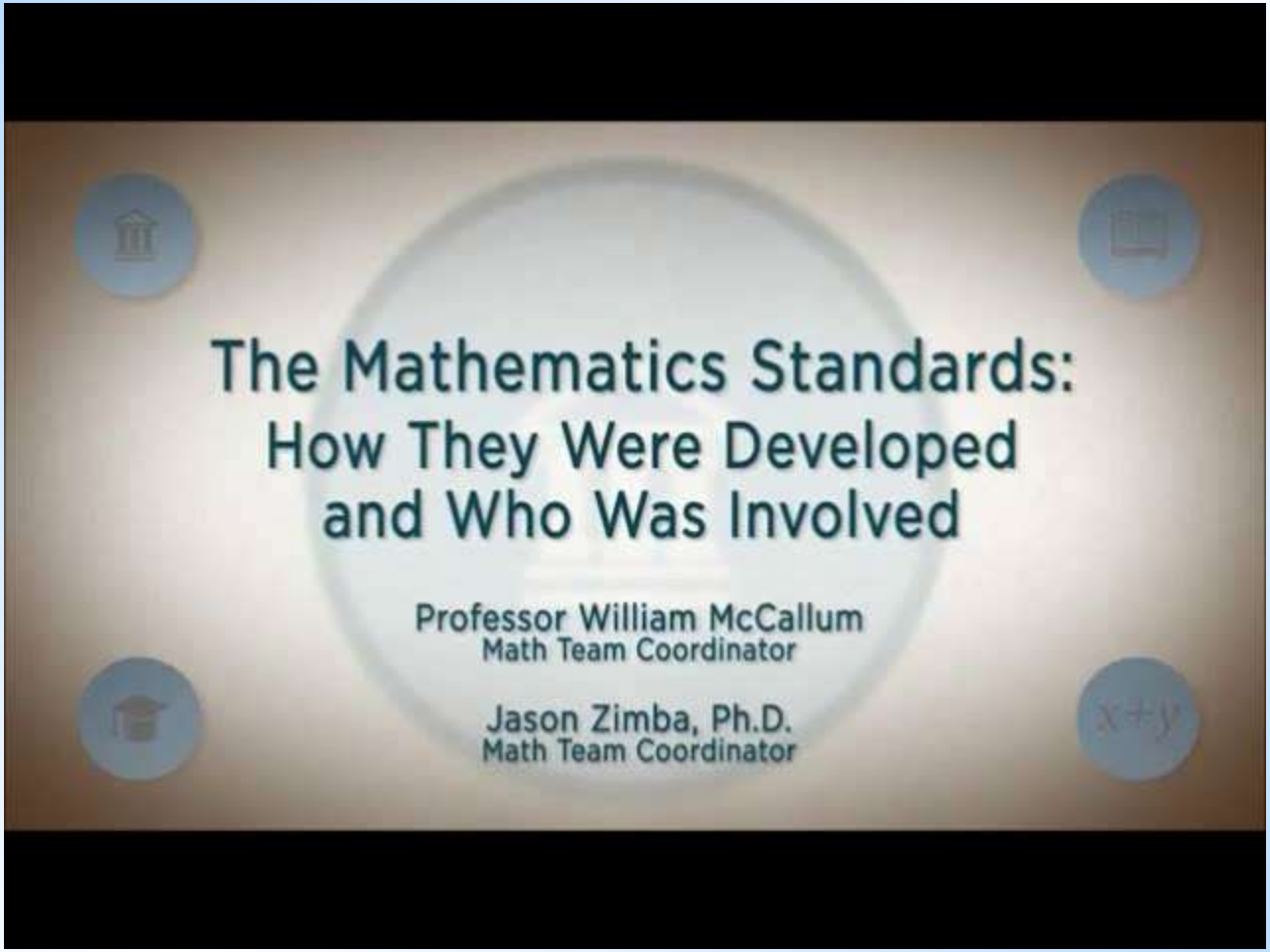
Common Core State Standards for Mathematics: *The Key Shifts (Rigor)*

