of year in grades 7-12. Including common assessments at the end of marking periods 1 and 3 will give additional data and information regarding student progress on the course standards. This information can be used to help identify students in need of support to successfully master course standards. Most model districts visited had at least quarterly common assessments in place. The new QSAC standards also require the use of benchmark assessments to monitor student progress.

Implementation Plan: Development of these assessments will be a summer 2019 curriculum project for each course in grades 7-12. The assessments will be given using a technological platform to allow teachers to easily analyze the results.

Curriculum: Common assessments will be added to the curriculum documents.

Resources: N/A

Staffing: N/A

Professional Development: All staff would be made aware of additional common assessments during curriculum meetings with supervisors.

Cost: 30 courses x 3 teachers x 2 days x \$300 = \$54,000

Recommendation: Implement consistent 6-8 and algebra I, geometry, algebra II program resources.

Rationale: Model comparative districts visited each had complete, coherent, and consecutive text resources at the schools.

NCTM (2016): A coherent, well-articulated curriculum is an essential tool for guiding teacher collaboration, goal-setting, analysis of student thinking, and implementation. In a time when open educational resources are increasingly available, it is imperative that teachers be provided with curricular materials that clearly lay out well-reasoned organizations of student learning progressions with regard to mathematical content and reasoning.

Implementation Plan: A committee would be formed to review curriculum materials and textbooks to determine possible materials for adoption. The materials would then be piloted before making a recommendation to purchase.

Curriculum: Updates and alignment to new curricular resources

Resources: Hardcover and online texts and resources, manipulatives, digital resources, and assessments related to the curriculum.

Staffing: N/A

Professional Development: Teachers would require professional development with the

implementation of new curriculum resources, particularly any online and digital component where content can be assigned to students online or through Google Classroom.

Cost: \$525,000 (estimated)

Recommendation: Update resources and textbooks in precalculus, calculus and statistics courses.

Rationale: Textbooks in all of these courses are out of date and do not include any online resources for teachers or students. The book conditions are worsening, and it is becoming difficult to purchase replacements of the same edition for some of the courses.

Implementation Plan: A committee would be formed to review curriculum materials and textbooks to determine possible materials for adoption. The materials would then be piloted before making a recommendation to purchase.

Curriculum: Update and align to new curricular resources

Resources: Hardcover and online texts and resources, manipulatives, digital resources, and assessments related to the curriculum.

Staffing: N/A

Professional Development: Teachers would require professional development with the implementation of new curriculum resources, particularly any online and digital component where content can be assigned to students online or through Google Classroom.

Cost: \$140,000 (estimated)

Computer Science Recommendations

Recommendation: Create a new computer science course called CS1: Programming for ONE and ALL.

Rationale: This is a semester-long introductory computer course with no prerequisites required. Currently, students cannot take a computer science course until they successfully complete Geometry. We have also noticed that most students currently enrolled in Intro to Computer Science are honors level students. We feel it is important to increase access to computer science to all students regardless of prior math ability. This course will be taught with a drag and drop environment to teach the fundamentals of coding without having to memorize commands. Elements of Game Design and App Design will be used to engage students in applications of the content. This course will gives students fundamental understanding of algorithms to help with further courses, develop and increase critical thinking skills and foster creativity and collaboration in design of applications.

Implementation Plan: This course will begin in the 2020-21 school year.

Impact on Intro to Computer Science: With the implementation of CS1, we would need to adjust the current Intro to Computer Science curriculum. We recommend to change the name to CS2: Introduction to Object-oriented Programming. The curriculum would then focus on learning programming constructs and syntax through text-based languages. We also recommend to include more student choice in projects and increase the amount of time spent on both collaboration and independent thinking.

Curriculum: New curriculum would be written for the course. There are multiple college-level curriculum frameworks that will be evaluated to determine which will be purchased and adapted to meet the needs of BRRSD students.

Resources: A class library of textbooks based on programming would be utilized.

Staffing: Additional staffing would be required (4 semester sections expected).

Professional Development: N/A

Cost:

Two sections (four-half year sections) of additional staffing Class library of textbooks: \$1,500 Curriculum framework: \$1,500 Curriculum writing CS1: \$2,700 Curriculum writing CS2: \$2,700

Recommendation: Add Data Structures course to the Computer Science Program (in partnership with Rutgers University).

Rationale: We are proposing to expand the computer science offerings at Bridgewater-Raritan High School (BRHS) so that students have the opportunity to complete a four-year computer science (CS) program. The outcome will be to better prepare students for a post-secondary school CS program. Over the past five years the number of computer science sections in our school has grown, and it has been determined that another course linked to a post-secondary school is necessary. Currently students are offered an introduction to computer science (Intro to CS) course, AP Computer Science Principles (AP CSP), and AP Computer Science A (AP CSA). There are currently students who complete all of our CS courses before their senior year and do not have an opportunity to continue their studies in CS, yet plan to pursue a future in CS. This proposed course, Data Structures, linked with Rutgers University, will meet the need to offer students a four-year computer science program in our school. Students will be able to pay to receive Rutgers University credit for CS112 (Data Structures).

Implementation Plan: This course is meant for students who successfully complete AP Computer Science A. Currently, 36 qualifying students have expressed interest in taking this course next year. Currently, we do not have another computer science course to offer these students. This course would begin in the 2019-20 school year.

Curriculum: The curriculum framework will be based on the Rutgers Data Structures course. Curriculum writing will be necessary to adapt it for a full year BRHS course.

Resources: Textbooks would be needed.

Staffing: An additional one or two sections of staffing would be needed to implement the course.

Professional Development: The teacher of the course would take the course at Rutgers University and be in contact with Rutgers University professors throughout the course.

Cost: We have applied for and been awarded a state grant to receive funding that would cover the entire cost for this course, other than staffing costs. One or two additional sections of staffing would be needed Laptops: \$49,000 (covered by state grant) Laptop Cart: \$1,100 (covered by state grant) Textbooks: \$8,500 (covered by state grant) Professional development: \$3,000 (covered by state grant) Curriculum writing: \$4,500 (covered by state grant)

With the addition of the two recommended computer science courses, the computer science program course progression would look like the following:



Proposed Program Plan Timeline

	Year 0 Program Review 2018-2019	Year 1 Draft Year 2019-2020	Year 2 Implementation and Mapping 2020-2021	Year 3 Implementation 2021-2022	Year 4 Implementation
Staffing					
Programs/ Courses		*Eliminate 4A Math *Replace Essentials of Algebra I and HS Math Workshop I with Algebra I with additional support class *Split AP Calculus BC into two courses *Add Data Structures computer course	*Eliminate Essentials of Geometry and Math Workshop II *Open Honors and AP enrollment *Add CS1 programming course *Replace Math Analysis with	*Eliminate Essentials of Algebra II and Math Workshop III *Introduce STEM and Humanities Career Pathways starting with Algebra II	

			College Algebra/Trig	
Curriculum	*Curriculum work to meet QSAC requirements *Incorporate performance tasks in curricula. *Develop common standards-based assessments *Write Algebra I support class curriculum *Write new BC Calculus curriculum *Write Data Structures curriculum	*Update Geometry curricula *Write CS1 curriculum and revise CS2 curriculum *Write College Algebra/Trig curriculum	*Write Algebra II STEM and Humanities curricula	
Resources/ Technology		*Update Exemplars resources *Manipulatives *Introduce STMath Program Gr 1-2 * Pilot textbooks for grades 6, 7, 8 *Pilot textbooks for HS math	*Introduce STMath Grades 3-4 *Textbook purchase for grade 6 ,7, 8	

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APPENDIX A

Teacher Survey Questions

1. How often are the following instructional strategies used in your classroom when teaching this course?

- 2. How often are you available to provide support outside of scheduled classroom time for this math course? Check all that apply.
- 3. Approximately how many students attend your outside support sessions for this math course each week?

4. Which calculator models are best suited for instruction for this math course?

5. I have access to the following technologies for this math course when needed.

6. How often do you incorporate each of the following technologies in this math course?

7. How often do you use assessment results to inform instruction for this math course?

8. How do you establish student groups in this math course? Check all that apply.

9. How often do you vary student groups in this math course?

10. How often do you incorporate mathematical reasoning and modeling into instruction for this math course?

11. Daily math instructional time is adequate for me to deliver content in this math course.

12. I believe a summer assignment for this course is beneficial for students.

13. I believe that math homework for this course helps students better understand the math content.

14. How many times per week do you typically assign homework to students in this math course?

15. How many of your students in this math course complete homework on a consistent basis?

16. How much time do you anticipate most students will take to complete a typical homework assignment?

17. I am concerned that my students in this math course sometimes miss instructional time for math to participate in other school activities. (i.e. music lessons/concerts, chorus, field trips, assemblies, etc).

18. Curriculum pacing for this grade/course allows for student understanding.

19. Our curriculum for this grade/course allows opportunities to integrate with other courses/disciplines.

20. I am familiar with the State Standards for my grade/course.

21. The curriculum for my grade/course meets the State Standards.

22. By the end of the year, students have met the expectations of the State Standards for the course.

23. I feel that the rigor of this course adequately prepares students for standardized assessments.

24. Grades earned by students in this course adequately reflect their understanding of the course content.

25. I have adequate time to meet with my colleagues to discuss math curriculum related issues in this course.

26. Approximately how many of each of the following assessments do you give each marking period in this math course?

27. Please indicate the frequency in which you use assessment data for the following purposes in this math course.

28. How often do students in this math course use the computer to complete math instructional activities and/or assessments each marking period?

