



INITIAL FINDINGS

Standardized Test Scores

Increasing standardized test scores requires utilizing a scientific process to determine the contributing factors and develop proactive solutions. Systems thinking is a theoretical framework that will help to formulate proactive solutions to improving math test scores in the local public school. Systems thinking is the study of a system's structure and behavior (Senge et al., 2000). Senge et al. (2000) recommends analyzing a system by evaluating events, patterns and trends, developing a systemic structure, and developing mental models. According to Senge et al. (2000):

Behind each pattern of behavior is a systemic structure—a set of unrelated factors that interact, even though they may be widely separated in time and place, and even though their relationships may be difficult to recognize. When studied, these structures reveal points of greatest leverage: the places where the least amount of effort provides the greatest influence for change. These are not necessarily the points of highest authority; they are the places where the ingrained channels of cause and effect are most susceptible to influence (p. 82).

This reports only includes patterns and trends and a systemic structure due to the limitations of available resources.

Students that take math in grades 3 to 8, Algebra 1, Geometry, and Algebra 2 are responsible for completing the Partnership of Assessment for Readiness of College and Career (PARCC) assessment. High school students are required to complete the New Jersey Biology Competency Test too. Presently, all K-8 and high school students fall below the state average for meeting or exceeding the PARCC assessment.

Standardized Test Scores Patterns and Trends

Grade 3 to Grade 8

Table 1. Percent Passing All Students - Source NJ.com

	School A	School B	School C	School D	School E	School F	Average
Grade 3	10	23.7	15.3	0	7	54.8	18.47
Grade 4	15.1	37.2	8.1	25.4	4.1	17.7	17.93
Grade 5	9.9	15.7	9.8	10.4	16.1	19.0	13.45
Grade 6	9.4	7.7	4.4	36.1	6.1	26.4	15.01
Grade 7	16.1	5.4	11.5	5.2	8.3	23.9	11.73
Grade 8	4.8	13.0	10.4	14.3	13.6	24.7	13.47
Average	10.8	17.12	9.9	15.2	9.2	27.75	15.02

The School F has the highest average when compared to the other K-8 schools. School E School has the lowest average when compared to the other K-8 schools. Students in the grade level three scored higher when compared to the other 4 to 8 grade levels. Students in the grade level seven scored the lowest when compared to the other 3 to 8 grade levels. Students at the School F grade level three scored the highest when compared all of the other K to 8 schools at each grade level. School D grade level three scored the lowest when compared to all of the other schools at each grade level.

Table 2. Percent Passing African American Students - Source NJ.com

	School A	School B	School C	School D	School E	School F	Average
Grade 3	12.5	20	13.3	n/a	7.1	n/a	13
Grade 4	n/a	25	7.1	n/a	5.3	9.5	11.7
Grade 5	n/a	n/a	n/a	7.7	n/a	n/a	7.7
Grade 6	0	21.4	0	n/a	n/a	7.1	9.5
Grade 7	0	n/a	7.4	n/a	9.1	11.5	7
Grade 8	n/a	n/a	6.7	n/a	n/a	18.2	12.45
Average	2	22.13	8.6	7.7	7.1	11.58	10.22

African American students at School B School have the highest scoring average when compared to the other K to 8 schools. African American students at the School A scored the lowest when compared to the other schools. Grade 3 students scored the highest when compared to the other grade levels. Grade 7 scored the lowest when compared to the other grade levels in the K to 8 schools. African American students at the School B in grade 4 scored the highest when compared to other grade levels at the K to 8 schools. African American students for grades 6 and 7 at the School A and grade 6 at the School C scored the lowest when compared to other grade levels.

Table 3. Percent Passing Hispanic Students - Source NJ.com

	School A	School B	School C	School D	School E	School F	Average
Grade 3	9.8	23.8	15.8	22.2	8.7	26.2	17.75
Grade 4	16.4	29.8	9.8	21.8	0	20.6	16.4
Grade 5	10.9	20.5	12.8	11.9	18.8	24.4	16.55
Grade 6	12.0	0	n/a	23.6	0	30.1	13.14
Grade 7	19.7	4.3	13.0	4.3	9.1	27.0	12.9
Grade 8	4.1	10	12.5	11.6	8.3	26.6	12.18
Average	12.2	14.7	12.8	15.9	7.48	25.81	14.4

Hispanic students at the School F had the highest scoring average. Hispanic students at the School E had the lowest scoring average. Students in grade level 3 had the highest scoring average when compared to other grade levels. Students in grade level 8 had the lowest scoring average when compared to the other grade levels. Students in grade level 6 at the School F had the highest scoring average when compared to all other grade levels. Students in grade level 6 at School B and School E had the lowest scoring averages when compared to all other grade levels.

Table 4. Percent Passing Male Students - Source NJ.com

	School A	School B	School C	School D	School E	School F	Average
Grade 3	14.1	25.8	14.3	4.3	0	29.0	14.5
Grade 4	14.5	28.1	7.7	25.4	3.3	17.1	16.01
Grade 5	6.9	7.7	0	3.2	22.2	15.8	9.3
Grade 6	14.7	11.8	4.2	22.2	5	16.3	12.4
Grade 7	9.1	n/a	12.0	0	n/a	29.1	12.6
Grade 8	5.4	n/a	20.0	7.4	n/a	22.2	13.75
Average	10.8	18.4	9.7	10.4	7.6	21.58	13.1

Male students at the School F had the highest scoring average when compared to the other K to 8 schools. Male students at School E had the lowest scoring average when compared to the other K to 8 schools. Students in grade level 4 had the highest scoring level when compared to the other grade levels in the K to 8 schools. Students in grade level 5 had the lowest scoring level when compared to the other grade levels. Students in grade level 7 at School F had the highest scoring level when compared to all other grade levels. Students in grade level 5 at School C, grade level 7 at School D, and grade level 3 at the School E had the lowest scoring level when compared to all other grade levels.

