Cambridge Public Schools

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# Update to School Committee on CPS Mathematics Initiatives

## January 9, 2015

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The Cambridge Public Schools' Department of Science, Technology, Engineering and Math launched three large initiatives in the 2014-2015 school year:

- The roll out of Math in Focus in all elementary and upper schools
- The implementation of the Accelerated Math Pathway (referred to as the AMP) in grades seven and eight at all upper schools and Amigos
- The start of a summer "bridge" and support program for rising seventh and eighth graders which covers one half year of eighth grade math to students entering the 8th grade AMP class

This report aims to highlight the accomplishments and challenges in implementing these three initiatives as well as the departments' next steps.

*Initiative 1: Roll out of Math in Focus*

Implementation:

In SY 2013-2014 the math department entered Phase 2 Develop/Pilot of the Curriculum Review Cycle. During this phase, forty-four teachers piloted the Math in Focus Program in their classrooms. At least one classroom at each grade level was represented in the pilot and 13 schools participated.

This school year, 2014-2015, the math department moved into Phase 3 Implementation/Monitoring with the roll out of Math in Focus district-wide. This phase is guided by the following questions:

- Are we teaching the intended curriculum as it was designed?
- Are we making progress towards our desired results?
- Are students with disabilities accessing the curriculum successfully?
- What is the instructional core? How do changes in curriculum materials affect the core?
- What kinds of coaching do teachers need to implement the curriculum and improve instruction?
- What "problems of practice" are emerging based on formative and summative assessment data?

The roll out of MiF in 2014-2015 consisted of district wide implementation in grades 1, 4, 5, 6, 7, and 8. Some schools, by choice, have implemented in grades 2 and 3 (Amigos, Cambridgeport, Graham and Parks, Kennedy-Longfellow, King Open and King in 2nd and 3rd, Baldwin in 3rd). To ensure fidelity of implementation and ensure a focus on mathematics, all schools this year have included a math goal as part of their School Improvement Process. By 2015-2016, all students in grades Kindergarten through Eighth grade will be using Math in Focus in their classrooms. Chart 1 shows the original Math in

Focus implementation schedule proposed last year. Schools marked "Math in Focus Pilot Classroom," piloted the program during the 2013-2014 school year and are continuing their implementation this year.

***2014-2015 Math Implementation***

| | Kindergarten | Grade 1 | Grade 2 | Grade 3 | Grade 4 | Grade 5 |
|---|---|---|---|---|---|---|
| **Amigos** | | | | | | |
| **Baldwin** | | | | | | |
| **Cambridgeport** | | | | | | |
| **FMA** | | | | | | |
| **G & P** | | | | | | |
| **Haggerty** | | | | | | |
| **K-Lo** | | | | | | |
| **King Open** | | | | | | |
| **M. L. King Jr.** | | | | | | |
| **Morse** | | | | | | |
| **Peabody** | | | | | | |

= Math in Focus Implementation
= Math in Focus Pilot Classroom
= MKEA Assessment Implementation

Chart 1: District Developed Roll out Schedule of Math in Focus at the Elementary Level.

The implementation of MIF has included three full days of required professional development (one day in either June or August, one day in September and one day in November.) These days were facilitated by trainers from Houghton Mifflin Harcourt and developed in collaboration with CPS staff. Based on teacher feedback from the first two sessions, the third training included demonstration lessons by the Houghton Mifflin Harcourt staff at grades 1, 3, 4, 5, 6 and 8. In addition, an after school drop in technology support session was offered for 90 minutes, facilitated by the Houghton Mifflin Harcourt trainers. In the fall, almost all staff members implementing Math in Focus for the first time were able to participate in the all day professional development. Houghton Mifflin Harcourt also facilitated a half-day professional development experience for administrators in August; all principals with schools implementing Math in Focus attended and were provided training to support their understanding of the philosophical approach of Math in Focus. Administrators were provided tools to assist them in supporting teachers at their schools.

In addition, teachers had the option of signing up for 12 hours of optional after school professional development facilitated by CPS math coaches and in one case co-facilitated by a 4$^{th}$ grade teacher who had piloted Math in Focus during the 2013-2014 school year. The professional development is grouped into three different sections, one for first and second grade teachers, one for third, fourth and fifth grade teachers and one for middle school teachers. Chart 2 outlines the number of teachers enrolled in the district sponsored professional development at each grade level.

| Grade Level | Number of Teachers Enrolled |
|---|---|
| 1st | 14 |
| 2nd | 3 |
| 3rd | 6 |
| 4th | 12 |
| 5th | 11 |
| 6th-8th | 10 |
| | |
| Total | 56 |

Chart 2: Teachers Enrolled in District Sponsored Math in Focus Professional Development

District staff and building based instructional coaches worked to select Transfer Tasks for all grade levels to implement district wide in October/November. These baseline tasks were used to develop rubrics that can be used consistently at the K-5 and 6-8 levels to evaluate students' abilities to transfer their mathematical knowledge to new and novel situations. Moving forward, the district assessments will be modified to include at least one Transfer Task.

Anecdotal data received from teachers have included feedback that they have "faith" that Math in Focus and the new curriculum maps are well aligned with the Common Core Standards. Coaches have indicated that coach-teacher conversations are even more closely aligned with the Standards. The district has heard over and over again that teachers feel supported because they now have a comprehensive set of resources to meet and exceed the rigor of the Common Core. The access to online materials from previous grade levels as well as re-teach and extension resources is helping teachers differentiate their instruction.

The transition to Math in Focus has not been without bumps, but as teachers develop experience with the tool, they find that it strikes a good balance between conceptual understanding, procedural understanding, and application of knowledge in new and unfamiliar situations. Teachers are also reporting that the grade band professional development the district is offering has allowed them to collaborate and plan across schools, while deepening their understanding of how to use Math in Focus more effectively to meet the Common Core standards and increase student achievement.

Even though the number of resources Math in Focus provides teachers has proven to be a strength of the program, early in the implementation teachers were finding it

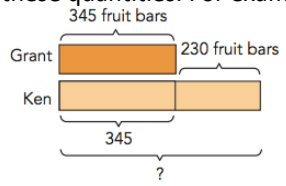
challenging to determine when to use which resources and then matching those resources to the needs of students. The structure of a Math in Focus lesson is different from what the teachers have been used to. Teachers and administrators are still trying to familiarize themselves with this structure. As with the roll out of any new program, teachers have struggled to maintain pace in order to ensure Common Core standards are met, in addition to digging deep into the content. One reason, for example, is that teachers have had to backfill skills for students in upper elementary and middle school grades for those students who are newly introduced to MiF. This has slowed down the pace of instruction. For example, at the seventh grade level most students have had no exposure to bar modeling,* so teachers have had to devote time to teaching a skill that students would have normally learned earlier in the Math in Focus program. Coaches are attending to these challenges during planning sessions and supporting teachers making decisions based on students' needs.

Data Analysis:

Research from Herold, Fedor & Fullen describes what is commonly referred to in literature as "the Implementation Dip" that often results after any type of change. Often when a major change in curriculum occurs, the expectation is that there will be immediate gains when such a change as curriculum or instructional strategies is introduced. Fullen defined this dip in his 2001 book Leading in a Culture of Change as, "… a dip in performance and confidence as one encounters an innovation that requires new skills and new understandings (p. 40)." Martin et al., discuss the Implementation Dip in their 2014 publication, Handbook of Professional Development in Education: Successful Models and Practices, PreK-12. They remind us that, "teacher and student performance can get worse before it gets better," and "dips in implementation (and in standardized test scores as a result) can be catastrophic for schools and districts because such dips are often used as reasons to abandon the reform before it has had a chance to take hold (472)." This research supported the STEM Department's hypothesis that district assessment scores were likely to drop as Math in Focus was implemented.

In order to analyze this year's data, specific questions (i.e. item analysis), rather than overall scores, were assessed. Questions that were in common between the 2013 and 2014 school years were analyzed to look for patterns of improvement, or dips that may have occurred. It is important to note that classrooms that piloted Math in Focus during the 2013-2014 school year did not administer the District Assessments and therefore at some grade levels (most notably 8th grade where two schools piloted) there is a lack of

* Bar modeling is defined as a method that has students draw diagrams in the form of bars to represent know and unknown quantities as well as the relationship between these quantities. For example:




(from Singapore Math: A Visual Approach to Word Problems)

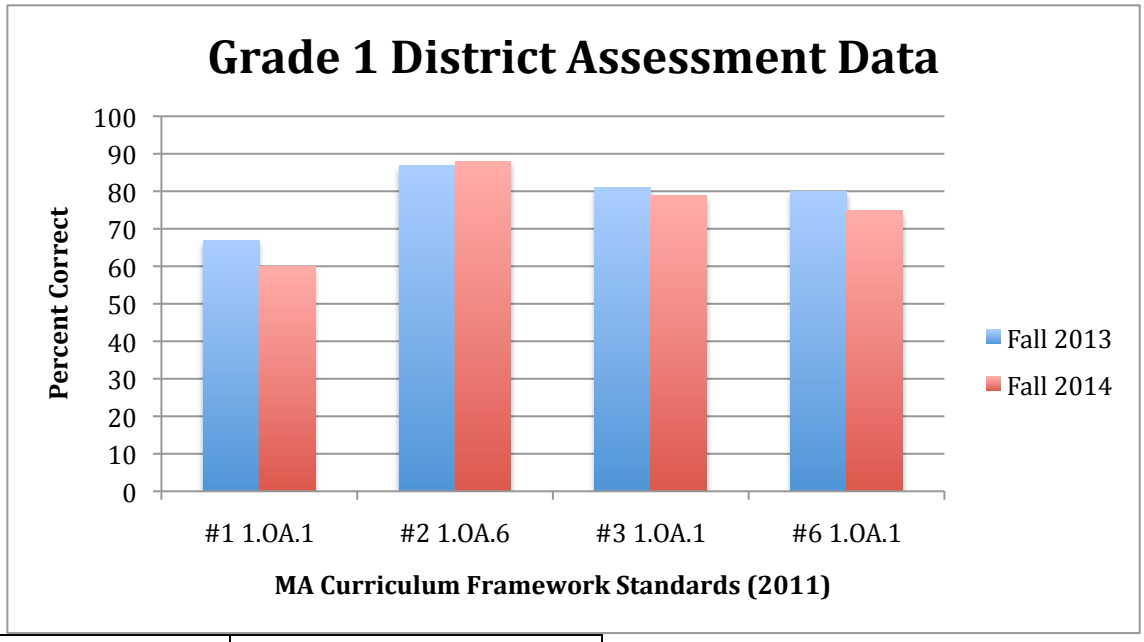
2013 data available for comparison. We were therefore unable to determine if teacher scores improved in year two of using Math in Focus. District Assessments were modified between the 2013 and 2014 school years to correlate with the pace of Math In Focus, and even though overall questions did not change more than 20%, at some grade levels (again, most notably at 8th grade) the majority of the change happened on the fall assessment.

Currently, the math department does not have common assessments at the unit level that are diagnostic in nature, and can be used to evaluate the implementation of the curriculum. Moving forward, a plan will be developed that brings teacher teams together to develop common unit assessments that will be administered more frequently and more targeted to the content covered in the unit.