29. I integrate sample PARCC and/or Model Curriculum questions into daily instruction in this math course.

30. I feel that the text book and accompanying resources made available to me by the district adequately addresses the concepts and standards within the curriculum for this math course.

31. How often do you utilize the following resources in this math course?

32. I have access to adequate manipulative resources to support instruction for this math course.

33. There are adequate resources available to remediate and enrich instruction for students in this math course.

34. Please list any physical or virtual manipulatives you use to support instruction in this math course.

35. Please list any physical or virtual manipulatives you would like to have but are currently not available for instruction in this math course.

36. How often do you use each of the following manipulatives in this math course?

37. How often do you access the online teacher textbook and/or related online resources for this math course?

38. How often do you have students use the following in this math course?

39. What other furniture or physical resources would you like to have available to facilitate math instruction in this course?

40. Please share any additional comments regarding this math course/curriculum.

41. Do you teach any mathematics courses in addition to the course(s) you have already responded about in a survey?

42. If BRRSD were to offer additional mathematics or computer science courses, what courses would you like offered?

- 43. How important are each of the following types of professional development?
- 44. Please list some topics you would like to see included in professional development.
- 45. Would you be willing to visit another colleague's classroom as a form of PD?

46. Would you be willing to have other teachers visit your classroom as a form of PD?

Math Staff Survey Grades K-12 Responses

Select the statement with which you most strongly agree:

212 responses



- 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.

Select the statement with which you most strongly agree:



- The role of the student is to memorize information that is presented and then use it to solve routine problems on...
- The role of the student is to be actively involved in making sense of mathematics tasks by using varied...
 Option 3
- The role of student is to memorize information that is presented and then use it to solve routine problems on...

Select the statement with which you most strongly agree:

212 responses



Select the statement with which you most strongly agree:



Please select the grade level you currently teach.

274 responses



Please select your school.



Please select a math course you are currently teaching. All questions in the upcoming section should be answered ...ess can be repeated for each course.



Please select a math course you are currently teaching. All questions in the upcoming section should be answered ...ess can be repeated for each course. ³⁵ responses



Please select the grade level math course you are currently teaching. All questions in the upcoming section sho...ess can be repeated for each course. 38 responses



Please select the grade level math course you are currently teaching. All questions in the upcoming section sho...ess can be repeated for each course.





1. How often are the following instructional strategies used in your classroom when teaching this course?



2. How often are you available to provide support outside of scheduled classroom time for this math course? Check all that apply.

273 responses



3. Approximately how many students attend your outside support sessions for this math course each week?



4. Which calculator models are best suited for instruction for this math course?

270 responses



5. I have access to the following technologies for this math course when needed.





6. How often do you incorporate each of the following technologies in this math course?

7. How often do you use assessment results to inform instruction for this math course?



8. How do you establish student groups in this math course? Check all that apply.

267 responses



9. How often do you vary student groups in this math course?


10. How often do you incorporate mathematical reasoning and modeling into instruction for this math course?

269 responses



11. Daily math instructional time is adequate for me to deliver content in this math course.



12. I believe a summer assignment for this course is beneficial for students.

269 responses



13. I believe that math homework for this course helps students better understand the math content.



14. How many times per week do you typically assign homework to students in this math course?

270 responses



15. How many of your students in this math course complete homework on a consistent basis?



16. How much time do you anticipate most students will take to complete a typical homework assignment?

271 responses



17. I am concerned that my students in this math course sometimes miss instructional time for math to participat...s, chorus, field trips, assemblies, etc). ²⁷⁰ responses



18. Curriculum pacing for this grade/course allows for student understanding.

270 responses



19. Our curriculum for this grade/course allows opportunities to integrate with other courses/disciplines.



20. I am familiar with the State Standards for my grade/course.

270 responses



21. The curriculum for my grade/course meets the State Standards. ²⁶⁸ responses



22. By the end of the year, students have met the expectations of the State Standards for the course.

270 responses



23. I feel that the rigor of this course adequately prepares students for standardized assessments.



24. Grades earned by students in this course adequately reflect their understanding of the course content.

271 responses



25. I have adequate time to meet with my colleagues to discuss math curriculum related issues in this course.



26. Approximately how many of each of the following assessments do you give each marking period in this math course?



27. Please indicate the frequency in which you use assessment data for the following purposes in this math course.



28. How often do students in this math course use the computer to complete math instructional activitie.../or assessments each marking period?

270 responses



29. I integrate sample PARCC and/or Model Curriculum questions into daily instruction in this math course.



30. I feel that the text book and accompanying resources made available to me by the district adequately addresse...n the curriculum for this math course. ^{267 responses}



31. How often do you utilize the following resources in this math course?



32. I have access to adequate manipulative resources to support instruction for this math course.

268 responses



33. There are adequate resources available to remediate and enrich instruction for students in this math course.



36. How often do you use each of the following manipulatives in this math course?



37. How often do you access the online teacher textbook and/or related online resources for this math course?





38. How often do you have students use the following in this math course?

41. Do you teach any mathematics courses in addition to the course(s) you have already responded about in a survey?



Please select from the choices below.

80 responses



43. How important are each of the following types of professional development?



45. Would you be willing to visit another colleague's classroom as a form of PD?



46. Would you be willing to have other teachers visit your classroom as a form of PD?



APPENDIX B

Parent Survey Questions

1. Please indicate all special programs and services received by each child.

2. I am comfortable helping each child with his/her math homework.

3. I am concerned that each child sometimes misses instructional time for math to participate in other school activities. (i.e. music lessons/concerts, field trips, assemblies, etc).

4. With regard to this past year, my child was appropriately challenged within his/her math class.

5. With regard to this past year, my child received appropriate math support within his/her math class.

6. As a parent, I believe it is important for my child to apply mathematical skills and thinking to problem solving.

7. My child has a positive attitude towards learning mathematics.

8. Summer packets help my child maintain mathematical skills.

9. My child is able to identify and correct mathematical mistakes.

10. The average amount of time my child spends on his/her math homework per night is...

11. There is adequate time allocated to math instruction per school day.

12. How effective are district math assessments in preparing each child for success on standardized tests (MAP, PARCC, SAT, ACT, AP exams, etc.)

13. Which models of instruction does my child's teacher regularly use in the classroom for math instruction?

14. Select all technologies each child has access to at home.

15. Outside of scheduled math classroom time, my child receives the following support in math.

16. I have used the following resources to keep informed about my child's math performance.

17. I have used the following resources to keep informed about my child's math program. (Use the scroll bar to reveal more options)

18. Would you be interested in attending a Parent Math Information Night where staff shares concepts and strategies being used in your child's math class?

19. If you were to attend a Parent Math Information Night, what topics would you like discussed?

20. Are there any courses in math that are not currently offered that would meet the needs of your child(ren)?

21. Please share any additional information that you feel would be relevant about the math program in our district.

22. At what grade level would like your child to first be offered a computer science class?

23. If BRRSD were to offer additional computer science courses, what courses would you like offered?

Choose the statement with which you most strongly agree:

475 responses



Choose the statement with which you most strongly agree:



- 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 teacher is to tell students exactly what definitions, formulas, and rules they should know and demonstrate how to use this information to solve mathematical p...

Please indicate the grade level of each child attending BRRSD.



Please indicate the school that each child attends.



1. Please indicate all special programs and services received by each child.



2. I am comfortable helping each child with his/her math homework.



3. I am concerned that each child sometimes misses instructional time for math to participate in other school activities. (i.e. music lessons/concerts, field trips, assemblies, etc).



4. With regard to this past year, my child was appropriately challenged within his/her math class.



5. With regard to this past year, my child received appropriate math support within his/her math class.



6. As a parent, I believe it is important for my child to apply mathematical skills and thinking to problem solving.



7. My child has a positive attitude towards learning mathematics.



8. Summer packets help my child maintain mathematical skills.



9. My child is able to identify and correct mathematical mistakes.



10. The average amount of time my child spends on his/her math homework per night is...



11. There is adequate time allocated to math instruction per school day.



12. How effective are district math assessments in preparing each child for success on standardized tests (MAP, PARCC, SAT, ACT, AP exams, etc.)



13. Which models of instruction does my child's teacher regularly use in the classroom for math instruction?



14. Select all technologies each child has access to at home.



15. Outside of scheduled math classroom time, my child receives the following support in math.



16. I have used the following resources to keep informed about my child's math performance.



17. I have used the following resources to keep informed about my child's math program. (Use the scroll bar to reveal more options)



18. Would you be interested in attending a Parent Math Information Night where staff shares concepts and strateg...ing used in your child's math class? ⁴⁷⁶ responses



22. At what grade level would like your child to first be offered a computer science class?



APPENDIX C

Survey Questions

Student Survey Questions

1. I think mathematics is important in life.

- 2. I prefer working alone rather than with other students when doing mathematics.
- 3. I enjoy participating in discussions that involve mathematics.
- 4. I enjoy hearing the thoughts and ideas of my classmates about the math I am learning.
- 5. I feel nervous when taking a math test in this class.
- 6. How often are the following instructional strategies used in the math classroom?
- 7. How often do you solve meaningful problems in your math class?
- 8. How often do you use hands-on manipulatives in your math class?
- 9. I am receiving appropriate support to be successful in this math class.
- 10. How often do you utilize the following supports outside of scheduled classroom time for this math course?

