

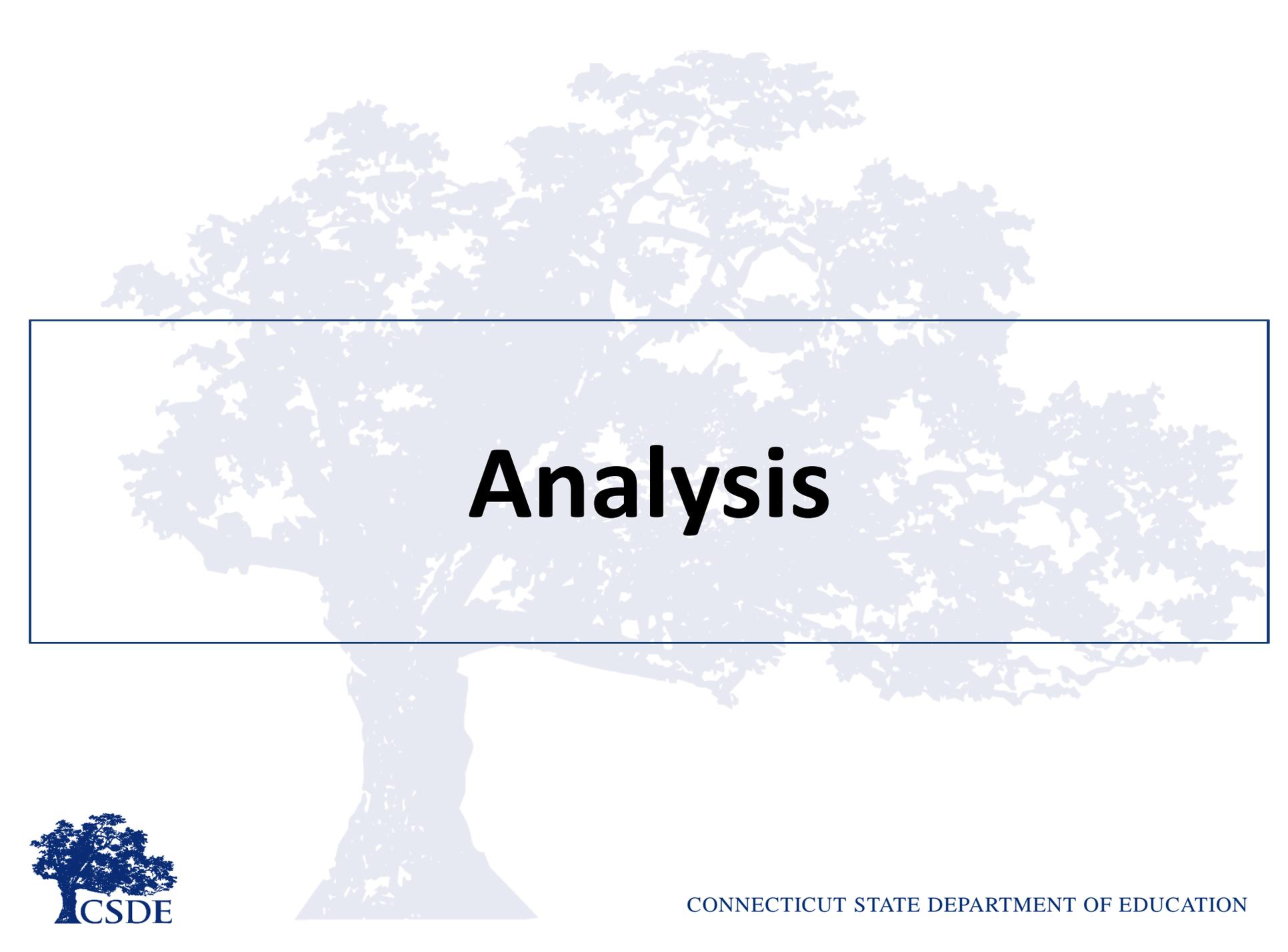


CONNECTICUT STATE DEPARTMENT OF EDUCATION

Target Scores: How is Connecticut doing on the Math Standards and what can we learn?

Performance Matters

October 17, 2019



Analysis



Background

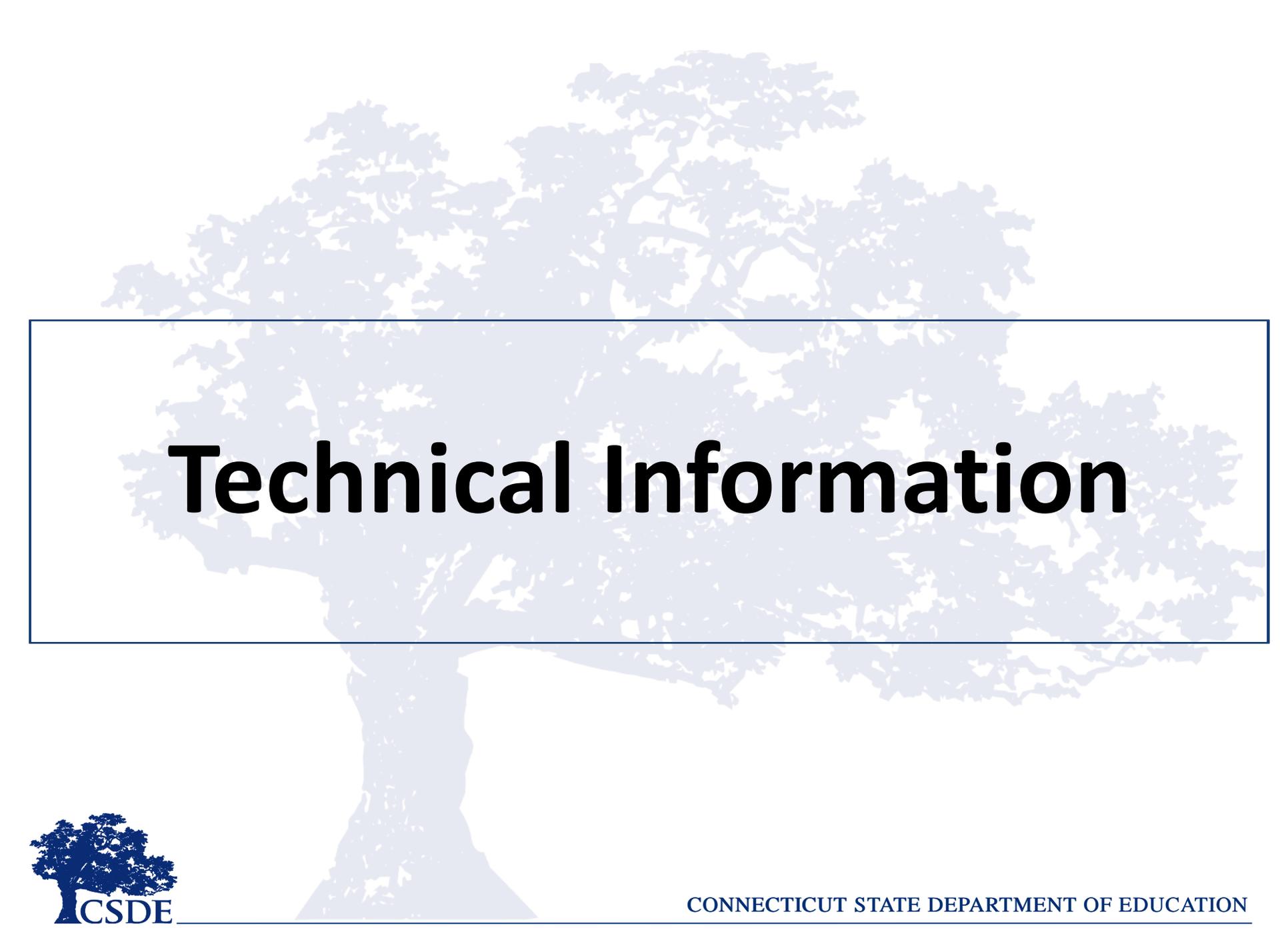
- Connecticut has been administering the Smarter Balanced Assessment since 2015
- Claim and target level data is only reported as “+”, “=” or “-”
- Claim 1 targets are based on the grade level content standards
- Claims 2, 3 & 4 targets are based on the Standards for Mathematical Practice
- Targets have depth of knowledge (DOK) ranges identified in the [blueprint](#)



Purpose

- Determine strengths and areas in need of improvement
- Identify trends in math achievement based on assessment targets
- Inform curricular and instructional decisions
- Drive professional learning





Technical Information



Student Target Scores

- Student target score: The distance from *proficient* as a proportion of score points

Example 1: Amelia took one item, worth one point and got it correct

	Points Available	Expected score for proficiency	Amelia's Score
	1	.6	1
Target Score	$1 - 0.6 = .4$		

	Points Available	Expected score for proficiency	Cai's Score
	2	1.4	1
Target Score	$\frac{1 - 1.4}{2} = -.2$		

Example 2: Cai took one item, worth two points and scored 1 out of 2 points

Example 3: Mani took two items, both worth one point, and the easier one correct but the harder one incorrect

	Points Available	Expected score for proficiency	Mani's Score
	1	.7	1
	1	.5	0
Total	2	1.2	1
Target Score	$\frac{1 - 1.2}{2} = -.1$		

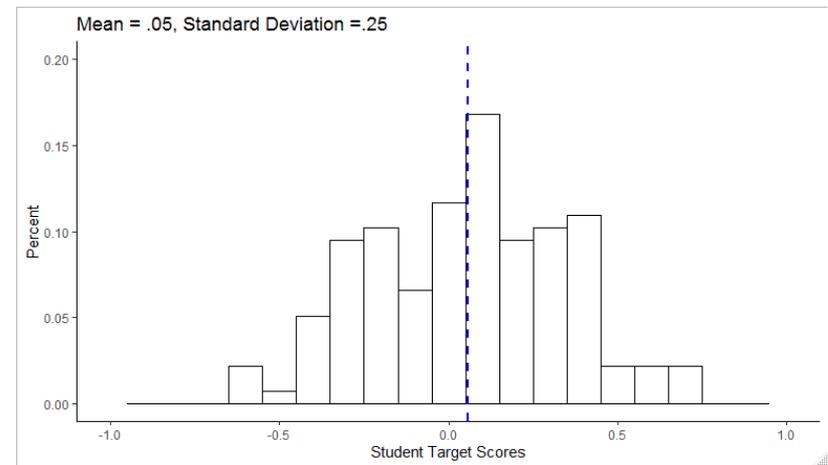
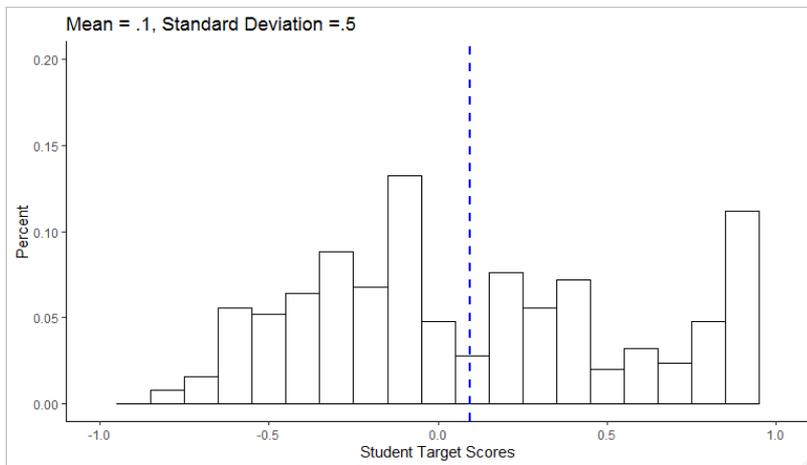
“Proficiency” changes with each grade – we expect students to know and do more each year.