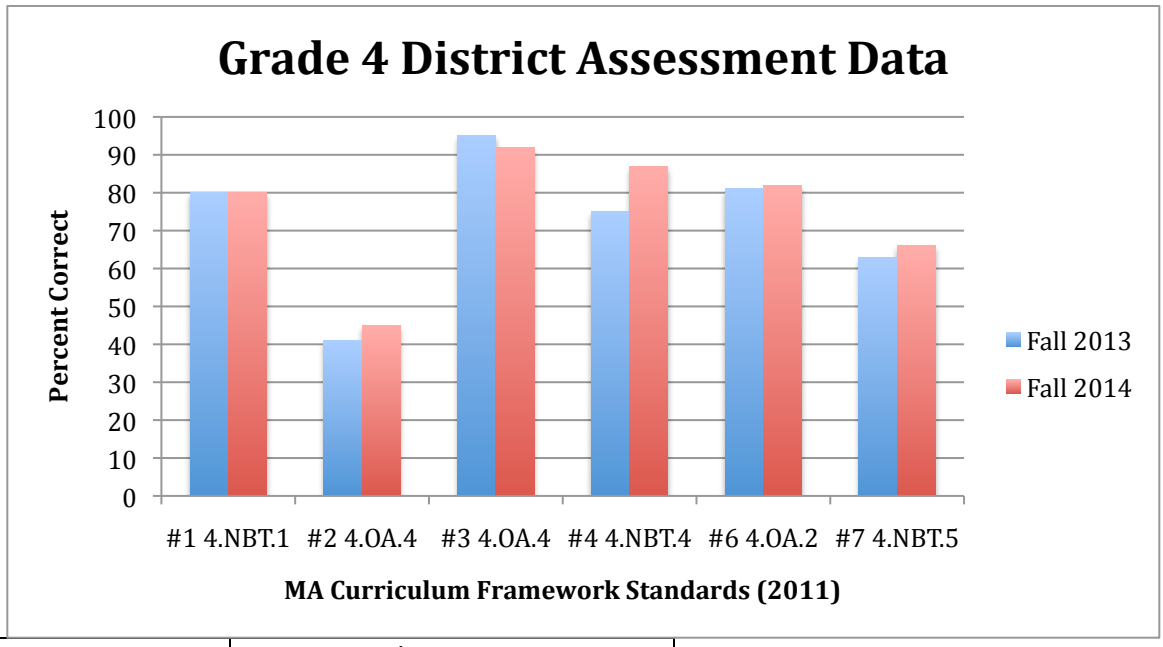
In the graphs that follow, each graph has the question number and actual standard of the Massachusetts Curriculum Framework (2011) on the X-axis and the percent of students that answered the question correctly on the Y-axis. Below each graph is a chart linking the question to the mathematical topic covered.

- *Elementary:*
  Implementation of Math in Focus occurred in all twelve schools at grades one, four and five this year. Given our understanding of the research around "Implementation Dips," we anticipated that student proficiency would drop between 2013 and 2014 district wide in those grades. To our surprise student scores were up on many questions and any dips that we witnessed were small.

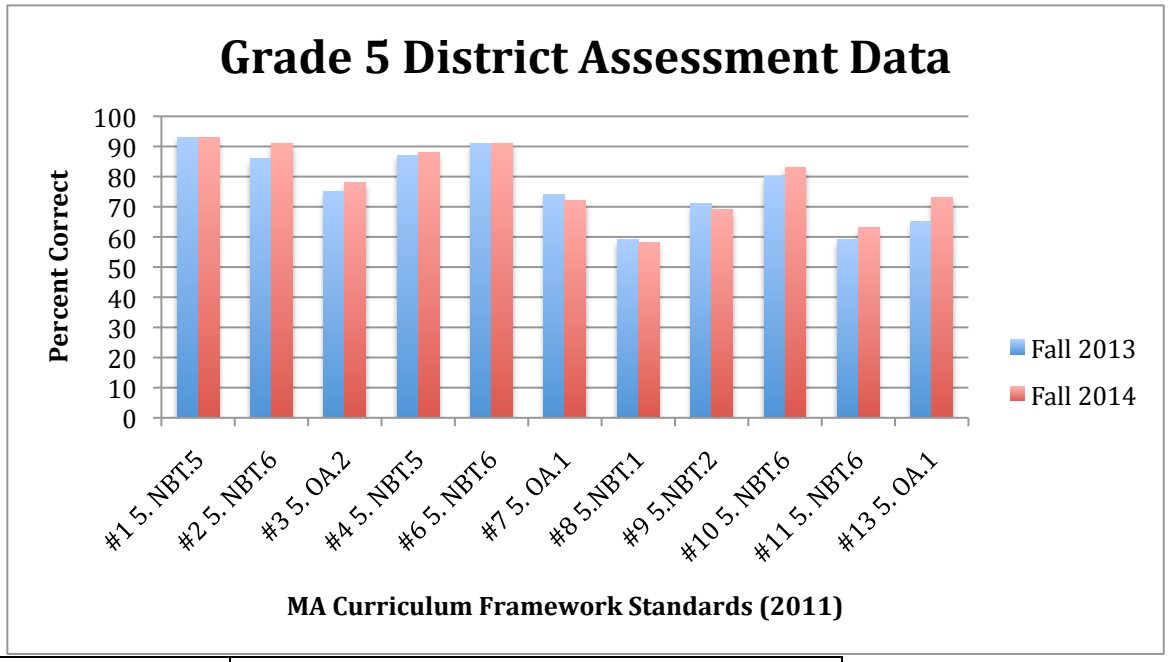
  At the first grade level, there were four questions in common between 2013 and 2014 and percent correct dropped slightly on three questions and improved on the fourth. At the fourth grade level six questions were in common between the two years compared and student scores stayed the same or went up on five out of the six questions. Finally, at grade five 11 questions were consistent between 2013 and 2014. Student scores stayed the same or improved on eight of the 11 questions.




| | |
|---|---|
| Question #1 | Addition word problem |
| Question #2 | Addition computation |
| Question #3 | Addition word problem |
| Question #6 | Addition word problem |

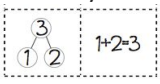


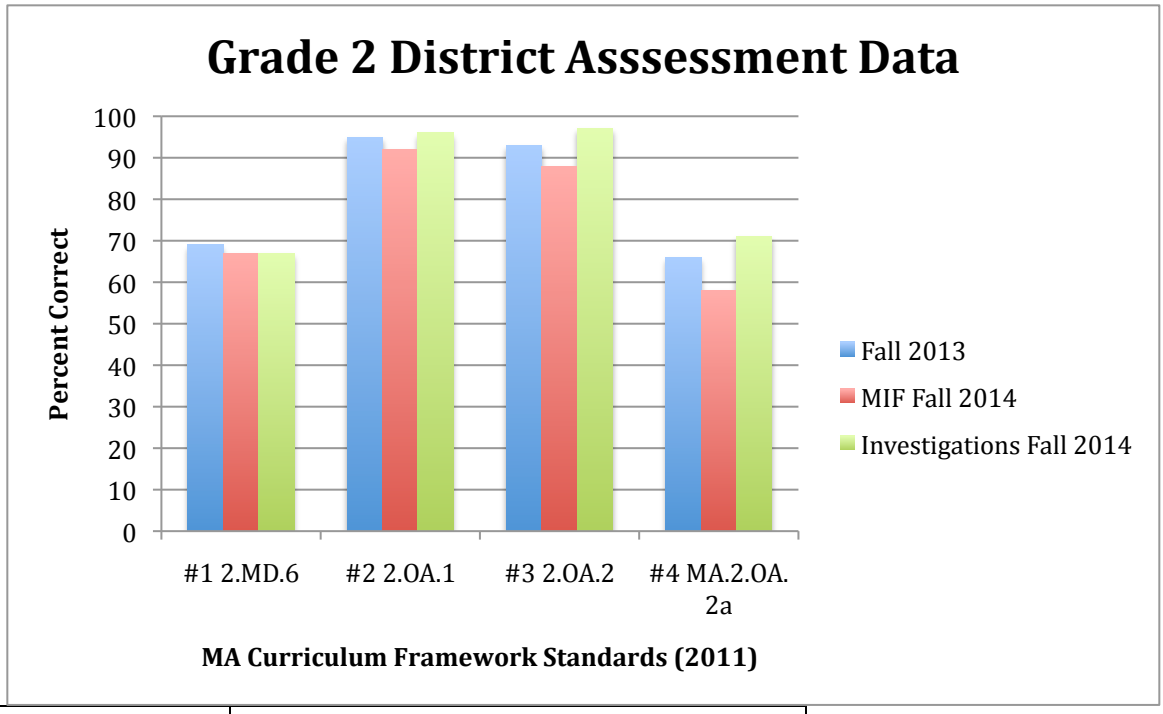

| | |
|---|---|
| Question #1 | Place value/multiplication |
| Question #2 | Prime numbers |
| Question #3 | Factors |
| Question #4 | Addition word problem |
| Question #6 | Multiplication word problem |
| Question #7 | Multiplication word problem |




| | |
|---|---|
| Question #1 | Multiplication word problem |
| Question #2 | Division word problem |
| Question #3 | Write a simple expression |
| Question #4 | Multiplication word problem |
| Question #6 | Inverse operations multiplication/division |
| Question #7 | Use of parenthesis in an expression |
| Question #8 | Place value with decimals |
| Question #9 | Exponents - powers of ten |
| Question #10 | Place value whole numbers |
| Question #11 | Division word problem |
| Question #13 | Evaluating expressions with parenthesis |

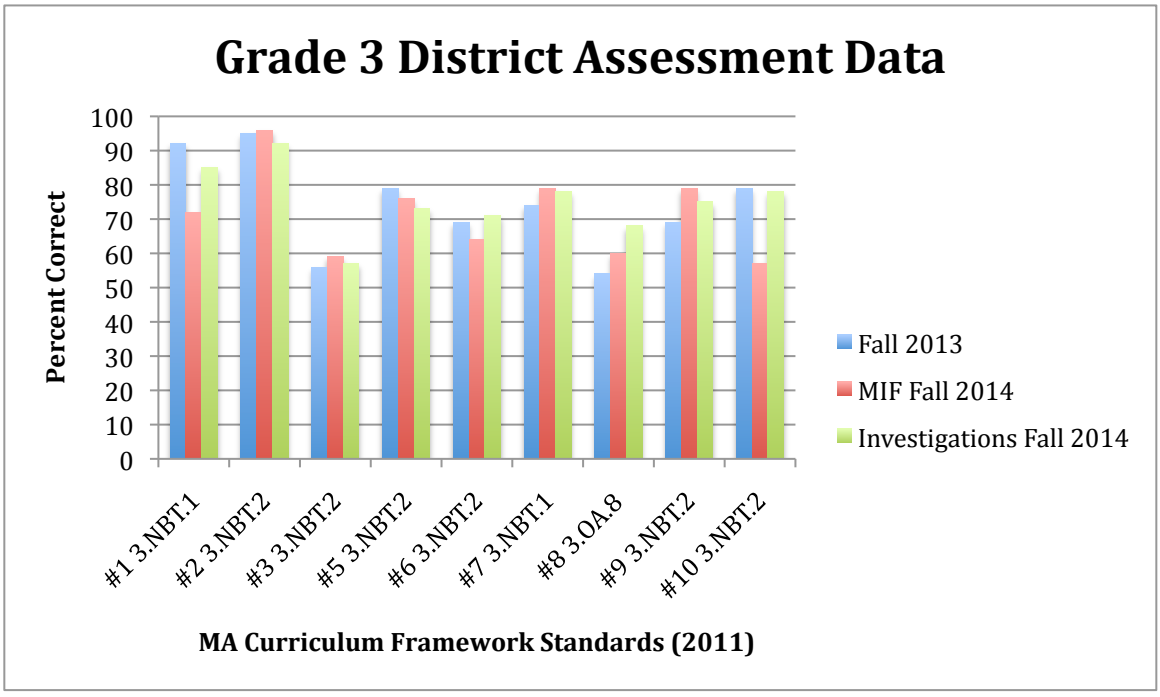
The data at second and third grade, where all schools have not fully transitioned to Math in Focus is slightly more complex and less consistent. At second grade, classrooms that are have fully transitioned to Math in Focus did show the anticipated Implementation Dip while classrooms still using Investigations performed slightly better on most questions. It is important to note that most classrooms still using Investigations have begun implementing the components of Math in Focus, such as bar modeling or number bonds* that the individual teachers are most comfortable with.

