

2014 Judith Jacobs Lecture



Curriculum Matters!

For students, for teachers, and for teacher educators

Barbara J. Reys

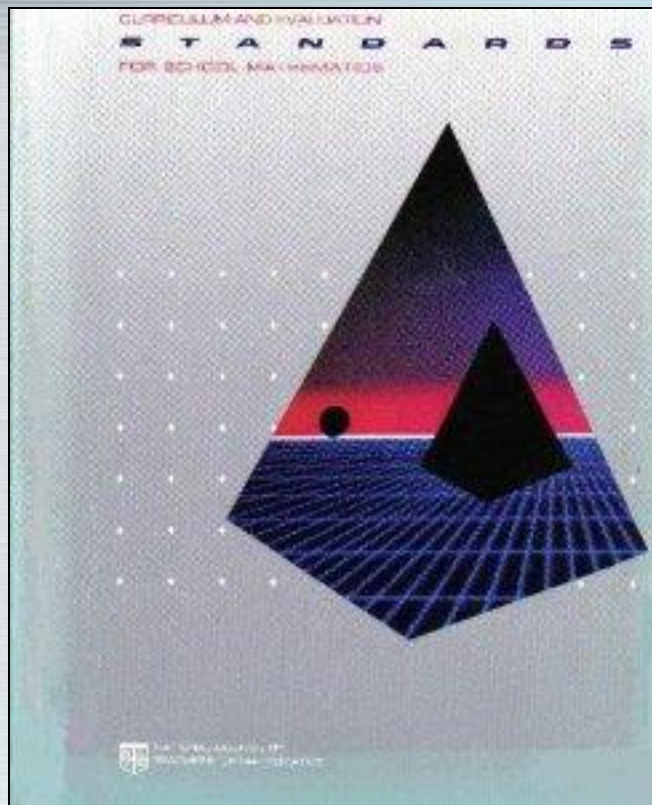
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Paper available at: <http://www.amte.net/conferences/conf2014/featreys>





Curriculum and Evaluation Standards for School Mathematics, 1989



Elementary and Secondary Education Act (ESEA)

- Signed into law in 1965
- Emphasizes equal access to education
- Requires high standards for curriculum and accountability
- Authorizes federally funded education programs that are administered by the states



Lyndon B. Johnson at the ESEA signing ceremony, with his childhood schoolteacher Ms. Kate Deadrich Loney