Table 5. Percent Passing Female Students - Source NJ.com

	School A	School B	School C	School D	School E	School F	Average
Grade 3	6.5	21.4	16.3	17	13	22.5	16.11
Grade 4	16.9	28.1	8.6	13.5	5.3	18.5	15.2
Grade 5	12.9	24	15.4	15.2	7.7	24.6	16.5
Grade 6	5.4	4.5	4.8	21.9	7.7	35.1	13.2
Grade 7	23.3	n/a	11.1	10.0	n/a	18.6	15.75
Grade 8	23.3	n/a	11.1	10	n/a	18.6	15.8
Average	11.6	19.5	9.96	16.1	8.43	24.3	12.3

Female students at the School F had the highest scoring average when compared to the other K to 8 schools. Female students at the School E had the lowest scoring level when compared to the other schools. Students in grade level 5 had the highest scoring averages when compared to all other grade levels. Students in grade level 6 had the lowest scoring average when compared to all other grade levels. Students at School F grade 6 had the highest scoring level when compared to all other grade levels in all other schools. Students at the School B grade 6 had the lowest scoring average when compared to all other grade levels.

High School

Table 6. Algebra 1 - Grade 9

	Below	Met	Above
All	90.1	9.9	0
White	92.9	7.1	0
African American	95.5	4.5	0
Asian	n/a	n/a	n/a
Hispanic	86.8	13.2	0
Male	90.3	9.7	0
Female	89.8	10.2	0

Hispanic students scored the highest average on the Algebra 1 assessment when compared to the other ethnicities. African American students scored the lowest on the Algebra 1 assessment when compared to the other ethnicities. Female students outperformed the male students on the Algebra 1 assessment.

Table 7. Geometry - Grade 10

	Below	Met	Above
All	94.7	4.9	0.4
White	95	5	0
African American	98.7	1.3	0
Asian	93	7	0
Hispanic	95.7	4.3	0
Male	94.3	5.7	0.8
Female	95.7	5.3	0.4

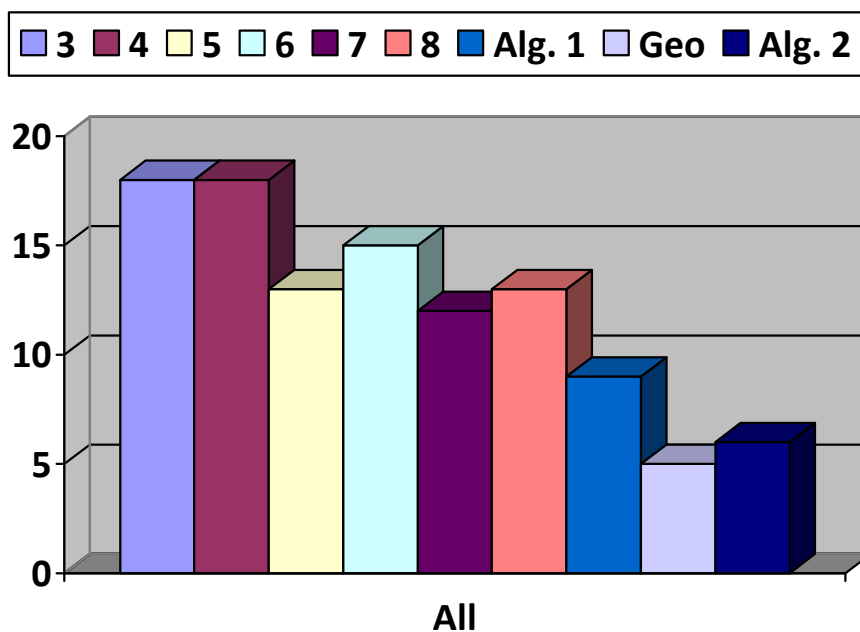
Asian students scored the highest average on the Geometry assessment when compared to the other ethnicities. African American students scored the lowest on the Geometry assessment when compared to the other ethnicities. Male students outperformed the female students on the Geometry assessment.

Table 8. Algebra 2 - Grade 11

	Below	Met	Above
All	94	6	0
White	84.6	15.4	0
African American	98.4	1.6	0
Asian	92.3	7.7	0
Hispanic	90	10	0
Male	98.1	1.9	0
Female	94.1	5.9	0

