Where Are We Now?
Standards and New Assessments During Year One

Happy Epic Pi Day!

Greater Cleveland Council of Teachers of Mathematics
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Underlying Principle

- "*Everyone is good at mathematics because everyone can think. And mathematics is about thinking.*"
  - Yeap Ban Har, National Institute of Education, Singapore.

- Corollary 1: Strategies that attempt to remove thinking from learning are bound to fail in the long run.
- Corollary 2: When learning is effective, "getting the right answer" is but a small piece of the work.
- Corollary 3: The most important thing teachers and parents can do is convince students that their thinking matters.

Where Are We?

Brief History of Standards

- 1989: Standards released by the National Council of Teachers of Mathematics
- Early 1990s: States developed standards in various subjects
- 2001: No Child Left Behind Act required state standards and assessments in English language arts (ELA), mathematics, and (later) science
- 2000s: Growing recognition:
  - State standards were shallow and repetitive
  - State standards varied widely in quality, rigor, and topics
  - State standards were not preparing students for college and careers
  - Most careers will require some post-secondary training
  - Not enough progress compared to international peers

Brief History of Standards (cont.)

- 2007: Governors and state superintendents began discussing shared standards across interested states
- 2009: Common Core State Standards Initiative launched
  - 48 states participated in the development of standards in ELA and mathematics
  - Broad, bipartisan effort
- 2010: Common Core State Standards released
  - Ohio adopted the Common Core in June 2010 along with Ohio's own standards in science and social studies
  - By late 2011, Common Core adopted by 45.5 states and the District of Columbia

Concerns and Responses

- Myth: A national curriculum
  - The Common Core describes **Standards** (i.e., goals, the "what")
  - Curriculum and instruction (i.e., the "how") remain local decisions
- Myth: Takeover by the federal government
  - The Standards were written by content experts, under the direction of states, and coordinated by the Council of Chief State School Officers and the National Governors Association
  - U.S. Department of Education provided grants to two multi-state consortia to develop assessments aligned to new standards
  - Adoption of the standards and use of these assessments is and has been voluntary, state by state

Concerns and Responses

- Most of the concerns about the Common Core State Standards are about other things:
  - Assessment
  - Curriculum materials (e.g., textbooks)
  - Teacher evaluation
  - Data privacy
  - …
- Most of these would be concerns for *any* set of standards
- And some people object to *any* academic standards
- Examples of "crazy" math problems
  - Usually not from the standards but from a locally-chosen textbook or assessment

Are the Standards High Enough?

- Standards establish the floor for all students
  - Some students will want and need more
- College readiness
  - Definition: "readiness for entry-level, credit-bearing courses in mathematics at four-year colleges as well as courses at two-year colleges that transfer for credit at four-year colleges"
  - Result: Three years of high school math, at the level of Algebra II
- Distinguish college readiness from STEM readiness
  - Students interested in careers in science, technology, engineering, or mathematics (STEM) will need more
  - The CCSS suggests additional standards (marked with "+") for these students
  - Appendix A suggests acceleration strategies to allow a path to calculus in high school

Are the Standards Too High?

- The standards are based on research about
  - Student learning
  - Standards of high-achieving countries
  - Requirements for college and careers
- Success is more strongly predicted by effort than by talent
  - Duckworth's research on "grit"
  - Dweck's research on "growth mindset"
- What is the most underutilized resource in school classrooms?
  - Teach children that their thinking matters
  - Kids can do remarkable things when given a chance