1965

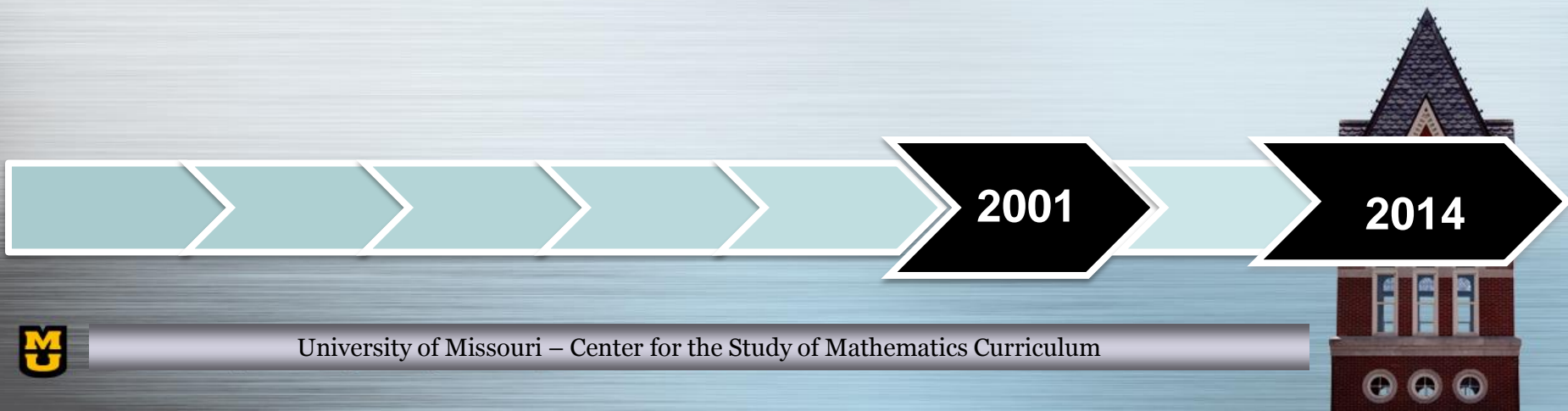
2014



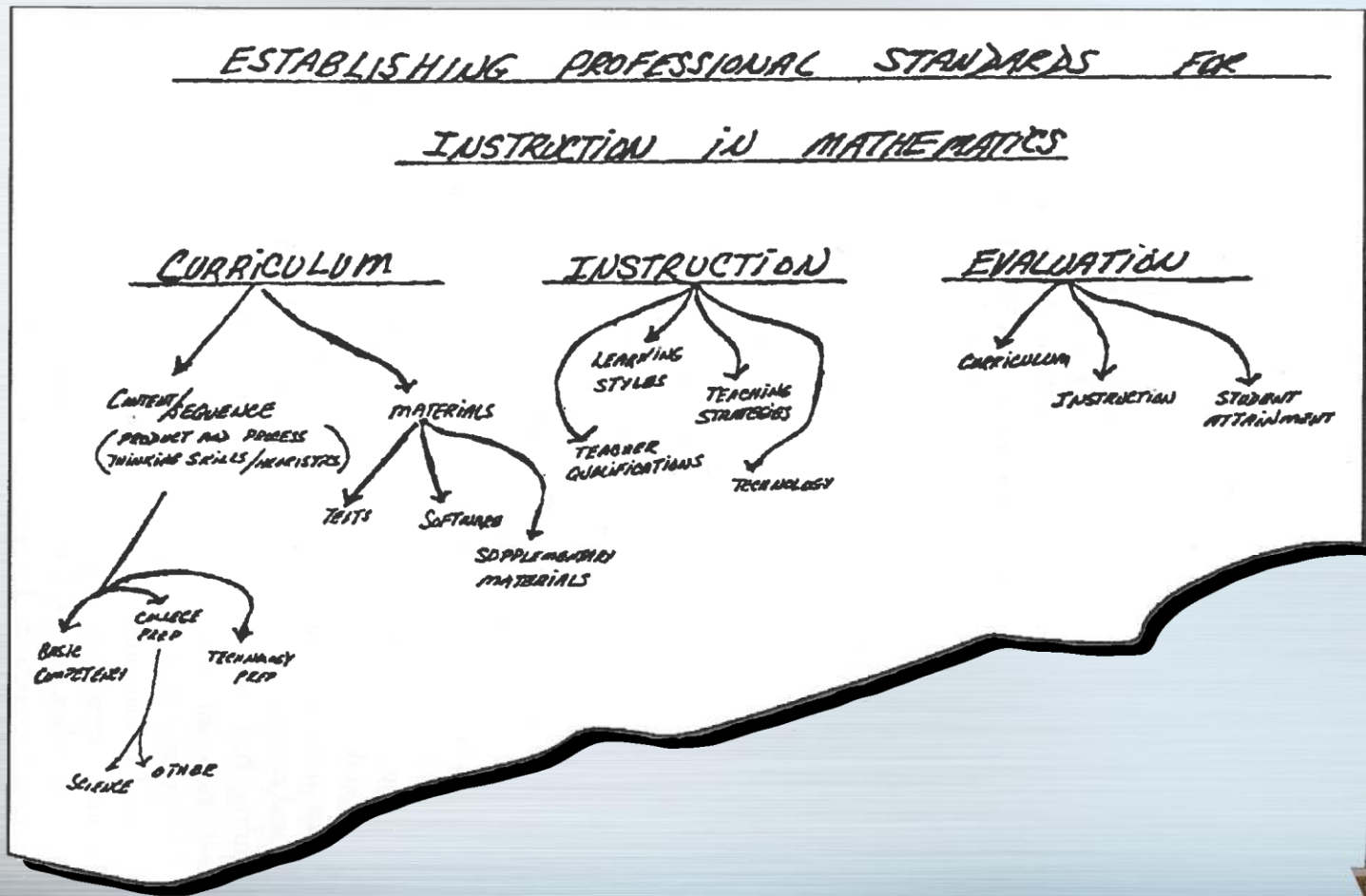
Reauthorization of ESEA: No Child Left Behind Act (2001)

Goal 1:

By 2013-**2014**, all students will reach high standards, at a minimum attaining proficiency in reading/language arts and mathematics.

