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TO: Dr. David Title
FROM: Dr. Margaret Boice
DATE: June 19, 2013
RE: Algebra Data for CPM Analysis

Attached you will find a report that includes the following information:

- Teacher mark (grades) data from the 2011-2012 and the 2012-2013 school years
- Student mark distributions for the 2012-2013 school year
- Midterm exam analysis for the 2012-2013 school year
- Parent and student survey results from January 2013

The following statements summarize the results of this report.

- Throughout the CPM pilot, the students' marks and exam grades remained constant, as compared to prior years.
- Students' results on the midterm exams do not indicate a significant difference in grades, in spite of the increase in rigor of the exam as compared to previous years.
- The results of the parent and student surveys indicate a slight increase in tutor use over grade 7 pre-algebra, which is not unusual when students move to Algebra 1, a more rigorous course. We do not have data on tutor use in Algebra 1 in prior years, so it is not possible to make that comparison.
- The Board has approved a textbook that meets or exceeds the instructional value provided by CPM, and also provides parents and students with a format that is more familiar to these groups.

If any Board members have questions about these documents, please ask them to contact me at 203-255-8309 or at mboice@fairfieldschools.org

Algebra Data for CPM Analysis

During the 2014-2015 school year, students will be expected to take the new SBAC state assessment. This assessment will challenge the student's mathematical thinking through the use of rigorous problems, different than problems in past CAPT/CMT assessments. For this reason, the district chose to pilot the CPM resource during the 2012-2013 school year in Algebra. To best understand the influence of the CPM resource, an analysis of mark, assessment, and survey data were used to determine the influence on student learning.

Mark Data

An analysis of marks was conducted to determine the change in marks from the student's final mark in the Pre-Algebra course from grade 7. A mark is defined as the letter grade that the student earns in the course. Marks were collected from students who took Pre-Algebra in grade 7 and Algebra in grade 8. A change was identified as a difference between the Algebra quarter marks from the final mark in Pre-Algebra during the student's 7th grade year. For example, if a mark went from an A in 7th grade Pre-Algebra to an A- in Algebra during their 8th grade year, this student was counted in the category of drop in mark. Additionally, if a student went from a final mark of B in Pre-Algebra to a B+ in Algebra, this would be considered an increase in mark. Any students that had to drop the course were removed from the analysis because they did not have an Algebra mark to compare against back to the Pre-Algebra final mark.

Table 1: 2010-2011 change from final Pre-Algebra Grade for Students in Algebra 8

	Quarter 1 Change	Quarter 2 Change	Quarter 3 Change
<i>Drop in Grade</i>	54.8%	61.5%	57.9%
<i>Stay the Same</i>	30.6%	25.7%	24.9%
<i>Increase in Grade</i>	14.6%	12.8%	17.3%

Note: N = 343 students

Table 2: 2011-2012 change from final Pre-Algebra Grade for Students in Algebra 8

	Quarter 1 Change	Quarter 2 Change	Quarter 3 Change
<i>Drop in Grade</i>	58.4%	60.2%	57.3%
<i>Stay the Same</i>	27.2%	26.0%	25.1%
<i>Increase in Grade</i>	14.4%	13.8%	17.5%

Note: N = 353 students

Table 3: 2012-2013 change from final Pre-Algebra Grade for Students in Algebra 8

	Quarter 1 Change	Quarter 2 Change	Quarter 3 Change
<i>Drop in Grade</i>	38.4%	49.1%	44.3%
<i>Stay the Same</i>	33.2%	31.8%	25.6%
<i>Increase in Grade</i>	28.4%	19.0%	30.1%

Note: N = 352 students

Tables 1 and 2 illustrate how the students performed before the implementation of the pilot CPM resource. As the data in tables 1 and 2 illustrate, a majority of students had a drop in grade from their Pre-Algebra final grade when they went to Algebra during their 8th grade year. This is not unusual when students move from pre-algebra to algebra 1, a more difficult course. However, the data in table 3 shows that more students maintained their mark from the prior year with the implementation of the pilot CPM resource. Contrary to some claims, students' marks have not been negatively influenced by the use of CPM.