Effect size = mean target score / Standard deviation

**Higher mean,
higher standard deviation**

Lower mean, lower standard deviation



Both groups have a target effect size of 0.2



Comparison to what districts already see

- Districts already see “Above proficient” “Near Proficient” or “Below Proficient” for the targets.
- Effect sizes near .2 roughly correspond to “above proficient” and below -.2 roughly correspond to “below proficient”. We thus set .2 as a “meaningful” difference
- A more nuanced approach – how far above proficient?
- Year to year view without clicking between windows





Target Performance



Target Data Considerations

Target performance was evaluated in two ways at the state and district level:

- Grade level target performance over time
- Domain performance across grades and over time
 - Rough and matched cohorts

Additional evaluation of target data at the state level included:

- Math certifications vs. elementary certifications
- Demographic performance



Domain Data

- We wanted to connect the performance of the same students year over year. We aggregated the items into domains.

Elementary domains (3-5)	Middle Grades domains (6-8)
Operations and Algebraic Thinking Numbers and Operations Base 10 Numbers and Operations: Fractions Measurement and Data Geometry	Ratios and Proportional Relationships (6 th and 7 th grades only) The number system Expressions and Equations Functions (8 th grade only) Geometry Statistics and Probability

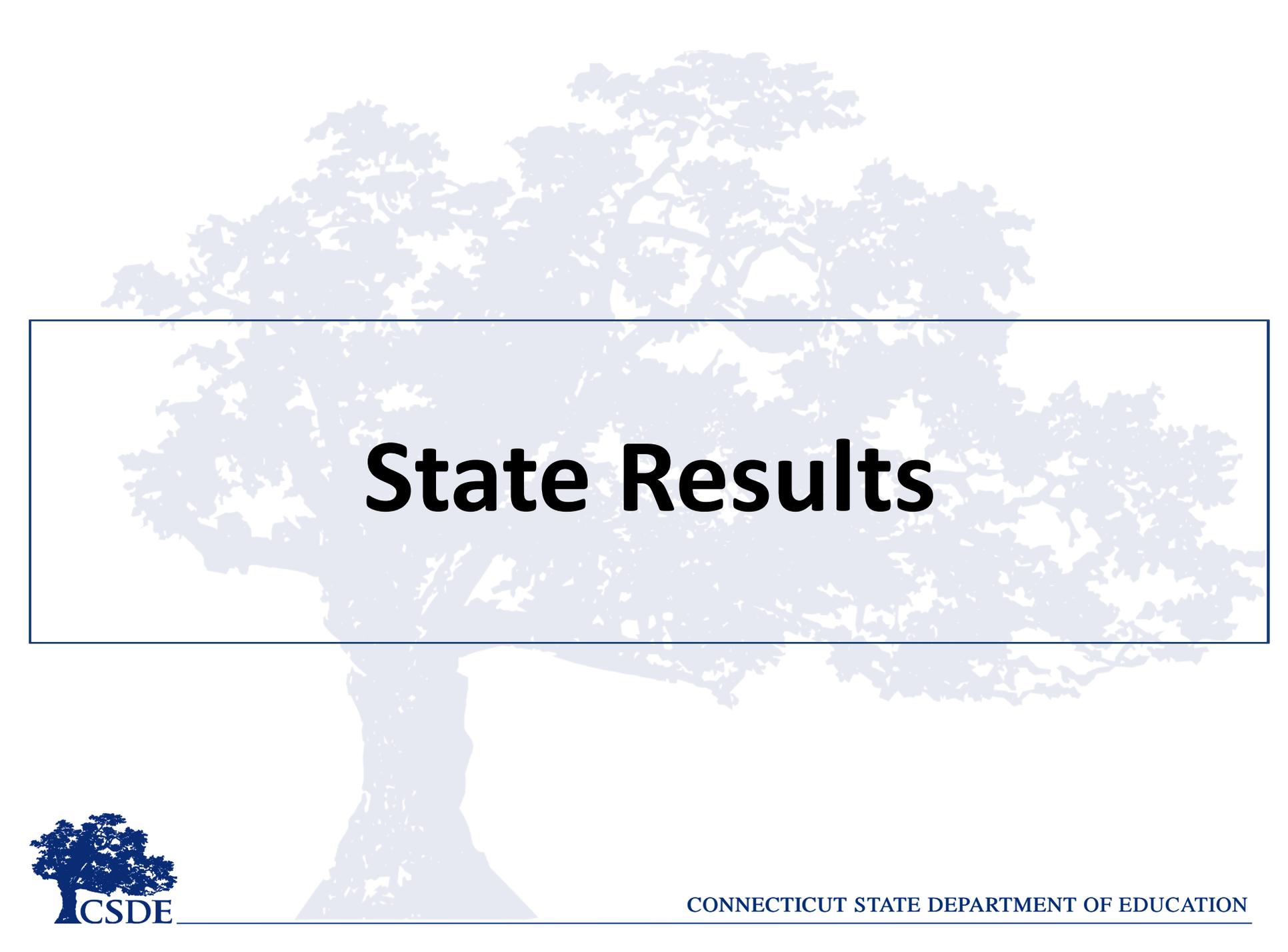
- And looked at cohorts of students

	Graduation Year	Grade 3 Test Year	Grade 4 Test Year	Grade 5 Test Year	Grade 6 Test Year	Grade 7 Test Year	Grade 8 Test Year
Elementary Cohorts	2026	2017	2018	2019			
	2025	2016	2017	2018			
Middle Cohorts	2023				2017	2018	2019
	2022				2016	2017	2018

Matched cohort; those students who stayed in district for grades 3-5 or grades 6-8.

Rough cohort – all students in a district.