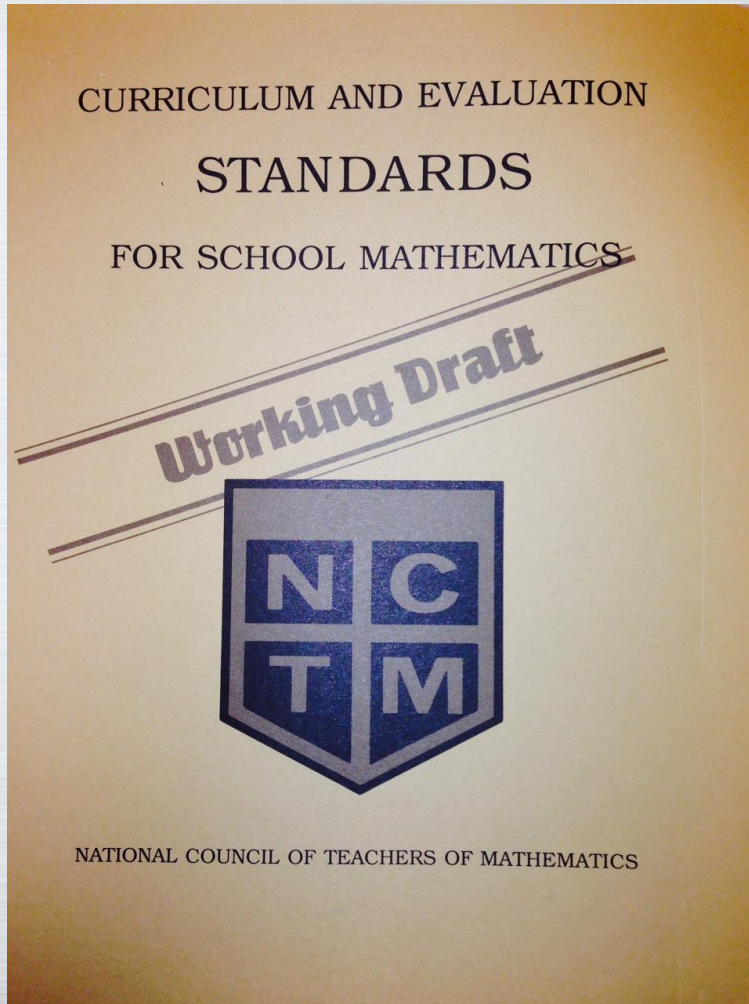


Early plan for NCTM Standards, drawn by Jim Fey, 1985



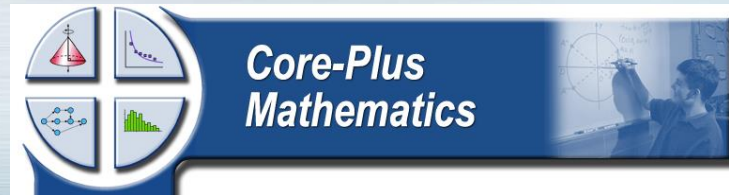
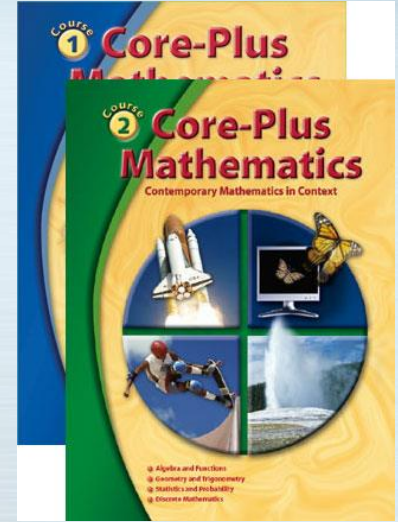
Source: McLeod, 2003





- Conceptual development
- Problem solving and reasoning
- Active student engagement

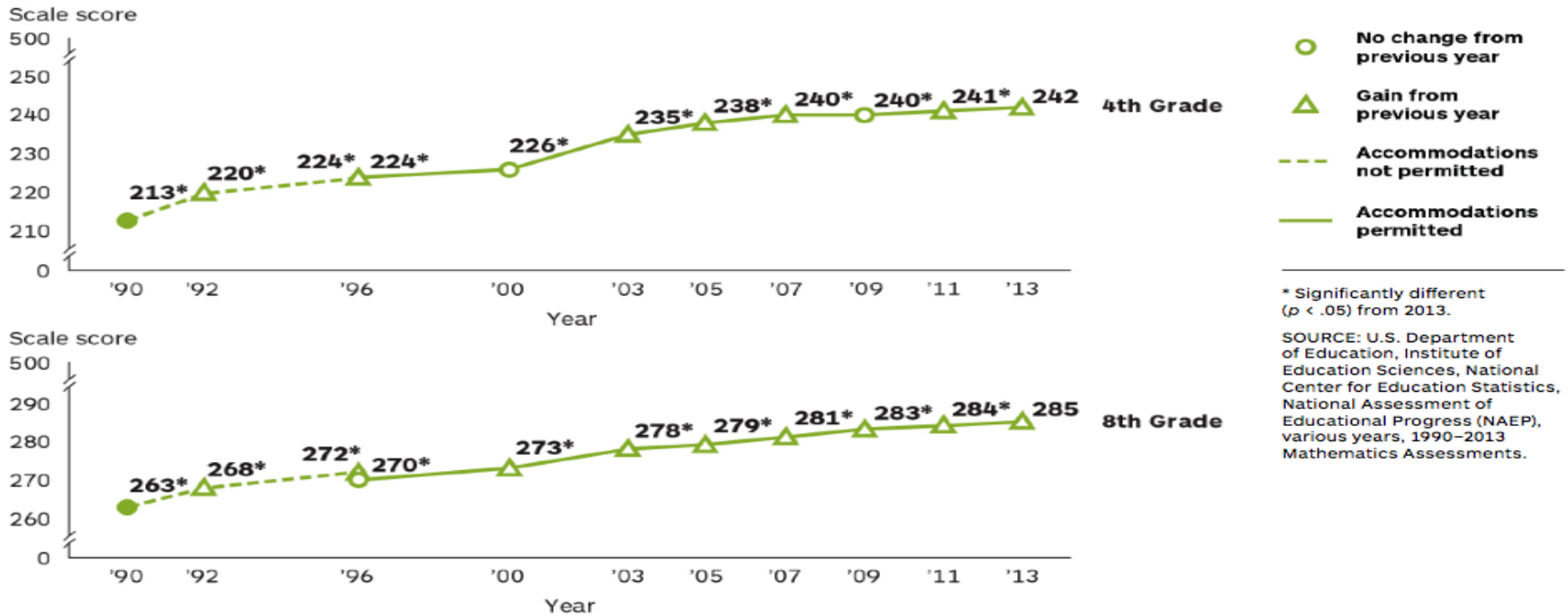




Math Performance on NAEP – Grades 4 and 8 (1990-2013)

THE NATION'S REPORT CARD > 2013 MATHEMATICS AND READING

FIGURE 2. Trend in fourth- and eighth-grade NAEP mathematics average scores



(See: Kloosterman & Walcott, 2010; Usiskin, 2014)



Common Core State Standards Initiative:

A context for reform/improvement



Standards-based reform strategy

“Establish clear goals for student achievement through the establishment of standards and related assessments, generate data to improve teaching and learning, create incentives for change through rewards and sanctions, and provide assistance to low-performing schools” (Goertz, 2008).