Table 4: Mark Distribution for Grade 8 Algebra for 1st Quarter

Mark	2012-2013	2011-2012	2010-2011
<i>A</i>	53%	44%	53%
<i>B</i>	40%	42%	36%
<i>C</i>	6%	13%	10%
<i>D</i>	0%	1%	1%
<i>F</i>	0%	0%	0%

Note: Data in the tables rounded to the nearest percent

Table 5: Mark Distribution for Grade 8 Algebra for 2nd Quarter

Mark	2012-2013	2011-2012	2010-2011
<i>A</i>	47%	38%	41%
<i>B</i>	39%	42%	39%
<i>C</i>	12%	17%	16%
<i>D</i>	2%	3%	4%
<i>F</i>	0%	0%	0%

Note: Data in the tables rounded to the nearest percent

Table 6: Mark Distribution for Grade 8 Algebra for 3rd Quarter

Mark	2012-2013	2011-2012	2010-2011
<i>A</i>	50%	45%	47%
<i>B</i>	35%	38%	38%
<i>C</i>	13%	15%	13%
<i>D</i>	1%	1%	2%
<i>F</i>	0%	1%	0%

Note: Data in the tables rounded to the nearest percent

Tables 4, 5, and 6 illustrate the distribution of marks over a three year span in the grade 8 Algebra. Marks in the A range are the marks A+, A, and A- (and so forth for each other area). The data in these tables illustrate that the distribution of A's and B's for the first three quarters for this current year has been at or above the rate to each of the two years prior. The conclusion that the marks of 8th graders have been negatively influenced by the use of CPM in terms of marks could not be substantiated from this data.

Table 7: Mark Distribution for Algebra 12 for the 1st Quarter

Mark	2012-2013	2011-2012	2010-2011
A	30%	30%	34%
B	35%	32%	28%
C	19%	22%	19%
D	9%	9%	13%
F	3%	7%	5%

Note: Data in the tables rounded to the nearest percent

Table 8: Mark Distribution for Algebra 12 for the 2nd Quarter

Mark	2012-2013	2011-2012	2010-2011
A	27%	29%	26%
B	28%	27%	30%
C	21%	24%	18%
D	12%	10%	15%
F	9%	10%	11%

Note: Data in the tables rounded to the nearest percent

Table 9: Mark Distribution for Algebra 12 for the 3rd Quarter

Mark	2012-2013	2011-2012	2010-2011
A	30%	30%	32%
B	35%	32%	27%
C	19%	19%	20%
D	15%	8%	12%
F	3%	11%	9%

Note: Data in the tables rounded to the nearest percent

Tables 7 through 9 illustrate the mark distributions at the high schools for first, second, and third quarters. As the data in the tables illustrate, the marks at the low end of the distribution have been relatively stable or improved. For example, the D and F distribution for the first quarter for this year improved from the two years prior, while the second quarter mark distributions of D's and F's improved from the 2010-2011 school year. However, in the second and third quarters, the combined percentage of D's and F's in comparison to the 2011-2012 school year was similar.

The combined percentage of A's and B's also has remained consistent, which is comparable to the distributions of D's and F's. The grade distribution of A's and B's for the 2012-2013 school

year in Algebra has been at the same rate of the prior two years. For example, the combined percentage of A's and B's for the second quarter this year was a 55%. In comparison, the 2011-2012 and 2010-2011 school year had a combined percentage of A's and B's to be 56% and 56% respectively. The overall conclusion from this mark data is that generally, the marks distributions did not change when compared to historical mark distributions.