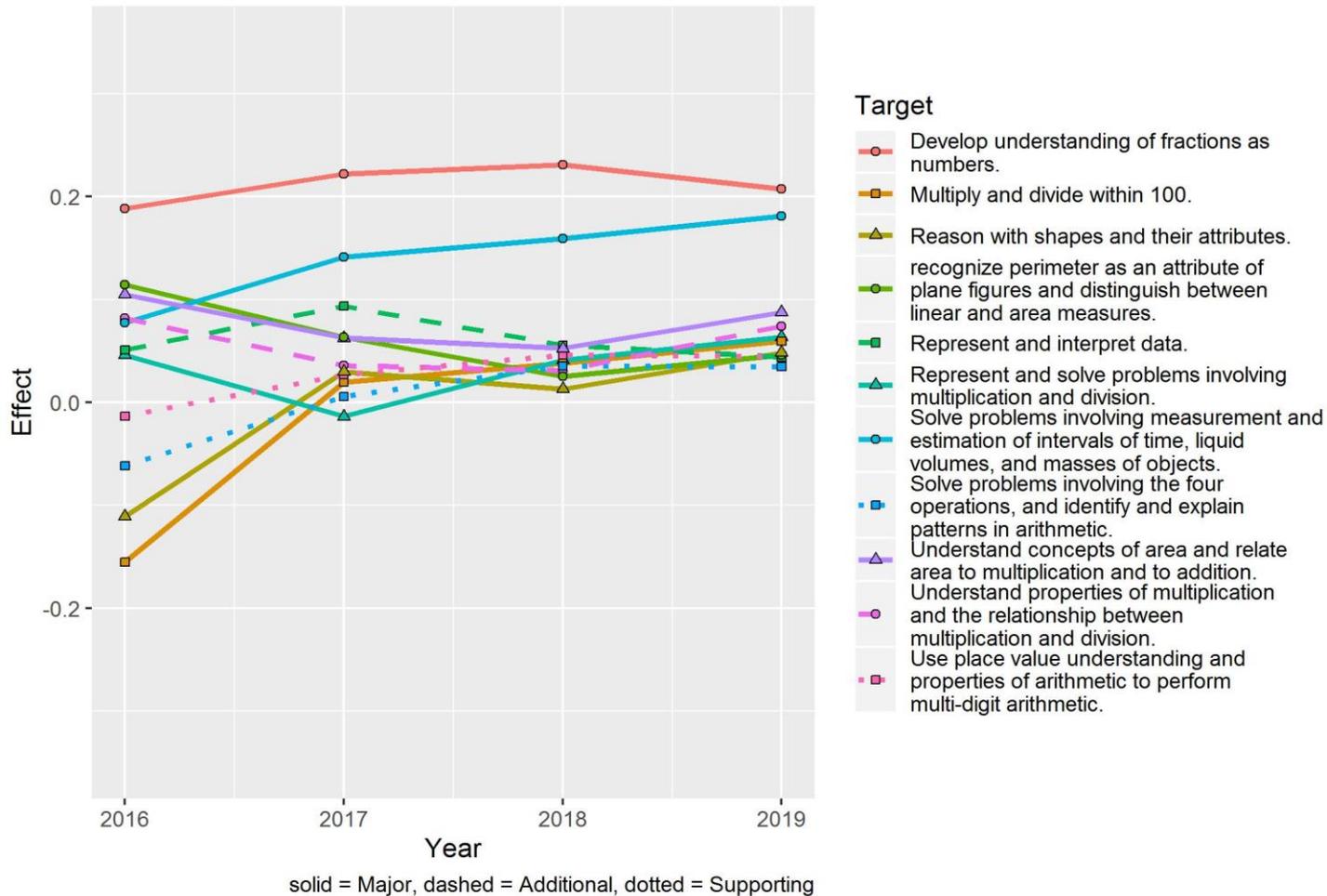


State Results

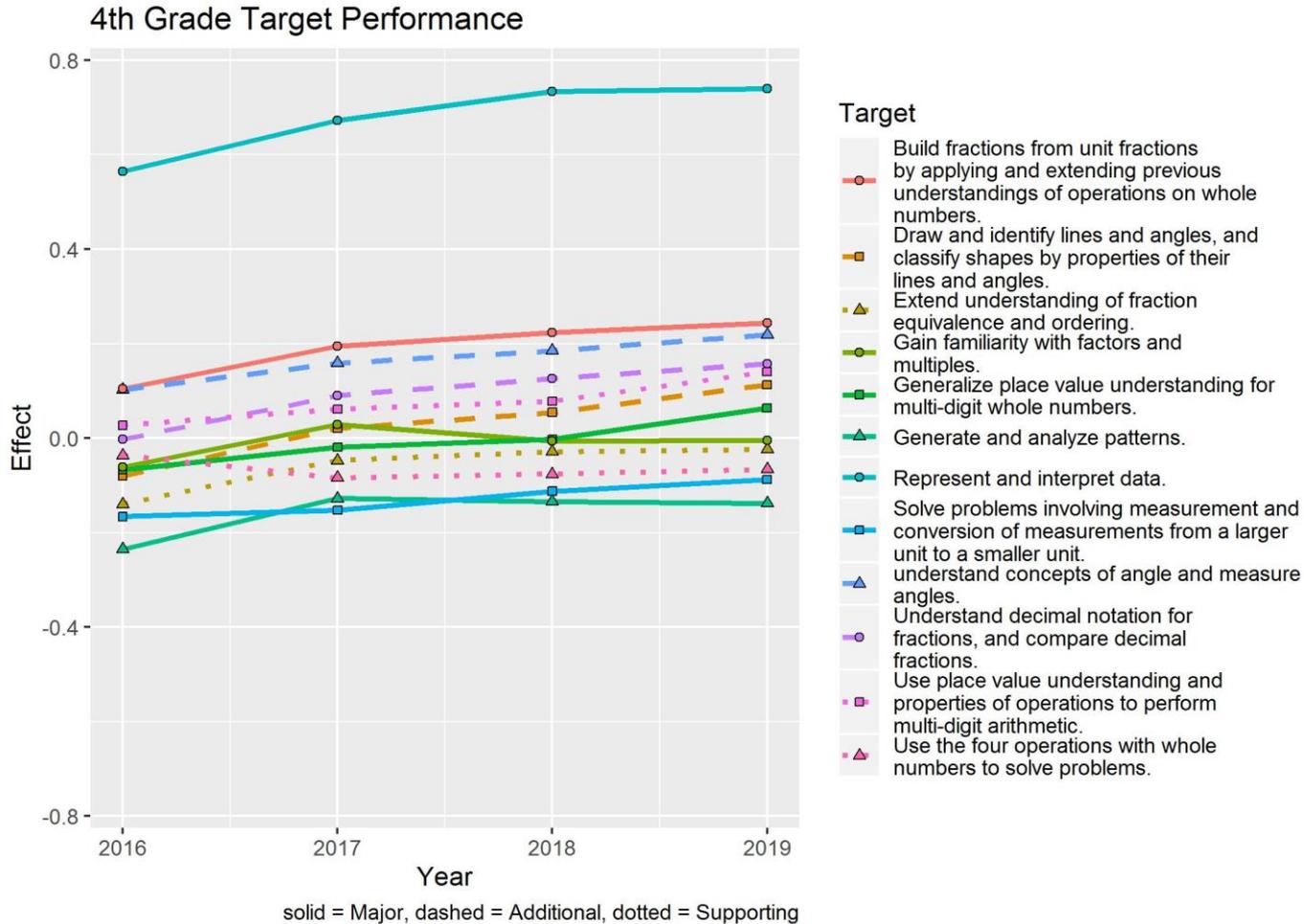


Grade 3

3rd Grade Target Performance

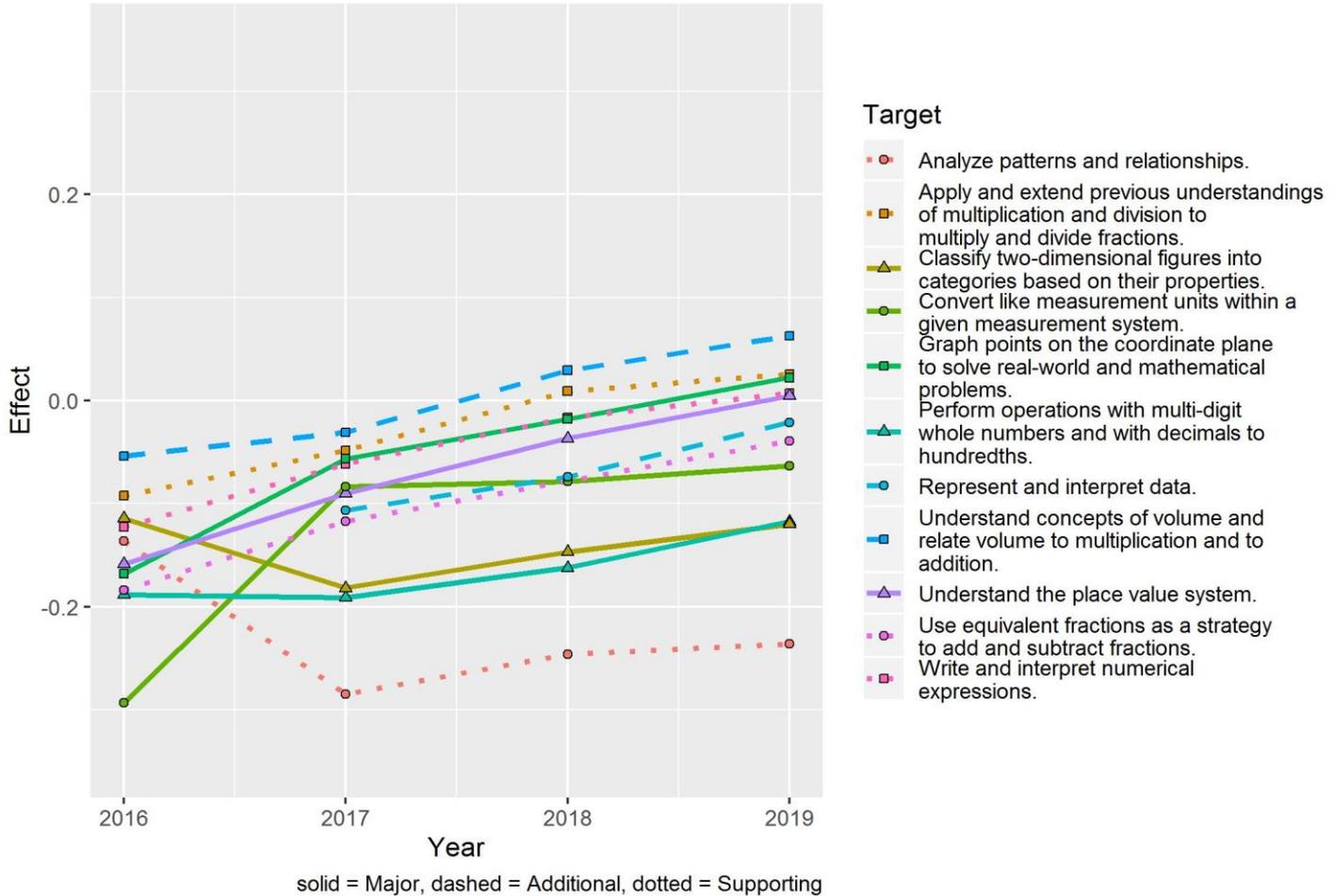


Grade 4



Grade 5

5th Grade Target Performance



Grade 6

6th Grade Target Performance



Target

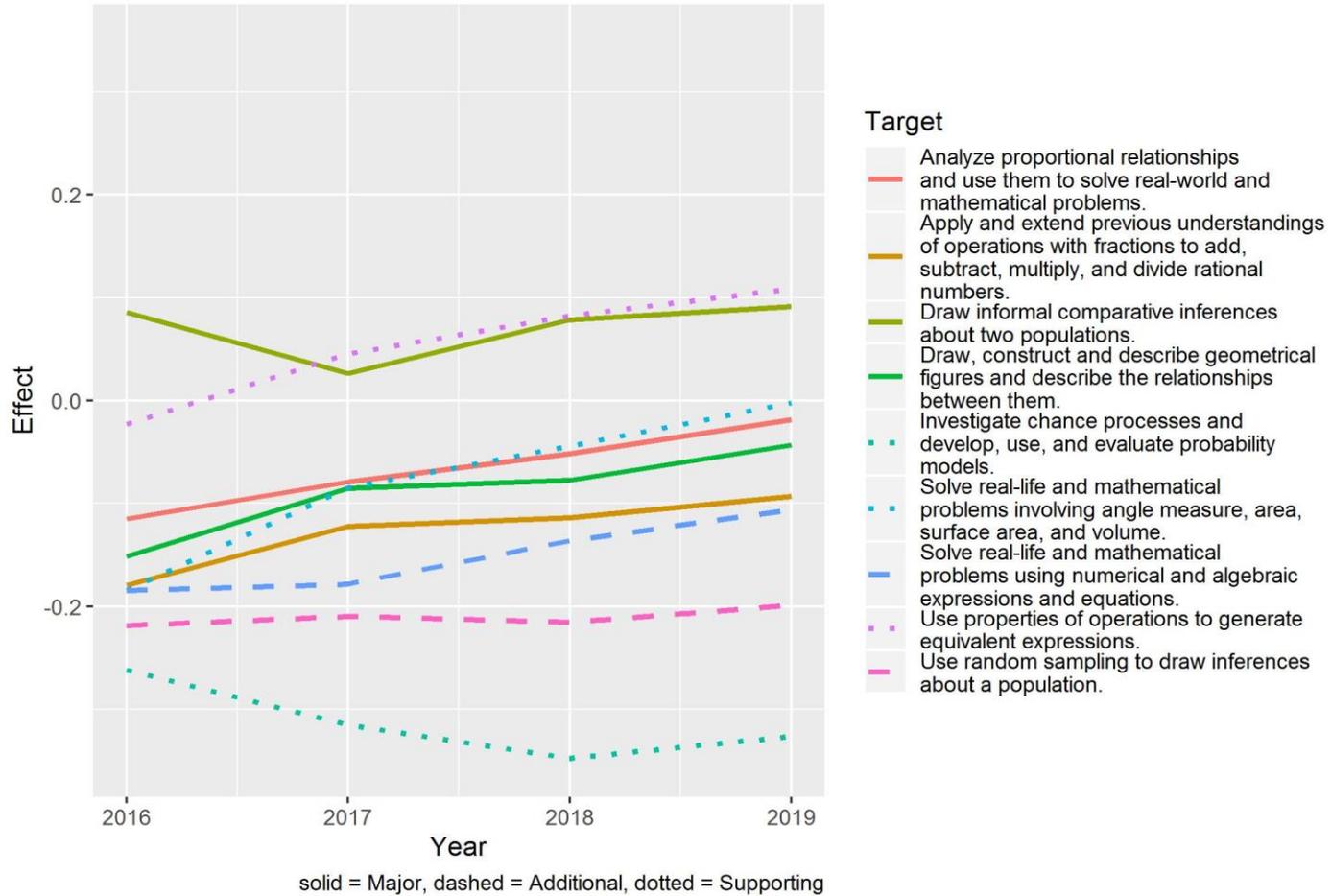
- Apply and extend previous understandings of arithmetic to algebraic expressions.
- Apply and extend previous understandings of multiplication and division to divide fractions by fractions.
- △ Apply and extend previous understandings of numbers to the system of rational numbers.
- Compute fluently with multi-digit numbers and find common factors and multiples.
- Develop understanding of statistical variability.
- △ Reason about and solve one-variable equations and inequalities.
- Represent and analyze quantitative relationships between dependent and independent variables.
- Solve real-world and mathematical problems involving area, surface area, and volume.
- △ Summarize and describe distributions.
- Understand ratio concepts and use ratio reasoning to solve problems.