11. How do you prepare for math assessments in this course? Select all that apply.

- 12. On average, how much time do spend studying for a test in this math class?
- 13. Technology can make mathematics easier to understand.
- 14. How often do you use each of the following technologies in your math class?
- 15. How often do you use a calculator when completing your math homework?
- 16. I have access to the following resources at home. Check all that apply.
- 17. How often do you access the online textbook for this class?
- 18. What type of textbook would you prefer for this course?
- 19. How often is math content presented using multiple ways to help me understand?
- 20. As a math student, I can learn related information quickly and apply what is being learned to new situations.
- 21. There is enough daily instructional time for me to understand the content in this math class.
- 22. I am aware of the daily instructional objective/goal for this math class
- 23. My previous math classes have prepared me well for this class.
- 24. This math class has prepared me well for standardized math assessments (PARCC, AP, SAT, etc.)
- 25. I am being appropriately challenged in this math class.
- 26. What is the average amount of time you work on math homework for this class each night?
- 27. I feel that completing math homework helps me better understand the math content for this course.
- 28. Summer assignments help me maintain my mathematical knowledge.
- 29. If a computer science course were offered at your grade level, would you be interested in taking it?
- 30. If we were to offer additional computer science courses, what courses would you like to see offered?
- 31. What lesson/project/activity did you most enjoy in this class? Why?
- 32. What lesson/project/activity did you find most difficult in this class? Why?
- 33. What is something you would change to improve this math class?
- 34. What is one thing that helped you be successful in this course?
- 35. Please share any additional feedback relevant to this class.

NCTM Mathematical Beliefs Survey Questions

1. Choose the statement with which you most strongly agree:

- 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.
- 2. Choose the statement with which you most strongly agree:
 - 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 teacher is to tell students exactly what definitions, formulas, and rules they should know and demonstrate how to use this information to solve mathematical problems.
- 3. Choose the statement with which you most strongly agree:
 - 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 consider the reasoning of others.
- 4. Choose the statement with which you most strongly agree:
 - An effective teacher provides students with appropriate challenge, encourages perseverance in solving problems, and supports productive struggle in learning mathematics.
 - 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.

BRRSD Math 3-12 Student Survey Results

Select the statement with which you most strongly agree:

10,910 responses



- 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 discussions.

Select the statement with which you most strongly agree:

10,887 responses



Select the statement with which you most strongly agree:

10,884 responses



Select the statement with which you most strongly agree:

10,898 responses



Please select your current grade level.

10,950 responses



Please select the school you currently attend.

10,944 responses



Please select the math course you are currently enrolled in.

2,278 responses



Please select the math course you are currently enrolled in.

1,920 responses



Please select the math course you are currently enrolled in.

2,088 responses



Please select the course in which you are currently seated.

4,622 responses



1. I think mathematics is important in life.

10,939 responses



2. I prefer working alone rather than with other students when doing mathematics.

10,914 responses



3. I enjoy participating in discussions that involve mathematics.

10,875 responses



4. I enjoy hearing the thoughts and ideas of my classmates about the math I am learning.

10,884 responses



5. I feel nervous when taking a math test in this class.

10,914 responses



6. How often are the following instructional strategies used in the math classroom?



7. How often do you solve meaningful problems in your math class?

10,877 responses



8. How often do you use hands-on manipulatives in your math class?

10,873 responses



9. I am receiving appropriate support to be successful in this math class. 10,872 responses



10. How often do you utilize the following supports outside of scheduled classroom time for this math course?



11. How do you prepare for math assessments in this course? Select all that apply.

- 75% Review Class Notes
- 72% Complete Teacher Made Study Guide/Review
- 48% Re-do Homework or Classwork Problems
- 38% Online Resources
- 30% Parent Support with Content
- 27% Extra Help with Teacher
- 24% Textbook
- 16% Peer Study Group
- 15% I Don't Study
- 9% Tutor
- 5% Tutorial Period
- 7% Other
12. On average, how much time do spend studying for a test in this math class?

10,886 responses



13. Technology can make mathematics easier to understand.

10,853 responses



14. How often do you use each of the following technologies in your math class?



15. How often do you use a calculator when completing your math homework?

10,858 responses



16. I have access to the following resources at home. Check all that apply.

10,811 responses



17. How often do you access the online textbook for this class?

10,862 responses



18. What type of textbook would you prefer for this course?

10,800 responses



19. How often is math content presented using multiple ways to help me understand?

10,803 responses



20. As a math student, I can learn related information quickly and apply what is being learned to new situations.

10,822 responses



21. There is enough daily instructional time for me to understand the content in this math class.

10,855 responses



22. I am aware of the daily instructional objective/goal for this math class

10,855 responses



23. My previous math classes have prepared me well for this class. 10,804 responses



24. This math class has prepared me well for standardized math assessments (PARCC, AP, SAT, etc.)

10,832 responses



25. I am being appropriately challenged in this math class.

10,871 responses



26. What is the average amount of time you work on math homework for this class each night?

10,895 responses



27. I feel that completing math homework helps me better understand the math content for this course.

10,851 responses



28. Summer assignments help me maintain my mathematical knowledge.

10,786 responses



29. If a computer science course were offered at your grade level, would you be interested in taking it?

10,740 responses



APPENDIX D

Sample Assessments and Rubrics

Sample 6th Grade MEA

Assignment - Letter 1

Tom Dubs 17 Ocean Dr. Palm Coast, FL 32164

Dear Students,

I am writing because I need your help. My son, who is about your age, has a birthday coming up soon and I want to build him a tree house. I have never built one in Florida before and was hoping that you could give me some advice. I found the perfect tree where I can build one with perfect rectangular sides, but I'm not sure what type of wood to use. This is where I need some advice from you.

The tree house I want to build has a base of 8ft by 4ft and a height of 5ft. What I need to know is which type of wood would be best for the construction of this tree house? I don't want to spend a lot of money to build this, but it must be safe for my son and his friends to play in. On the next page is some information that your team must consider. With this information please rank from best to worst the wood that I should use to build it. Then I need you to explain your procedure/thinking so that can I understand your choice.

I look forward to hearing from you soon. Thank you, Tom Dubs

Wood Type	Price	Weather Resistance	Other Info.
Oak	\$0.27 / sqft	Not weather resistant	Strong, May have some knots
Pine	\$0.62 / sqft	Not weather resistant	May warp, may have some knots and imperfections.
Spruce	\$0.06 / sqft	Weather resistant	Very light, flexible

Tree House Data

Whitewood	\$0.15 / sqft	Weather resistant	Selected for strength,
			smooth on all sides,
			generally used for
			above ground
			projects

Diagram of tree house



Tree House Proposal

Dear Mr. Dubs, Our team, ______, has looked at the provided tree house data and suggests that lumber you should use to build your tree house is

We ranked the lumber in this order:

- 1.

 2.
- 3. _____ 4.

The procedure we used to come to this decision was:

Sincerely,

Assignment Letter 2

Tom Dubs 17 Ocean Dr. Palm Coast, FL 32164

Dear Students,

I am writing because I need your help. My son, who is about your age, has a birthday coming up soon and I want to build him a tree house. I have never built one in Florida before and was hoping that you could give me some advice. I found the perfect tree where I can build one with perfect rectangular sides, but I'm not sure what type of wood to use. This is where I need some advice from you.

The tree house I want to build has a base of 8ft by 4ft and a height of 5ft. What I need to know is which type of wood would be best for the construction of this tree house? I don't want to spend a lot of money to build this, but it must be safe for my son and his friends to play in. On the next page is some information that your team must consider. With this information please rank from best to worst the wood that I should use to build it. Then I need you to explain your procedure/thinking so that can I understand your choice.

I look forward to hearing from you soon. Thank you, Tom Dubs

Tree House Data

Wood Type	Price	Weather Resistance	Other Info.
Oak	\$0.27 / sqft	Not weather resistant	Strong, May have some knots
Pine	\$0.62 / sqft	Not weather resistant	May warp, may have some knots and imperfections.
Spruce	\$0.06 / sqft	Weather resistant	Very light, flexible
Whitewood	\$0.15 / sqft	Weather resistant	Selected for strength, smooth on all sides, generally used for above ground projects

Diagram of tree house



Tree House Proposal

Dear Mr. Dubs, Our team, ______, has looked at the provided tree house data and suggests that lumber you should use to build your tree house is

We ranked the lumber in this order:

- 1. _____
- 2._____
- 3. _____

The procedure we used to come to this decision was:

Sincerely,

Sample Rubric

Math - Problem Solving : Tree House

Teacher Name: xx xx

Student Name:

CATEGORY	4	3	2	1
Mathematical Reasoning	Uses complex and refined mathematical reasoning.	Uses effective mathematical reasoning	Some evidence of mathematical reasoning.	Little evidence of mathematical reasoning.

Working with Others	Student was an engaged partner, listening to suggestions of others and working cooperatively throughout lesson.	Student was an engaged partner but had trouble listening to others and/or working cooperatively.	Student cooperated with others, but needed prompting to stay on-task.	Student did not work effectively with others.
Explanation	Explanation is detailed and clear.	Explanation is clear.	Explanation is a little difficult to understand, but includes critical components.	Explanation is difficult to understand and is missing several components OR was not included.
Strategy/Procedu res	Typically, uses an efficient and effective strategy to solve the problem(s).	Typically, uses an effective strategy to solve the problem(s).	Sometimes uses an effective strategy to solve problems, but does not do it consistently.	Rarely uses an effective strategy to solve problems.