Midterm Data

Another data point used to analyze student learning in Algebra was the midterm assessment. This assessment was given in both the middle and high school Algebra courses during the 2012-2013 school year. However, the midterm assessment was edited by the teachers in the summer of 2012 to increase the rigor of the assessment. This increase in rigor was accomplished by removing prior topics that students were expected to master when coming into the Algebra course (e.g., rational number operations, graphing points, etc.), and replacing them with tasks with increased rigor in the topics taught and learned in the Algebra course.

High School

To collect data on the midterm, an approximate 20% random sample of the population of high school students in Algebra was selected (83 out of 425 student in 2011-2012 and 80 students from 410 students in 2012-2013). The teachers submitted itemized data for the amount of points earned for each question. This data collection was conducted in both the 2011-2012 and 2012-2013 school years, thus allowing for a comparative analysis for student achievement on identical tasks that were on both assessments.

Table 10: Midterm Comparative Analysis on Identical Questions for the High School

Year	Expressions	Functions	Linear Equations	Linear Functions
<i>2011-2012</i>	84.81%	73.42%	79.04%	74.13%
<i>2012-2013</i>	86.55%	81.41%	75.72%	72.46%

The data in table 10 represent the average score students achieved in the various concept areas. For example, in the expressions area, the average score on all the problems in this area was an 84.81% in 2011-2012. In all, two concept areas went up, while two areas went down. The results illustrate that there was no significant difference between the students' performance on the identical questions on both high school administrations of the midterm.

The data in table 11 illustrate the average score of high school student performance for all the questions on the midterm for the sample. Additional tasks were added to the exam to increase the rigor in the topics from the prior year. Table 11 illustrates how the overall rigor of the assessment increased when compared to the prior year if you compare the 2012-2013 average results in table 10. For example, the average on the linear functions questions that were identical to the prior year's midterm was a 75.72%. However, when the more rigorous questions were included, the overall average on the linear functions questions combined for the 2012-2013 midterm was a 72.02%. This supports the claim that the additional questions increased the rigor of the assessment.

Table 11: Midterm by Topic for the High School 2012-2013

Year	Expressions	Functions	Linear Equations	Linear Functions	Overall Average
<i>2012-2013</i>	78.16%	64.99%	75.76%	72.02%	71.84%

Over the last five years, the averages on the midterm have illustrated a positive trend. As illustrated in table 12, the average score on the midterm in 2008-2009 was 64.5%, compared to 71.8% from this current year. However, this current year's average did drop to 71.4% from the recent high average of 75.9% in 2011-2012. Teacher feedback indicates that this was due the assessment being more rigorous after the removal of review tasks (graphing a point, fraction operations, etc.), as supported by the paragraph above.

Table 12: High School Midterm Average Scores by Year

Year	Average Score
<i>2012-2013</i>	71.8%
<i>2011-2012</i>	75.9%
<i>2010-2011</i>	69.2%
<i>2009-2010</i>	65.7%
<i>2008-2009</i>	64.5%

Middle School

The middle school also administered the same midterm assessment as the high school during the 2012-2013 school year, which was different than past practice. Because of this change, no comparative data to the prior year was available for comparison purposes. Similar to that of the high school, an approximate 20% random sample of grade 8 Algebra students was collected for itemized points for each problem on the midterm (67 out of 352 students). The data in Table 13 does provide information to how the sample of students did on the various topics on the assessment (similar to that of the high school in Table 11).

Table 13: Midterm by Topic for Grade 8 Algebra

Year	Expressions	Functions	Linear Equations	Linear Functions	Overall
<i>2012-2013</i>	91.26%	85.96%	93.32%	89.90%	87.76%

Table 13 illustrates that the 8th grade students performed well on the midterm assessment. The students did well in all areas of the assessment, with the highest performing area being linear equations. These 8th grade Algebra students performed well on a rigorous assessment. Consequently, the claim that students' achievement was negatively impacted by the use of the CPM pilot is not supported.