* Number bonds are pictorial representations the part-part-whole relationships. Number bonds consist of a minimum of 3 circles that are connected by lines. The "whole" is written in the first circle and its "parts" are written in the adjoining circles. 




| | |
|---|---|
| Question #1 | Representing addition on a number line |
| Question #2 | Addition word problem |
| Question #3 | Addition word problem |
| Question #4 | Subtraction computation |

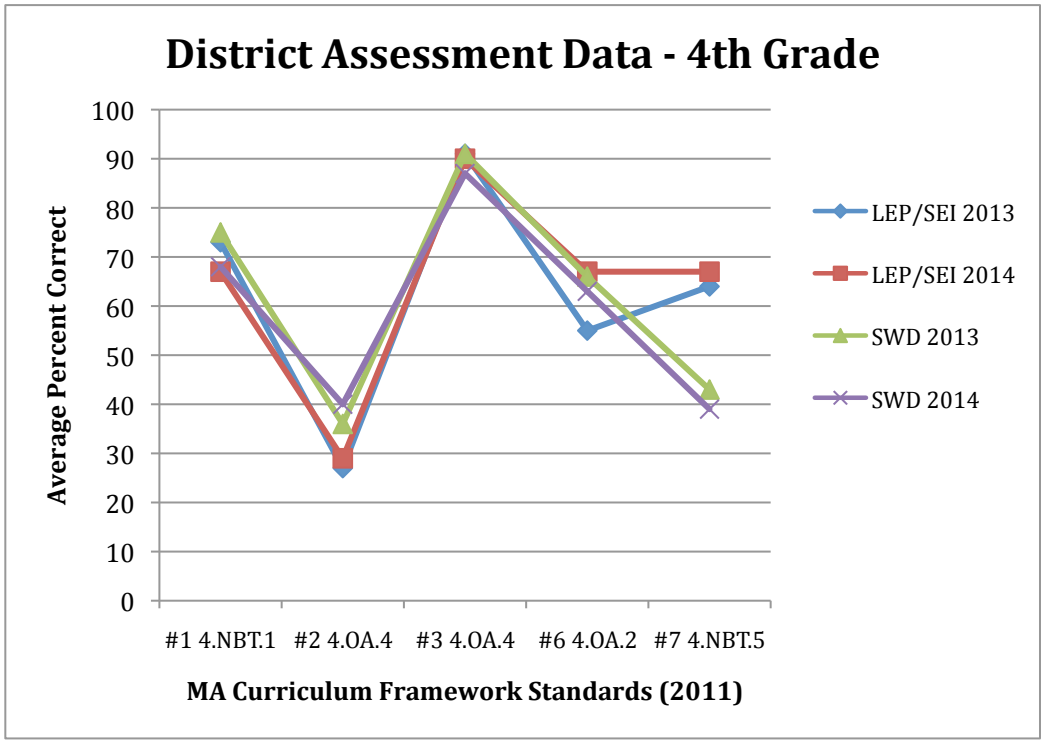
At third grade, in Fall 2014, classrooms implementing Math in Focus out performed classrooms in Fall 2013 and/or classrooms still using Investigations as the primary resource on half of the questions.



| | |
|---|---|
| Question #1 | Round whole number |
| Question #2 | Subtraction word problem |
| Question #3 | Addition with 3 numbers |
| Question #5 | Addition with 3 numbers |
| Question #6 | Subtraction word problem |
| Question #7 | Round whole number |
| Question #8 | Commutative property with addition |
| Question #9 | Estimate with addition/word problem |
| Question #10 | Multi-step word problem |

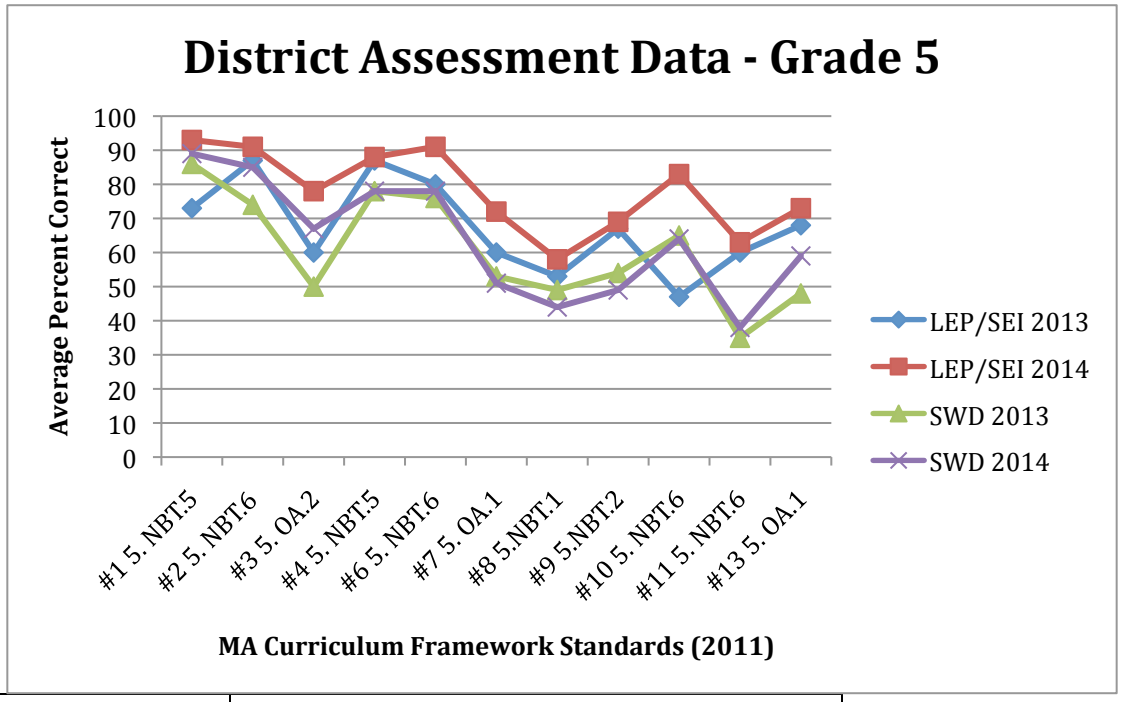
One of the goals of the new Curriculum Review Cycle is to develop curriculum that better meets the needs of students with disabilities (SWD) and LEP/SEI (Limited English Proficiency/Sheltered English Immersion) students. In order to analyze any early signs of Math in Focus impact on these populations, Fall 2013 and Fall 2014 data was compared. District data is most complete at grades 4 and 5 and therefore is presented below.

At the fourth grade level the pattern of strengths and weaknesses for Students with Disabilities and those with Limited English Proficiency are very similar, except when multiplication in world problems is assessed. Between 2013 and 2014 minimal growth was evident in LEP/SEI populations and the SWD data appears flat and is showing a slight dip on some questions.



| | |
|---|---|
| Question #1 | Place value/multiplication |
| Question #2 | Prime numbers |
| Question #3 | Factors |
| Question #6 | Multiplication word problem |
| Question #7 | Multiplication word problem |

At the fifth grade level, scores for students of Limited English Proficiency or in the Sheltered English immersion program improved across almost all questions. Students with Disabilities performed better than in 2013 on half the questions. At both fourth and fifth grade, the overall pattern of proficiency is the same for both the SWD and LEP/SEI subgroups.

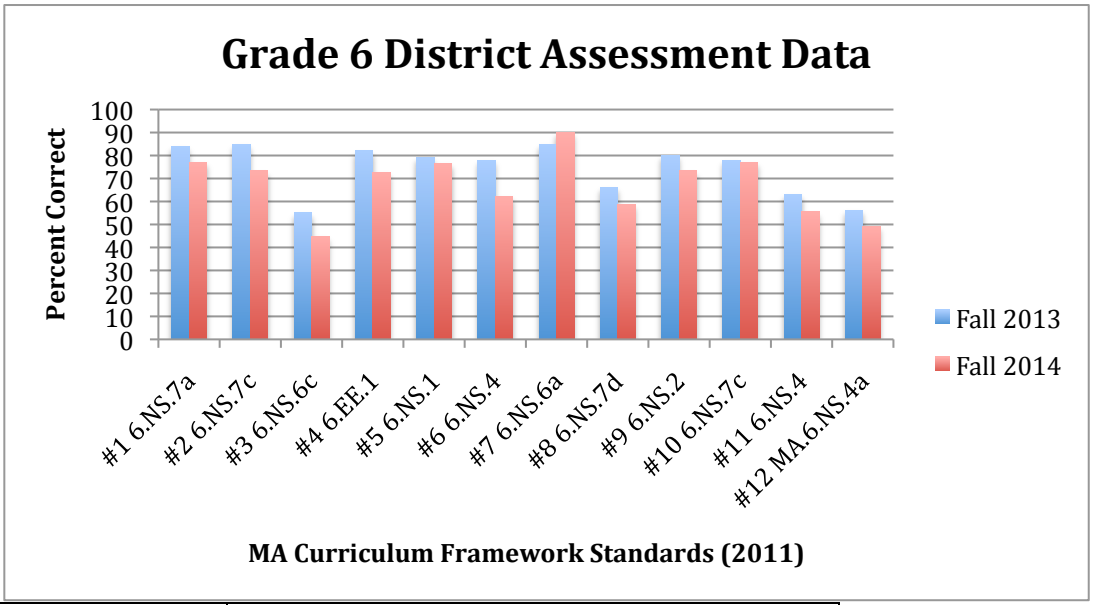



| | |
|---|---|
| Question #1 | Multiplication word problem |
| Question #2 | Division word problem |
| Question #3 | Write a simple expression |
| Question #4 | Multiplication word problem |
| Question #6 | Inverse operations multiplication/division |
| Question #7 | Use of parenthesis in an expression |
| Question #8 | Place value with decimals |
| Question #9 | Exponents - powers of ten |
| Question #10 | Place value whole numbers |
| Question #11 | Division word problem |
| Question #13 | Evaluating expressions with parenthesis |

In summary, students in elementary classrooms using Math in Focus are performing as well on the District Assessment in the fall of 2014 as in the fall of 2013. Although early in the year, preliminary data indicates students are more proficient on many standards this year as compared with last year. No dip in performance is evident in year one of implementation of the Math in Focus program. Students with Disabilities, with Limited English Proficiency, or in the Sheltered English Immersion Program continue to underperform as compared to the standards. In response to this, the Bi-lingual department has established a data inquiry and intervention cycle to address these deficits utilizing common formative assessment. Student Services is also investigating root causes to determine the reasons for the lack of student achievement for Students with Disabilities.