Professional Development Module

Delaware Department of Education



Delaware Department of Education

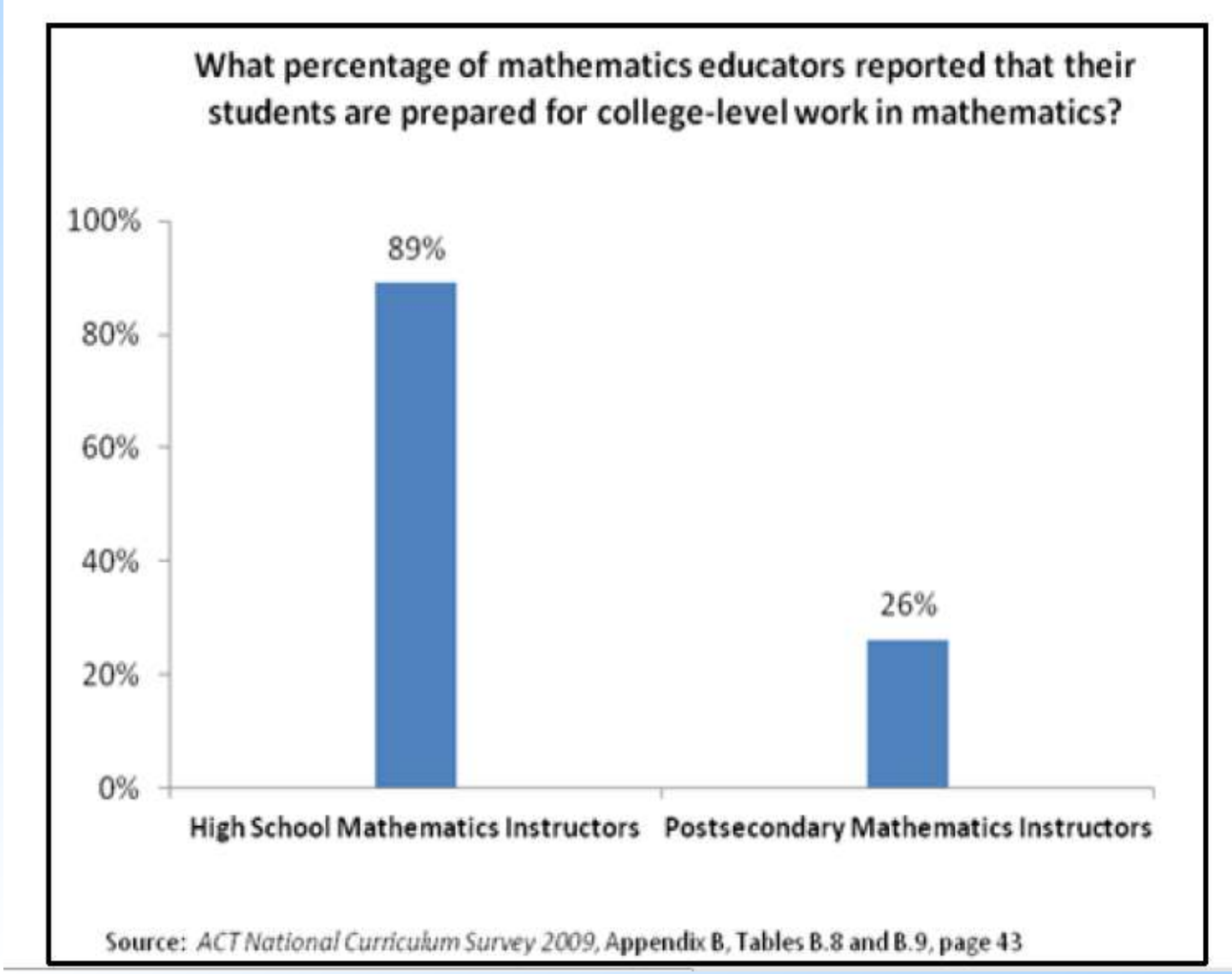
The Background of the Common Core

Initiated by the National Governors Association (NGA) and Council of Chief State School Officers (CCSSO) with the following design principles:

- Result in College and Career Readiness
- Based on solid research and practice evidence
- Fewer, higher and clearer

achievethecore.org

College Math Professors Feel HS students Today are Not Prepared for College Math



Delaware Department of Education

What The Disconnect Means for Students

- Nationwide, many students in two-year and four-year colleges need remediation in math.
- Remedial classes lower the odds of finishing the degree or program.
- Need to set the agenda in high school math to prepare more students for postsecondary education and training.