solid = Major, dashed = Additional, dotted = Supporting



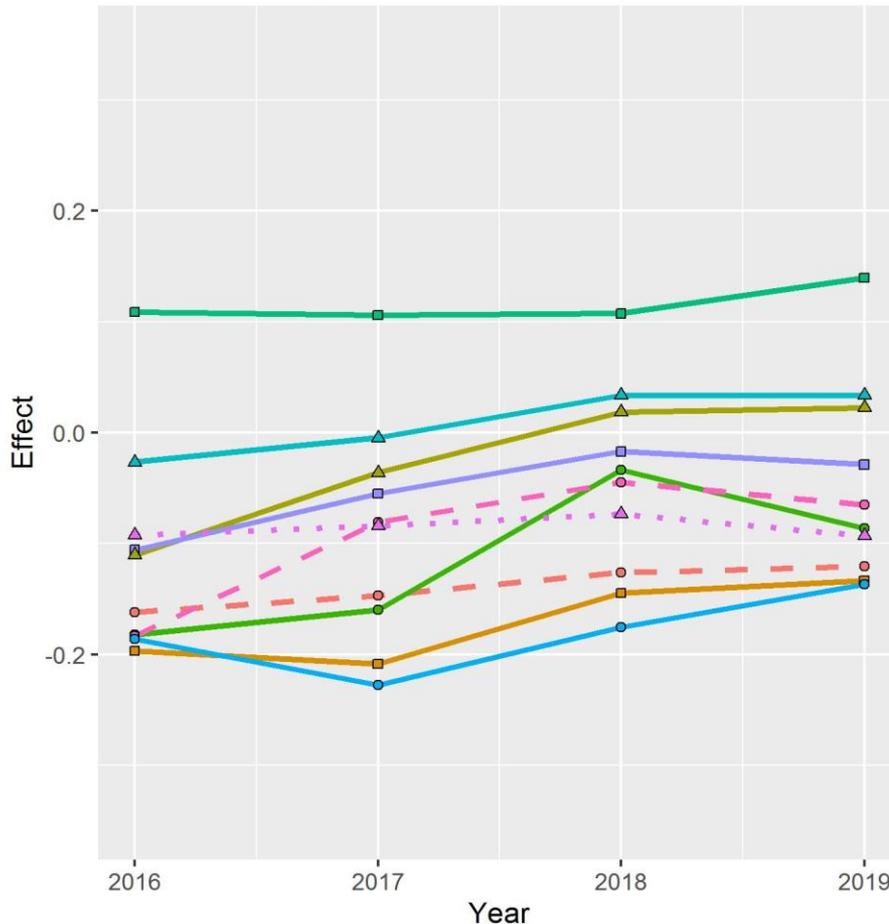
Grade 7

7th Grade Target Performance



Grade 8

8th Grade Target Performance



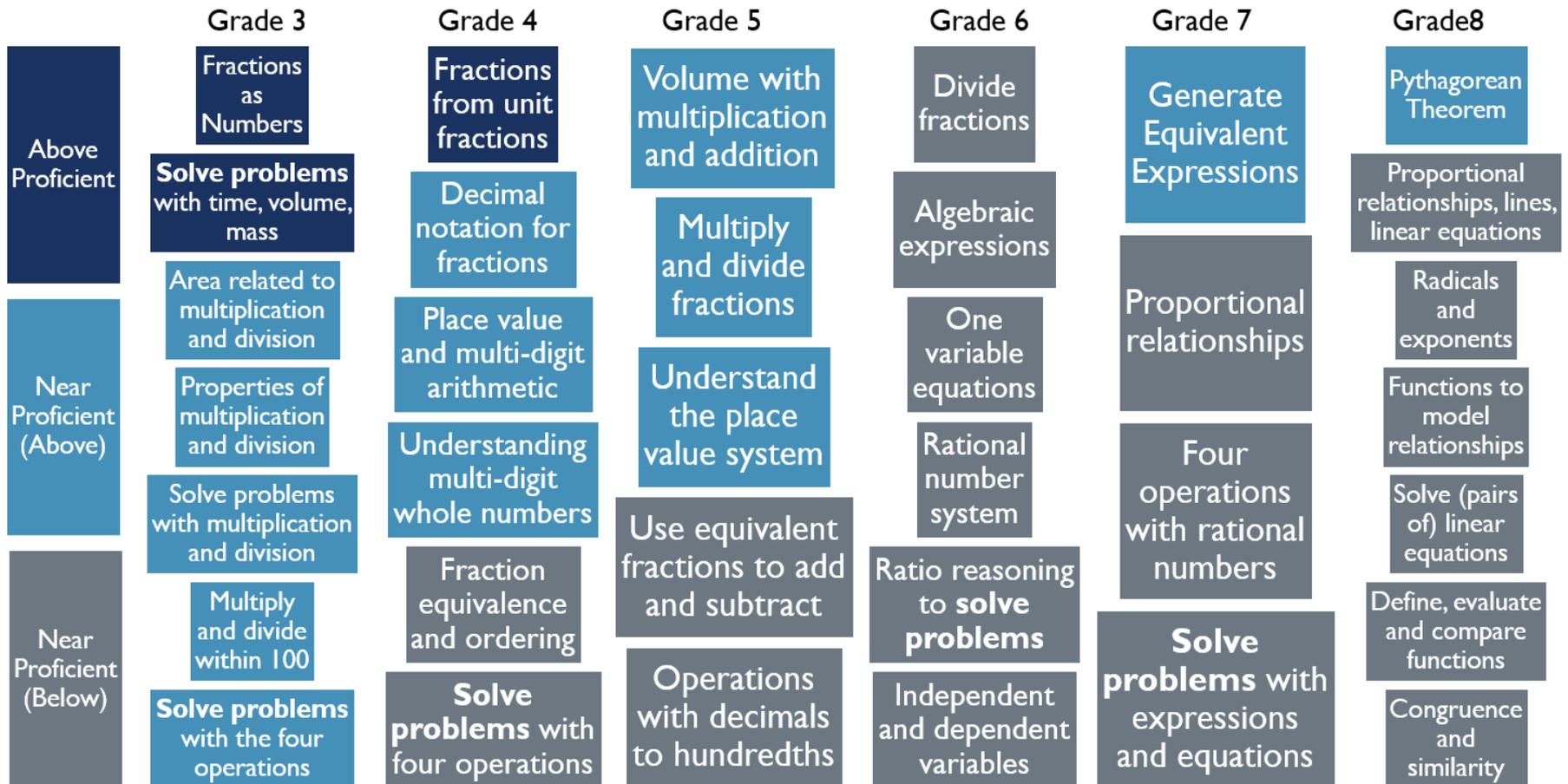
solid = Major, dashed = Additional, dotted = Supporting

Target

- Analyze and solve linear equations and pairs of simultaneous linear equations.
- Functions: Define, evaluate, and compare functions.
- △ Investigate patterns of association in bivariate data.
- Know that there are numbers that are not rational, and approximate them by rational numbers.
- Solve real-world and mathematical problems involving volume of cylinders, cones and spheres.
- △ Understand and apply the Pythagorean theorem.
- Understand congruence and similarity using physical models, transparencies, or geometry software.
- Understand the connections between proportional relationships, lines, and linear equations.
- △ Use functions to model relationships between quantities.
- Work with radicals and integer exponents.



Major work of the Grade



Target Connections

- Coherence within and across grades
- Logical pre-requisites needed for student success of mathematical content
- Content standard clusters are the same as the targets
- Mapping clusters to targets to understand connections between targets



Impact of Connections

M	+	3D	Solve problems involving the four operations, and identify and explain patterns in arithmetic.	4A	4C		
A	+	3E	Use place value understanding and properties of operations to perform multi-digit arithmetic.	4D	4E		
M	=	3F	Develop understanding of fractions as numbers.	3K	5F	4G	5J
M	+	3G	Solve problems involving measurement and estimation of intervals of time, liquid volumes, and	4I			
S	-	3H	Represent and interpret data.	4J			
M	-	3I	Geometric measurement: understand concepts of area and relate area to multiplication and to	3J	5I	4I	5F
A	-	3J	Geometric measurement: recognize perimeter as an attribute of plane figures and 3-4 distinguish	4I			
S	+	3K	Reason with shapes and their attributes	4L	5K		
M	-	4A	Use The Four Operations With Whole Numbers To	5F	5A	6A	8B
A	+	4C	Generate And Analyze Patterns	5B			
S	+	4B	Gain Familiarity With Factors And Multiples	6E	6C		
M	+	4D	Generalize Place Value Understanding For Multi-Digit Whole Numbers	4E	5C	4A	
M	+	4E	Use Place Value Understanding And Properties Of Operations To Perform Multi-Digit Arithmetic	5D	4A		
M	+	4F	Extend Understanding Of Fraction Equivalence And	4H	5E	5F	4G
M	+	4G	Build Fractions From Unit Fractions By Applying And Extending Previous Understandings Of	4H	5E	5F	4I
M	+	4H	Understand Decimal Notation For Fractions, And Compare Decimal Fractions	4I	5C		
S	+	4I	Solve Problems Involving Measurement And Conversion Of Measurements From A Larger Unit	6H	5I	5F	5G
S	+	4J	Represent And Interpret Data.	5H			
A	+	4K	Geometric Measurement: Understand Concepts Of Angle And Measure Angles.	7F.5	HS.G-CO.A		
A	+	4L	Draw And Identify Lines And Angles, And Classify Shapes By Properties Of Their Lines And Angles.	5K			
A	+	5A	Write and interpret numerical expressions.	6E	6C		
A	-	5B	Analyze patterns and relationships.	6E	6G	6F	6A



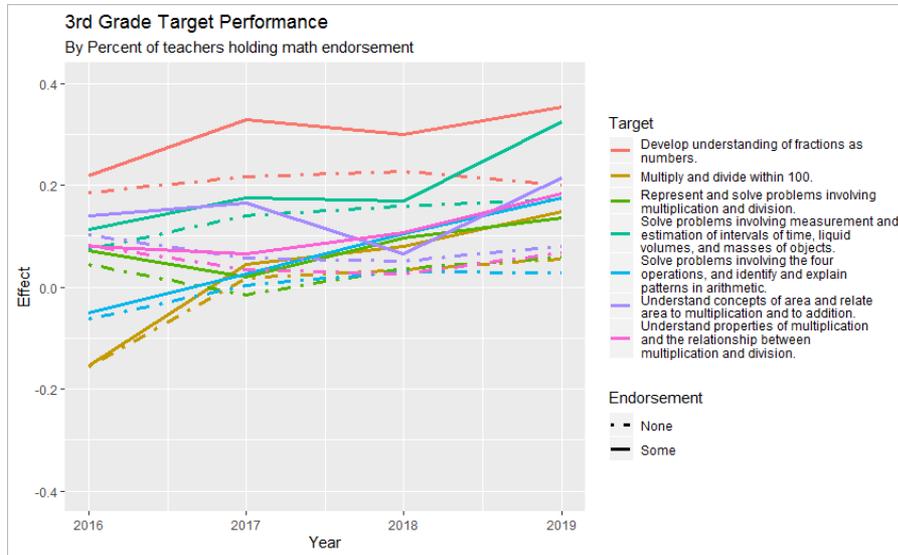
Teacher Content Knowledge

- Drop in performance at 5th and 6th grade
- Queried the teacher certifications for all teachers in the state. All teachers must hold some certification, but some hold (either primarily, or in addition), Math Elementary, Math Middle School, Bilingual Math Elementary or Bilingual Math Middle School.
- Calculated the percent of full time equivalent teachers at a grade level in a given school who held a math certification. Ultimately categorizing students as belonging to a grade/school where some teachers held math certification verses no teachers held math certification
- Unable to directly match students to teachers.
- All 7th and 8th grade teachers must hold a math specific endorsement.
- The plots do not control for SES or other demographic information.