- *Upper Schools*:
  At the sixth and seventh grade levels, the "Implementation Dip" continues to be evident, however less than what was expected based on the research of Fullen (2001) and Herold & Fedor (2008).

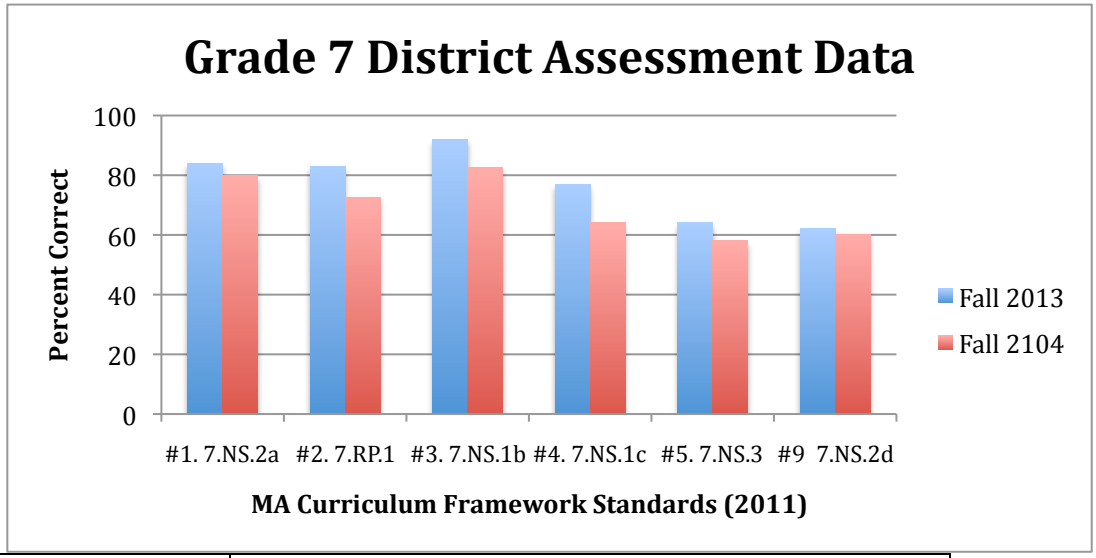
  As the graph below shows, there are 12 questions in common between the 2013 and 2014 district assessment at grade six. Two of the questions, number two and number five, were administered in the winter last year. Although there is a slight dip on most questions, the fact that students are performing almost as well three months earlier on two questions and within the expected dips due to the new implementation, is encouraging.




| Question #1 | Inequality |
|---|---|

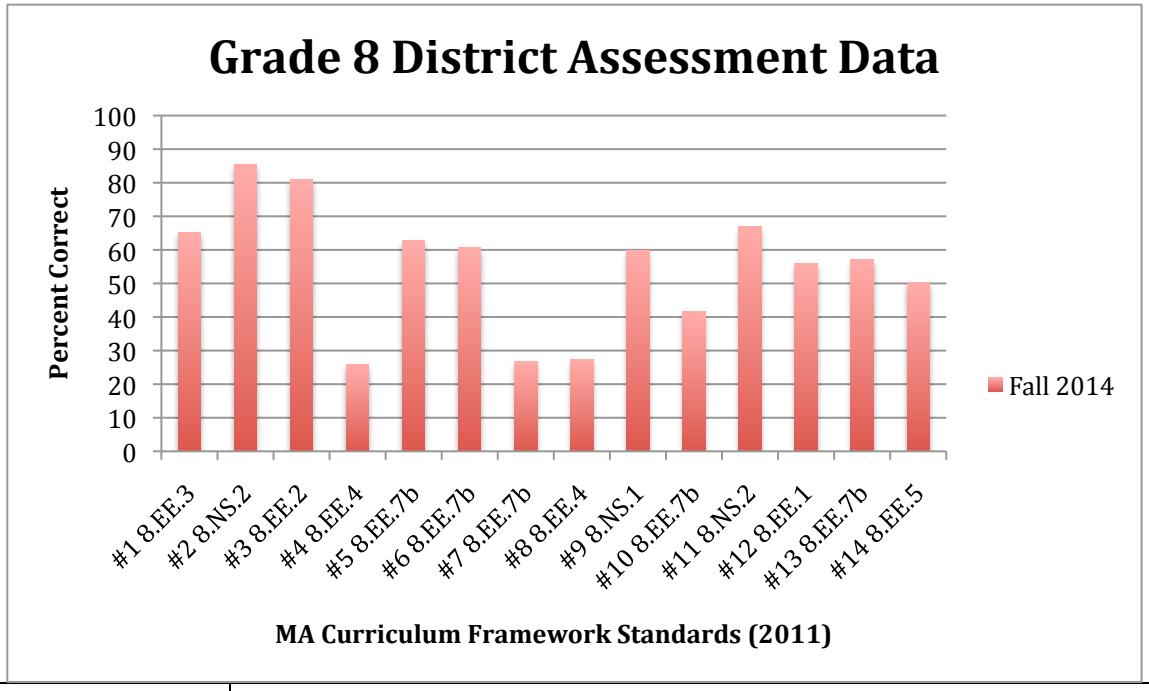
| | |
|---|---|
| Question #2 | Absolute value on number line |
| Question #3 | Order decimals on number line |
| Question #4 | Exponents |
| Question #5 | Division of fractions |
| Question #6 | Least common multiple |
| Question #7 | Negative numbers on number line |
| Question #8 | Absolute value word problem |
| Question #9 | Division of 3-digit number by 2-digit number |
| Question #10 | Absolute value on number line |
| Question #11 | Greatest common factor |
| Question #12 | Greatest common factor (open response) |

At seventh grade there were eight questions in common between the 2013 and 2014 exams, but questions one, four and five were administered in the winter last year and questions six and seven were given in the spring. Student performance did dip on all questions, though only slightly. However, it is important to point out that the questions being given on the fall assessment show students are being exposed and expected to demonstrate mastery of more rigorous concepts earlier in the year.




| | |
|---|---|
| Question #1 | Multiplying with positive and negative numbers |
| Question #2 | Word problem with rations |
| Question #3 | Solving equations |
| Question #4 | Simplifying expression based on number line |
| Question #5 | Simplifying expression based on number line |
| Question #9 | Word problem with positive and negative numbers |

For comparison reasons, the data at 8th grade is inconclusive. An attempt was made to correlate the test back to the 2012-2013 school year, but data only exists for three schools, RAUS, Amigos and CSUS. The following graph shows student performance on the 2014 fall District Assessment, but does not provide comparative data to past two school years.



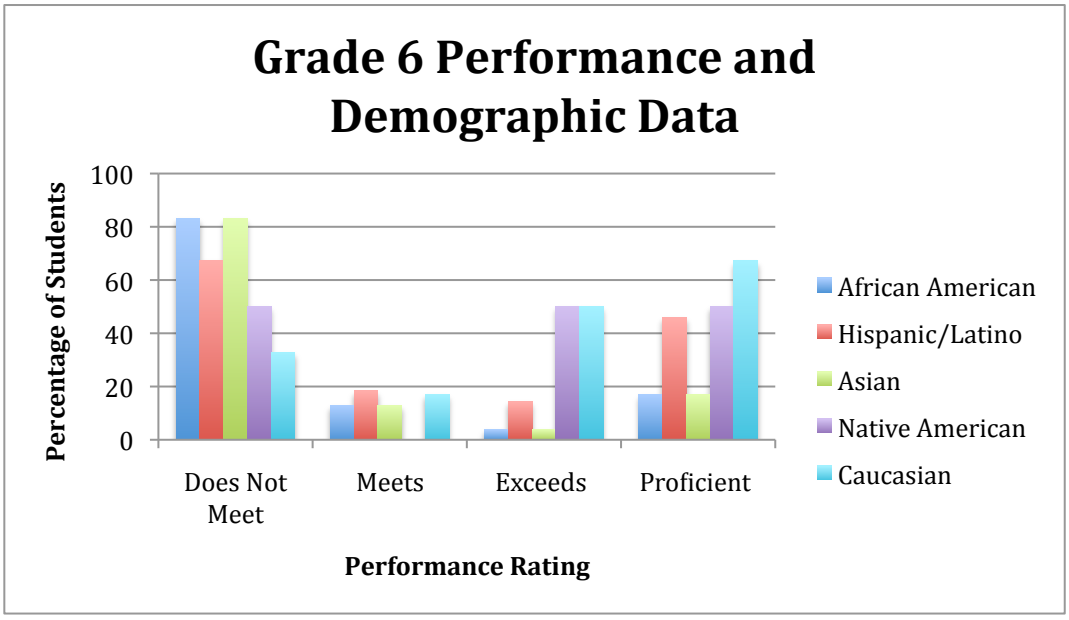

| | |
|---|---|
| Question #1 | Scientific notation |
| Question #2 | Locate irrational numbers on the number line |
| Question #3 | Square roots |
| Question #4 | Scientific notation |
| Question #5 | Solving equations word problem |
| Question #6 | Solving equations |
| Question #7 | Solving equations |
| Question #8 | Scientific notation word problem |
| Question #9 | Identification of irrational numbers |
| Question #10 | Identifying equivalent equations |
| Question #11 | Comparing size of irrational numbers using rational approximations |
| Question #12 | Integer exponents |
| Question #13 | Solving equations |
| Question #14 | Graphing proportional relationships and interpreting rate as slope (open response) |

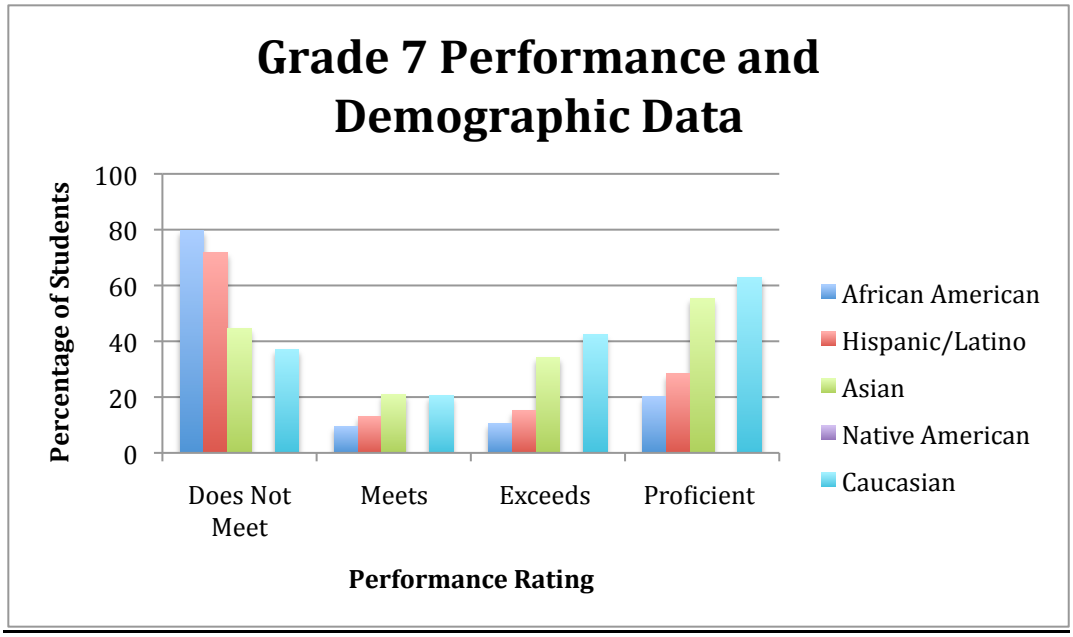
Due to the amount of backfill needed at the Upper School level, teachers were unable to complete all standards prior to administering the District Assessment. As a result, scores were lower on questions aligned to those standards.