Date Created: Jul 31, 2013 10:09 am (CDT)

APPENDIX E

Assessment Data

Five-year AP Mathematics and Computer Science Exam Results

AP[®] Five-Year School Score Summary (2018)

🗸 Data Updated Aug 31, 2018, Report Run Nov 14, 2018

Bridgewater-Raritan Regional High School (310753) Bridgewater-Raritan Regional High School (310753)

Dridgemate	Bric	lgewater-Raritan	Regional High S	chool (310753)			Nev	v Jersey					Global			
Calculus	s AB		1.000	12.10100.001	110000-005		2207002	12/11/02/17		(2010) (C)			200 200 200	1.1.1.1.1.1.1.1.1	2014/12/201	
	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	20	14 201	5 2016	2017	2018	_
	5 85	62	74	58	43	3,366	3,032	3,608	2,992	2,735	72,	511 66,41	1 76,875	59,590	60,069	
	4 20	24	14	36	40	1,757	2,038	2,036	2,270	2,241	48,	984 51,76	53,696	57,084	53,531	
	3 10	9	/	12	21	1,622	1,821	1,715	2,215	2,350	52,	0/6 56,48	52 53,743	66,211	65,145	
	2 4	4	2	3	10	2 1 1 1	3 205	2 2 2 5	1,947	2,070	31,	775 08 21	05 103	64,800	63,360	
Total Evan	120	100	09	100	114	0.774	10 320	10 456	10.952	1,347	204	706 204.2	19 200 526	217.620	210.259	
Mean Scor	a 453	4.42	4 59	4 37	4.02	3 34	3.23	3 38	3 32	3.23	234	94 2.86	2 96	2 93	2 93	
						510.1				0.00					2.000	
Calculus BC	2															
	2014	2015	2016	2017	2018	2014	2015	2016	2017	201	8	2014	2015	2016	2017	2018
5	82	80	65	65	59	2 653	2 581	2 890	2.676	2.83	24	54.335	54.148	60.907	56 706	56 519
4	14	14	13	27	38	710	783	602	880	1.01		18 525	10 551	10 248	24.096	26,090
2	6	7	14	15	10	571	601	661	869	1.03	22	18 200	21 482	21 481	26 441	28,050
	1	,	2	2	2	175	194	215	464	59	-	F 066	6 505	7 207	18 720	20,331
2	1		2	2	2	227	411	215	120	50.	0	15 250	17 725	16 461	7.006	7 827
Total Furners	102	101	0.4	100	110	327	411	4 900	F 000	144 F F F		112 285	110 411	10,401	122.050	120 746
Total Exams	103	101	94	109	110	4,445	4,050	4,002	5,009	5,50		112,205	0.70	125,504	133,059	139,740
Mean Score	4.72	4.72	4.50	4,42	4.31	4.17	4.06	4.10	4.10	4.0	4	5.01	3.72	3.01	3.79	5.74
Calculus BC	L: AB Subsco	re														
	2014	2015	2016	2017	2018	2014	2015	2016	2017	201	8	2014	2015	2016	2017	2018
5	90	92	70	76	76	2,921	3,131	2,964	2,951	3,27	79	61,853	66,942	64,077	64,513	68,099
4	6	7	19	25	34	673	647	956	1,072	1,06	53	18,826	19,481	26,201	29,981	28,228
3	6	2	5	7	7	467	453	466	570	76	6	14,440	15,234	16,379	18,754	22,203
2	1			1	1	194	174	138	311	35	2	7,040	6,555	5,764	13,291	13,760
1						190	245	278	105	12	6	10,121	11,194	12,875	6,511	7,454
Total Exams	103	101	94	109	118	4,445	4,650	4,802	5,009	5,58	36	112,280	119,406	125,296	133,050	139,744
Mean Score	4.80	4.89	4.69	4.61	4.57	4.34	4.34	4.29	4.29	4.2	6	4.03	4.04	3.98	4.00	3.97
Statistics																
Statistics	2014	2015	2016	2017	2019	2014	2015	2016	2017	20	10	2014	2015	2016	2017	2019
- [2014	2013	2016	2017	2018	2014	2015	2016	2017	20	10	2014	2013	2016	2017	2010
5	30	33	28	29	22	1,468	1,340	1,484	1,628	1,0	069	26,333	26,390	29,674	29,455	32,544
4	0	25	17	13	10	1,721	1,015	2,014	1,020	2,1	103	30,013	37,409	44,900	34,512	47,330
3	3	9		6	4	1,54/	1,/3/	1,/26	1,954	1,9	904	45,137	49,495	51,457	53,650	55,770
2		2				836	995	763	1,193	1,0)35	32,794	36,556	32,193	43,716	35,574
1	1		2			701	890	1,081	1,207	1,4	123	41,746	46,435	48,876	55,468	52,580
Total Exams	42	69	47	48	42	6,273	6,577	7,068	7,610	8,1	34	184,623	196,365	207,166	216,801	223,804
Mean Score	4.5/	4.29	4.4/	4.48	4.43	3.39	3.23	3.29	3.17	3.	19	2.86	2.80	2.88	2.72	2.87
C	Culture A															
Computer	Science A															
- [2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	8	2014	2015	2016	2017	2018
5	9	20	26	21	21	479	726	719	978	1,05	1	8,397	12,015	12,117	14,780	16,175
4	10	15	24	14	19	508	695	/53	824	854		9,122	12,135	11,951	12,753	13,876
3	2	6	4	4	4	326	394	733	778	843		6,588	7,505	13,439	13,315	14,266
2	~	1	1	1	1	155	160	380	382	446		3,007	3,529	7,208	6,950	1,121
1	2	2	2	1		519	535	481	631	672		12,205	14,018	13,419	13,026	13,337
Total Exams	23	44	57	41	45	1,987	2,510	3,066	3,593	3,86	0	39,319	49,202	58,134	60,824	65,381
Mean Score	4.04	4.14	4.25	4.29	4.53	3.14	3.37	3.28	3.32	3.31	,	2.96	3.09	3.04	3.15	3.18
Computer	Science Driv	ciples														
computer	2014	actives	2016	2017	2010	2014	2015	3010	2017	20	10	2014	2015	2016	2017	2010
- [2014	2015	2016	2017	2018	2014	2015	2016	2017	20	10	2014	2015	2016	2017	2018
5				40	55				293	50	01				6,188	10,235
4				15	16				391	61	0/				9,765	15,412
3				3	5				679	1,0	151				18,038	26,510
2									291	4	40				9,513	15,281
1									117	24	47				6,622	10,050
rotal Exams				58	76				1,771	2,9	300				50,126	77,488
mean Score				4.64	4.00				3.26	3.	29				2.99	3.01

Print / Download Options

2016-17 SAT, PSAT and ACT Results

PSAT/SAT/ACT - Participation

This table shows the percentage of 10th and 11th graders that took the PSAT 10 or PSAT NMSQT exams in 2016-17. This table also shows the percentage of 12th graders that have taken the SAT or ACT this year or in prior years.

Test	% of Students in School	% of Students in State
Percentage of students taking the PSAT	66.5%	89.4%
Percentage of students taking the SAT	100.0%	94.7%
Percentage of students taking the ACT	32.7%	28.3%

PSAT/SAT/ACT - Performance

This table shows the average test score, based on highest scoring test, for the PSAT, SAT, and ACT tests by subject area for students in the school and across the state. This table also shows the percentage of students at or above College Readiness Benchmarks for each test. Students that score at or above these benchmarks have a high chance of success in credit-bearing college courses.

Test	School Average Score	State Average Score	College Readiness Benchmarks	School - % of Students scoring at or above Benchmark	State - % of Students scoring at or above Benchmark
PSAT - Reading and Writing	563	481	Varies By Grade	91%	67%
PSAT - Math	574	483	Varies By Grade	81%	49%
SAT - Reading and Writing	595	551	480	90%	77%
SAT - Math	607	552	530	80%	58%
ACT - Reading	25	24	22	71%	65%
ACT - English	25	24	18	86%	79%
ACT - Math	26	24	22	79%	65%
ACT - Science	24	23	23	64%	54%

2015-16 SAT, PSAT and ACT Results

PSAT/SAT/ACT Performance

This table presents the school and state mean scores.

PSAT/SAT/ACT Participation						
This table presents the schoolwide and statewide participation rates from the last academic year as indicated in PSAT and SAT and from the last cohort as indicated in ACT.						
College and Career Readiness Indicators	Schoolwide Participation	Statewide Participation				
Percent of Students Participating in PSAT	68.3%	95.5%				
Percent of Students Participating in SAT	62.2%	58.0%				
Percent of Students Participating in ACT	29.5%	27.6%				

2015-16	School Mean	State Mean
PSAT	1116	950
SAT		2
Reading and Writing	590	537
Math	603	538
ACT	-	-
Reading	25	23
English	24	22
Math	26	23
Science	24	22

2017-18 PARCC Math Results

The following slides show the district PARCC results for the 2017-18 school year as well as a four-year comparison for each grade level.

Bridgewater-Raritan Regional School District

Annual Report on Student Achievement Part 1

PARCC Partnership for Assessment of Readiness for College and Careers

October 2018 Dr. Daniel Silvia, Assistant Superintendent

Standardized Assessments in this Analysis

Partnership for Assessment of Readiness for College and Careers (PARCC)

- Mathematics (grades 3-8)
- Algebra I
- Geometry
- Algebra II

The purpose for this analysis is to answer these questions:

- How did the BRRSD perform on the PARCC assessments?
- How does the achievement of our students compare to students in the rest of the state? To other PARCC states?
- •What do the PARCC student achievement results tell us about the quality of the curriculum and instruction that we have in place?