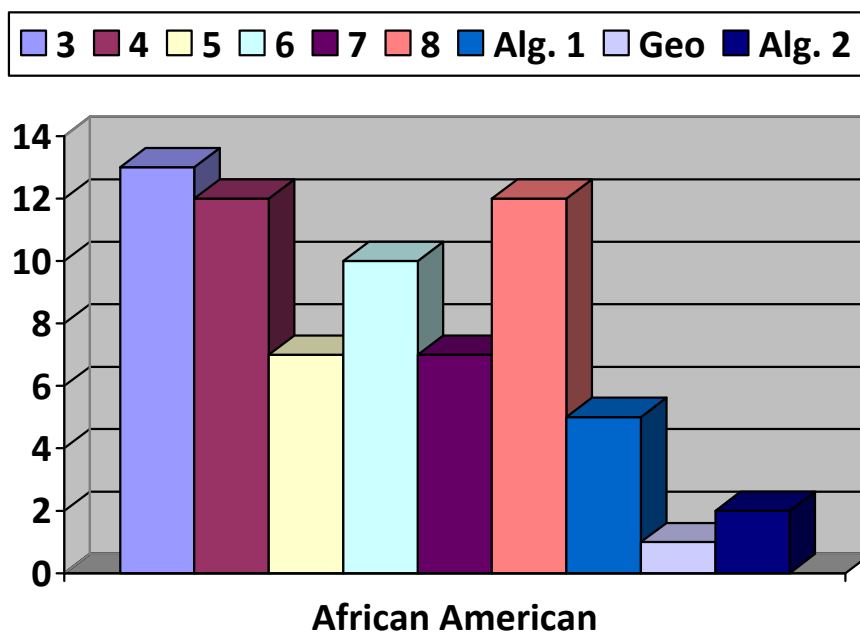
White students scored the highest average on the Algebra 2 assessment when compared to the other ethnicities. African American students scored the lowest on the Algebra 2 assessment when compared to the other ethnicities. Female students outperformed the male students on the Algebra 2 assessment.

Graph 1. PARCC Grade Level



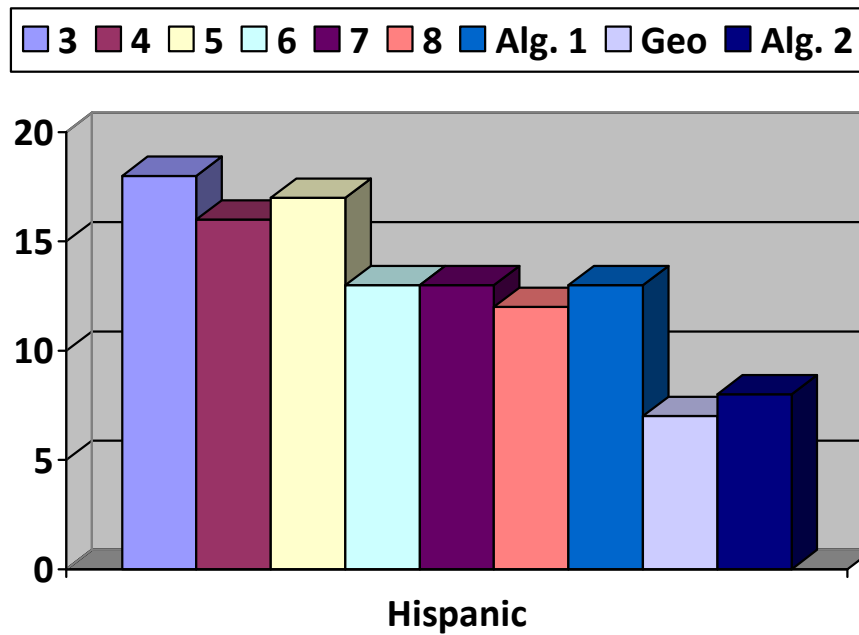
For all students, the pattern for grade level achievement is an irregular decline. In grade 3 and four, at least 18 percent of the students met the minimum achievement requirements for the PARCC assessment. In the Algebra 2 assessment, 6 percent of the students met the minimum achievement requirements. This is a decline of 12 percentage points.

Graph 2. PARCC Grade Level



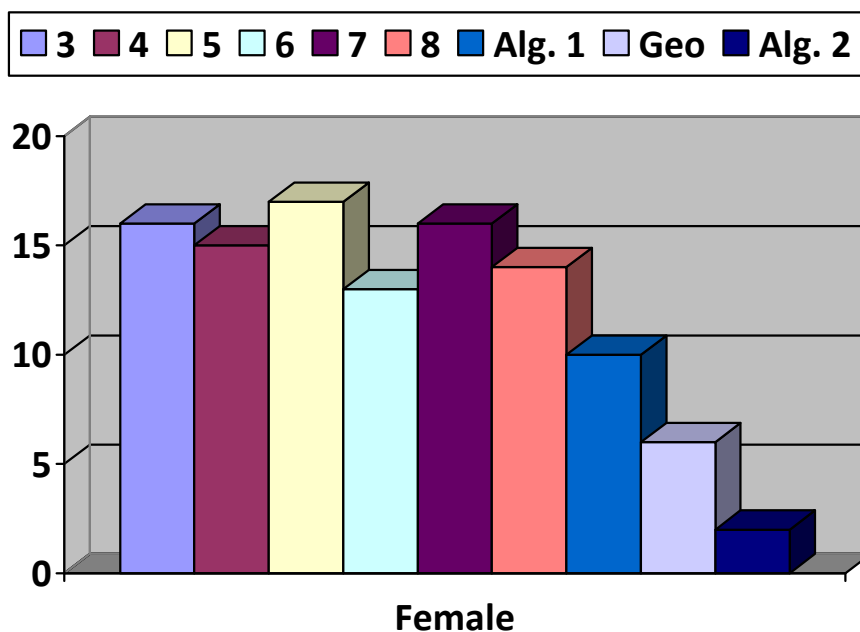
For African American students, the pattern for grade level achievement is an irregular decline. In grade 3, at least 13 percent of the students met the minimum achievement requirements for the PARCC assessment. In the Algebra 2 assessment, 2 percent of the students met the minimum achievement requirements. This is a decline of 11 percentage points.