Delaware Department of Education

The CCSS Requires Three Shifts in Mathematics

1. **Focus:** Focus strongly where the standards focus.
2. **Coherence**: *Think* across grades, and *link* to major topics
3. **Rigor:** In major topics, pursue *conceptual* **understanding,** procedural skill and *fluency*, and *application*

Delaware Department of Education

achievethecore.org

Shift #3: Rigor

- Rigor, as defined here, does not mean hard problems. It doesn't mean more difficult.
- Rigor, here, means something very specific. We are talking about the **balance of these components of conceptual understanding, fluency, and application.**

Delaware Department of Education

Conceptual Understanding

- **Conceptual understanding:** The Standards call for conceptual understanding of key concepts, such as place value and ratios. Teachers support students' ability to access concepts from a number of perspectives so that students are able to see math as more than a set of mnemonics or discrete procedures.

Delaware Department of Education

Fluency

- **Procedural skill and fluency:** The Standards call for speed and accuracy in calculation. Teachers structure class time and/or homework time for students to practice core functions such as single-digit multiplication so that students have access to more complex concepts and procedures.

Delaware Department of Education

Application

- **Application:** The Standards call for students to use math flexibly for applications. Teachers provide opportunities for students to apply math in context. Teachers in content areas outside of math, particularly science, ensure that students are using math to make meaning of and access content.

Delaware Department of Education

Frequently Asked Questions

- How can we assess fluency other than giving a timed test?
- Is it really possible to assess conceptual understanding? What does it look like?
- Aren't the Common Core State Standards for Math all about application and meaningful tasks?

Delaware Department of Education

Mathematics Fluency: A Balanced Approach

Delaware Department of Education

Rigor

- Conceptual Understanding:

  3.NF.1 **Understand** a fraction 1/*b* as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction *a/b* as the quantity formed by *a* parts of size 1/*b*.

- Procedural Skill and Fluency:

  5.NBT.5 **Fluently** multiply multi-digit whole numbers using the standard algorithm.

  - Application:

  7.NS.3 **Solve real-world and mathematical problems** involving the four operations with rational numbers.