“Standards-based” Reform Strategy

Establish challenging
curriculum
goals/standards

Measure and report
student progress
toward curriculum
goals; hold schools
accountable



Establish challenging
curriculum
goals/standards

Teaching
Curriculum
Materials
Course
Organization
Graduation
Requirements

Measure and report
student progress
toward curriculum
goals; hold schools
accountable

↓
Student
Learning



In response to NCLB (2001)

Each of 50 states developed:

- State standards
- State assessments
- Passing threshold for reporting proficiency



Mile wide, inch deep, and a foot tall!



Materials (per grade) included with one popular middle school mathematics series.



Example:

4th grade state mathematics standards

10 largest states

- 108 “unique” standards

See: 2007 article in *Teaching Children Mathematics*, 14(1), 6-11.



Gr. 4 mathematics standards common across 10 largest states in 2006:

(4 of 108 learning goals)

- *Read, write, compare, and order whole numbers.*
- *Read, write, compare and order decimals.*
- *Add and subtract decimals.*
- *Solve problems involving whole number multiplication and division.*

See: 2007 article in *Teaching Children Mathematics*, 14(1), 6-11.



Gr. 4 standards included in only one of ten states:

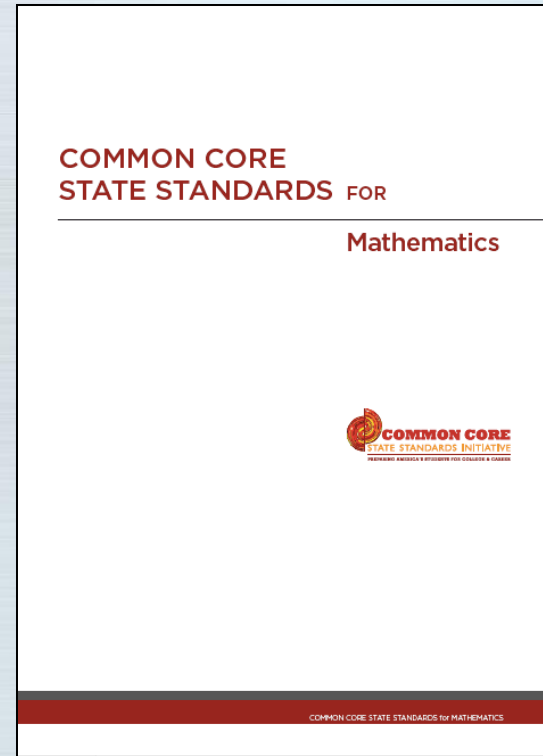
(28 of 108 learning goals)

Examples:

- *Use concrete materials and symbolic notation to represent numbers in bases other than base ten, such as base five.*
- *Compare decimal number system to the Roman numeral system (using the Roman numerals I, V, X, L, C, D, and M.)*
- *Use models to identify perfect squares to 100.*



Common Core State Standards for Mathematics (2010)



Strengths of CCSSM

- Focus on understanding, conceptual development
- Focus on development of mathematical practices



Practices, Processes, Proficiencies

| NCTM (2000) | Adding It Up (2001) | CCSSM (2010) |
|-----------------|--------------------------|------------------------------------------------------------------|
| Problem solving | Strategic competence | Make sense of problems and persevere in solving them. |
| Reasoning | Adaptive reasoning | Reason abstractly and quantitatively |
| Connections | Conceptual understanding | Look for and express regularity in repeated reasoning. |
| Communication | Procedural fluency | Construct viable arguments and critique the reasoning of others. |
| Representations | Productive disposition | Look for and make use of structure |
| | | Use appropriate tools strategically |
| | | Attend to precision |
| | | Model with mathematics |

+ Habits of Mind (Cuoco, Goldenberg and Mark, 1996)



Strengths of CCSSM

- Focus on understanding, conceptual development
- Focus on development of mathematical practices
- Emphasis on, articulation of learning progressions



Progression for Volume

Grade 5:

Recognize volume as an attribute of solid figures and understand concepts of volume measurement.

- a. A cube with side length 1 unit, called a “unit cube,” is said to have “one cubic unit” of volume, and can be used to measure volume.
- b. A solid figure which can be packed without gaps or overlaps using n unit cubes is said to have a volume of n cubic units.



Progression for Volume

Grade 6:

- Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes ... show that the volume is the same as would be found by multiplying the edge lengths of the prism.
- Apply the formulas $V = l w h$ and $V = b h$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.



Progression for Volume

Grade 7:

Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

Grade 8:

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



Limitations of CCSSM

- Limited recognition of influence of technology.
- Limited guidance at the high school level regarding integration of content.



Some Open Questions

- Will the assessment consortia produce high quality assessments and will they be affordable?
- What about long-term maintenance of the Common Core? How will improvements/changes be made (process, timeline)?
- Are high quality Common Core-aligned curriculum resources available and can districts afford them?



Implementation of CCSSM: A Status Report



“It is easier to change the location of a cemetery, than to change the school curriculum.”