Graph 3. PARCC Grade Level



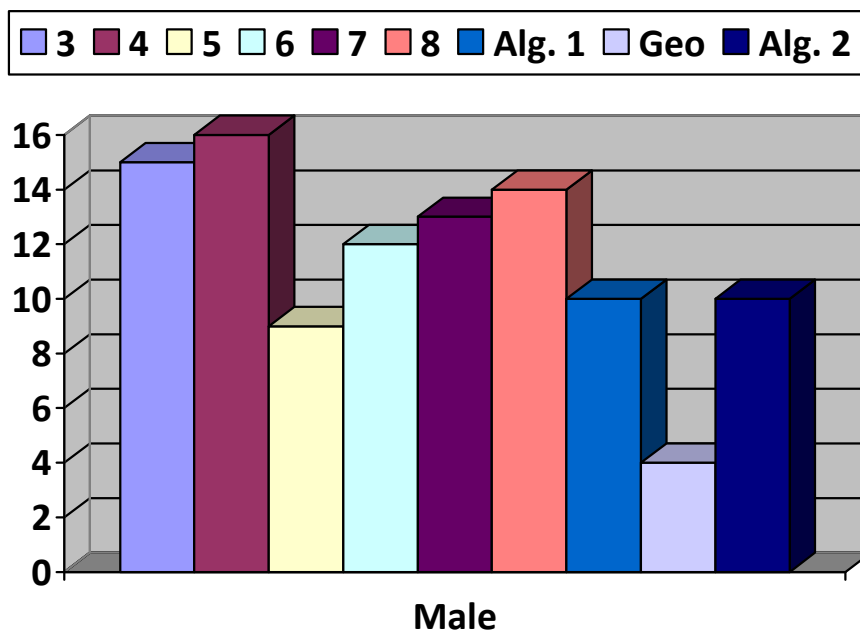
For Hispanic students, the pattern for grade level achievement is an irregular decline. In grade 3, at least 18 percent of the students met the minimum achievement requirements for the PARCC assessment. In the Algebra 2 assessment, 8 percent of the students met the minimum achievement requirements. This is a decline of 10 percentage points.

Graph 4. PARCC Grade Level



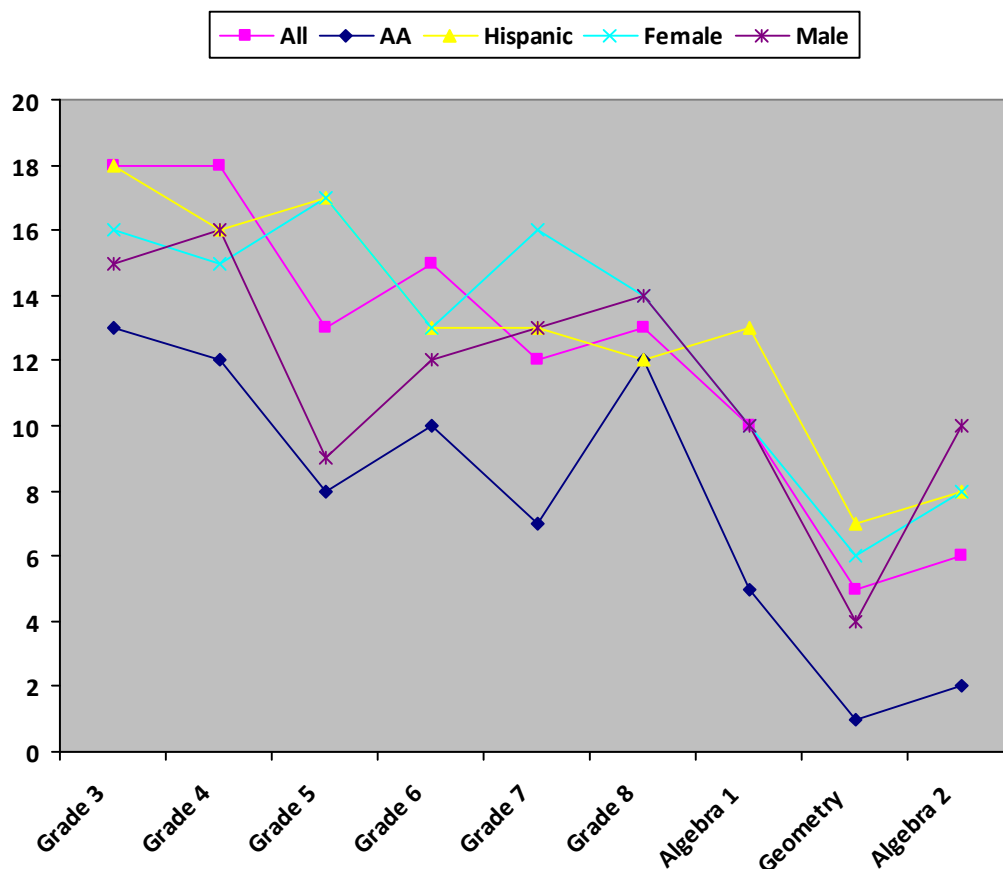
For female students, the pattern for grade level achievement is an irregular decline. In grade 3, at least 16 percent of the students met the minimum achievement requirements for the PARCC assessment. In the Algebra 2 assessment, 2 percent of the students met the minimum achievement requirements. This is a decline of 14 percentage points.

Graph 5. PARCC Grade Level



For male students, the pattern for grade level achievement is an irregular decline. In grade 3, at least 15 percent of the students met the minimum achievement requirements for the PARCC assessment. In the Algebra 2 assessment, 10 percent of the students met the minimum achievement requirements. This is a decline of 5 percentage points.