achievethecore.org

Delaware Department of Education

Sample Problems

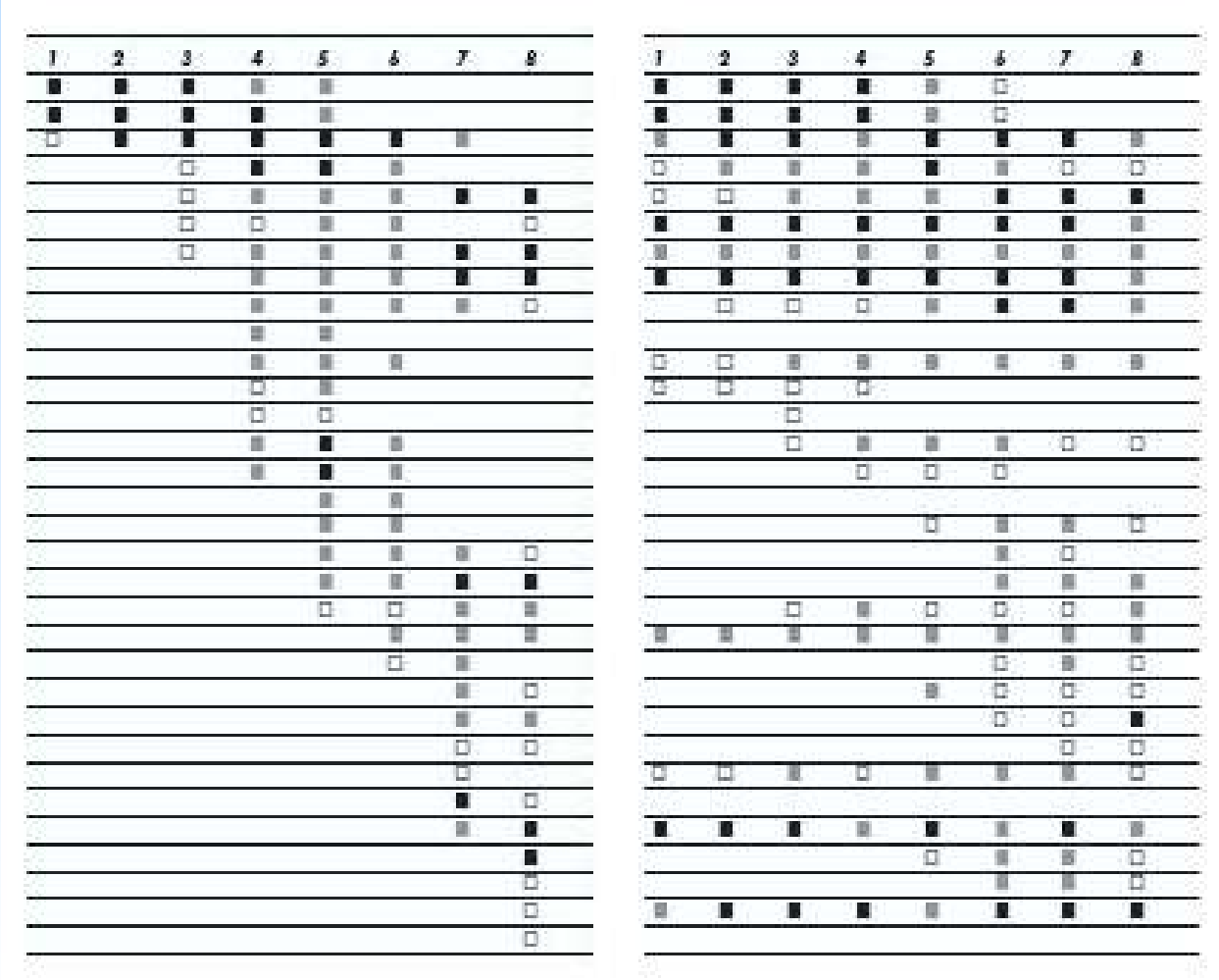
- Work on a few problems. Be prepared to discuss why you must have a balance between all 3 aspects of rigor.

- How can assessing (with tests, HW problems, exit tickets) all 3 aspects of rigor affect student learning?

Delaware Department of Education

The Shape of Math in A+ Countries

Mathematics topics intended at each grade by at least two-thirds of A+ countries



Mathematics topics intended at each grade by at least two-thirds of 21 U.S. states

[1] *Schmidt, Houang, & Cogan, "A Coherent Curriculum: The Case of Mathematics." (2002).*

Delaware Department of Education

Mathematical Practices

- 1.Make sense of problems and persevere in solving them.
- 2.Reason abstractly and quantitatively.
- 3.Construct viable arguments and critique the reasoning of others.
- 4.Model with mathematics.
- 5.Use appropriate tools strategically.
- 6.Attend to precision.
- 7.Look for and make use of structure.
- 8.Look for and express regularity in repeated reasoning.

Delaware Department of Education

The Coming CCSS Assessments Will Focus Strongly on the Major Work of Each Grade

SMARTER
Balanced Assessment Consortium

A quality assessment should strive to reinforce focus and coherence at each grade level by testing for proficiency with central and pivotal mathematics rather than covering too many ideas superficially – a key point of the Common Core Standards.

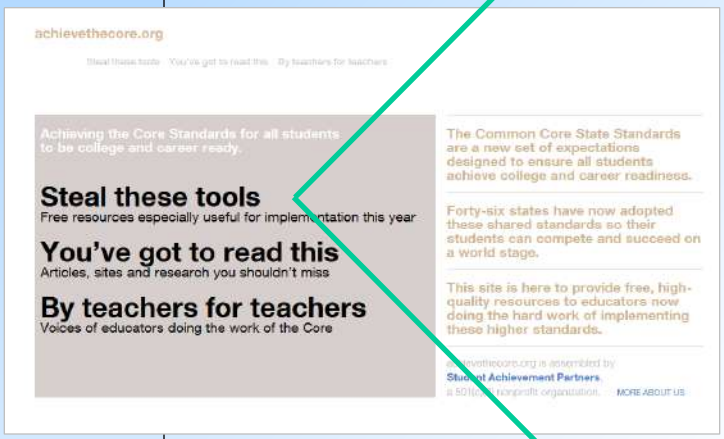
PARCC Releases ITN To Develop Assessments