Woodrow Wilson

President of Princeton University (1902-1910)

28th President of the United States (1913–1921)



Media Headlines About Common Core

Common Core: A Puzzle to Public

Education >

Common Core: Opponents worry about sex, tests and loss of local control

James Call, 09/04/2013 - 05:02 PM

School Choice and Common Core: Mortal Enemies

RealClearPolitics - Jan 31, 2014

A Common Core standards opponent claims they're part of world socialism

Vermillion Plain Talk [January 31, 2014](#)

Common Core opponents encouraged to pray for standards' defeat

Weingarten: Common Core implementation 'far worse' than Obamacare rollout



Streams of Concern

General public: Fear of federal control or loss of local autonomy.



Common Myths about the Common Core

- A national mandate dictating a national curriculum
- Dictate what textbooks teachers will use
- Control the curriculum of charter schools, private schools, and homeschooling
- Allow student data to be inappropriately tracked



Streams of Concern

General Public: Fear of federal control or loss of local autonomy.

Education Community: Dissatisfaction with:

- some content of the Common Core;
- timeline and lack of resources for implementation;
- unknowns related to new assessments;
- fear that the Common Core will stifle/limit curriculum innovation and experimentation.



Why I support common standards

Potential to increase the quality of ...

- Standards (articulation, content, progressions)
- Instructional materials aligned to standards
- High stakes assessments aligned to standards

And allow a focus on **TEACHING** and **LEARNING**.



What are key constituents' perceptions of the Common Core?



Public Perception of Common Core

- Two-thirds of Americans have not heard of the Common Core.
- Among the other third, four of 10 believe they CAN make education in the United States more competitive globally; six of 10 said the standards will make the U.S. less competitive or have no effect.

Source: 2013 PDK Gallup Report



Public Perception of Curriculum Reform Agenda

- Identified critical thinking skills as the most important of the 21st-century skills, closely followed by communication skills.

Source: 2013 PDKGallup Report

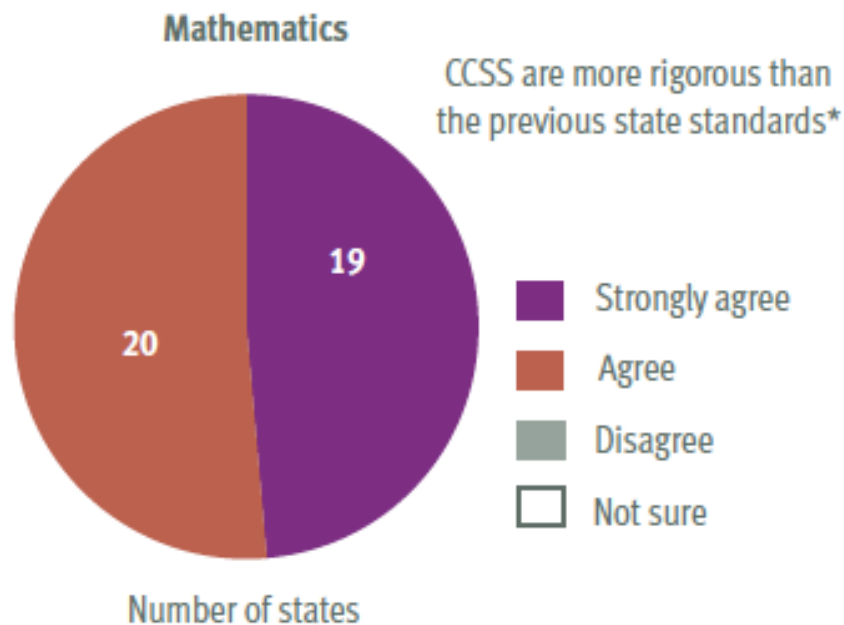


State Education Agency Perceptions

All respondents agree or strongly agree that the Common Core Standards are more rigorous than their state's previous standards