Vocabulary

- PARCC defines five levels in characterizing whether a student's performance on the assessment meets the expectations of the grade level standards:
 - Level One: Not Yet Meeting Expectations
 - •Level Two: Partially Meeting Expectations
 - •Level Three: Approaching Expectations
 - Level Four: Meeting Expectations
 - •Level Five: Exceeding Expectations

2018 Participation in PARCC

Grade/Test	Total Population	Number Tested	Percentage Tested	Change from 2017
Grade 3 ELA	650	635	98%	+1%
Grade 3 Math	650	639	98%	+1%
Grade 4 ELA	639	631	99%	+2%
Grade 4 Math	639	631	99%	+1%
Grade 5 ELA	680	672	99%	+2%
Grade 5 Math	680	673	99%	+2%
Grade 6 ELA	680	665	98%	+2%
Grade 6 Math	680	666	98%	+1%
Grade 7 ELA	647	634	98%	+1%
Grade 7 Math	487	472	97%	0%
Grade 8 ELA	687	685	99.7%	+2.7%
Grade 8 Math	387	385	99%	+5%
Algebra I (BRMS)	327	325	99%	+2%
Geometry (BRMS)	140	140	100%	+2%

*Some students in grade 7 and 8 participated in the PARCC Algebra I or Geometry assessment. Thus, PARCC Math 7 and Math 8 outcomes are not representative of grade level performance as a whole.

2018 Participation in PARCC

Grade/Test	Total Population	Number Tested	Percentage Tested	Change from 2017
Grade 9 ELA	709	706	99.57%	+2.57%
Grade 10 ELA	681	596	88%	+32%
Grade 11 ELA	708	100	14%	-11%
Algebra 1 (BRHS)	386	381	99%	+6%
Geometry (BRHS)	496	471	95%	+19%
Algebra II (BRHS)	666	418	63%	+12%

*Note that in grade 11 ELA, students taking an AP exam are exempt from PARCC.

2018 PARCC Mathematics														
	Count of Valid Test Scores	Not Yet Meeting (Level 1)	Partially Meeting (Level 2)	Approaching Expectations (Level 3)	Meeting Expectations (Level 4)	Exceeding Expectations (Level 5)	District % >= Level 4	State %>= Level 4						
Gr. 3	639	3.1%	7.4%	16.0%	41.5%	32.1%	73.6%	53.0%						
Gr. 4	631	2.1%	8.1%	20.0%	47.4%	22.5%	69.9%	<mark>49.4</mark> %						
Gr. 5	673	2.1%	7.3%	22.4%	49.9%	18.3%	68.2%	<mark>48.8</mark> %						
Gr. 6	666	3.2%	<mark>11.3%</mark>	22.2%	44.6%	<mark>18.8%</mark>	63.4%	<mark>43.5%</mark>						
Gr. 7	472	2.8%	11.9%	31.8%	49.2%	4.4%	53.6%	43.4%						
Gr. 8	384	10.9%	16.7%	35.7%	36.5%	0.3%	36.7%	<mark>28.</mark> 2%						
Alg. I	706	3.5%	8.5%	17.6%	55.7%	14.7%	70.4%	45.8%						
Geo	611	1.8%	13.9%	31.1%	34.0%	19.1%	53.2%	<mark>29.5</mark> %						
Alg. II	421	8.6%	9.7%	12.6%	57.7%	11.4%	69.1%	28.6%						

Comparison of BRRSD's Spring 2015, Spring 2016, Spring 2017, Spring 2018 PARCC Administrations Mathematics

	% Not Yet Meeting Expectations (Level 1)			% Partially Meeting Expectations (Level 2)			% Approaching Expectations (Level 3)			% Meeting Expectations (Level 4)			% Exceeding Expectations (Level 5)				% Change in Level 1 and Level	% Change in Level 4 and				
Grade	201 5	201 6	201 7	201 8	201 5	201 6	201 7	201 8	201 5	201 6	201 7	201 8	201 5	201 6	201 7	201 8	201 5	201 6	201 7	201 8	2 from 2015 to 2018	Level 5 From 2015 to 2018
G3	1	2	4	3	8	8	6	7	16	16	18	16	53	47	42	42	22	27	30	32	+1	-1
G4	1	2	2	2	7	9	9	8	21	22	19	20	57	52	53	47	14	14	17	23	+2	+5
G5	1	2	2	2	15	8	7	7	32	27	27	22	36	45	50	50	16	17	14	18	-7	+16
G6	1	4	2	3	13	15	10	11	25	27	23	22	43	36	42	45	19	17	23	19	0	+2
G7	2	4	5	3	14	15	17	12	38	35	37	32	45	44	38	49	2	3	2	4	-1	+6
G8	8	8	11	11	20	20	19	17	40	35	37	36	32	37	33	37	0	0	1	0	0	+5
Algebra I	4	2	5	4	13	6	11	9	18	22	17	18	53	63	55	56	11	7	12	15	-4	+7
Geometry	5	2	2	2	19	11	11	14	40	26	26	31	32	41	48	34	4	19	13	19	-8	+17
Algebra II	11	7	11	9	17	10	7	10	30	23	13	13	41	56	50	58	2	4	19	11	-9	+26
																				2	6	






































Math Total PARCC Performance by Race/Ethnicity

APPENDIX F

Sample of a 5th Grade Teacher Schedule

5th Grade	Μ	Т	W	TH	F
PERIOD 1 9:18 - 10:01	Duty/ Meeting	Duty/ Meeting	Duty/ Meeting	Duty/ Meeting	Duty/ Meeting
PERIOD 2 10:04 - 10:47	Science/SS (A)	Science/SS (B) Science/SS (A)		Science/SS (B)	Science/SS (A)
PERIOD 3 10:50 - 11:33	Prep	Prep	Prep	Prep	Prep
PERIOD 4 11:36 - 12:19	Math (A)	Math (B)	Math (A)	Math (B)	Math (A)
PERIOD 5 12:22 - 1:05	Lunch	Lunch	Lunch	Lunch	Lunch
PERIOD 6 1:08 - 1:51	Math (A)	Math (B)	Math (A)	Math (B)	Core
PERIOD 7 1:54 - 2:37	Science/SS (B)	Science/SS (A)	Science/SS (B)	Science/SS (A)	Science/SS (B)
PERIOD 8 2:40 - 3:23	Math (B)	Math (A)	Math (B)	Math (A)	Math (B)
HomeRoom Dismissal 3:26 - 3:40	HR Dismissal	HR Dismissal	HR Dismissal	HR Dismissal	HR Dismissal

APPENDIX G

Intermediate School Math Course Descriptions

5E/AI Mathematics

The Math 5E/AI Course develops the necessary skills in order to: conceptually develop mathematics, conjecture, reason logically, solve non-routine problems, and communicate about and through mathematics as well as connect ideas between mathematics and other disciplines. Instructional focus of this course is in four critical areas: (1) connecting ratio and rate to whole number multiplication and division and using concepts of ratio and rate to solve problems; (2) completing understanding of division of fractions and extending the notion of numbers to the system of rational numbers, which includes negative numbers; (3) writing, interpreting, and using expressions and equations; and (4) developing understanding of statistical thinking. Students will also build from their work with area in elementary school by reasoning about relationships among shapes to determine area, surface area, and volume. They find areas of right triangles, other triangles, and special quadrilaterals by decomposing these shapes, rearranging or removing pieces, and relating the shapes to rectangles and triangles. Using these methods, students discuss, develop, and justify formulas for areas of triangles, parallelograms, and trapezoids. Students find areas of polygons and surface areas of prisms and pyramids by decomposing them into pieces whose area they can determine. They reason about right rectangular prisms with fractional side lengths to extend formulas for the volume of a right rectangular prism to fractional side lengths.

Math 5

The Grade 5 Mathematics course provides opportunities for students to develop the conceptual understanding and procedural fluency of mathematics. Students will reason mathematically and effectively communicate their reasoning to others. Instructional time will focus on three critical areas: (1) developing fluency with addition and subtraction of fractions, and developing understanding of the multiplication of fractions and of division of fractions in limited cases (unit fractions divided by whole numbers and whole numbers divided by unit fractions); (2) extending division to 2-digit divisors, integrating decimal fractions into the place value system and developing understanding of operations with decimals to hundredths, and developing fluency with whole number and decimal operations; and (3) developing understanding of volume. Procedural fluencies for the course includes multi-digit multiplication.

6E Mathematics

The Grade 6E course develops the necessary skills in order to: connect ideas between mathematics and other disciplines, learn how to study mathematics, develop the ability to explore, conjecture, and reason logically, solve non-routine problems, and communicate about and through mathematics. This course prepares the student with the skills and abstract thinking needed to be successful in Algebra I. The course covers all of the Grade 7 Mathematics Standards as well as extending into the Grade 8 Mathematics standards in order to accelerate students one year above grade level upon completion. The 6E Mathematics Course provides the necessary skills, concepts, and understanding vital for success in Algebra I. Instructional time focuses on the following critical areas: (1) developing understanding of and applying proportional relationships; (2) developing understanding of operations with rational numbers and working with expressions and linear equations; (3) solving problems involving scale drawings

and informal geometric constructions, and working with two- and three-dimensional shapes to solve problems involving area, surface area, and volume; (4) drawing inferences about populations based on samples and investigate probability models; (5) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; and (6) grasping the concept of a function and using functions to describe quantitative relationships.