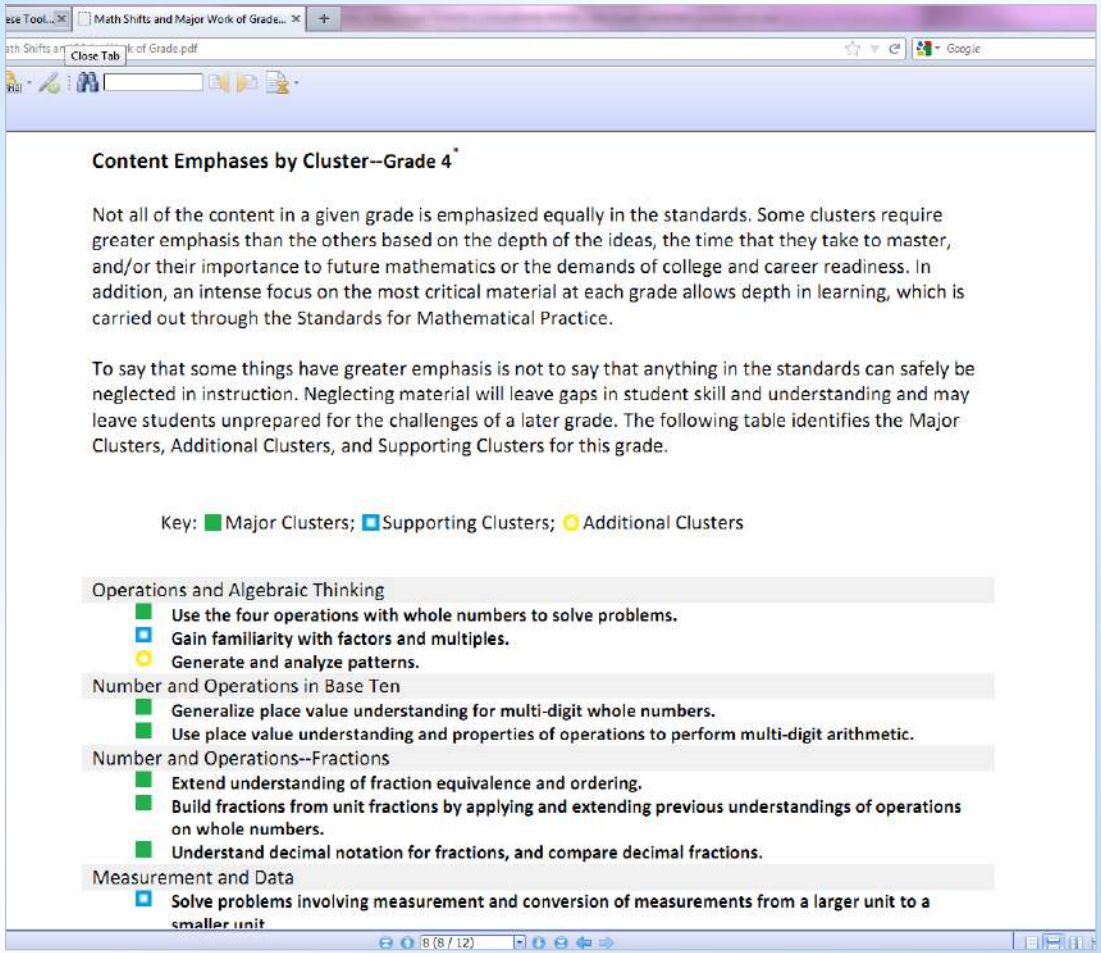
Submitted by parcc- on Fri, 2011-12-30 19:16
Major milestone met for first test administration in 2014-2015

Design for focus and coherence. Consistent with the design of the CCSSM, the previous iteration of the assessment design adopted by the Leadership Team, and the extended discussion of emphases in the standards in the *PARCC Model Content Frameworks*, the Mathematics Assessment System as a whole and in each component will focus heavily on the major content[102] of each grade.