Source: CEP Report, Yr. 3

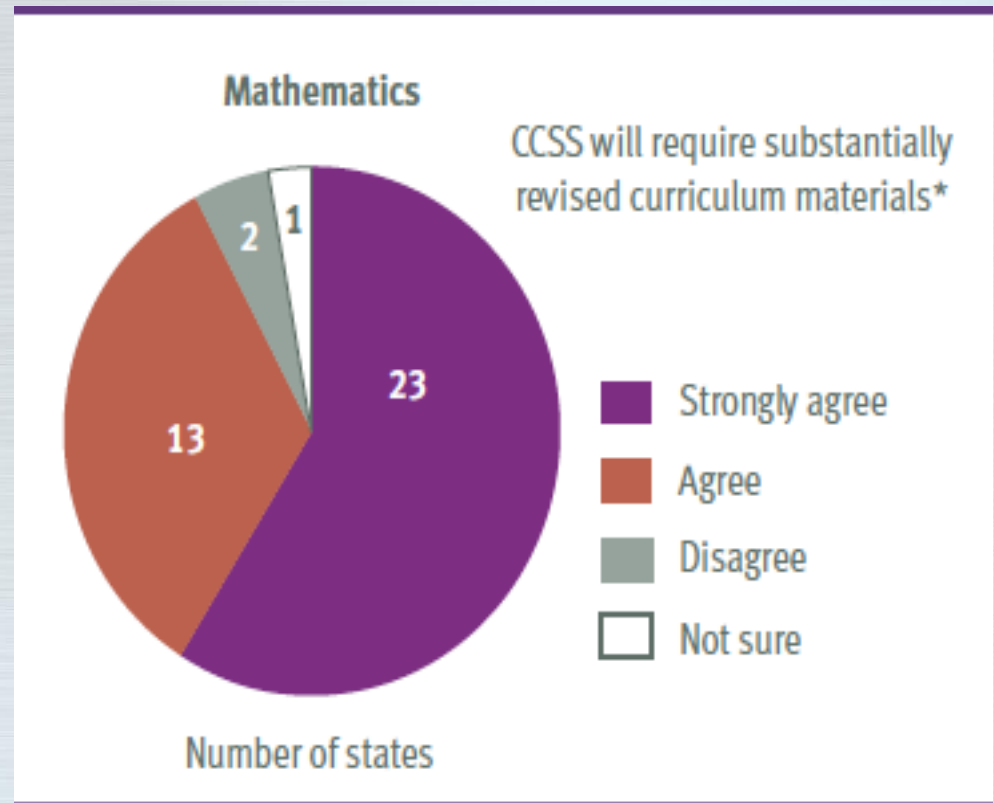
Figure 1. Rigor of the Common Core



State Agency Perceptions

Nearly all of the states surveyed indicate that substantially revised curriculum materials are needed to implement Common Core.

Source: CEP Report, Yr. 3



State Agency Perceptions

In all but two states, officials considered it unlikely that their state would reverse, limit, or change its decision to adopt Common Core during 2013-14.

Source: CEP, 2013



State Legislative Action - Standards

Legislation introduced in **2013** to further study, delay, modify, or stop implementation, or “de-adopt” CCSS:

Passed:

Indiana (delay implementation; require further study)

Michigan (prohibits funding of implementation without legislative approval)

Wisconsin (delay implementation until study is completed)

Introduced/Pending:

Illinois (delay implementation, estimate costs)

Kansas (prohibit funding for implementation)

Michigan (prohibit implementation)

New York (void adoption)

Ohio (void adoption)

Pennsylvania (delay implementation, conduct review, gather information)

South Dakota (void adoption)

Failed:

Alabama

Florida

Georgia

Missouri

Source: <http://www.ccrslegislation.info>



Teacher Perceptions of CCSSM

- Common Core Standards are more rigorous than their previous state standards.
- Common Core require them to teach more conceptually and incorporate more communication, problem solving, and exploration.
- Common Core-aligned state assessment and evaluation systems will influence their instructional practices.

Source: Choppin, Davis, Drake, & Roth McDuffie (2013)



Teacher Perceptions of CCSSM

- Slightly over two-thirds of teachers are using textbooks that were adopted prior to implementation of the CCSSM.
- One-third of teachers stated a need for better-aligned curriculum materials.
- Just over 60% are regularly accessing online resources to supplement existing textbooks. Others are creating their own curriculum materials.

Source: Choppin, Davis, Drake, & Roth McDuffie (2013)



What's needed?



Curriculum Standards: Necessary but not sufficient

The Common Core Standards (and aligned assessments) must be partnered with high quality **curriculum materials** and focused and ongoing **professional development** that improves teaching.



Curriculum Materials

- Teachers are increasingly drawing upon materials outside their district-adopted textbook. They report doing this in order to align their program to CC.



Googled “5.MD.3a” -- 52,000 hits

Common Core State Standards Initiative | Mathematics | Grade 5 ...
www.corestandards.org/Math/Content/5/MD

Volume of Rectangular Prisms - MHEonline.com
<https://www.mheonline.com/emcrosswalk/pdf/5/L09-08.pdf>

KCAS Unit Study for 5.MD.3, 5.MD.4, 5.MD.5 - Project PACED
www.projectpaced.com/.../1/3/.../grade_5__unit_of_study_5.md.345.pdf

Understanding volume - for teachers | LearnZillion
learnzillion.com/lessons/1796-understanding-volume

CCSS.Math.Content.5.MD.C.3a - OER Commons
www.oercommons.org/browse/alignment/CCSS.Math.Content.5.MD.C.3a

Common Core Browser: CCSS.Math.Content.5.MD.C.3a ...
betterlesson.com/.../ccss-math-content-5-md-c-3a-a-cube-with-side-lengt

5.MD Measurement and Data - Pinterest
www.pinterest.com/teach41731/5md-measurement-and-data



Curriculum Materials

- Teachers are increasingly drawing upon materials outside their district-adopted textbook in order to align their program to CC.
- Districts are providing e-tablets to all students.
Rationale: E-tablets enrich the technology experience of students; provide access to current curriculum resources.