Math 6

The Math 6 Course develops the necessary skills in order to: conceptually develop mathematics, conjecture, reason logically, solve non-routine problems, and communicate about and through mathematics as well as connect ideas between mathematics and other disciplines. Instructional focus of this course is in four critical areas: (1) connecting ratio and rate to whole number multiplication and division and using concepts of ratio and rate to solve problems; (2) completing understanding of division of fractions and extending the notion of numbers to the system of rational numbers, which includes negative numbers; (3) writing, interpreting, and using expressions and equations; and (4) developing understanding of statistical thinking. Students will also build from their work with area in elementary school by reasoning about relationships among shapes to determine area, surface area, and volume. They find areas of right triangles, other triangles, and special quadrilaterals by decomposing these shapes, rearranging or removing pieces, and relating the shapes to rectangles and triangles. Using these methods, students discuss, develop, and justify formulas for areas of triangles, parallelograms, and trapezoids. Students find areas of polygons and surface areas of prisms and pyramids by decomposing them into pieces whose area they can determine. They reason about right rectangular prisms with fractional side lengths to extend formulas for the volume of a right rectangular prism to fractional side lengths.

Intermediate School Math Course Descriptions

Math 7

The Grade 7 Mathematics course develops the necessary skills in order to: connect ideas between mathematics and other disciplines, learn how to study mathematics, develop the ability to explore, conjecture, and reason logically, solve non-routine problems, and communicate about and through mathematics. This course provides the students with the fundamentals needed to succeed in further mathematics courses. Grade 7 Mathematics in conjunction with Grade 8 Mathematics provide the necessary skills, concepts, and understanding vital for success in Algebra I. In Grade 7, instructional time should focus on four critical areas: (1) developing understanding of and applying proportional relationships; (2) developing understanding of operations with rational numbers and working with expressions and linear equations; (3) solving problems involving scale drawings and informal geometric constructions, and working with two-and three-dimensional shapes to solve problems involving area, surface area, and volume; and (4) drawing inferences about populations based on samples and investigate probability models.

7E Mathematics

The Grade 7E course develops the necessary skills in order to: connect ideas between mathematics and other disciplines, learn how to study mathematics, develop the ability to explore, conjecture, and reason logically, solve non-routine problems, and communicate about

and through mathematics. This course prepares the student with the skills and abstract thinking needed to be successful in Algebra I. The course covers all of the Grade 7 Mathematics Standards as well as extending into the Grade 8 Mathematics standards in order to accelerate students one year above grade level upon completion.

Math 8

The Grade 8 Mathematics course develops the necessary skills in order to: connect ideas between mathematics and other disciplines, learn how to study mathematics, develop the ability to explore, conjecture, and reason logically, solve non-routine problems, and communicate about and through mathematics. Geometry concepts will be extended from the Grade 7 Mathematics course. This course will begin with a focus on the skills and abstract thinking needed to be successful in Algebra I and then will move into linear algebra content from Algebra I. In Grade 8, instructional focus is on the following three areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

Algebra I A

Algebra I

This course develops the necessary skills in algebra in order to: connect algebra to geometry, connect algebra to probability and statistics, connect ideas between mathematics and other disciplines, learn how to study mathematics, develop the ability to explore, conjecture, and reason logically, solve non-routine problems, and communicate about and through mathematics. Topics include: use of variables, addition, subtraction, multiplication and division in algebra, slopes and lines, exponents and powers, quadratic equations and square roots, polynomials, linear systems, and factoring. **Summer assignment required.**

Geometry Honors

Geometry (Honors)

Prerequisite - Algebra I and must also meet department selection criteria. **Summer assignment required.**

APPENDIX H

Enrollment Data

Course #	Course Name	Student Count	Section Avg
P4MA0421	Math 4	482	17.9
P4MA0422	Math 4A	75	10.7
P4MA0A41	Math 4AI	73	24.3
IMA00521	Math 5	432	21.6
IMA00522	5E Math	73	24.3
IMA00528	RC Math 5	25	6.3
IMA00A52	5AI Math	102	20.4
IMA00621	Math 6	462	22
IMA00622	6E Math	165	20.6
IMA00L92	LLD Math	16	8
IMA00628	RC Math 6	34	6.8
MMA00721	Grade 7 Mathematics	330	20.6
MMA00723	Grade 7E Mathematics	156	26
MMA00725	Algebra I (7)	167	20.9
MMA00728	RC Grade 7 Mathematics	39	9.8
MMA00798	LLD Math	3	3
MMA00821	Grade 8 Mathematics	311	18.3
MMA00823	Algebra I (8)	142	23.7
MMA00825	Geometry (8)	165	23.6
MMA00828	RC Grade 8 Mathematics	39	7.8
MMA00898	LLD Math	9	4.5
HMA10202	Mathematics SI-A	9	9
HMA10206	Algebra I A	289	23.9
HMA10207	Geometry A	346	24

2018-19 Enrollment Data and Class Sizes for Grades 4-12 Mathematics

HMA10208	Ess Geometry A	59	14.8
HMA10210	Algebra II A	345	25.6
HMA10218	Ess Algebra II A	65	16.3
HMA10229	Precalculus A	258	25.8
HMA10237	Math Analysis A	82	16.4
HMA10251	Ess Algebra I A	45	15
HMA10263	Calculus A	171	21.4
HMA10265	Probability & Statistics A	112	22.4
HMA20200	Intro to Computer Science A - S1	88	22
HMA20200	Intro to Computer Science A - S2	87	21.8
НМА20239	Unified Calculus III H	44	22
HMA20240	Differential Equat H	42	21
HMA30209	Geometry H	32	16
HMA30211	Algebra II H	168	24
HMA30214	Precalculus H	185	26.4
HMA50200	AP Computer Science A	56	18.7
HMA50201	AP Computer Science Principles	84	21
HMA50220	AP Calculus AB	127	25.4
HMA50234	AP Calculus BC	127	25.4
HMA50252	AP Prob & Stat	77	25.7
HMA50620	Advanced Mathematics of Engineering	53	26.5
HMA60200	Math I Workshop	9	4.5
HMA60201	Math II Workshop	9	4.5
HMA60204	Math IV Workshop	20	10
HMA60207	Math III Workshop	6	3
НМА60221	Math I Workshop SI	3	3
HSE70358	Math 21st Century Living - LS	13	6.5
HSE70764	Math 9/10	17	8.5
HSE70766	Math 11/12	12	6
HSE70835	Geometry A	38	7.6

HSE70839	Math 21st Century Living	6	3
HSE70852	Essentials of Geometry	28	9.3
HSE70854	Algebra I A	45	9
HSE70858	Essentials of Algebra II	17	5.7
HSE70862	Math I	7	7
HSE70864	Math II	9	9
HSE70868	Math IV	14	7
HSE70973	Algebra II A	39	9.8
HSE70976	Essentials of Algebra I	45	11.3

Three-Year Demographic Trends in Specified Math Programs in Grades 7-12

			201	15-16					201	6-17					201	7-18		
	Total	Hispanic	Black	White	Asian	FDC	Total	Hispanic	Black	White	Asian	FDC	Total	Hispanic	Black	White	Asian	FDC
Total	4188	486	125	2468	1109	293	4294	558	112	2423	1201	327	4296	617	99	2268	1312	335
Hon/AP	1016	37	5	390	584	18	1100	43	3	408	646	15	1192	60	5	396	731	22
Academic Geo +	1931	162	55	1287	427	87	1882	203	50	1196	433	105	1796	208	48	1107	433	95
Math 7, Math 8	724	165	31	472	56	108	797	187	32	497	81	132	817	206	25	489	97	136
Algebra I HS	199	37	7	134	21	20	217	47	6	141	23	25	228	56	4	142	26	24
Essentials	255	62	16	161	16	42	244	59	16	155	14	37	205	58	14	118	15	43
Workshop	63	23	11	24	5	18	54	19	5	26	4	13	58	29	3	16	10	15
Percent of each level made up of				2015-16						2016-17						2017-18		
the given subgroup		Hispanic	Black	White	Asian	FDC		Hispanic	Black	White	Asian	FDC		Hispanic	Black	White	Asian	FDC
Overall		12%	3%	59%	26%	7%		13%	3%	56%	28%	8%		14%	2%	53%	31%	8%
Hon/AP		4%	0%	38%	57%	2%		4%	0%	37%	59%	1%		5%	0%	33%	61%	2%
Academic Geo +		8%	3%	67%	22%	5%		11%	3%	64%	23%	6%		12%	3%	62%	24%	5%
Math 7, Math 8		23%	4%	65%	8%	15%		23%	4%	62%	10%	17%	6	25%	3%	60%	12%	17%
Algebra I HS		19%	4%	67%	11%	10%		22%	3%	65%	11%	12%		25%	2%	62%	11%	11%
Essentials		24%	6%	63%	6%	16%		24%	7%	64%	6%	15%		28%	7%	58%	7%	21%
Workshop		37%	17%	38%	8%	29%		35%	9%	48%	7%	24%		50%	5%	28%	17%	26%