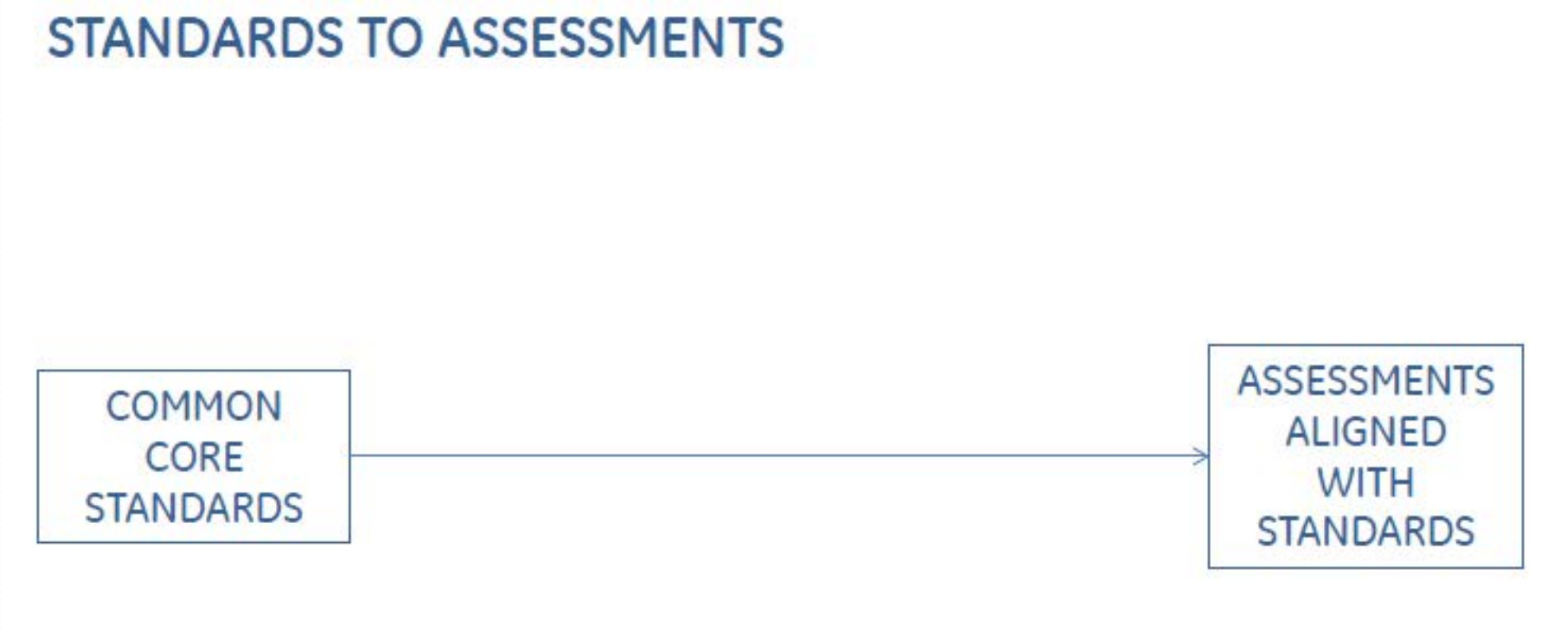
Ohio's Responses to Concerns

- House Bill 487, signed summer 2014
  - Establishes standards review committees in math, English language arts, science, and social studies
    - Seven appointed individuals on each committee
    - Brad Findell serves on the mathematics standards committee
  - Establishes "safe harbor" for schools and teachers in 2015
  - Strengthens laws protecting student data
  - Reduces from 10 to 7 end-of-course exams to replace Ohio Graduation Test
- Ohio Standards Coalition
  - http://www.theohstandard.org/