Digital Curriculum Programs in School Mathematics



Enciclomedia
(Mexico)



**Fuse Algebra 1,
Geometry, & Algebra 2**
(Houghton Mifflin
Harcourt)

(Khan
Academy)



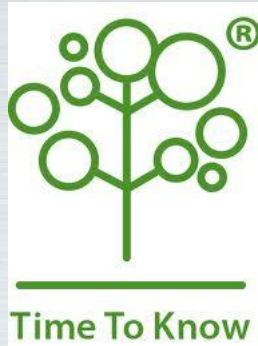
KHAN
ACADEMY



ALEKS[®]
ALEKS
(McGraw
Hill)



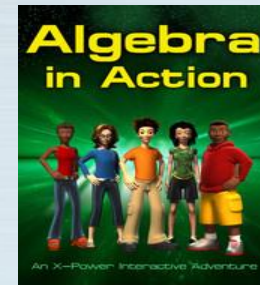
Kinetic
Pre-Algebra,
Algebra, Geometry,
Algebra II
(Perfection
Learning)



Time To Know
(Time To Know)



Digital Textbook
(South Korea)



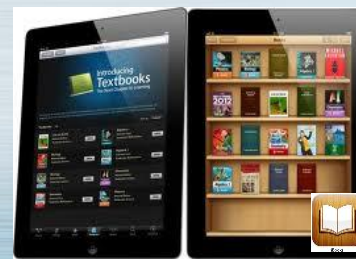
**Algebra in
Action**
(Slim
Goodbody
Corporation)



agile Mind
(Agile Mind, Inc.)



**DreamBox
Learning
Math**
(DreamBox
Learning)



**Apple iBooks
for McGraw-
Hill, Pearson,
Houghton
Mifflin
Harcourt**

Collage compiled by A.J. Edson



**“Textbooks don’t have to be text
and they don’t have to be
books.”**

Inkling, Inc.



*“A digital textbook is **not** just taking an image of a [print] textbook and putting it on an electronic device to read it. A digital textbook is something that takes school content and takes advantage of the properties of digital media to produce that school content in a completely new way that’s much stronger for learning.”*

Jeremy Roschelle (2011)



Common Core-aligned Assessments

- Will the new Common Core aligned assessments deliver on the promise of monitoring student acquisition of both mathematics content AND mathematics practices?
- Will the cost of the new consortia assessments inhibit their use?
- How will initial assessment results impact perceptions and willingness to continue with the Common Core initiative?



Going Forward ...

1. Ensure that the Common Core is a living document.
2. Demand that the Common Core, as implemented and assessed, keeps the Promise of BOTH career and college readiness
3. Adapt and create materials that capitalize on present and emerging technologies to support implementation.
4. Promote research-based opportunities for teacher learning.
5. Ensure the content and quality of the Common Core-aligned assessments.
6. Support research to monitor and learn from implementation.

Source: *Agenda for Action: Implementation of CCSS (2012)*



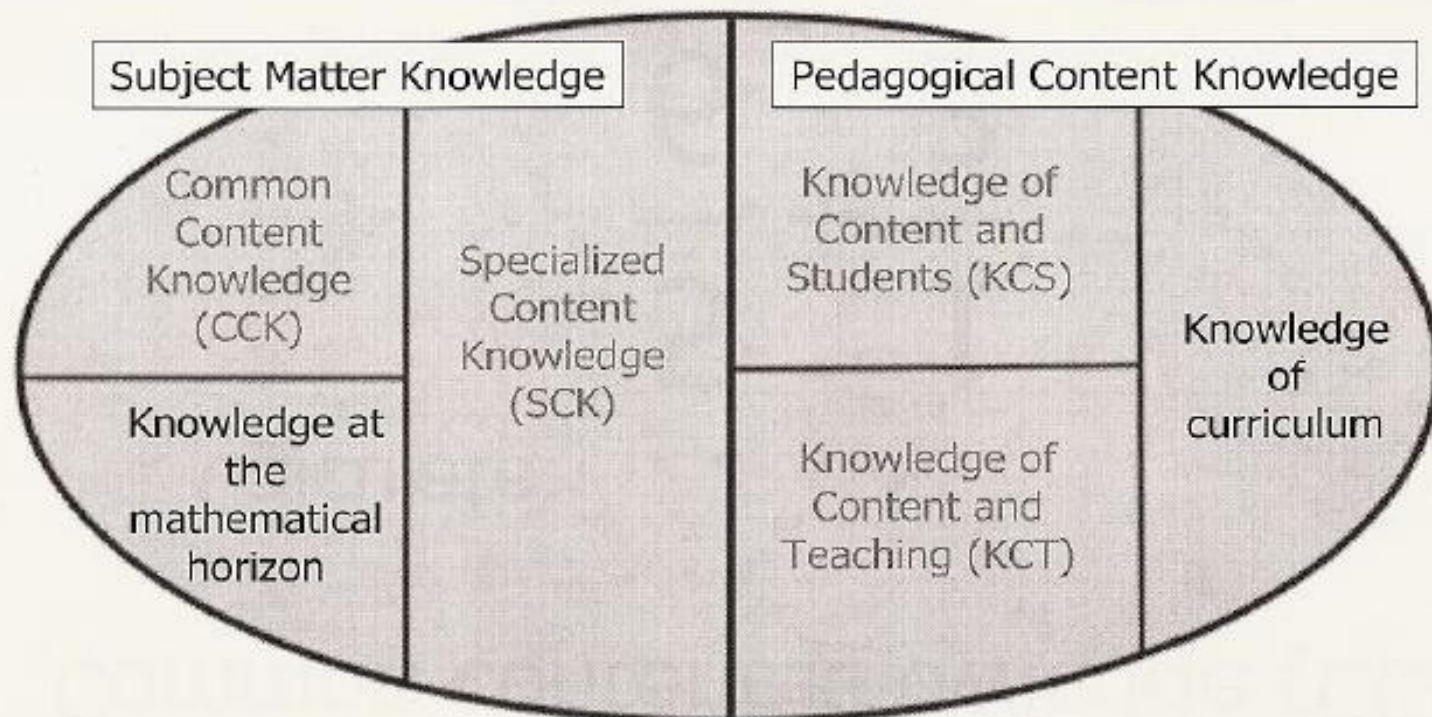
**Everyone has a role, including
mathematics teacher educators.**



What is the curriculum of “curriculum” in preservice teacher education courses?