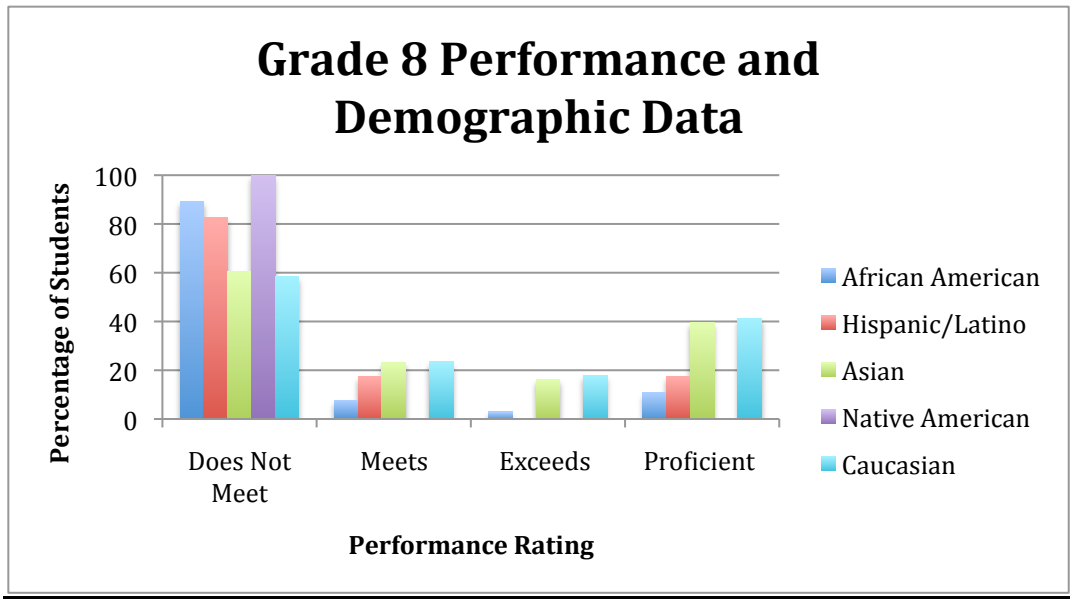
At the Upper Schools we now have the capability of analyzing demographic data due to our use of the Edwin platform. Each of the following three graphs shows what percentage of students in each subgroup received which performance rating. Performance ratings identified as follows:

- Below 70%: "does not meet," expectations
- 70 to 85%: "meets" expectations
- Above 85%: "exceeds" the expectations.

Students that either met or exceeded expectations are deemed "proficient" and recorded together in the fourth column.






Across all three grades, African American students perform below their peers. At sixth grade Asian students and African American students have the most ground to gain while at seventh and eighth grade African American and Hispanic/Latino students are performing at the lowest end (see section on recommendations to address this challenge). Caucasian students are consistently scoring the highest across all three grades. At sixth grade Caucasian and Native American students are scoring the best while at seventh and eighth grade it is Caucasian and Asian students performing highest. We do not have the same level of demographic data from previous administrations of the District Assessment to provide a

comparison analysis, but these identified demographic gaps are also represented in our 2013-2014 MCAS data:

**MATH - All Grades - % Proficient/Advanced**
**2013-2014**

| | CPS | | STATE | |
|---|---|---|---|---|
| | 2013 | 2014 | 2013 | 2014 |
| All Students | 62% | 61% | 61% | 60% |
| Sts. w/ disabilities | 26% | 26% | 23% | 23% |
| ELL/FELL | 36% | 41% | 35% | 35% |
| Low-Income | 44% | 45% | 41% | 41% |
| African American/Black | 41% | 43% | 39% | 39% |
| Asian | 79% | 75% | 79% | 79% |
| Hispanic/Latino | 50% | 50% | 39% | 39% |
| White | 79% | 77% | 67% | 67% |
| High Needs | 43% | 44% | 40% | 40% |

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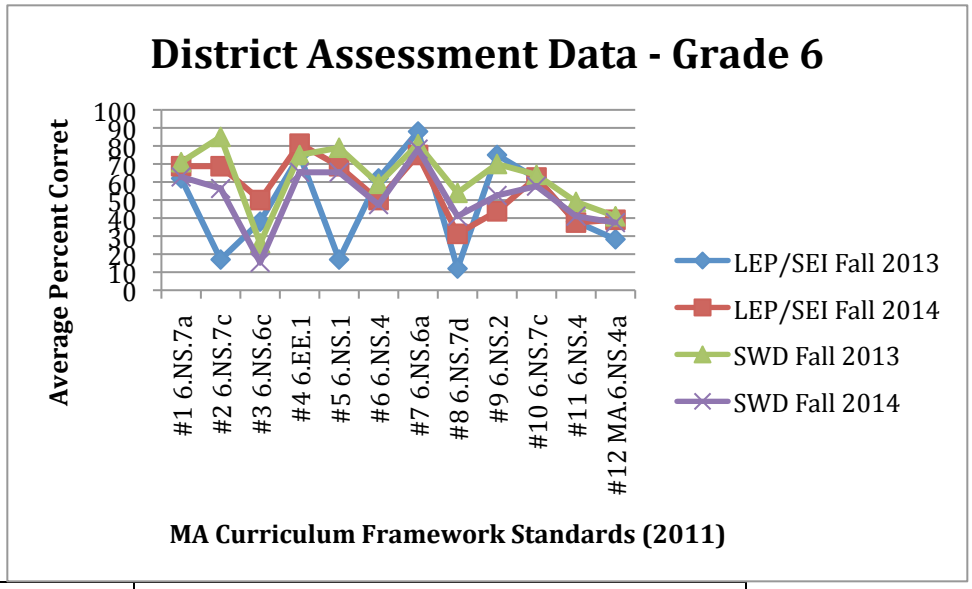
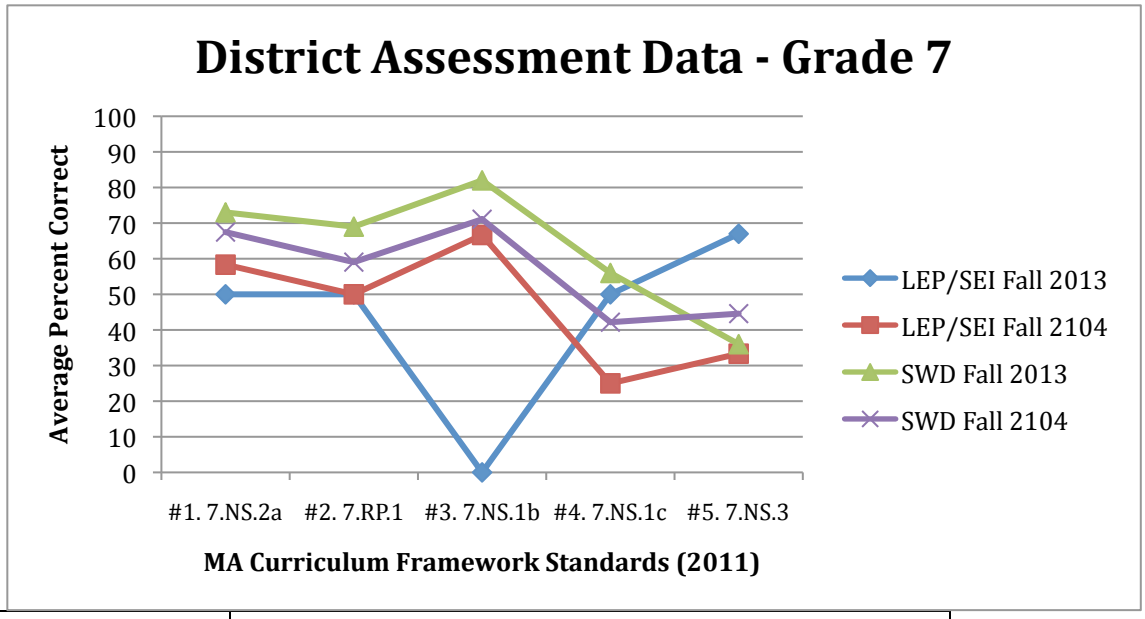
A similar data analysis of LEP (Limited English Proficiency)/SEI (Sheltered English Immersion) and SWD subgroups was performed at the Upper School level. There are some gaps in the data from 2013-2014 that impact the accuracy of any conclusions drawn from this data when so few students are represented.

At grade 6 it is important to note that only eight students are represented in the 2013 LEP/SEI data and only 12 in 2014. The data does not show a clear pattern of growth or any clear dips between the Fall of 2013 and the Fall of 2014 for LEP/SEI students; students improved on some questions between 2013 and 2014 while simultaneously dipping on others. Students with Disabilities appear to have dipped on all questions.



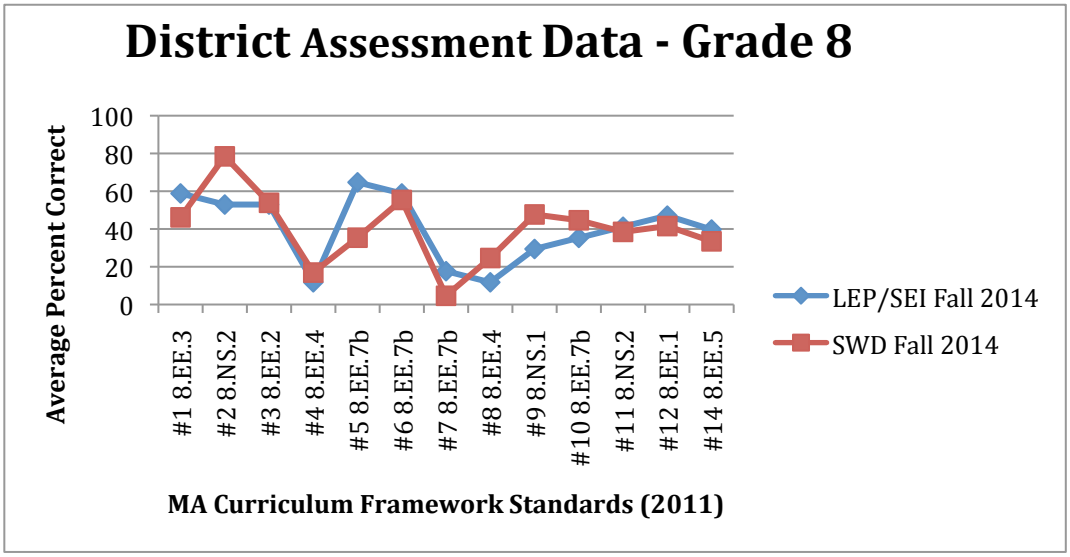

| | |
|---|---|
| Question #1 | Inequality |
| Question #2 | Absolute value on number line |
| Question #3 | Order decimals on number line |
| Question #4 | Exponents |
| Question #5 | Division of fractions |
| Question #6 | Least common multiple |
| Question #7 | Negative numbers on number line |
| Question #8 | Absolute value word problem |
| Question #9 | Division of 3-digit number by 2-digit number |
| Question #10 | Absolute value on number line |
| Question #11 | Greatest common factor |
| Question #12 | Greatest common factor (open response) |

At grade seven, the numbers of LEP/SEI students are low: only three students in 2013 and 12 students in 2014. Students that are identified as LEP or in the SEI program improved on some questions, as compared to the fall of 2013, while dipping on others. Students with Disabilities dipped on all but one question.




| | |
|---|---|
| Question #1 | Multiplying with positive and negative numbers |
| Question #2 | Word problem with ratios |
| Question #3 | Solving equations |
| Question #4 | Simplifying expression based on number line |
| Question #5 | Simplifying expression based on number line |
| Question #9 | Word problem with positive and negative numbers |

Data at the 8th grade level is representative of one year. As discussed earlier, most of the Fall 2014 questions were assessed later in either the winter or spring of 2014 when no schools entered data. Therefore, the following graph looks at how the LEP/SEI and SWD subgroups performed this year.