Graph 7. Overall Grade Level Comparisons



The graph 7 confirms that there is an overall irregular decline for grade level achievement. The most significant decrease is from grade 8 to Geometry for all students. The most significant decrease for African American students is from grade 8 to Geometry. The most significant decrease for Hispanic students is from Algebra 1 to Geometry. The most significant decrease for females is from grade 8 to Geometry. The most significant decrease for male students is from grade 8 to Geometry. There are also significant increases. The most significant increase for all students is from grade 5 grade 6. The most significant increase for African American students is from grade 7 to grade 8. The most significant increase for female students is from grade 5 to grade 8 and Geometry to Algebra 2. The most significant increase for male students is from grade 7 to grade 8.

Table 9.		
Math - Grade 1 Scope and Sequence		
Instructional Content	Days	Approximate End Date
Introduction	1	September 6, 2017
Chapter 1: Addition Concepts	15	September 27, 2017
Chapter 2: Subtraction Concepts	16	October 18, 2017
Chapter 3: Addition Strategies	17	November 21, 2017
Chapter 4: Subtraction Strategies	16	December 8, 2017
Chapter 5: Addition and Subtraction Relationships	15	January 9, 2018
Chapter 6: Count and Model Numbers	14	February 2, 2018
Chapter 7: Compare Numbers	18	February 26, 2018
Chapter 8: Two-Digit Addition and Subtraction	12	March 16, 2018
Chapter 9: Measurement	10	April 13, 2018
		Test Date April 16, 2018
Chapter 10: Represent Data	10	
Chapter 11: Three-Dimensional Geometry	15	

The standards not completed before the approximate PARCC testing date are as follows:

Measurement and Data

C. Represent and interpret data.

4. Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.

Geometry**A. Reason with shapes and their attributes.**

1. Distinguish between defining attributes (e.g., triangles are closed and three-sided) versus non-defining attributes (e.g., color, orientation, overall size); build and draw shapes to possess defining attributes.
2. Compose two-dimensional shapes (rectangles, squares, trapezoids, triangles, half-circles, and quarter-circles) or three-dimensional shapes (cubes, right rectangular prisms, right circular cones, and right circular cylinders) to create a composite shape, and compose new shapes from the composite shape.
3. Partition circles and rectangles into two and four equal shares, describe the shares using the words halves, fourths, and quarters, and use the phrases half of, fourth of, and quarter of. Describe the whole as two of, or four of the shares.

Understand for these examples that decomposing into more equal shares creates smaller shares.

Student PARCC score declines could be a result of the omissions of standards related to Measurement & Data and Geometry.

Table 10.		
Math - Grade 2 Scope and Sequence		
Instructional Content	Days	Approximate End Date
Introduction	1	September 7, 2017
Chapter 1: Number Concepts	15	September 28, 2017
Chapter 2: Numbers to 1,000	16	October 23, 2017
Chapter 3: Basic Facts and Relationships	17	November 28, 2017
Chapter 4: 2-Digit Addition	16	December 21, 2017
Chapter 5: 2-Digit Subtraction	15	January 23, 2018
Chapter 6: 3-Digit Addition and Subtraction	14	February 14, 2018
Chapter 7: Money and Time	18	March 15, 2018
Chapter 8: Length in Customary Units	12	April 9, 2018
		Test Date April 16, 2018
Chapter 9: Length in Metric Units	10	
Chapter 10: Data	10	
Chapter 11: Geometry and Fraction Concepts	15	

The standards not completed before the approximate PARCC testing date are as follows:

Measurement and Data

D. Represent and interpret data.

10. Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put together, take-apart, and compare problems⁴ using information presented in a bar graph.

Geometry**A. Reason with shapes and their attributes.**

1. Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces. Identify triangles, quadrilaterals, pentagons, hexagons, and cubes.
2. Partition a rectangle into rows and columns of same-size squares and count to find the total number of them.
3. Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words halves, thirds, half of, a third of, etc., and describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape

Student PARCC score declines could be a result of the omissions of standards related to Measurement & Data and Geometry.

Table 11.		
Math - Grade 5 Scope and Sequence		
Instructional Content	Days	Approximate End Date
Chapter 1: Place Value, Multiplication, and Expression	15	September 26, 2017
Chapter 2: Divide Whole Numbers	12	October 16, 2017
Chapter 3: Add and subtract Decimals	15	November 13, 2017
Chapter 4: 2-Multiply Decimals	10	December 5, 2017
Chapter 5: Divide Decimals	12	January 3, 2018
Chapter 6: Add and Subtract Fractions with Like Denominators	13	January 22, 2018
Chapter 7: Multiply Fractions	14	February 13, 2018
Chapter 8: Divide Fractions	8	February 28, 2018
Chapter 11: Geometry and Volume	14	March 20, 2018
Chapter 9: Algebra: Patterns and Graphing	10	April 11, 2018
		Test Date April 16, 2018
Chapter 10: Convert Units of Measure	10	

The standards not completed before the approximate PARCC testing date are as follows:

Measurement and Data

A. Convert like measurement units within a given measurement system.

1. Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.

Student PARCC score declines could be a result of the omissions of standards related to Measurement & Data.

Table 12.		
Math - Grade 8 Scope and Sequence		
Instructional Content	Days	Approximate End Date
Chapter 1: Rational Numbers	15	September 25, 2017
Chapter 2: Graphs & Functions	14	October 17, 2017
Chapter 3: Exponents & Roots	25	December 1, 2017
Chapter 4: 2-Ratios, Proportions, & Similarities	15	January 3, 2018
Chapter 5: Geometric Relationships	20	February 2, 2018
Chapter 7: Multi-Step Functions	14	February 27, 2018
Chapter 8: Graphing Lines	17	March 22, 2018
Chapter 9: Data, Predictions, & Linear Functions	10	April 13, 2018
		Test Date April 16, 2018
Chapter 6: Measurement and Geometry	13	April 11, 2018

The standards not completed before the approximate PARCC testing date are as follows:

Expressions and Equations

Work with radicals and integer exponents.

2. Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.

7. Solve linear equations in one variable.

a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an

equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).

Geometry

C. Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres. 9. Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

Student PARCC score declines could be a result of the omissions of standards related to Measurement & Data, Expressions & Equations, and Geometry.

Table 13.		
Math - Algebra 1 Grade 8 Scope and Sequence		
Instructional Content	Days	Approximate End Date
Chapter 0: Preparing for Algebra	4	September 11, 2017
Chapter 1: Expressions, Equations and Functions & Project	12	September 27, 2017
Chapter 2: Linear Equations	12	October 17, 2017
Chapter 3: Linear Equations	8	October 27, 2017
Chapter 4: Equations and Linear Functions & Project	13	November 21, 2017
Chapter 5: Linear Inequalities & Project	15	December 15, 2018
Chapter 6: Systems of Linear Equations and Inequalities & Project	18	January 23, 2018
Chapter 7: Exponents and Exponential Functions & Project	13	February 13, 2018
Chapter 8: Quadratic Expressions and Equations & Project	18	March 14, 2018
Chapter 9: Quadratic Functions and Questions	9.5	March 28, 2018
Pi Day	1	March 29, 2018
		Test Date April 16, 2018
Chapter 9: Quadratic Functions and Questions	11.5	April 30, 2018
Chapter 12: Statistics and Probability	9	May 11, 2018
Chapter 10: Radical Functions and Geometry & Project	13	June 1, 2018

The standards not completed before the approximate PARCC testing date are as follows:

Expressions and Equations

Work with radicals and integer exponents.

2. Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.

7. Solve linear equations in one variable.

a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).

Geometry

C. Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.

9. Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

Student PARCC score declines could be a result of the omissions of standards related to Measurement & Data and Geometry.

Table 14.		
Math - Algebra 1 Grade High School Scope and Sequence		
Instructional Content	Days	Approximate End Date
Chapter 0: Preparing for Algebra	4	September 11, 2017
Chapter 1: Expressions, Equations and Functions & Project	12	September 27, 2017
Chapter 2: Linear Equations	12	October 17, 2017
Chapter 3: Linear Equations	8	October 27, 2017
Chapter 4: Equations and Linear Functions & Project	13	November 21, 2017
Chapter 5: Linear Inequalities & Project	15	December 15, 2018
Chapter 6: Systems of Linear Equations and Inequalities & Project	18	January 23, 2018
Chapter 7: Exponents and Exponential Functions & Project	13	February 13, 2018
Chapter 8: Quadratic Expressions and Equations & Project	18	March 14, 2018
Chapter 9: Quadratic Functions and Questions	9.5	March 28, 2018
Pi Day	1	March 29, 2018
		Test Date April 16, 2018
Chapter 9: Quadratic Functions and Questions	11.5	April 30, 2018
Chapter 12: Statistics and Probability	9	May 11, 2018
Chapter 10: Radical Functions and Geometry & Project	13	June 1, 2018

The standards not completed before the approximate PARCC testing date are as follows:

Expressions and Equations

Work with radicals and integer exponents.

2. Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.

7. Solve linear equations in one variable.

a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).

Geometry

C. Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.

9. Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

Student PARCC score declines could be a result of the omissions of standards related to Expressions 7 Equations and Geometry.

Table 15.		
Math - Geometry High School Scope and Sequence		
Instructional Content	Days	Approximate End Date
Unit 1: Equations and Formulas	19	October 2, 2017
Unit 2: Graphing in the Coordinate Plane	11	October 19, 2017
Unit 3: 2D Figures	10	November 2, 2017
Chapter 1: Tools of Geometry	10	November 27, 2017
Chapter 3: Parallel and Perpendicular Lines	9	December 11, 2017
Chapter 2: Proofs	12	January 5, 2018
Chapter 4: Congruent Triangles	9	January 19, 2018
Chapter 5: Relationships within Triangles	6	January 31, 2018
Chapter 8: Right Triangles and Trigonometry	14	February 22, 2018
Chapter 7: Similarity	8	March 7, 2018
Chapter 6: Polygons and Quadrilaterals	12	March 23, 2018
PI Day	1	March 24, 2018
		Test Date April 16, 2018
Chapter 12: Circles	12	April, 20, 2018
Chapter 9: Transformations	10	May 7, 2018
Chapter 10: Area	6	May 15, 2018
Chapter 11: Surface Area and Volume	6	May 24, 2018

The standards not completed before the approximate PARCC testing date are as follows:

Congruence

A. Experiment with transformations in the plane

1. Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.
2. Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).
3. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
4. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
5. Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.

B. Understand congruence in terms of rigid motions

6. Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.
7. Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.
8. Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.

Similarity, Right Triangles, and Trigonometry

Understand similarity in terms of similarity transformations

1. Verify experimentally the properties of dilations given by a center and a scale factor:
 - a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.
 - b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.
2. Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.
3. Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

Circles

Understand and apply theorems about circles

2. Identify and describe relationships among inscribed angles, radii, and chords. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.
3. Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.

Expressing Geometric Properties with Equations

- A. Translate between the geometric description and the equation for a conic section
 1. Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation
 7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.