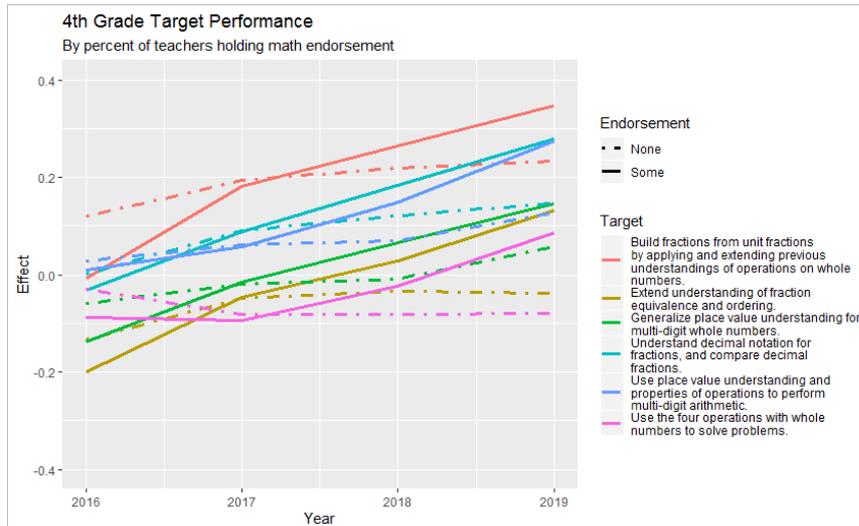


Certification Impact Grades 3-4

Some = 5.6% of students

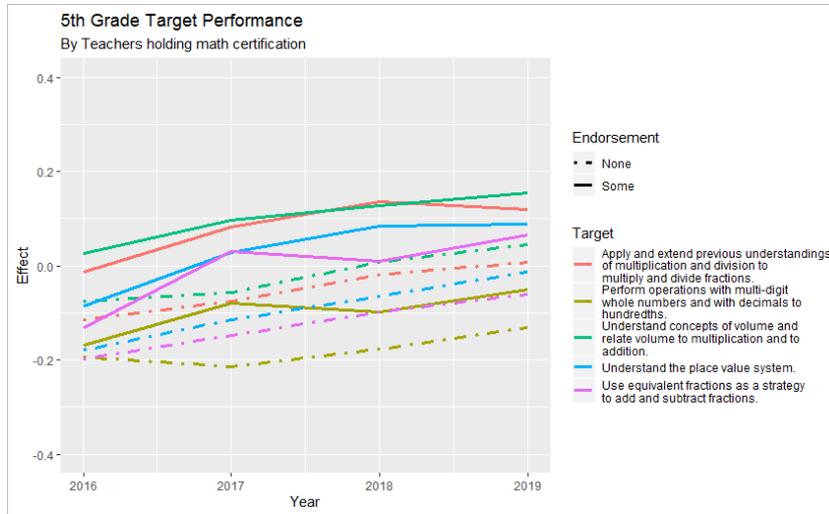


Some = 9.1% of students

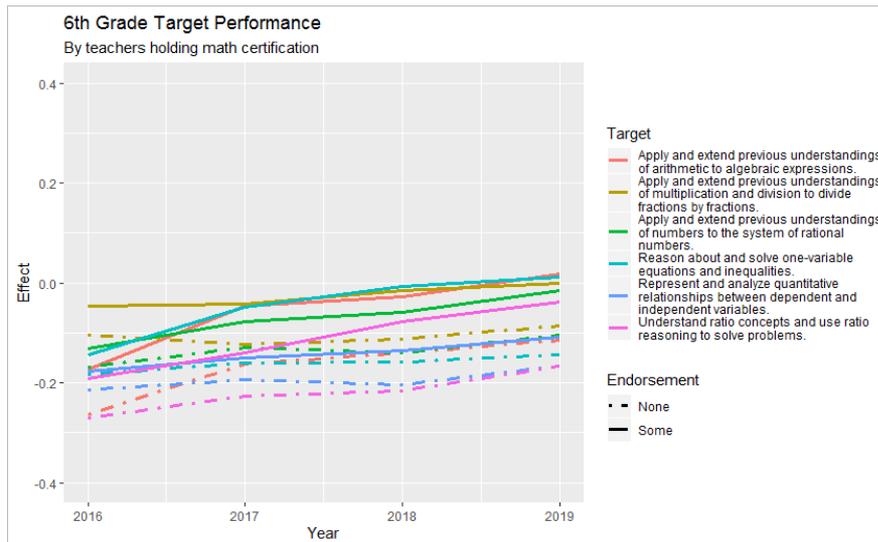


Certification Impact Grades 5-6

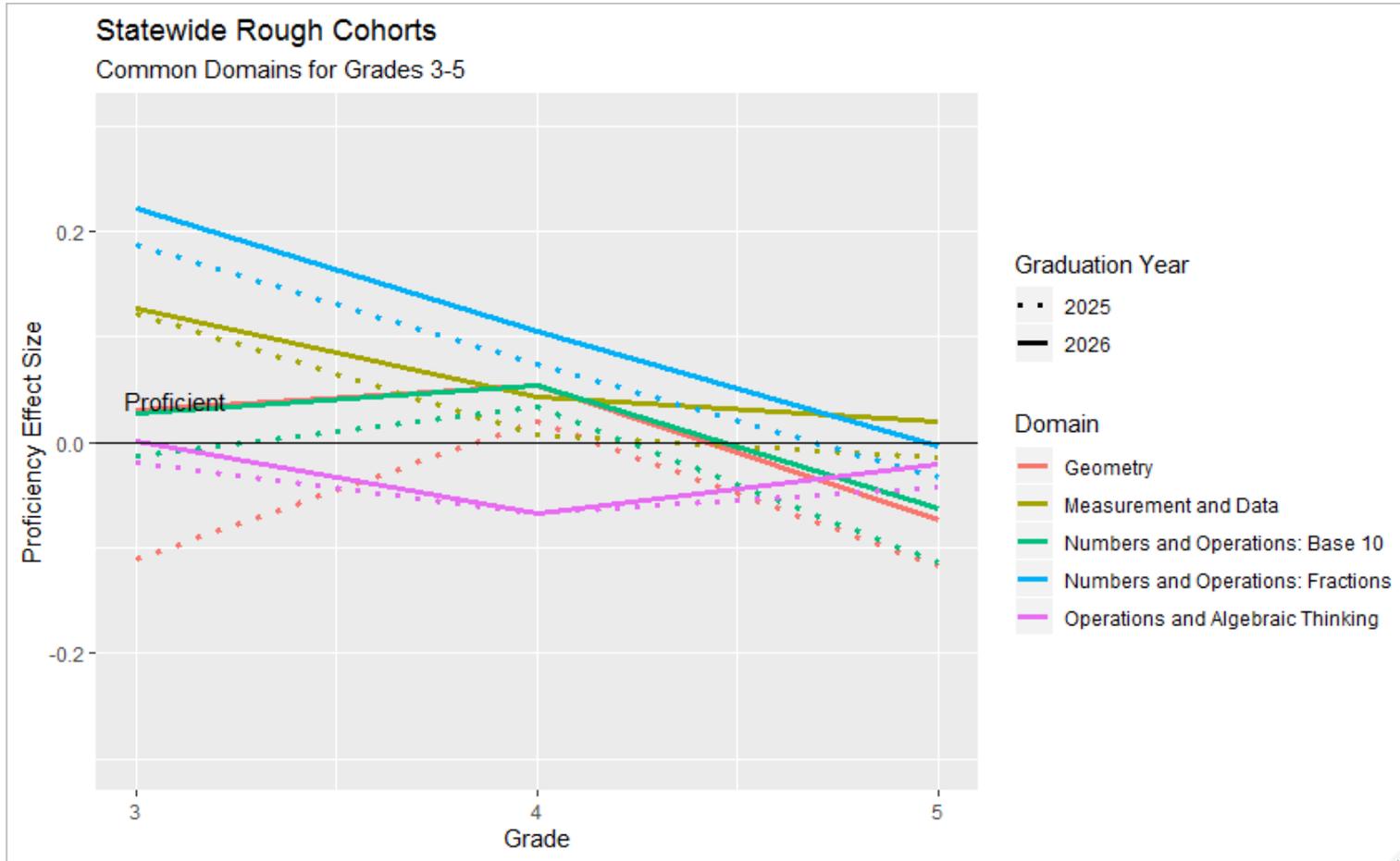
Some = 18.2% of students



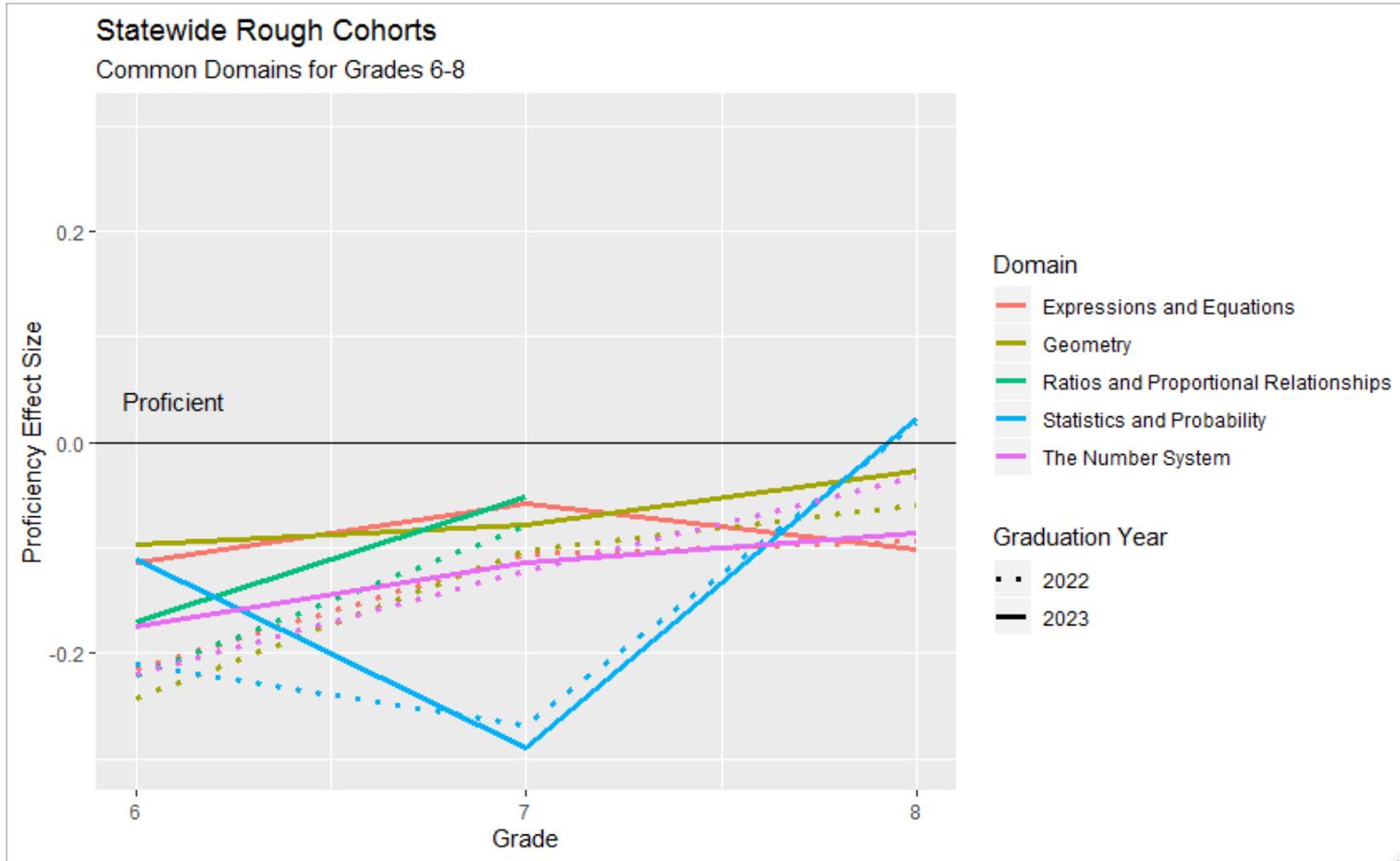
Some = 63.3% of students



Domain Rough Cohort 3-5

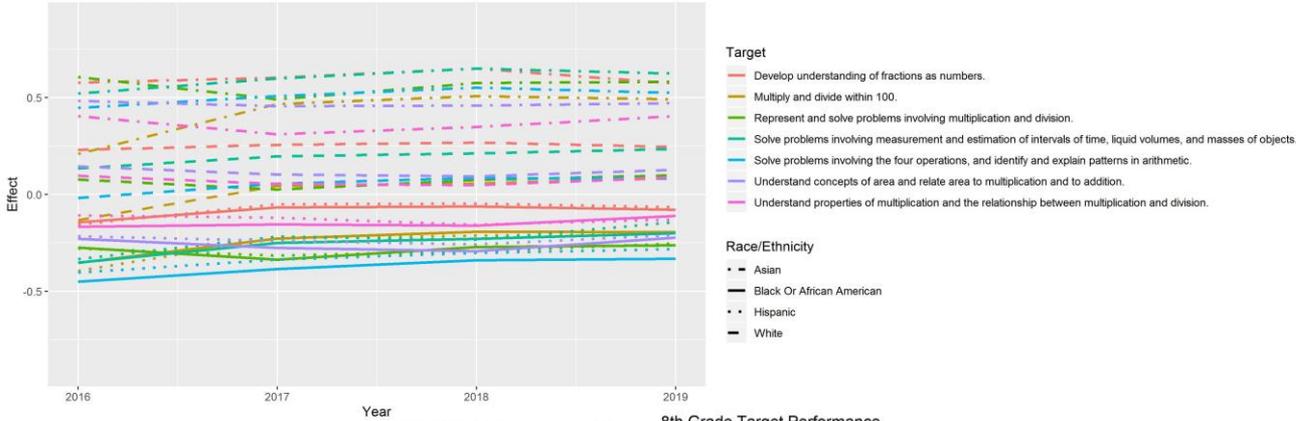


Domain Rough Cohort 6-8

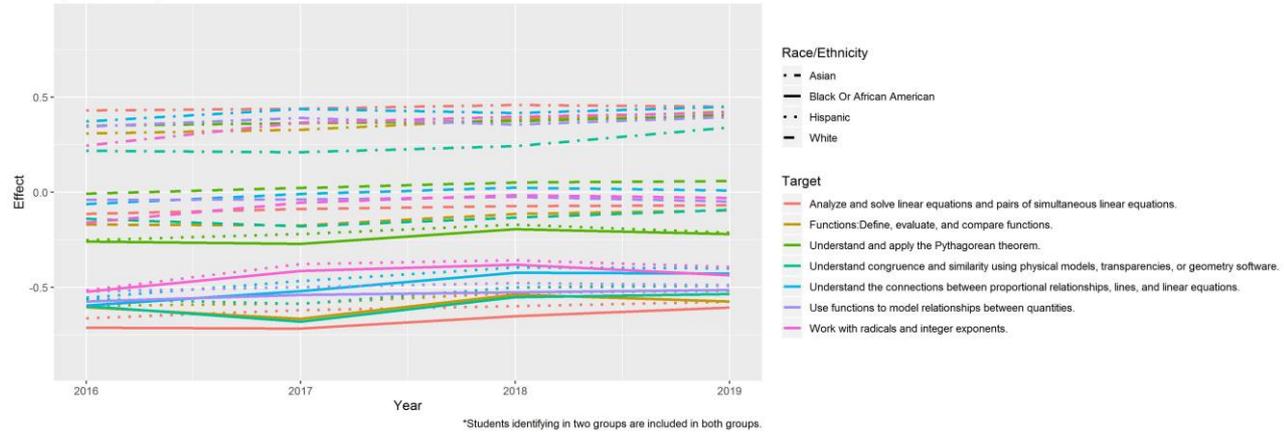


Sample Race/Ethnicity

3rd Grade Target Performance
By Race/Ethnicity

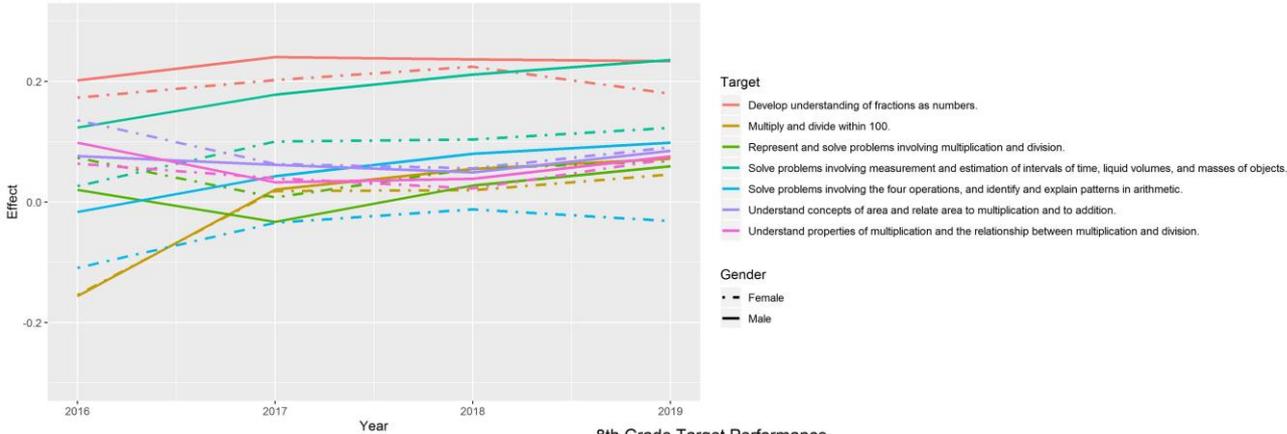


8th Grade Target Performance
By Race/Ethnicity

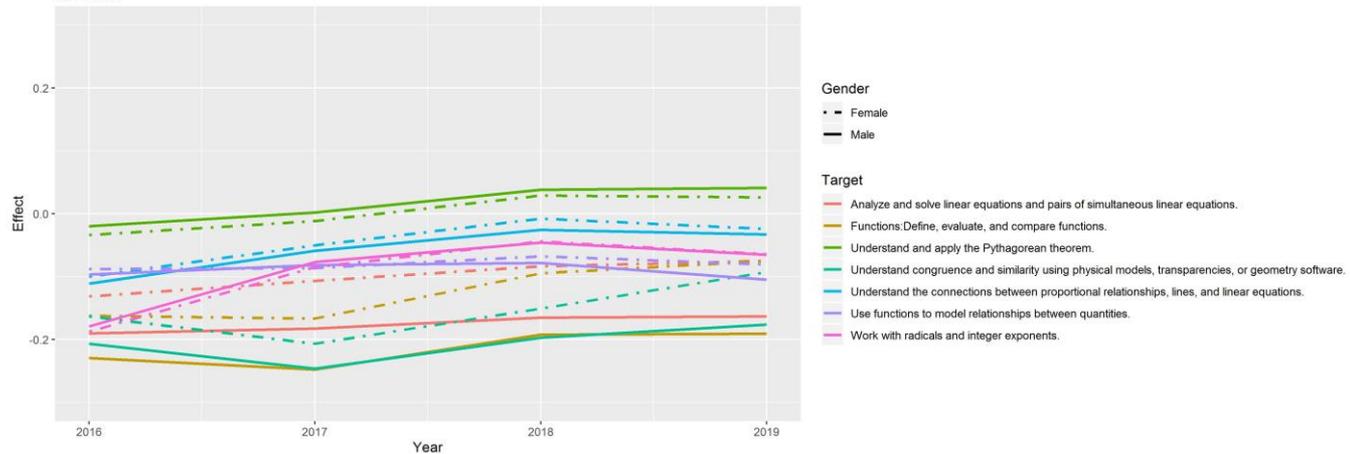