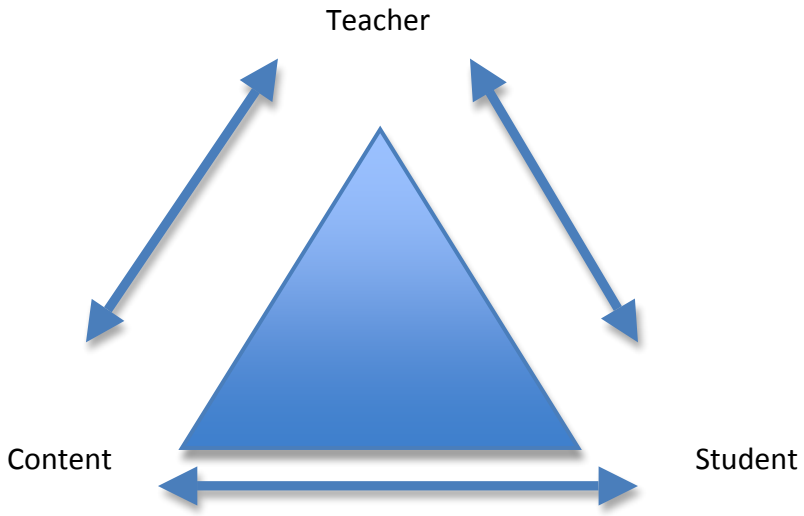

| | |
|---|---|
| Question #1 | Inequality |

| | |
|---|---|
| Question #2 | Absolute value on number line |
| Question #3 | Order decimals on number line |
| Question #4 | Exponents |
| Question #5 | Division of fractions |
| Question #6 | Least common multiple |
| Question #7 | Negative numbers on number line |
| Question #8 | Absolute value word problem |
| Question #9 | Division of 3-digit number by 2-digit number |
| Question #10 | Absolute value on number line |
| Question #11 | Greatest common factor |
| Question #12 | Greatest common factor (open response) |

In summary, Upper School scores dipped more (at least at sixth and seventh grade where comparison data exists) than was seen at the elementary level. More backfill was needed to address skills gaps that existed for students not exposed to the Math in Focus program in prior years. These skill gaps, coupled with the increased rigor and pace of the curriculum and the district requirement that District Assessments be given in a particular window led to students taking the assessment prior to learning all content. Dips for students identified as LEP/SEI or SWD were greater at the Upper Schools and is likely due to the same factors. Although some growth was evident for LEP/SEI students, the SWD subpopulation dipped more consistently across all grades and all questions.

Math in Focus and the Instructional Core:

The Curriculum Review Cycle was founded on the belief that the Instructional Core is key to improve student learning. In pictorial form, the Instructional Core is often drawn as a pyramid:




Richard Elmore (2008) argues that there are only three ways to improve student learning at scale:

1) Raise the level of content that students learn
2) Increase the teachers' skill and knowledge
3) Increase the level of students' engagement

Elmore reminds us that if you change one part of the Instructional Core you must change the other two. If the content that students are taught increases then the skills that teachers need to teach that content must also be addressed. In addition, ensuring that students are engaged in the content is necessary for the learning to occur. In Phase 3 of the Curriculum Review Cycle, departments are expected to analyze the work done to address the Instructional Core.

Through implementing the Math in Focus program, the department has raised the level of content that students are being exposed to at the elementary and upper school levels. Math in Focus introduces some content earlier than the MA Framework requires mastery and provides teachers the resources to not only meet, but also exceed the expectations of the Common Core. In order to support teachers in developing the skills to address this more rigorous curriculum, professional development opportunities were offered during the school day, in an after school choice course, and in real time through focused coaching cycles. The resources that Math in Focus provides helps teachers differentiate their instruction and meet students where they are at, increasing their engagement in the curriculum.

Next Steps:

Moving forward, the district will be rolling out Math in Focus in the remaining second and third grade classes and all Kindergarten classes in the 2015-2016 school year. A plan for professional development that builds on the successes of this school year will be implemented to support teachers. Materials will be purchased for all Kindergarten classrooms and current material supplies will be reevaluated for enrollment expectations. Finally, the district will continue to work with coaches and teachers in implementing Transfer Tasks as a part of district assessments to better determine how our students are doing in applying their mathematical knowledge to new and novel situations.

Data analysis on the winter and spring District Assessments will be completed at the first through eighth grades in March and June. Teachers will again be required to administer the Upper School assessments in Edwin while elementary teachers must enter data into TestWiz. School based instructional coaches/interventionists will hold data meetings with math teachers and develop plans to include more cumulative review throughout the year on key standards that are identified as weak on the District Assessments. Coaches will also work with teachers to better utilize the Math in Focus resources to differentiate their instruction. Professional development in the after school Math in Focus choice course will continue through April for all enrolled teachers.

Moving forward, tiered systems of support at the elementary level will be strengthened to close proficiency gaps, including more targeted interventions, and expansion of summer programming. The district is evaluating a universal screener that could be used at the Upper Schools to identify at risk students and provide interventions.

A plan will be developed this spring for implementation of common unit/chapter assessments that are diagnostic in nature and can be used to better assess the implementation of Math in Focus. The district set the following goal as a result of the Math in Focus implementation: “By SY 2016/2017 the percent of students achieving proficiency, as measured by MCAS, will increase by 10%.” Massachusetts will have moved to PARCC by the 2016-2017 school year, so it is the intention of the department to modify District Assessments in conjunction with state assessments to set adequate goals for progress and ensure equity of outcomes for all students.

The department is also considering a budget initiative to reinstate the summer Math 180 Program for rising sixth and rising seventh grade students in order to continue to develop mathematical skills for struggling students and proactively address some of the demographic gaps we are clearly seeing in middle school. In the future, we are exploring the expansion of summer programs to increase the number of students proficient in grade level mathematics and are Algebra I ready.

***Initiative 2: Accelerated Math Pathway***

Implementation:
During the 2013-2014 school year, the CPS math department accepted School Committee's challenge that the number of students entering the 8th grade Accelerated Math Pathway (AMP) class would double between the 2014-2015 and 2015-2016 school years while moving towards the goal of Algebra I completion for most Upper School students. Chart 3 outlines two years of data on students enrolled in Algebra I during the middle school years. Please note (*) that the specific numbers referenced in Chart 3 are for 8th grade students that enrolled in Geometry as freshman. Students that left the district or took Algebra I as sixth and seventh graders are discussed below, but not counted in Chart 3.

| School | 2012-2013 | | 2013-2014 | | 2014-2015 | |
|---|---|---|---|---|---|---|
| | # Enrolled in Algebra I | # Passed CRLS Algebra I Exam* | # Enrolled in Algebra I | # Passed CRLS Algebra I Exam* | # Enrolled in 8th Grade AMP | # Passed CRLS Algebra I Exam** |
| Amigos | 7 | 3 | 8 | 4 | 11 | May 2015 |
| CSUS | 21 | 21 | 21 | 9 | 23 | |
| PAUS | 3 | 0 | 3 | 0 | 25 | |
| RAUS | 26 | 10 | 28 | 14 | 23 | |
| VLUS | 26 | 1 | 26 | 15 | 24 | |
| Total: | 83 | 35 | 86 | 42 | 106 | |

Chart 3: Algebra I Enrollment and Passing Data from 2012-2014 (**Enrollment does not guarantee placement in Geometry as a freshman; students will still need to pass the CRLS Algebra I exam in May)

During the 2012-2013 school year 83 students completed Algebra I at the upper schools with 42% passing the CRLS exam and taking Geometry as ninth graders. That number increased to 86 students taking Algebra I during the 2013-2014 school year. Of the 86 students completing the course work, 42 (or 49%) of students passed the CRLS exam and enrolled in Geometry during the ninth grade. Of the 86 students taking Algebra I last year, 7% left the district and an additional 5% were 6th or 7th graders that passed the test but are taking Geometry or Algebra II as 7th and 8th graders. In total, 49 students passed the CRLS exam, or 57% of enrolled students.

This year, enrollment in Algebra I through the Accelerated Math Pathway, has increased to 106 students, a 22% jump since the 2012-2013 school year. Although this increase is something to celebrate, and the School Committee's goal of doubling the number of students in the eighth grade AMP class next year is worthy and ambitious, the CPS Department of Science, Technology, Engineering and Math proposes moving forward on

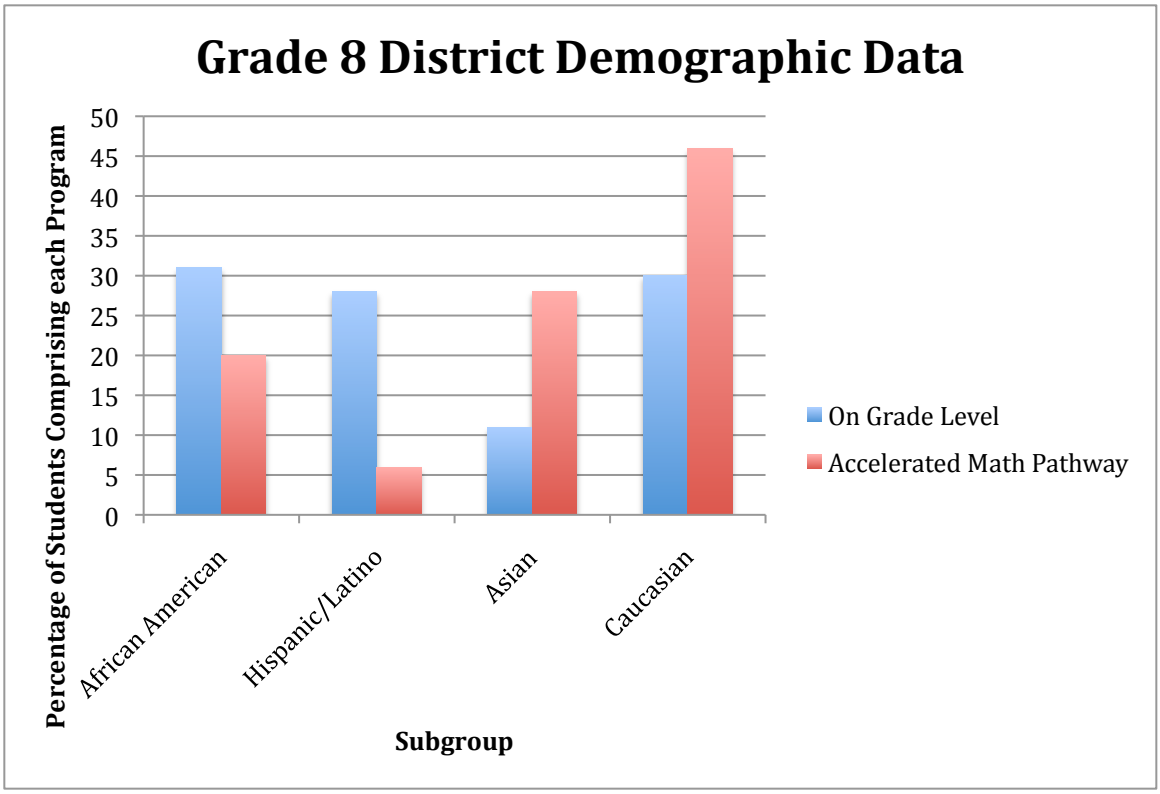
this goal by doubling the number of students entering the AMP at 7th grade, as opposed to eighth grade, for the 2016-2017 school year, in order to:

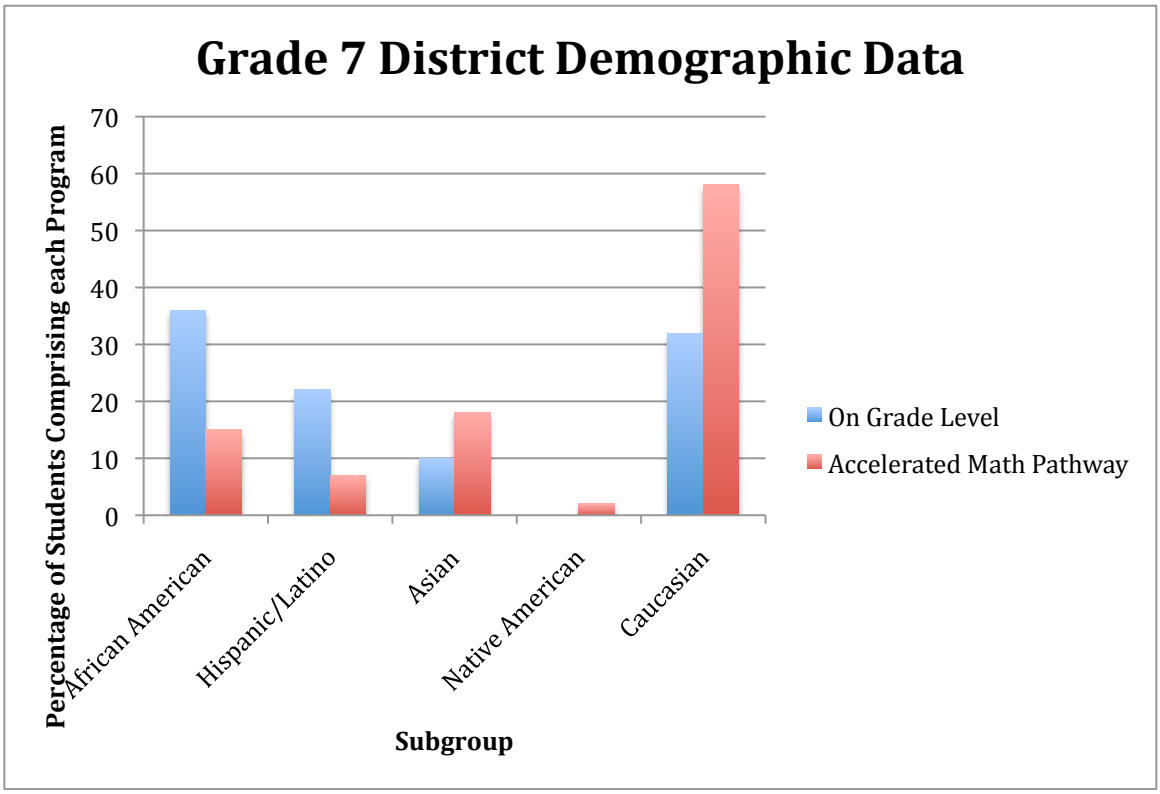
- collect enough data to evaluate the first year of implementation of the Accelerated Math Pathway
- assess modifications attempted in the 2015-2016 school year

The 2014-2015 school year implementation of the AMP has had successes and challenges for both teachers and students. Students have reported feeling challenged in the new class and teachers have indicated that students in the on-grade level classes are taking on intellectual leadership in ways that would have been unlikely in previous years when the AMP students had been in their classrooms. This data is teacher reported and additional data will be collected through a student survey in order to better capture the benefits and challenges our students have experienced.

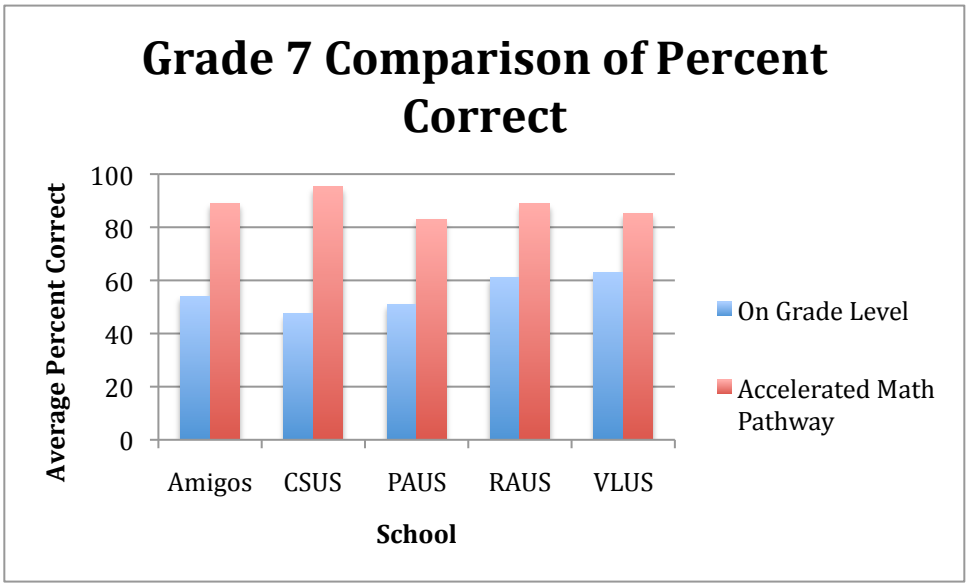
Data Analysis:

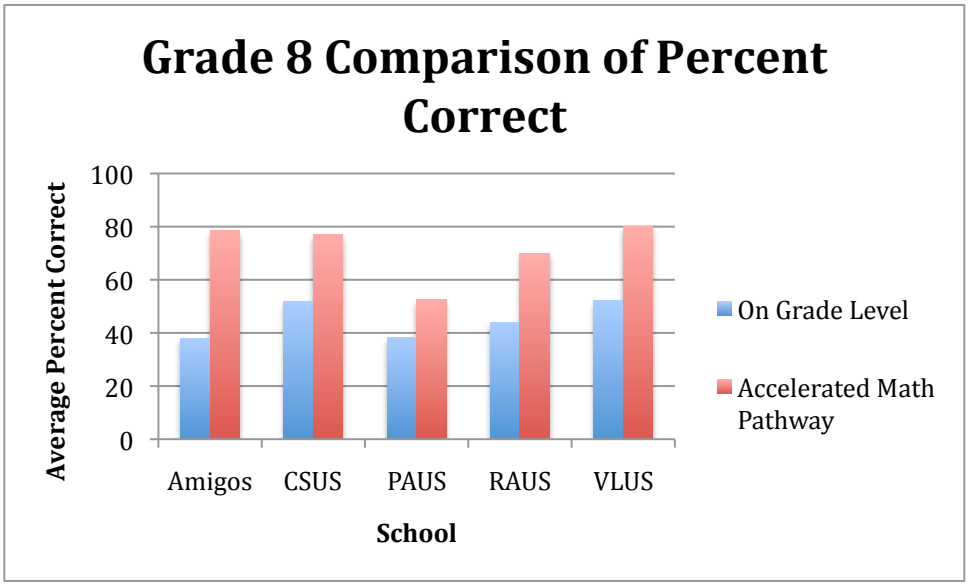
- *Demographic Analysis:*
  The Department of Science, Technology, Engineering and Mathematics shares the School Committee's vision that the diversity of our schools should be celebrated and represented in both the on-grade level and AMP classes. The current AMP rosters are not reflective of the larger student body. The following two graphs show the percentage of students across all Upper Schools and Amigos in both the on-grade level and AMP classes at 7th and 8th grade. The representation of Latino/Hispanic and Students of Color are much higher in the on-grade level class while the percent of Asian students is higher in the AMP class. Data on free and reduced lunch, special education services, and ELL/FLEP status follow similar trends, with a higher proportion of low SES, high needs, and ELL/FLEP status students in the on-grade level class. Not surprisingly, when MCAS advanced/proficient data is analyzed, the on-grade level classes contain a higher proportion of students receiving Needs Improvement or Warning on MCAS.


Grade 8 District Demographic Data
Percentage of Students Comprising each Program
50
45
40
35
30
25
20
15
10
5
0
African American
Hispanic/Latino
Asian
Caucasian
Subgroup
On Grade Level
Accelerated Math Pathway


Grade 7 District Demographic Data
Percentage of Students Comprising each Program
70
60
50
40
30
20
10
0
African American
Hispanic/Latino
Asian
Native American
Caucasian
Subgroup
On Grade Level
Accelerated Math Pathway

- *District Assessment Data:*
  At both seventh and eighth grade, students enrolled in the Accelerated Math Pathway outperformed their peers in the On Grade Level class in all schools.




Although at both seventh and eighth grade, students in the AMP class outperformed their grade level peers, performance universally was lower at eighth grade than at seventh grade.

Implementation Challenges:

- *Scheduling Challenges*: Scheduling challenges at the Upper Schools, due to their small size and one teacher per grade level structure, forced some buildings to cohort schedule resulting in leveled classes in other content areas. Most noticeable has been an accelerated science class in one school. Very often, strong math students also show aptitude in the physical science (chemistry and physics) and this is playing out where cohort scheduling has occurred.

- *Class Size Limitations:* Class size limitations and building space has posed challenges in allowing students to move into the AMP. Our seventh grade classes are close to capacity in a number of schools. This limits our ability to enroll more than 25 students in the AMP. For example, when grade-level size is close to 95 students, adding a second section of AMP requires 46 students to be enrolled in the AMP. Leaving space in AMP sections for transfer students or those that are able to move into the class after the start of the year causes a challenge. This requires the on-grade level classes be larger in order to allow for flexible mobility into the AMP classes.

- *Math in Focus Roll Out*: Teachers rolled out Math in Focus this year as well as the Accelerated Math Pathway. This has meant simultaneously learning a new program while 8$^{th}$ grade teachers were asked to teach Algebra I standards. As a result, there have been quite a lot of competing demands placed on teachers. However, they have persevered. Professional development was provided for coaches with Edgenuity and after school professional development for grade 8 teachers. Eighth grade teachers are attending all day professional development in early February on the platform and building based coaches have been working on refining Algebra I units within the program. The district plans to offer an afterschool professional development course for teachers of Algebra I during the 2015-2016 school year.

Unintended Consequences:

- *Timing*: In addition to scheduling challenges from the cohort perspective, core courses are consistently less than sixty minutes across all schools, which is exacerbating the pacing challenge that teachers are facing. When the Innovation Agenda launched, the district scheduling recommendations included 60 minutes in the core areas. The district implementation of Math in Focus at the same time as the Accelerated Math Pathway has caused a depth versus breadth concern in the AMP classes. Very often the first year a new curriculum is implemented the pace slows down as both students and

teachers familiarize themselves with new approaches and strategies. This year, however, teachers are trying to teach an additional five months of content while implementing this new program. This challenge, coupled with the shorter than recommended classes, has made the pacing feel too fast for both teachers and students.