Delaware Department of Education

Smarterbalanced.org and PARCC.org





www.achievethecore.org

Delaware Department of Education

The Organization in the PARCC Model Content Frameworks for Mathematics

Examples of Key Advances from Previous Grades or Courses

Discussion of Mathematical Practices in Relation to Course Content

Fluency Recommendations

PARCC Model Content Frameworks

PARCC Frameworks

Key: ■ Major Clusters; ■ Supporting Clusters; ○ Additional Clusters

Content Emphases by Cluster: HS Alg

The Real Number System (N-RN)

- ○ Use properties of rational and irrational numbers (3)

Quantities★ (N-Q)

- ■ Reason quantitatively and use units to solve problems (1, 2, 3)

Seeing Structure in Expressions (A-SSE)

- ■ Interpret the structure of expressions (1, 2)
- ■ Write expressions in equivalent forms to solve problems (3)

Arithmetic with Polynomials and Rational Expressions (A-APR)

- ■ Perform arithmetic operations on polynomials (1)
- ■ Understand the relationship between zeros and factors of polynomials (3)

Creating Equations★ (A-CED)

- ■ Create equations that describe numbers or relationships (1, 2, 3, 4)

Reasoning with Equations and Inequalities (A-REI)

- ■ Understand solving equations as a process of reasoning and explain the reasoning (1)
- ■ Solve equations and inequalities in one variable (3, 4)
- ○ Solve systems of equations (5, 6)
- ■ Represent and solve equations and inequalities graphically (10, 11, 12)

Interpreting Functions (F-IF)

- ■ Understand the concept of a function and use function notation (1, 2, 3)
- ■ Interpret functions that arise in applications in terms of the context (4, 5, 6)
- ■ Analyze functions using different representations (7, 8, 9)

Building Functions (F-BF)

- ■ Build a function that models a relationship between two quantities (1)
- ○ Build new functions from existing functions (3)

Linear, Quadratic, and Exponential Models★ (F-LE)

- ■ Construct and compare linear, quadratic, and exponential models and solve problems (1, 2, 3)
- ■ Interpret expressions for functions in terms of the situation they model (5)

Interpreting categorical and quantitative data (S-ID)

- ○ Summarize, represent, and interpret data on a single count or measurement variable (1, 2, 3, 4)
- ■ Summarize, represent, and interpret data on two categorical and quantitative variables (5, 6)
- ■ Interpret linear models (7, 8, 9)

Delaware Department of Education

PARCC Model Content Frameworks for Mathematics Version 2-Aug.

Cautions: Implementing the CCSS is...

- Not about “gap analysis”
- Not about buying a text series
- Not a march through the standards
- Not about breaking apart each standard

Delaware Department of Education

Resources

- www.achievethecore.org
- www.illustrativemathematics.org
- www.pta.org/4446.htm
- www.commoncoretools.me
- www.corestandards.org
- www.parcconline.org/parcc-content-frameworks
- www.smarterbalanced.org/k-12-education/common-core-state-standards-tools-resources/

Delaware Department of Education

- www.doe.k12.de.us/commoncore
- www.educationnorthwest.org/common-core
- www.ccsso.org/Resources.html
- www.corestandards.org
- www.centeroninstruction.org/
- www.learningpt.org/greatlakeseast/
- www.youtube.com/playlist?list=PLD7F4C7DE7CB3D2E6

Delaware Department of Education

- www.illustrativemathematics.org/
- www.math.arizona.edu/~ime/progressions/
- www.education.ohio.gov/GD/Templates/Pages/ODE/ODEDetail.aspx?page=3&TopicRelationID=1907&ContentID=120301&Content=120301
- www.parcconline.org/parcc-content-frameworks
- www.p21.org/tools-and-resources/publications/p21-common-core-toolkit

Delaware Department of Education

- www.teachingchannel.org/
- www.achievethecore.org/
- www.pta.org/4446.htm
- dww.ed.gov/
- www.balancedassessment.concord.org
- www.insidemathematics.org
- www.map.mathshell.org/materials/tasks.php
- www.illuminations.nctm.org
- www.OhioRC.org

Delaware Department of Education