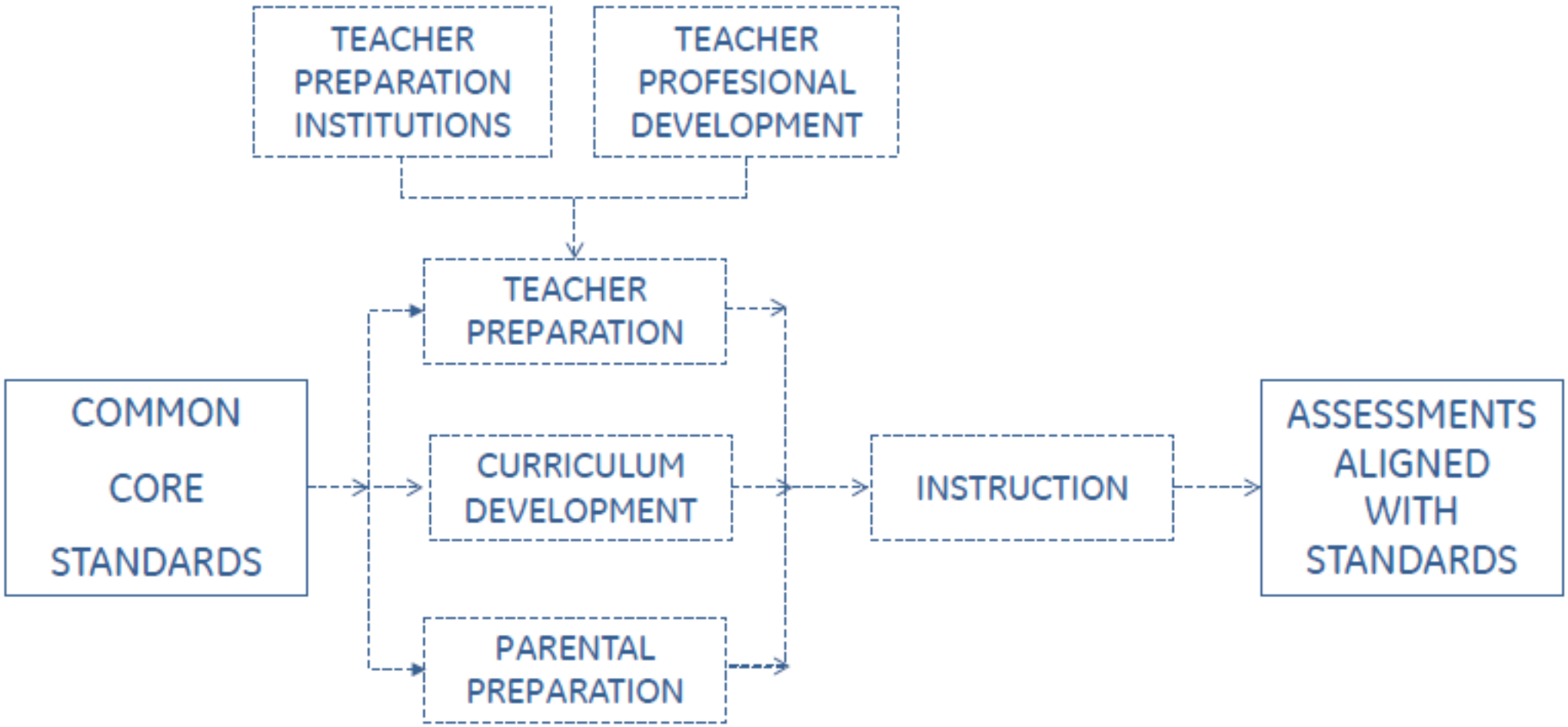
Current Assessment Concerns

- PARCC tests and new AIR tests rolling out
  - Logistical challenges (e.g., technology, scheduling)
  - Content challenges
  - Anxiety about change the unknown
  - Parents opting out (for many different reasons)
- What really has changed?
  - Time students spend on required state tests?
  - Time students spend on preparing for state tests?
  - Time instruction is disrupted because other students are taking tests?
- House Bill 74, under consideration, aims to respond …

Ohio Mathematics and Science Coalition



STANDARDS TO ASSESSMENTS



Separate Policy Decisions

- Standards
- Curriculum and instruction
- Assessments aligned to those standards
- Uses of those assessments

Key Shifts

Common Core State Standards for Mathematics

K-8 Content Shifts

- Primary focus on number in grades K-5
- Fractions as numbers on the number line, beginning with unit fractions
- Fluency with standard algorithms, supported by strategies based in place value and properties of operations
- Much statistics in grade 6-8
- Much algebra and geometry in grades 7-8

High School Content Shifts

- Number and quantity
  - Number systems, attention to units
- Modeling
  - Threaded throughout the standards
- Geometry
  - Proof for all, transformations
- Algebra and functions
  - Organized by mathematical practices
- Statistics and probability
  - Inference for all, based on simulation

CCSS 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

CCSS Instructional Shifts

- **Focus**: focus strongly on key ideas, understandings, and skills in each grade and course
- **Coherence**: think across grades, and link to major topics in each grade
- **Rigor**: in major topics, pursue with equal intensity
  - conceptual understanding,
  - procedural skill and fluency, and
  - applications

Mathematics Teaching Practices

- Establish mathematics goals to focus learning
  - [Driven by standards for mathematics content and practice]
- Implement tasks that promote reasoning and problem solving
  - And support productive struggle
- Build procedural fluency and conceptual understanding
  - Use and connect mathematical representations
- Facilitate meaningful mathematical discourse
  - Pose purposeful questions
  - Elicit and use evidence of student thinking

Problem solving
Reasoning and proof

Connections
Representation

Communication

Mathematics Teaching Practices

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Conceptual Understanding
Procedural Fluency

Strategic Competence
Adaptive Reasoning

Productive Disposition

Chicken and Egg Problems

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A Pi Day Problem

- A cook-and-a-half bakes an pie-and-a-half in a hour-and-a-half. How many pies would 6 cooks bake in 4 hours?

  - Think
  - Draw a picture
  - Make a table

A Rich Problem

- A hen-and-a-half lays an egg-and-a-half in a day-and-a-half. How many eggs would 6 hens lay in 4 days?

  - Think
  - Draw a picture
  - Make a table

Extension Questions

a) 6 hens, 4 days. How many eggs?

b) 8 hens, 16 eggs. How many days?

c) 12 eggs, 3 days. How many hens?

d) 12 eggs, 7 days. How many hens?