- *Pacing*: The pacing dilemma has played out for some very strong math students who have the aptitude to learn Algebra I standards as a middle school student, but do not have the processing speeds to do so in this fast paced class. Parents have also been surprised that a course that is 1.5 years in length has 1.5 the amount of homework. We intend to improve communication with parents and students prior to student enrollment to ensure there is a shared understanding of the demands and expectations for the AMP course.

- *After School Support*: Finding available teachers to facilitate after school support has been challenging. Our Upper Schools have a small math teaching staff and they need to balance supporting students in the on-grade level and AMP classes, and attending professional development (including mandatory building and departmental professional development, choice courses, and for many RETELL training). A large budget was secured to fund an after school support program at all Upper Schools so that students who needed support in order to be successful in the AMP could get that support. We were only able to secure two teachers district wide to fill these positions. Only two Upper Schools are currently able to offer after school support to students in the AMP. In addition, the relegation of all support to after school hours limits the number of students willing and able to attend. Across both schools, only eight seventh graders and four eighth graders have consistently attended the after school support. These supports should stay in effect for the 2015-2016 school year.

<u>Lack of Fluidity:</u>

Although the AMP was built on the premise that students could easily move into or out of the class, in reality that is much harder at 8$^{th}$ grade than originally realized. A student who did not participate in the 7$^{th}$ grade AMP class and starts the year in the 8$^{th}$ grade on-grade level class must master half a year of 8$^{th}$ grade plus any material missed at the start of the year. Prior to the end of first quarter, eighth grade students in the AMP class complete three chapters of Math in Focus plus one supplemental chapter on angles. It has been extremely challenging for most students to complete the work for the half of eighth grade they missed by not enrolling in the seventh grade AMP class in addition to four units of 8$^{th}$ grade math. For students who are identified as ready to move into the AMP class at the end of seventh grade, a summer "bridge" program is a possibility, but it is essential we recognize that mastering five months of content in one six week summer

program is challenging for students – either because of pace or ability to commit to a summer program of that length. We believe that with the supports and strategies outlined in the coming pages we can prepare more students to enter the AMP at seventh grade and feel strongly that it is our responsibility to prepare students to enter the pathway earlier.

Recommendations:

The CPS STEM department believes that in order to best prepare students for Algebra I readiness in middle school, changes need to be instituted at the elementary level. We propose assembling an elementary task force comprised of elementary principals, math coaches, teachers, educators from the bilingual and special education departments, and members of the Teaching and Learning Team to develop recommendations on how to schedule intervention blocks that meet the needs of all students. We believe a new focus on differentiation at the elementary level coupled with true intervention blocks will allow us to raise-up the mathematics skills of *all* students so that our conversations are not focused on a few students who are able to participate in the AMP, but a majority of all seventh graders ready for this more rigorous curriculum.

We also believe that work at sixth grade is crucial in preparing a larger number of students for entrance into the AMP at seventh grade. We hope to work with Upper Heads to think creatively about additional supports during the school day, as student attendance in after school support programs are not as high as we would like. Beginning in the 2015-2016 school year the STEM Department would like to stipend teachers willing to run after school support classes for sixth grade students in order to develop their mathematics' skills. Regardless if students pursue the AMP course or not, this additional support should ensure a larger number of students find math success as 7$^{th}$ graders.

During the summer months we propose funding two different programs and are submitting budget initiatives around supporting:

- Rising Sixth and Seventh graders: The department suggests adding an AMP preparation summer program for students that, with a little support, can build the skills and problem solving abilities to enter the AMP class at seventh grade. We believe this program will help to address the demographic divide that exists between the on-grade level and AMP classes.

- Rising Eighth graders: A summer "bridge" program will still be offered for the students that can utilize this type of instruction in order to move up from the on-grade level 7th grade class to the AMP 8th grade class.

Transportation to and from these summer programs has been cited as a barrier to participation. We hope to find a solution to this challenge in order to ensure more

students can participate, in addition to advertising these opportunities earlier in the year so that families can plan their summer commitments.

Although CPS teachers have worked tirelessly to provide the best experience for all students in this transition year, the inconsistency in determining placement during the 2014-2015 school year left teachers and parents unsure of what it meant to be ready for the Accelerated Math Pathway. In order to address this challenge in the first year of implementation, the district staff researched other districts both locally and nationally with similar programs – three years of math in two years. Based on an analysis of a few programs, a draft set of criteria was shared with the building based instructional coaches. Using a Tuning Protocol, feedback was collected and a second draft developed. That second draft was "tuned" by the instructional coaches with the teachers in their schools as well as administration, where possible. Simultaneous, the Acting Director of Science, Technology, Engineering and Math reached out to the Instructional Council for guidance. The following revisions are based on those rounds of feedback.

In order to provide more consistency across the district, the following criteria will be used for all students when evaluating their readiness for the Accelerated Math Pathway at seventh grade:

- district assessments (including selected transfer questions)
- teacher recommendation (normed)
- MCAS score (actual score)
- Iowa Algebra Aptitude Test Score

During the winter and spring of the 2014-2015 school year, actual percentages for each of these factors will be determined by analyzing the profiles of students that have found success in the Accelerated Math Pathway. This includes determining if there are students thriving in AMP that did not score well on the 2013-2014 placement test.

Students' overall score will be used to rank them for their readiness and develop rosters for the Accelerated Math Pathway. Based on the number of students showing readiness, the appropriate number of sections of Accelerated Math will be offered at each upper campus. Students considered "on the fence" will receive a conference with their parent(s)/guardian(s), teachers, and appropriate school administrators where the collective group will determine their placement for the following school year. When consensus can not be reached, students will be given the opportunity to attempt the challenge of the Accelerated Math Pathway class, with the understanding that their placement will be reevaluated no later than the end of the first quarter. Students' not recommended for the Accelerated Math Pathway, based on their performance across the four indicated identifiers, whose parents override the district placement, will be placed if space permits.

Rising eighth graders interested in entering the Accelerated Math Pathway will be required to meet the same minimum threshold on the four identified criteria in order to enroll in the summer "bridge" program. Students that meet the criteria in the spring and declare a commitment to participate in the summer program will have spots reserved for them in the eighth grade class. Identifying students in the spring should allow the schools to develop rosters early enough to plan for the needed sections of seventh and eighth grade AMP.

Teachers will reevaluate students no later than the end of the first quarter to ensure accurate placement. Teachers will use one or two benchmarks in making movement recommendations. At seventh grade, teachers will use the Chapter 1 Test Prep from Math in Focus (typically given by October 3rd) or the Chapter 2 Test Prep from Math in Focus (typically given by October 31st). Eighth grade teachers in the on-grade level class will use either a selected set of questions from the Chapter 1 Test Prep or the Chapter 2 Test Prep given by October 31st. Teachers of the 8th grade AMP class will use either the Chapter 7 Test Prep (given by September 19th) or the Chapter 8 Test Prep (administered by October 22nd).

Movement into the AMP class will still require the recommendation of the math teacher. CPS math teachers will utilize consistent criteria in generating teacher recommendations. During their January 12th middle school meeting, teachers collaboratively drafted a rubric that assesses the following:

- *Mathematics skills have been comprehended and the student can apply skills in all problem solving instances:*
    - *as demonstrated by their class work*
    - *their critical thinking skills*
    - *the results of their classroom assessments and teacher observation*
- *Student:*
    - *is self-motivated*
    - *has ability to think critically and use logical reasoning*
    - *participation that promotes learning*
    - *is responsible to make up work*
    - *willingness to seek out resources*
    - *has ability to keep up with faster pace*

Students who are moved up will be provided a plan for acquiring the content knowledge missed while in the on-grade level class. The classroom teacher will develop the plan along with the parent(s)/guardian(s) and the student.

Teachers will conference with parents of struggling students prior to making any recommendations on students moving down a level. Teachers will develop a plan with students and provide ample opportunity for the student to be successful in the AMP class before suggesting to a parent that a child moves down.

*Teachers will consider moving students with failing grades and/or meet some of following criteria:*

- *Mathematics skills have not been comprehended and the student can not apply skills in all problem solving instances:*
    - *as demonstrated by their class work*
    - *their critical thinking skills*
    - *the results of their classroom assessments and teacher observation*

- *Student lacks:*
    - *self-motivation*
    - *the ability to think critically and use logical reasoning*
    - *the organizational skills*
    - *participation that promotes learning*

The STEM department is committed to collaboratively working with Upper Heads and teachers to build in supports for students so that they are able to find success in the AMP.

***Initiative 3: Summer Program***

The math department implemented a summer program for students in seventh and eighth grade in both the on-grade level and Accelerated Math Pathway classes. The math department hired one coordinator and two teachers to teach the program from July 7th – August 8th and anticipated running two sessions per day, one from 8:30-11:30am and one from 12:30-3:30pm. Based on 21 parent responses to a district survey, the morning section was offered when only three parents indicated that their child would attend an afternoon class.

Eight eighth graders and nine seventh graders participated in the summer program. Chart 4 highlights the number of students from each school that participated in the summer program as well as what class they are enrolled in for the 2014-2015 school year. One eighth grade student from Vassal Lane (* in the chart) is listed in the tally below but has left the district.

| | Grade 7 on-grade level | Grade 7 Accelerated Math Pathway | Grade 8 on-grade level | Grade 8 Accelerated Math Pathway |
|---|---|---|---|---|
| Amigos | 0 | 0 | 0 | 2 |
| Cambridge St Upper School | 1 | 0 | 0 | 2 |
| Putnam Ave Upper School | 0 | 0 | 0 | 1 |
| Rindge Ave Upper School | 0 | 1 | 1 | 1 |
| Vassal Lane Upper School | 3 | 2 | 2* | 0 |

Chart 4: Participation Rates in Summer Program by School and Grade Level

CPS staff members worked with East End House and Breakthrough to provide support at their summer programs. Teachers spent time at these programs tutoring in math. All students who completed the summer program and attempted the 8th grade Accelerated Math Pathway entrance exam passed.

Barriers to participation in the program included the late announcement of the program (surveys from parents were not collected until the end of May), lack of district provided

transportation, and the student time commitment. Some of the students that participated in the program missed no days of instruction while others were absent for as many as half the total number of days. Hiring the appropriate number of staff members proved problematic as staff was put in place before we knew the final numbers of students enrolling in the program. Even with such small class sizes, staff found it challenging to support on-grade level and Accelerated Math Pathway students in the same class, as the purpose of the work was so different.

Moving forward, the district proposes funding transportation for students as well as advertising this opportunity earlier in the school year. Specific fifth and sixth grade summer supports should be added. The district would also like to evaluate the success of the summer program by comparing overall AMP success of students that participated in a "bridge" program to those that learned the content during the school year. The 2014 summer coordinator has documented a revised timeline that addresses:

- targeting students
- parent and community outreach
- hiring staff
- curriculum development

In addition, we plan a family/student survey to collect data on the program's strengths and areas of growth.

During the 2014-2015 school year the new CPS Department of Science, Technology, Engineering and Math has collaborated with building based instructional coaches and teachers to implement new mathematics initiatives. There is still a need to collect data on the new Accelerated Math Pathway and around Math in Focus implementation and changes to be made to the summer program and entrance into the AMP, but we are confident that next steps, as outlined in this document, will build on the work we have begun ensuring all students are able to succeed as mathematicians. An update to this report will be presented to School Committee on February 3, 2015.

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