Sample Gender

3rd Grade Target Performance
By Gender

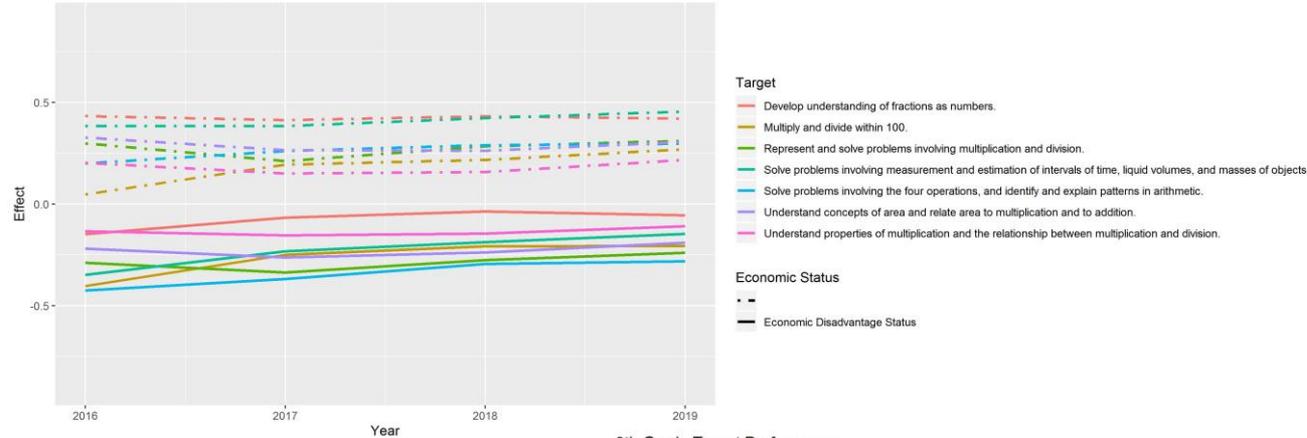


8th Grade Target Performance
By Gender

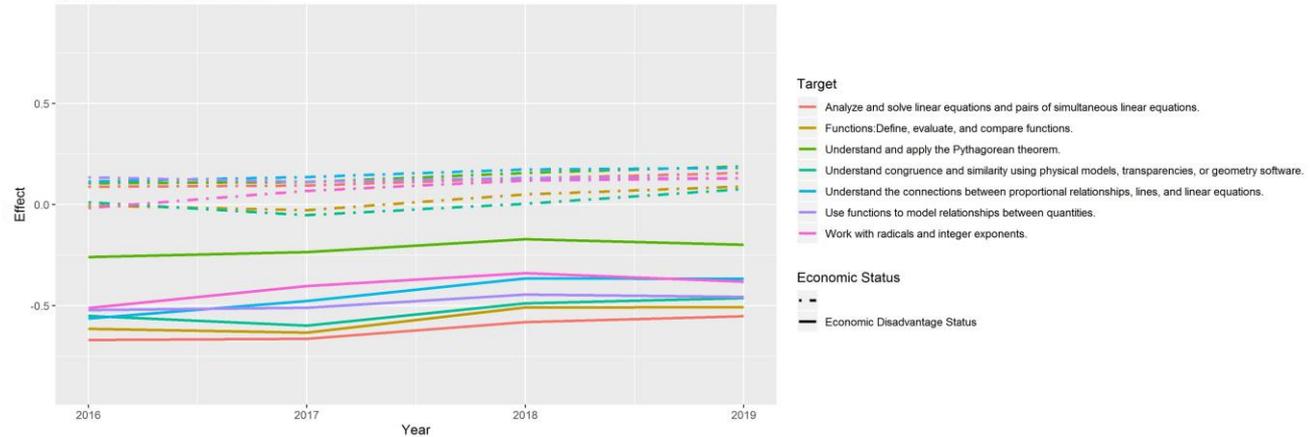


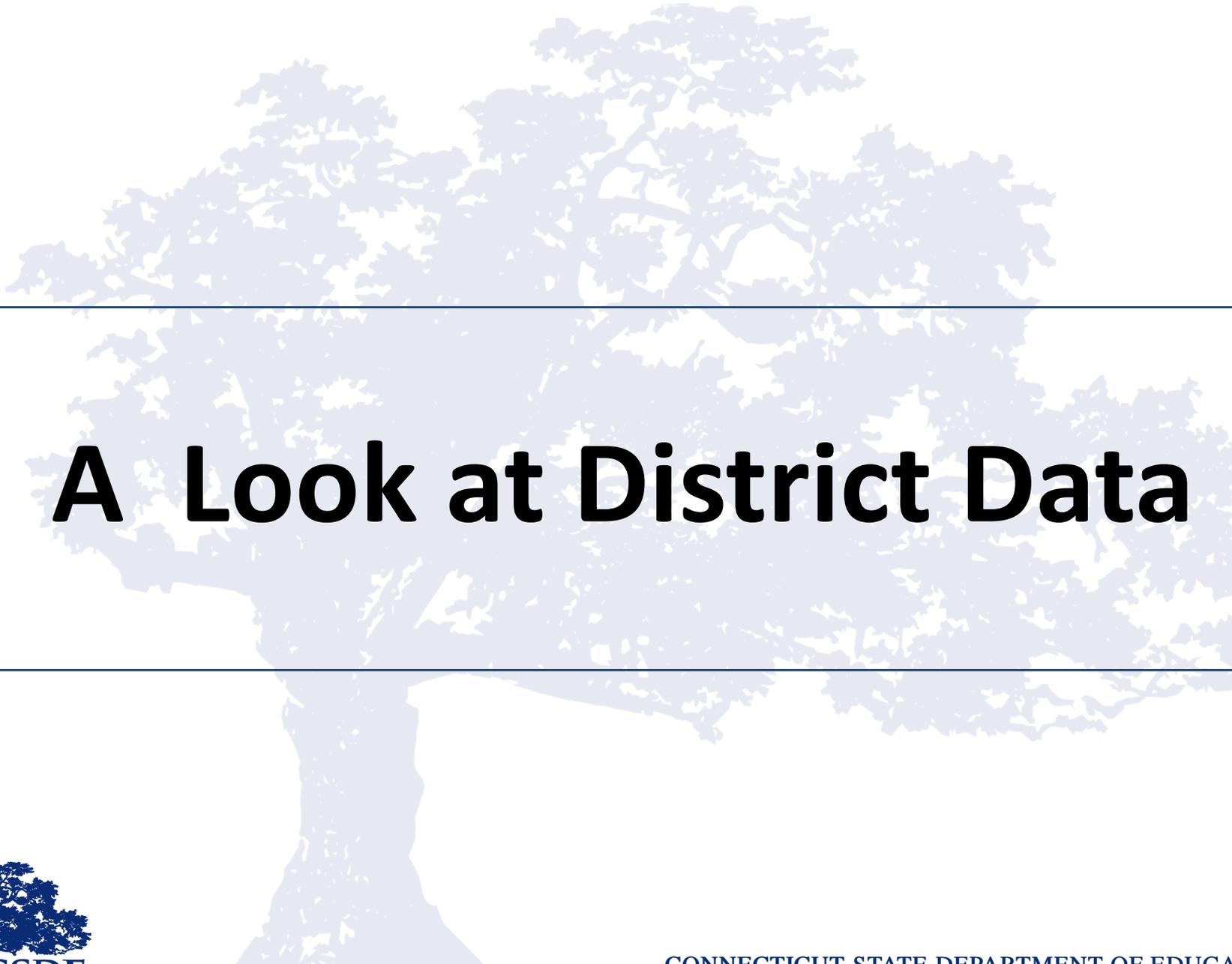
Sample Economic Disadvantage Status

3rd Grade Target Performance
By Economic Disadvantaged Status



8th Grade Target Performance
By Economic Disadvantaged Status





A Look at District Data

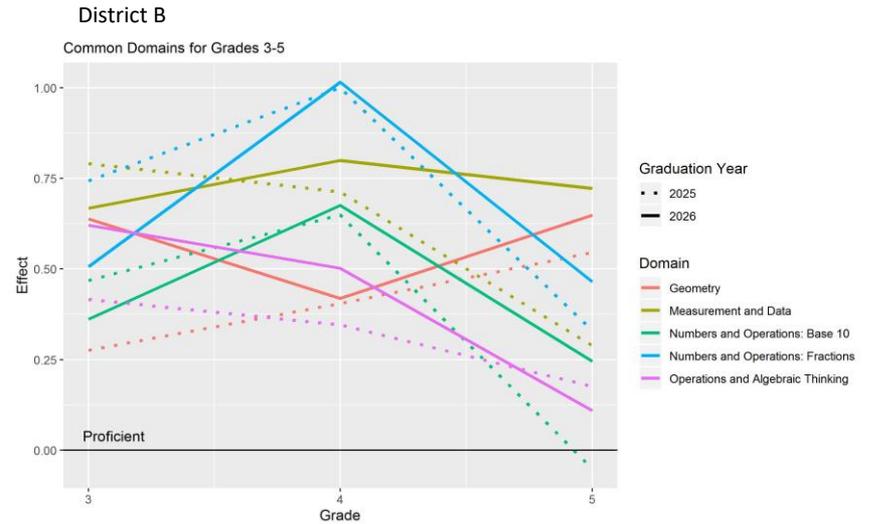
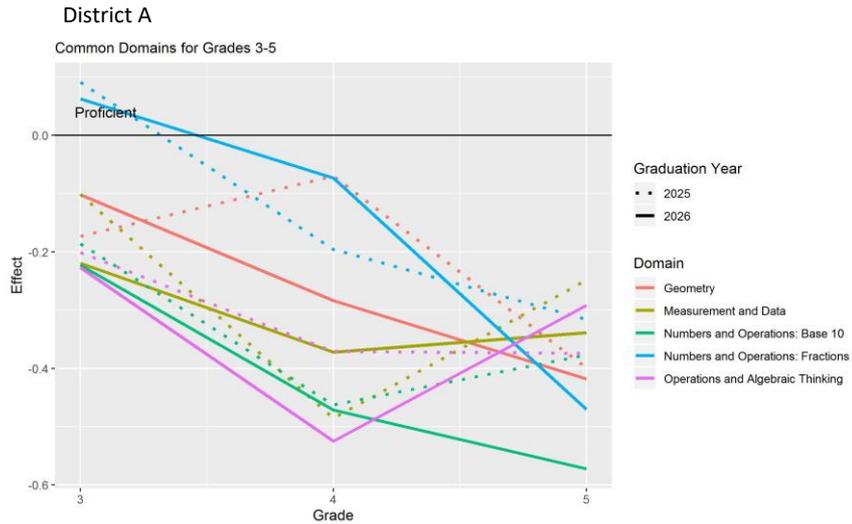


District Graphs

- Individual districts data for grade level and cohort performance was plotted
- Plots are intended to assist in identifying school needs such as:
 - Professional development
 - Curricula modifications