			201	5-16					201	6-17					201	7-18		
	Total	Hispanic	Black	White	Asian	FDC	Total	Hispanic	Black	White	Asian	FDC	Total	Hispanic	Black	White	Asian	FDC
Total	607	77	14	301	189	54	635	100	19	301	186	69	610	90	15	282	196	55
Grade 4 Math	475	74	14	257	108	53	529	95	19	269	122	68	476	85	13	244	113	52
Math 4A	69	2	0	31	33	1	62	5	0	23	30	1	67	5	0	32	26	3
Math 4AI	63	1	0	13	48	0	44	0	0	9	34	0	67	0	2	6	57	0
Percent of subgroup			201	5-16					201	6-17					201	7-18		
enrolled in each level	Overall	Hispanic	Black	White	Asian	FDC	Overall	Hispanic	Black	White	Asian	FDC	Overall	Hispanic	Black	White	Asian	FDC
Grade 4 Math	78%	96%	100%	85%	57%	98%	83%	95%	100%	89%	66%	99%	78%	94%	87%	87%	58%	95%
Math 4A	11%	3%	0%	10%	17%	2%	10%	5%	0%	8%	16%	1%	11%	6%	0%	11%	13%	5%
Math 4AI	10%	1%	0%	4%	25%	0%	7%	0%	0%	3%	18%	0%	11%	0%	13%	2%	29%	0%
Percent of each level made up of				2015-16						2016-17						2017-18		
the given subgroup		Hispanic	Black	White	Asian	FDC		Hispanic	Black	White	Asian	FDC		Hispanic	Black	White	Asian	FDC
Overall		13%	2%	50%	31%	9%		16%	3%	47%	29%	11%		15%	2%	46%	32%	9%
Grade 4 Math		16%	3%	54%	23%	11%		18%	4%	51%	23%	13%		18%	3%	51%	24%	11%
Math 4A		3%	0%	45%	48%	1%		8%	0%	37%	48%	2%		7%	0%	48%	39%	4%
Math 4AI		2%	0%	21%	76%	0%		0%	0%	20%	77%	0%		0%	3%	9%	85%	0%

Three-Year Demographic Trends in Grade 4 Mathematics Programs

2018-19 BRHS Math Demographic Breakdown

	Male	Female	White	Asian	Black	Hispanic	Other / Pacific Islander	Multi-Race	Total
AP	529	429	310	602	6	21	6	12	957
Honors	210	177	123	243	3	11	2	5	387
Academic	739	863	1028	249	47	224	10	42	1600
Academic ICS	85	39	89	9	4	19	2	1	124
Essentials	89	77	96	10	7	46	0	7	166
Resource	63	30	51	4	8	28	0	2	93
Total	1715	1615	1697	1117	75	349	20	69	3327

Percent of subgroup enrolled in each level	Male	Female	Wh	ite	As	ian	Bla	ck	Hispa	nic	Other Pacific Islande	/ Multi-Ra	ace	Overall
AP	31%	27%	18	18%		4%	8%		6%		30%	17%		29%
Honors	12%	11%	79	%	2	2%	4%	6	3%		10%	7%		12%
Academic	43%	53%	61	%	2	2%	639	%	64%	6	<mark>50%</mark>	61%		48%
Academic ICS	5%	2%	5%	%	1	%	5%	6	5%		10%	1%		4%
Essentials	5%	<mark>5%</mark>	6%	%	1	%	9%	6	13%	6	0%	10%		5%
Resource	4%	2%	39	3%		0%		11%			0%	3%		3%
Percent of level made up of the given subgroup	ercent of vel made up the given Male F		le	White		e Asi		В	lack	His	spanic	Other / Pacific Islander	Mu	llti-Race
AP	55%	45%	di j	329	6	63	8%		1%		2%	1%	1%	
Honors	54%	46%	0	329	6	63	8%		1%		3%	1%		1%
Academic	46%	54%		64%	6	16	5%		3%		14%	1%		3%
Academic ICS	69%	31%	0	72%	6	7	%		3%		15%	2%		1%
Essentials	54%	46%	6	58%		6	%		4%		28%	0%		4%
Resource	68%	32%	Ő.	55%	6	4	%		9%		30%	0%		2%
Overall	52%	49%		519	6	34	%		2%		10%	1%		2%

APPENDIX I K-8 Mathematics Course Progressions





Two Year Accelerated

(INTERMEDIATE SCHOOL)



APPENDIX J

Math Content Domains by Course

				Ma	th Conter	t Domains	1							
Grade Cost	ES COUNTER	orders Hunterson	nd pase Ten In Base Ten United States	s - Ground	ury wears	rement and Date	sard round and Radios and	Propositional Propositions	untre Staten	ons and states of the states o	ond Fur	alons we	ther & Quant	8
Kindergarten	X	X		X	X	X								
Grade 1		X		X	X	X								
Grade 2		Х		X	X	X								
Grade 2 Al		X	X	X	X	X								
Grade 3		X	X	X	X	X								
Grade 3AI		X	X	X	X	X								
Grade 4		X	X	X	X	X								
Grade 4 A		X	X	X	X	X								
Grade 4 Al		X	X	X	X	X								
Grade 5		X	X	X	X	X								
Grade 5E/AI				X			X	Х	X	X				
Grade 6				X			X	X	X	X				
Grade 6E		[X			X	X	X	X			,	
Grade 7				X			X	X	X	X				
Grade 7E				X			X	X	X	X	X			
Grade 8				X				X	X	X	X			
Algebra I										X	X	Х	X	
Geometry				X						X				
Algebra II										X	X	X	X	

APPENDIX K

From Catalyzing Change in High School Mathematics (2018)

The following excerpt explains research and best practices in regards to student tracking.

Student Tracking

Catalyzing Change uses *pathway* to describe a course progression for a student through high school mathematics. Pathways include tracks—fixed sequences of courses that are often determined in middle school or earlier. Courses in a track sequence often place students in different levels of the same course, with the levels identified by tags such as "honors," "advanced," "regular," or "remedial" or "adjusted." Tracking is insidious because it places some students into qualitatively different or lower levels of a mathematics course and, in some cases, puts students into terminal mathematics course pathways that are not mathematically meaningful and do not prepare them for any continued study of fundamental mathematical concepts. Too often, as Stiff and Johnson (2011) attest, placement into different tracks is based on a variety of nonacademic factors, such as perceived (but not potential) academic ability, race, socioeconomic status, gender, language, or other expectations ascribed to students by adults.

Student tracking in mathematics instruction in the United States is a significant issue. Tracking that puts students into qualitatively different course pathways, where some students have access to mathematics instruction that prepares them for postsecondary education opportunities and others do not, reinforces the misguided notion that only some people are capable of achieving in mathematics (Boaler 2011). A generation ago, Oakes (1985) documented the negative consequences to middle and high school students placed in the "low" track. Despite the known negative consequences, research indicates that too often students from marginalized groups continue to be tracked in ways that offer them less access to highly qualified mathematics teachers and less access to college preparatory pathways in mathematics (Nasir 2016). A recent report from the Organisation for Economic Co-operation and Development (OECD) found that more than 70 percent of students internationally attend schools where the principal reports that students are grouped by "ability" for mathematics instruction (OECD 2016a). A report from the Brown Center on American Education that examined data covering two decades found that, beginning in eighth grade, three-fourths of students in the United States were tracked in mathematics courses (Loveless 2013).

The learning opportunities provided to students in different levels, or tracks, is often substantially different. Students in the privileged "top" track typically experience mathematics instruction that cultivates their mathematical identities, conceptual understanding, and critical problem-solving and thinking skills. Students placed in the "low" track tend to focus on rote procedures, with instruction devoting little or no attention to developing their understanding or their belief that mathematics is something that they can do (Boaler, Wiliam, and Brown 2000; Oakes 1985). As a result, students in the "low" track do not receive the high-quality mathematics education that they deserve. The replication of this experience year after year has long-term negative effects on students' learning outcomes and their mathematical identities (Stiff and Johnson 2011).

Flores (2007) argues that these low expectations all too often become selffulfilling prophecies. Once students are placed in a low track, moving out of that track is very difficult (Stiff and Johnson 2011). Tracking students into weak, low-quality, and dead-end course pathways creates a gap that widens as it puts students further and further behind in the curriculum, leading to what is commonly referred to as the "achievement gap." This gap is more accurately labeled as an opportunity gap, since it is largely manufactured in schools by practices that place students into low-level courses and dead-end learning pathways, often with less effective instruction (Flores 2007). The placement of students in instructionally, qualitatively different, and dead-end course pathways is essentially "educide," since it severely limits, and all too often ends, students' opportunities in mathematics and mathematics-related careers. In recent years, many high schools, at least on paper, have done away with traditional three-level sorting (gifted and talented, regular, and lower level). One continued variant of tracking sorts students into one- or two-year versions of the same course. Students in the two-year version are essentially denied the opportunity to learn as much mathematics as their peers who are placed in the one-year course (American Educational Research Association 2006). In other forms of differential levels, some schools may label courses "algebra" or "algebra 2," although they are in no way rigorous enough to merit these course titles. Different groups of students are then tracked into these different versions (or levels) of algebra (Stein et al. 2011). The evidence suggests that students placed into less rigorous versions of algebra ultimately have lower achievement in mathematics, even if their performance in the less rigorous version of the course is stronger than that of students in more rigorous versions (Tyson and Roksa 2017). The result of these placement practices is the same: inequitable learning outcomes.

The research is unequivocal: the mathematics experience of students placed in a track (or level of a course) with less access to rigorous curriculum and high-quality instruction is qualitatively different from the mathematics experience of students not placed in such tracks (Oakes et al. 1990; Schmidt 2009; Schmidt, Cogan, and McKnight 2010/2011; Stiff and Johnson 2011; Tate and Rousseau 2002). Furthermore, this difference has long-term negative effects on achievement and affective outcomes for the students in tracks with less access to rigorous and high-quality instruction, and ultimately it exacerbates learning differentials.