Geometric Measurement and Dimension

A. Explain volume formulas and use them to solve problems

1. Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. Use dissection arguments, Cavalieri's principle, and informal limit arguments.
2. (+) Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.
3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

B. Visualize relationships between two-dimensional and three-dimensional objects

4. Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

Modeling with Geometry

A. Apply geometric concepts in modeling situations

1. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

Student PARCC score declines could be a result of the omissions of standards related to Congruence, Similarity, Right Triangles, & Trigonometry, Expressing Geometric Properties with Equations, Geometric Measurements and Dimension, and Modeling Geometry.

Table 16.		
Math - Algebra 2 High School Scope and Sequence		
Instructional Content	Days	Approximate End Date
Chapter 1: Expressions, Equations, and Inequalities	11	September 20, 2017
Chapter 2: Functions, Equations, and Graphs	9	October 3, 2017
Chapter 3: Linear Systems	8	October 17, 2017
Chapter 4: Quadratic Functions and Equations and Midterm Exam	16	November 8, 2017
Supplemental Unit 1: Transformations	12	December 5, 2017
Chapter 5: Polynomials and Polynomial Functions	12	December 21, 2017
Chapter 11: Probability and Statistics and Final Exam	19	January 31, 2018
Algebra Review	8	February 12, 2018
Chapter 6: Radical Functions and Rational Exponents	12	March 5, 2018
Chapter 8: Rational Functions	12	March 21, 2018
Chapter 7: Exponential and Logarithmic Functions	10	April 12, 2018
PI Day	1	April 13, 2018
		Test Date April 16, 2018
Chapter 9: Sequence and Series	9	May 1, 2018
Chapter 13: Periodic Functions and Trigonometry	13	May 18, 2018

Interpreting Functions

B. Interpret functions that arise in applications in terms of the context

4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.
6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

C. Analyze functions using different representations

7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
 - a. Graph linear and quadratic functions and show intercepts, maxima, and minima.
8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
 - a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

Seeing Structure in Expressions

B. Write expressions in equivalent forms to solve problems

3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
 - b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines

Building Functions

B. Build new functions from existing functions

3. Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

Reasoning with Equations and Inequalities

B. Solve equations and inequalities in one variable

4. Solve quadratic equations in one variable.
- Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.
 - Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b .

Solve systems of equations

7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$.

The Real Number System

A. Extend the properties of exponents to rational exponents.

2. Rewrite expressions involving radicals and rational exponents using the properties of exponents.

Student PARCC score declines could be a result of the omissions of standards related to Interpreting Functions, Analyze Functions Using Different Representations, Seeing Structure in Expression, Building functions, reasoning with Equations and Inequalities, Solve Systems of Equations, and The Real Number System.

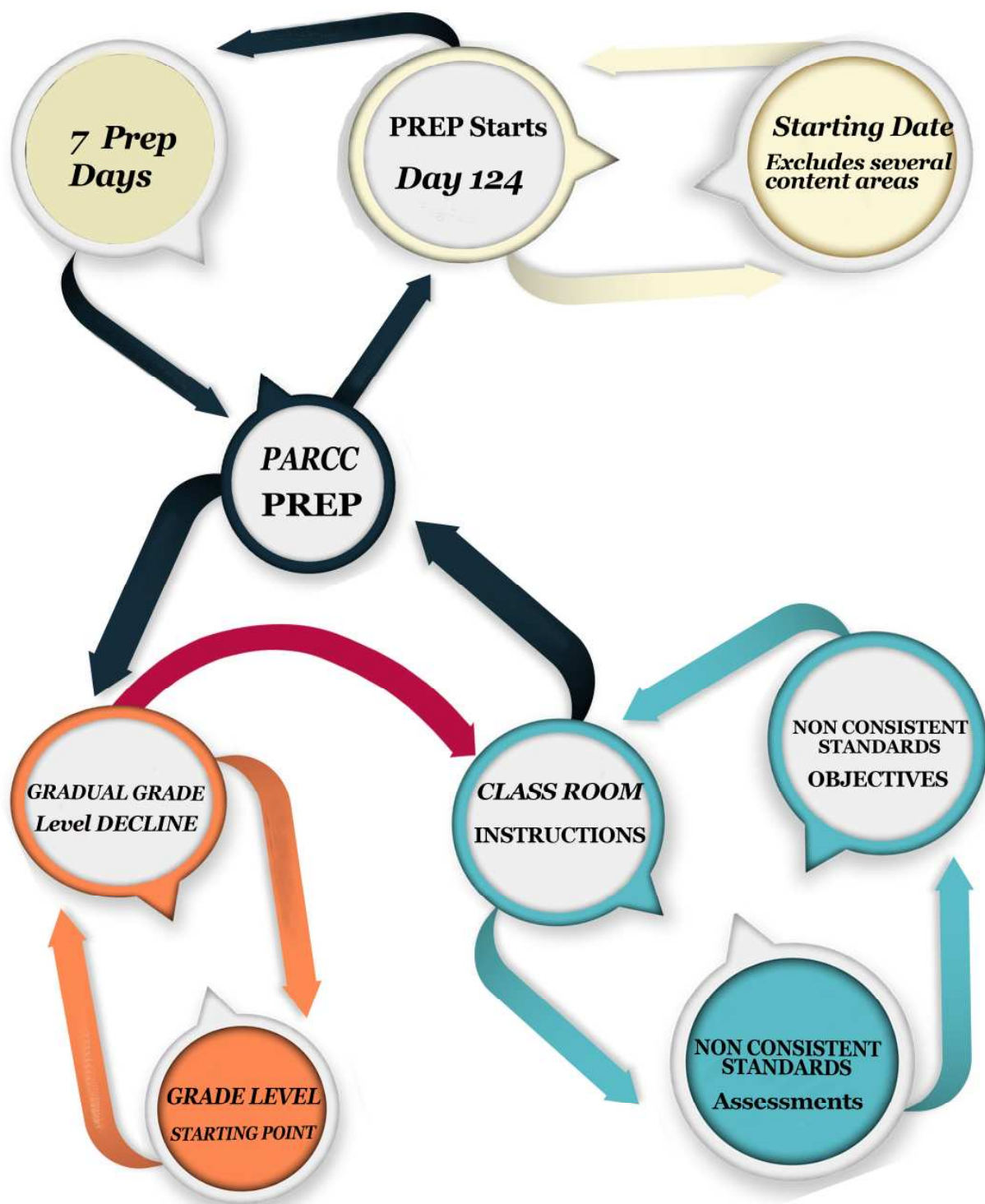
Table 17. Math Curriculum Assessment Format