 - Resources



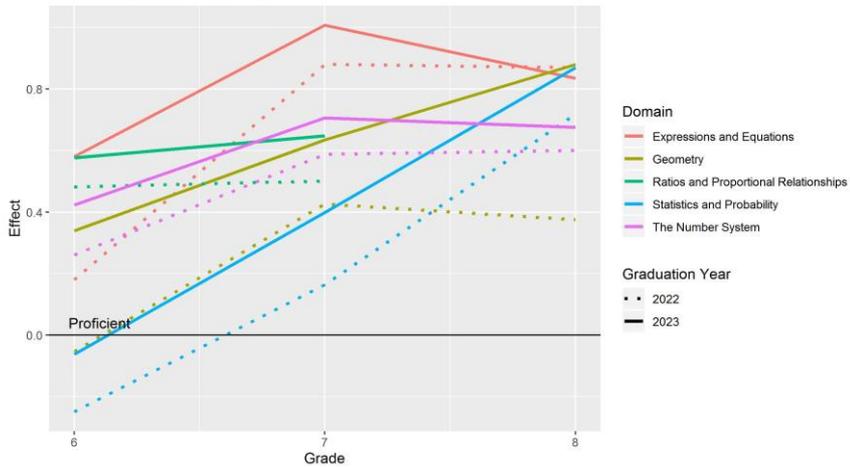
Elementary Sample



Middle School Sample

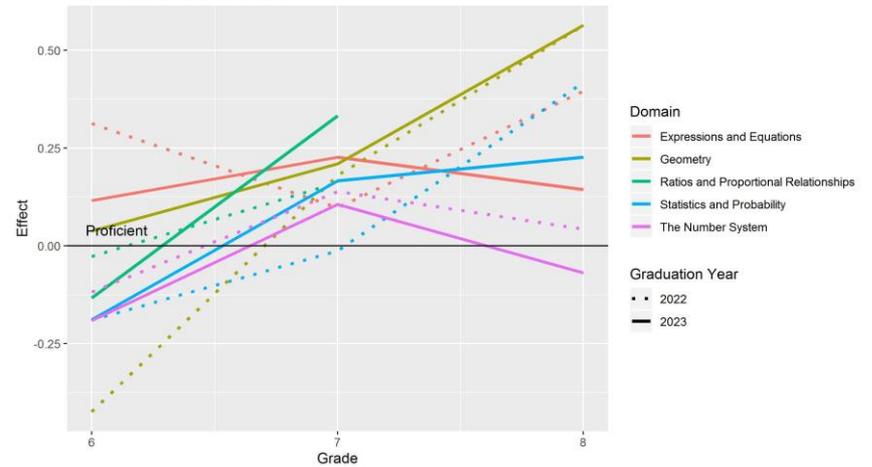
District C

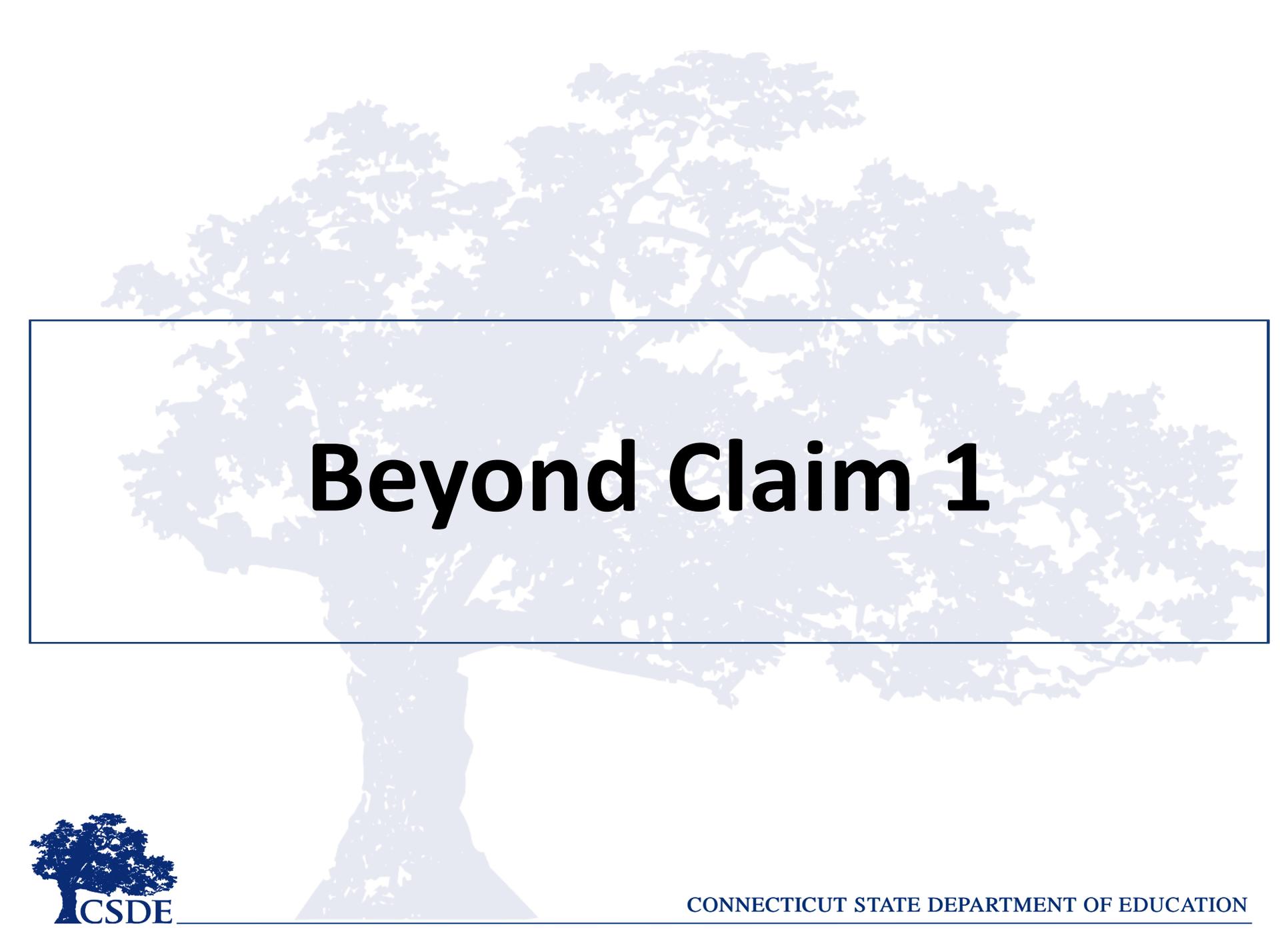
Common Domains for Grades 6-8



District D

Common Domains for Grades 6-8





Beyond Claim 1



Link to the Practice Standards

Claim 2 is most closely linked to math practice 1, 5, 7, and 8

- Make sense of problems and persevere in solving them
- Use appropriate tools strategically
- Look for and make use of structure
- Look for and express regularity in repeated reasoning

Claim 3 is most closely linked to math practice 3 and 6

- Construct viable arguments and critique the reasoning of others
- Attend to precision