De-tracking and eliminating low-level courses in high school mathematics can be one of the most challenging policy changes to enact because having different levels is essentially the default method for organizing mathematics in high school (Oakes 2008)—so much so that in many places it can be considered part of a "culture of exclusion" in mathematics education that largely goes unnoticed, even by teachers who are committed to equity (Louie 2017). Despite this reality, ample evidence indicates that de-tracking leads to success for more students (Boaler 2002; Boaler and Staples 2014: Burris and Weiner 2005: Strutchens, Quander, and Gutiérrez 2011). Despite the challenge, some school districts, such as those in San Francisco and Oakland, California, have developed specific plans to de-track secondary mathematics and create pathways through the secondary mathematics curriculum to better serve the needs of each and every student (Daro 2014). Evidence suggests that successfully de-tracked high school mathematics programs share, among other factors, two important characteristics: (1) connections and meaning in mathematics are emphasized by teachers, and (2) curricula are focused on key mathematical ideas (Horn 2006). Implementing a high school mathematics curriculum focused on the Essential Concepts and approaching those Essential Concepts with rigor and equitable instructional practices, as recommended in Catalyzing Change, can

increase the likelihood of successfully de-tracking and eliminating low levels of traditional high school mathematics courses while simultaneously fostering students' development of deeper understanding of mathematics.

Catalyzing Change recommends that students enroll in meaningful mathematics courses in all four years that they are in high school, specifically in courses that do not limit their ability to continue studying mathematics but expand their professional opportunities, equip them to understand and critique the world, and foster in them joy and an appreciation for the beauty of mathematics. By enrolling in such mathematics courses in every year of high school, students will have opportunities to explore important mathematics in high school beyond the Essential Concepts and will not experience a gap in their mathematics learning. A one- or two-year gap in high school mathematics enrollment can make reengaging in the learning of mathematics challenging for students whose educational and professional plans change after high school, and they find that they need more mathematics. Evidence suggests that students with four years of high school mathematics score significantly higher on college entrance exams and require less remediation in college (Achieve 2013). Furthermore, even if high school students do not immediately pursue postsecondary courses, mathematics that builds on the shared foundation of the Essential Concepts provides them with important knowledge and skills, not only for different careers but also for their personal lives.

Supporting Student Success in High School Mathematics

Rigorous K–8 mathematics standards, such as the Common Core State Standards for Mathematics (NGA Center and CCSSO 2010a) or their equivalent, coupled with research-informed effective teaching practices (Boston et al. 2017; NCTM 2014), can help ensure that students who are entering high school have the mathematics foundation necessary to succeed in the Essential Concepts beginning in ninth grade. However, although there has been significant progress overall in mathematics learning in kindergarten through grade 8 over the last thirty years (NCES 2015), it would be naïve to assume that every student who enters high school has had the mathematical experiences necessary for immediate success. The reasons for this are numerous, but one reason is the existence of K–8 systemic structures that prevent students from acquiring the necessary mathematical foundation.

One such barrier includes student tracking at the K–8 level. Although tracking becomes more obvious in high school, it is not just a high school concern (Flores 2008). Tracking frequently starts much earlier in K–12 education and often becomes visible only when students reach middle school. Loveless (2013) reported that in 2011 nearly two-thirds of fourth-grade teachers reported using "ability grouping" in mathematics instruction. All too often the practice of tracking begins in the primary grades (Akom 2011). For example, in some elementary schools where there are three first-grade teachers, students are rank-ordered at the end of kindergarten and divided into three groups, with one first-grade teacher receiving the "highest-achieving" one-third of the students, the second teacher receiving the middle one-third, and the third teacher receiving the final one-third. Such practices do a significant and long-term disservice to students.

A second obstacle is the traditional way in which many elementary- and middlelevel math interventions are structured. If interventions in mathematics exist at these levels, they frequently remove students from the grade-level curriculum. Although this practice may support students in acquiring skills and concepts that they previously missed, students may continue to fall behind in the grade-level curriculum if they are removed from it, and they are unlikely to be fully prepared to enter a common shared pathway in high school without additional support.

Effective interventions recognize that not all students learn at the same pace and provide *additional instructional time* instead of removing students from gradelevel instruction (Baker, Gersten, and Lee 2002)—or requiring low-level prerequisite courses in college (Complete College America 2016). This additional time often takes the form of a second period of mathematics instruction at the secondary level or a co-requisite college mathematics course in two- or four-year colleges. To maximize effectiveness, this additional time should be fluid, provide students with multiple opportunities to demonstrate their learning, and allow students to enter and leave as needed. The need for additional time should be determined by the results of frequent classroom-based formative assessments (Larson and Andrews 2015). Additional targeted instructional time is a support strategy that has demonstrated the potential to more than double success in college gateway mathematics courses (Complete College America 2016) and is used by several high-performing countries (Barber and Mourshed 2007; OECD 2011).

Effective targeted instructional support should be focused on content that is connected with and promotes the grade-level curriculum (Balfanz, MacIver, and Byrnes 2006; Burris, Heubert, and Levin 2006) and should not simply be a review of low-level procedural skills. Some education researchers have recommended this type of additional instructional time, with students receiving tailored instruction during one period to support success in their core mathematics course, as an effective strategy to support English language learners (Thompson 2017).

Additional supports are needed when students enter high school without having had an opportunity to experience a mathematics education that prepares them to participate in the high school mathematics curriculum. Many of the strategies mentioned above can be employed effectively in grades 9–12 as well. At the high school level, double-period versions of courses in a pathway can also be an effective approach to supporting students who may experience extraordinary challenge with the content. For example, in the first period of a double-period version of a course, students may receive just-in-time support on prerequisites or a preview of key



NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

Closing the Opportunity Gap in Mathematics Education

A Position of the National Council of Teachers of Mathematics

Question: How can we address differentials in access to high-quality teachers, instructional opportunities, and expectations in mathematics education?

NCTM Position

All students should have the opportunity to receive high-quality mathematics instruction, learn challenging grade-level content, and receive the support necessary to be successful. Much of what has been typically referred to as the "achievement gap" in mathematics is a function of differential instructional opportunities. Differential access to high-quality teachers, instructional opportunities to learn high-quality mathematics, opportunities to learn grade-level mathematics content, and high expectations for mathematics achievement are the main contributors to differential learning outcomes among individuals and groups of students.

Opportunity to learn remains one of the best predictors of student learning (NRC, 2001). Differentials in learning outcomes therefore are not a result of inclusion in any demographic group, but rather are significantly a function of disparities in opportunities that different groups of learners have with respect to access to grade-level (or more advanced) curriculum, teacher expectations for students and beliefs about their potential for success, exposure to effective or culturally relevant instructional strategies, and the instructional supports provided for students (Flores, 2007).

High-quality mathematics education is not just for those who want to study mathematics and science in college—it is required for many postsecondary education programs and careers (Achieve, 2005; ACT, 2006; National Science Board, 2008). Too many students—especially those who are poor, nonnative speakers of English, disabled, or members of racial or ethnic minority groups—are victims of low expectations for achievement in mathematics. For example, traditional tracking practices have consistently disadvantaged groups of students by relegating them to low-level mathematics classes, where they repeat work with computational procedures year after year, fall further and further behind their peers in grade-level courses, and are not exposed to significant mathematical substance or the types of cognitively demanding tasks that lead to higher achievement (Boaler, Wiliam, & Brown, 2000; Schmidt, Cogan, Houang, & McKnight, 2011; Stiff, Johnson, & Akos, 2011; Tate & Rousseau, 2002).

Wide variation in performance among U.S. schools serving similar students indicates that existing learning differentials can be closed and that demographic factors are not destiny when students receive high-quality instruction and the necessary support to learn gradelevel content (McKinsey & Company, 2009). The National Council of Teachers of Mathematics outlines a vision for high-quality mathematics instruction in *Principles and Standards for School Mathematics* (NCTM 2000) and *Mathematics Teaching Today: Improving Practice, Improving Student Learning* (NCTM 2007). Research indicates that

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all students can learn mathematics when they have access to high-quality mathematics instruction and are given sufficient time and support to master a challenging curriculum (Burris, Heubert, & Levin, 2006; Campbell, 1995; Education Trust, 2005; Griffin, Case, & Siegler, 1994; Knapp et al., 1995; Silver & Stein, 1996; Slavin & Lake, 2008; Usiskin, 2007). "Equity does not mean that every student should receive identical instruction; instead, it demands that reasonable and appropriate accommodations be made as needed to promote access and attainment for all students" (NCTM 2000, p. 12).

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NCTM Mathematics Teaching Practices

Mathematics Teaching Practices

Establish mathematics goals to focus learning. Effective teaching of mathematics establishes clear goals for the mathematics that students are learning, situates goals within learning progressions, and uses the goals to guide instructional decisions.

Implement tasks that promote reasoning and problem solving. Effective teaching of mathematics engages students in solving and discussing tasks that promote mathematical reasoning and problem solving and allow multiple entry points and varied solution strategies.

Use and connect mathematical representations. Effective teaching of mathematics engages students in making connections among mathematical representations to deepen understanding of mathematics concepts and procedures and as tools for problem solving.

Facilitate meaningful mathematical discourse. Effective teaching of mathematics facilitates discourse among students to build shared understanding of mathematical ideas by analyzing and comparing student approaches and arguments.

Pose purposeful questions. Effective teaching of mathematics uses purposeful questions to assess and advance students' reasoning and sense making about important mathematical ideas and relationships.

Build procedural fluency from conceptual understanding. Effective teaching of mathematics builds fluency with procedures on a foundation of conceptual understanding so that students, over time, become skillful in using procedures flexibly as they solve contextual and mathematical problems.

Support productive struggle in learning mathematics. Effective teaching of mathematics consistently provides students, individually and collectively, with opportunities and supports to engage in productive struggle as they grapple with mathematical ideas and relationships.

Elicit and use evidence of student thinking. Effective teaching of mathematics uses evidence of student thinking to assess progress toward mathematical understanding and to adjust instruction continually in ways that support and extend learning.

NCTM Principles to Actions, Ensuring Mathematical Success for All (2014)