Task Analysis

As noted earlier, an analysis of a specific task on the both the 2011-2012 and 2012-2013 midterm does provide specific insight to how students performed on a high level task in different years. The task in Figure 1 on the next page illustrates a specific item in the linear functions concept area on both the 2011-2012 and 2012-2013 midterm assessments at the middle and high schools. This task requires students to analyze the information from two different individuals based on various hours worked.

The student achievement numbers at the top of the task show the average score out of six. More specifically, the average score on this task for the high school students was 3.53 points out of 6 during the 2011-2012 school year, while in 2012-2013 the average was 4 points out of 6. For the 8th grade students in Algebra, the average number of points earned was 4.83 out of 6. This illustrates that the high school students performed at an improved rate on a higher level task, similar to a task that the SBAC assessment will include. Additionally, the 8th grade students in Algebra demonstrated their learning from the classroom instruction at a high rate, an 80.56% average score, which aligns to their performance on the entire assessment.

Figure 1: Task on the 2011-2012 and 2012-2013 Midterm Exam with Student Performance Data

High School 2011-2012	High School 2012-2013	Middle School 2012-2013
<i>3.46 points out of 6</i>	<i>4 points out of 6</i>	<i>4.83 points out of 6</i>

For an original graphic design, Lee charges a fixed fee of \$50 plus \$25 for each hour that he works. His main competitor, Sara, charges a fixed fee of \$40 plus \$30 for each hour that she works on a design. Sara advertises that her rates are cheaper. Use a graph, table, and/or equations to answer the following questions:

When would Lee & Sara charge the same amount? _____ (2 points)

When are Sara's rates cheaper? _____ (2 points)

When are Lee's rates cheaper? _____ (2 points)

Work Space:

Parent and Student Survey

In January 2013, parents and students were surveyed to receive feedback on the implementation of the pilot CPM resource (as posted on the district website in May 2013:

<http://fairfieldschools.org/downloads/friday/2013/may/Friday%20Packet%205-24-13.pdf>).

Parents and students were asked five questions each. These five questions related to the use of the online resources, if tutoring support was provided, and the use of cooperative learning groups. The information in Tables 14 and 15 illustrate the student's responses to the use of a tutor, while Tables 16 and 17 show the parent's responses.

Table 14: Student Survey Question 3

<i>Did you use an outside tutor for mathematics last year?</i>	
No Response	1.2%
No	91.3%
Yes	7.5%

Note: $N = 238$

Table 15: Student Survey Question 4

<i>Did you use an outside tutor for mathematics this year?</i>	
No Response	0.8%
No	85.1%
Yes	14.1%

Note: $N = 238$

Table 16: Parent Survey Question 3

<i>Did you use an outside tutor for mathematics last year?</i>	
No Response	3.4%
No	91.1%
Yes	5.4%

Note: $N = 208$

Table 17: Parent Survey Question 4

<i>Are you currently using an outside tutor for mathematics?</i>	
No Response	3.4%
No	82.3%
Yes	14.3%

Note: $N = 208$

As the information in Tables 14 to 17 illustrate, the rate of tutoring does increase from Pre-Algebra to Algebra from grade 7 to grade 8 respectively. These percentages were similar in both

the parent and student responses. We do not have data on use of tutors in Algebra 1 from previous years; therefore, the claim that the use of CPM caused more families to hire tutors could not be substantiated. The only conclusion that this data provides is that the rate of tutoring increases from Pre-Algebra to Algebra, which is a very typical occurrence.

Conclusion

The analysis of Algebra data provides a picture of how students performed during this year. The data suggests that the students performed as well or better as students in the past. The mark data suggests that the students performed at the same distribution in comparison to the historical data. The comparable midterm data suggests that the students performed just as well as in prior years. Therefore, the assertion that students were negatively affected could not be supported.

While the pilot of the CPM text resulted in similar or improved student achievement, the textbook was not recommended to the Board for adoption. A different textbook was recommended that provided the same or better level of instructional support and was formatted in a manner that was supportive of teacher, student and parent use in and out of the classroom.