Claim 4 is most closely lined to math practice 2, 4, and 5

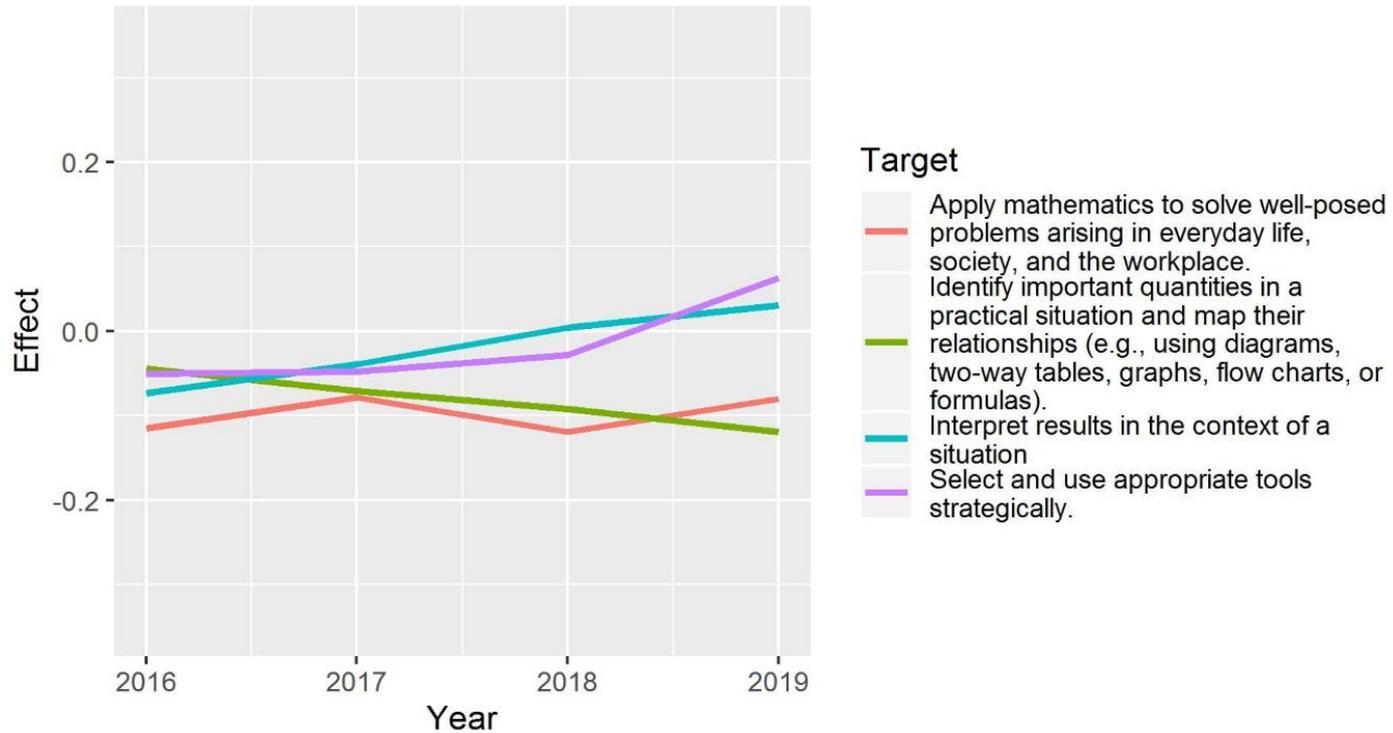
- Reason abstractly and quantitatively
- Model with mathematics
- Use appropriate tools strategically



Claim 2

Claim 2

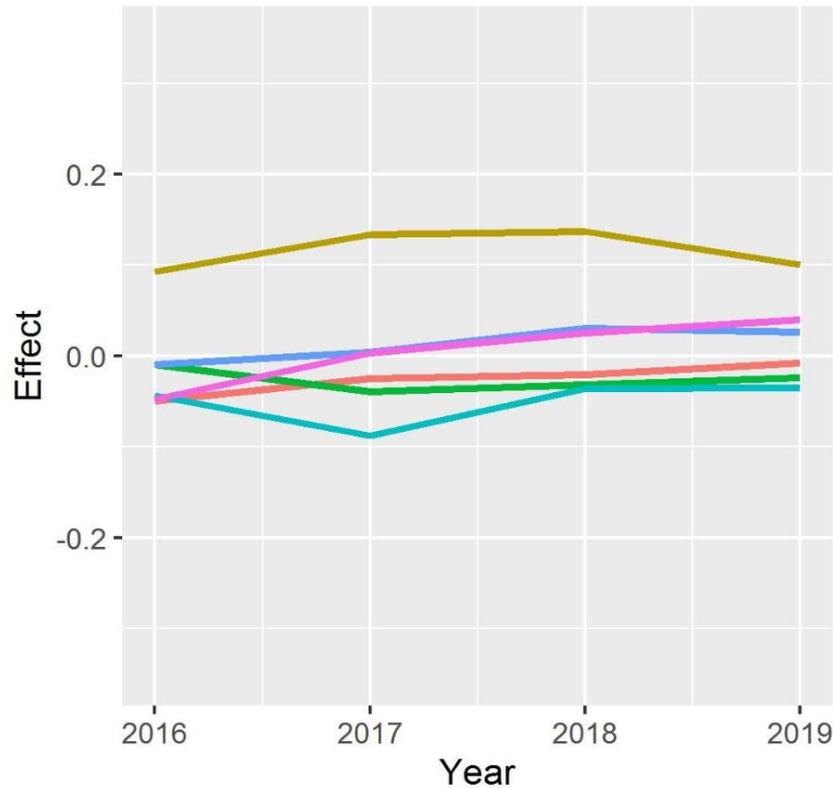
All Connecticut students



Claim 3

Claim 3

All Connecticut students



Target

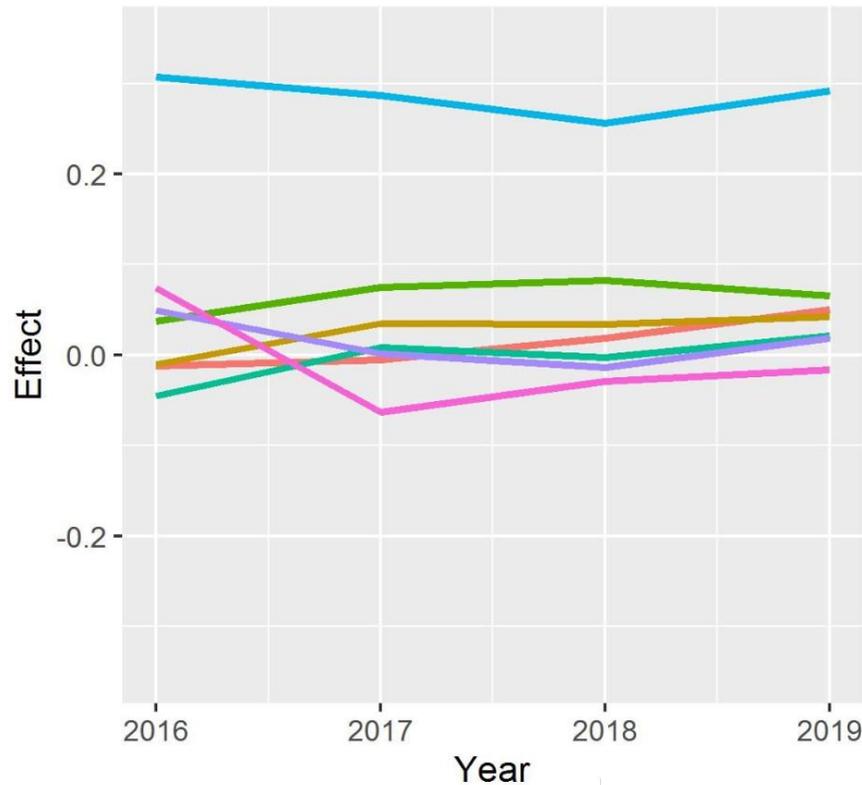
- Base arguments on concrete referents such as objects, drawings, diagrams, and actions.
- Construct, autonomously, chains of reasoning that will justify or refute propositions or conjectures.
- Distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in the argument—explain what it is.
- State logical assumptions being used.
- Test propositions or conjectures with specific examples.
- Use the technique of breaking an argument into cases.



Claim 4

Claim 4

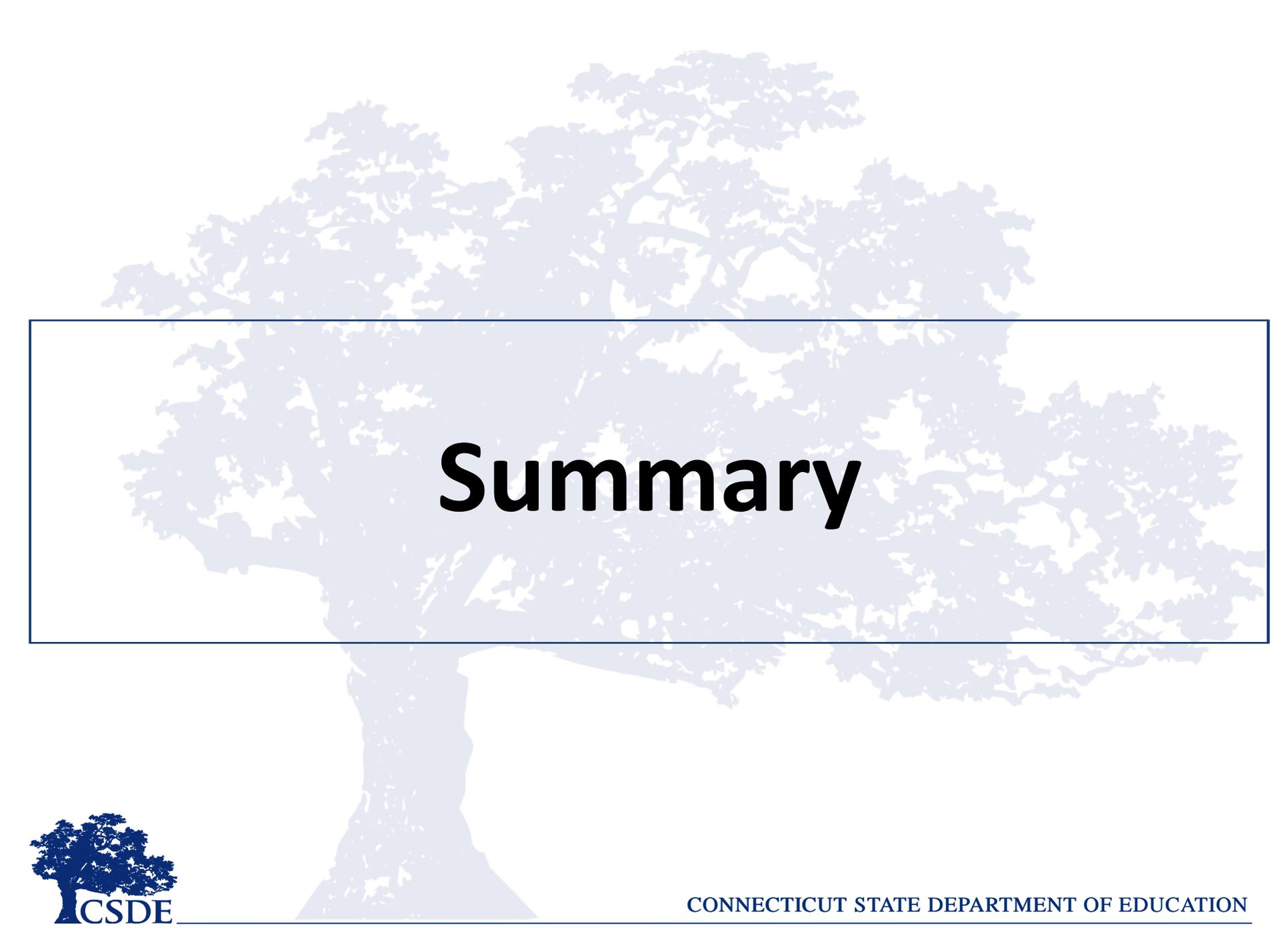
All Connecticut students



Target

- Analyze the adequacy of and make improvements to an existing model or develop a mathematical model of a real phenomenon.
- Apply mathematics to solve problems arising in everyday life, society, and the workplace.
- Construct, autonomously, chains of reasoning to justify mathematical models used, interpretations made, and solutions proposed for a complex problem.
- Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flow charts, or formulas).
- Identify, analyze, and synthesize relevant external resources to pose or solve problems.
- Interpret results in the context of a situation.
- State logical assumptions being used.





Summary



Broad Conclusions

- By 2019 all grade three targets near proficiency
- Targets related to problem solving have the greatest need
- Fractions domain has steepest decline in cohort data
- Younger students consistently higher performing than older peers
- Depressed performance 6-8
- Large differences between racial and ethnic groups and these differences grow over time
- Large disparity between students who are economically disadvantaged and those that are not
- Starkest difference between students identified as limited English proficiency
- Targets with higher DOK expectations have lower performance



Moving Forward

- Feedback on using the analysis to improve mathematics education
 - Professional learning
 - Curriculum development/revision
 - Instructional practice
- Additional analysis and similar plots by:
 - Performance band
 - SPED identification
 - Schools
- Suggestions on additional enhancements



Next Steps

- Look at the plots for your own district by accessing the [report](#).
 - Remember that this is a comparison to expectations – and our expectations change for each grade
 - Individual students for interventions are not identified based on this analysis
- What do the plots of the data tell you about math target performance in your district?
 - Strengths and areas in need of improvement
- What conclusions can be made about mathematics education in your district?
 - Think about root cause
- What can your district do to address the areas in need of improvement?
 - Action plan



Thank You

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