A Pictorial Solution

6 hens

Hh Hh Hh Hh

Ee Ee Ee Ee 1.5 days

Ee Ee Ee Ee 1.5 days

So 6 hens lay 12 eggs in 3 days

We need one more day

A Pictorial Solution

6 hens

Hh Hh Hh Hh

Ee Ee Ee Ee 1.5 days

Ee Ee Ee Ee 1.5 days

E E E E 1 day

So 6 hens lay 16 eggs in 4 days

A Tabular Solution

Hens	Days	Eggs
1.5	1.5	1.5
3	1.5	3
3	3	6
3	1	2
6	1	4
6	4	16

Let’s start again

We are beginning a new unit in Math 1

Chicken and Egg Problems

- A hen-and-a-half lays an egg-and-a-half in a day-and-a-half. How many eggs would 6 hens lay in 4 days?

Use the Units

$$\left(\tfrac{3}{2}\,\text{egg}\right)/\left(\tfrac{3}{2}\,\text{hen}\right)/\left(\tfrac{3}{2}\,\text{day}\right) = \left(1\ \text{egg/hen}\right)/\left(\tfrac{3}{2}\,\text{day}\right)$$

$$= \frac{2}{3}\,\text{egg}/\,\text{hen}/\,\text{day}$$

$$= \frac{2}{3}\,\frac{\text{egg}}{\text{hen}\cdot\text{day}}$$

6 hens, 4 days. How many eggs?

$$\frac{2}{3}\,\frac{\text{egg}}{\text{hen}\cdot\text{day}}\cdot 6\,\text{hens}\cdot 4\,\text{days} = 16\,\text{eggs}$$

- The homework is 1-49 odd. You may get started now.

Stop

Question

- What is a hen-day?

Other questions

b) 8 hens, 16 eggs. How many days?

$$\frac{16\,\text{eggs}}{8\,\text{hens}} \cdot \frac{3}{2} \frac{\text{hen} \cdot \text{day}}{\text{egg}} = 3\,\text{days}$$

c) 12 eggs, 3 days. How many hens?

$$\frac{12\,\text{eggs}}{3\,\text{days}} \cdot \frac{3}{2} \frac{\text{hen} \cdot \text{day}}{\text{egg}} = 6\,\text{hens}$$

d) 12 eggs, 7 days. How many hens?

$$\frac{12\,\text{eggs}}{7\,\text{days}} \cdot \frac{3}{2} \frac{\text{hen} \cdot \text{day}}{\text{egg}} = \frac{18}{7}\,\text{hens}$$

Mathematics Teaching Practices

- Establish mathematics goals to focus learning
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  - And support productive struggle
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What Now?

Five (5) Key Actions (from *Principles to Actions*)

0. Embrace the key shifts and evolve
   - Standards for Mathematics Content and Mathematical Practice
   - Focus, Coherence, Rigor (conceptual understanding, procedural fluency, and application)
   - Mathematics Teaching Practices
1. Communicate these shifts to parents and the broader community (**including success stories**)
2. Institute ongoing (mathematics-specific) professional development (as an antidote to isolation)
   - Deploy coaches and grow professional learning communities around common challenges
   - Expect collective responsibility for success and a culture of continual improvement, professional learning, and collaboration
3. Allocate resources so all students can succeed—a non-negotiable priority
   - Eliminate tracking of low-achieving students, and provide high-quality interventions and support structures
4. Cultivate high expectations, a growth mindset, safe environments, and positive dispositions
   - Promote curiosity, self-confidence, flexibility, and perseverance
   - Value productive struggle and creative solution paths
5. Insist upon diverse measures when evaluating students, teachers, and schools

Key Sites

- Ohio PTA: http://www.ptacommoncore.org/
- Common Core State Standards (official site)
  - http://www.corestandards.org/
- Achieve the Core (from Student Achievement Partners)
  - http://www.achievethecore.org/
- Partnership for Assessment of Readiness for College and Careers (PARCC)
  - http://parcconline.org/
- Smarter Balanced Assessment Consortium
  - http://www.smarterbalanced.org/
- Business Roundtable and US Chamber of Commerce advocacy website
  - http://TheCommonCore.com/

Other Implementation Resources

- The Mathematics Frameworks from the Partnership for Readiness for College and Careers (PARCC)
- The draft Mathematics Content Specifications from the Smarter Balanced Assessment Consortium (SBAC)
- The Mathematics Assessment Project (MAP)
- The Illustrative Mathematics Project (IMP)
- Bill McCallum's Common Core Tools blog
  - Progressions documents
- Common Core videos from the Hunt Institute
- Phil Daro's SERP Institute videos
- Inside Mathematics website