Grade Level	Assessment Formats
Math 1	Summarize, Essential Questions, Math Journal
Math 2	Summarize, Essential Questions, Math Journal
Math 3	Summarize, Essential Questions, Exit Slip, Homework, Textbook Quiz
Math 4	Summarize, Math Journal, Essential Question, Exit Slip
Math 5	Summarize, Math Journal, Essential Question, Exit Slip
Math 7	Essential Question, Summarize, Closure, Homework, Chapter Test
Math 8	Essential Question, Summarize, Closure, Homework, Chapter Test
Grade 8 Algebra 1	Homework, Exit ticket, District Test
Algebra 1	Homework, Exit Ticket, District Test
Geometry	Homework, Exit Ticket, District Test
Algebra 2	Homework, Exit Ticket, District Test

Table 18. Science Curriculum Assessment Format

Grade Level	Assessment Formats
Science 1	Exit Slip, Lesson Quiz, District Assessment
Science 3	Exit Slip, Lesson Quiz, District Assessment
Science 5	Exit Slip, Lesson Quiz, District Assessment
Science 8	Lesson quiz, District Test, Analysis, Class Discussion,
Chemistry Honors	Homework, Exit Ticker, District Test

Systemic Diagram



Systemic Diagram Evaluation

According to the available documentation, there exist several leverage points that will help to transition the local public school math scores to a higher level. Senge et al. (2000) reported that:

Behind each pattern of behavior is a systemic structure—a set of unrelated factors that interact, even though they may be widely separated in time and place, and even though their relationships may be difficult to recognize. When studied, these structures reveal points of greatest leverage: the places where the least amount of effort provides the greatest influence for change. These are not necessarily the points of highest authority; they are the places where the ingrained channels of cause and effect are most susceptible to influence (p. 82).

The three leverage points are associated with classroom instruction, PARCC preparation, and the gradual grade level decline.

According to reviewed curriculum guides many of the objectives for math and science need enhancement to represent the present New Jersey State Standards. Even more important, the assessments are not consistent with the standards and represent a "canned" approach to assessment of learning. This realignment will help to better equip students to successfully negotiate the PARCC assessment.

The next leverage point is the annual PARCC assessment preparation. In many of the math curriculum guides, seven days are allotted for the preparation. The challenge is that the curriculum guides reveal that several math content areas are not completed before the PARCC target date. The content areas not completed are found in Table 19. In order to help with this challenge, teachers should have at their disposal PARCC preparation materials. However, instead of the traditional process of covering the content areas that teachers have implemented according to the curriculum guide, principals will need to ensure that teachers expose their students to the content areas not covered during the year. Once they have accomplished this process, then the preparation materials need to be transferred to the next grade level and those teachers need to begin teaching standards

related to the next grade level. This will help to shift curriculum pace and ensure in the next year that teachers will have a head start at completing the entire curriculum before the next PARCC preparation time frame.

Table 19. Content Areas Not Covered Before PARCC Target Date

Grade Level	Content Area(s)
1	Represent Data, Three Dimensional Geometry
2	Length in Metrics, Data, Geometry & Fraction Concepts
5	Measurement & Data
8	Expressions & Equations, Geometry
8 Algebra 1	Expressions & Equations, Geometry
Algebra 1	Expressions & Equations, Geometry
Geometry	Congruence, Similarity, Rights Triangles, & Trigonometry, Circles, Expressing Geometric Properties with Equations, Geometric Measurement & Dimension, Modeling with Geometry,
Algebra 2	Interpreting Functions, Analyze Functions Using Different Representations, Seeing Structure in Expression, building Functions, Reasoning with Equations and Inequalities, Solve Systems of Equations, and The real Number System

The final leverage point involves the starting point for grade level 3. Grade level 3 for all students begins with 18% of the students successfully meeting or exceeding the requirements for the PARCC assessment. There are 6% of Algebra 2 students who successfully meet or exceed the requirements for the PARCC exam. this is a drop of 15 percentage points. Grade level 3 for African American students begins with 13% of the students successfully meeting or exceeding the requirements for the PARCC assessment. There are 2% of the African American Algebra 2 students who successfully meet or exceed the requirements for the PARCC exam. This is a drop of 11 percentage points. Grade level 3 for Hispanic students begins with 18% of the students successfully meeting

or exceeding the requirements for the PARCC assessment. There are 8% of Algebra 2 Hispanic students who successfully meet or exceed the requirements for the PARCC exam. This is a drop of 10 percentage points.

The state average for grade 3 students who meet or exceed the PARCC assessment requirements is 53 percent. Since the greatest decline for grade 3 students is 15 percentage points, it help to ensure that at least 68% of the local public school grade 3 students meet or exceed the PARCC assessment.

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