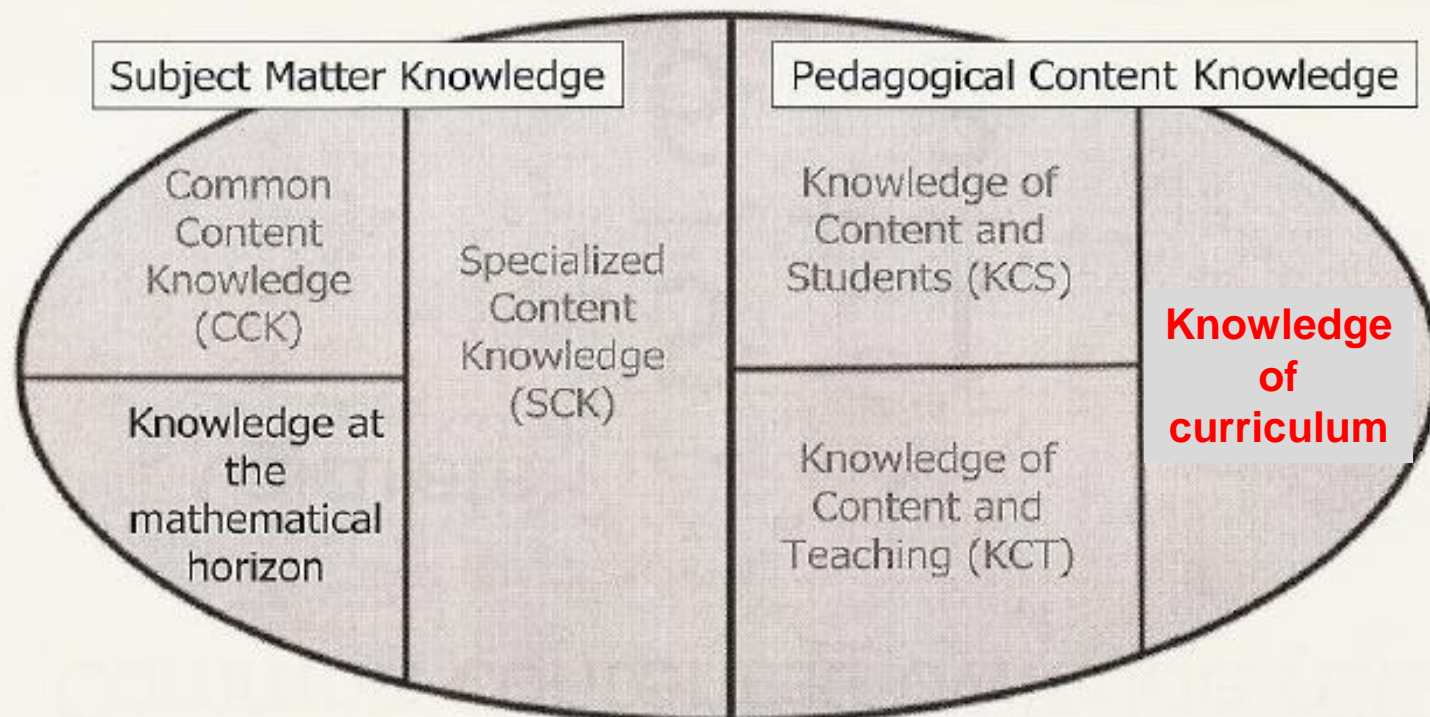
Mathematical knowledge for teaching



Source: Ball, Thames, & Phelps, 2008



Mathematical knowledge for teaching



Source: Ball, Thames, & Phelps, 2008



“Curriculum knowledge, with particular grasp of the materials and programs that serve as ‘tools of the trade’ for teachers.”

Source: Shulman (1987)



Knowledge of Curriculum

What are your learning goals for students related to curriculum?



Teacher Preparation: Major Areas of Study Related to Curriculum

- Curriculum governance
- Curriculum standards and learning progressions
- Curriculum resources
- Alignment of standards, materials, assessments



Curriculum Governance

- What mathematics should students learn and when should it be a focus of instruction?
- Who decides and what evidence (or values) inform these decisions?
- What is the federal, state, district, and school role in curriculum guidance/governance? Individual teacher's role?



Curriculum Standards and Progressions

- What are the big ideas and emphasis for the students I teach?
- How do these mathematical ideas/topics develop over time?
- What variations in development of understanding and proficiency might be expected? In what ways can teachers support learners at different points in the learning progression?



Curriculum Resources

- What tools and resources are available to support teaching (and learning) of key mathematical ideas?
- How do curriculum materials differ?
- What are key features or characteristics of good mathematical tasks, activities, and lessons?



Alignment of Standards, Curriculum Materials, and Assessments

- What does it mean for learning goals, materials, and assessments to be “aligned.”
- How do teachers evaluate the alignment of goals, materials, and assessments?



What does make a difference (what matters)?



The Basics of Mathematics Education Reform – the things that matter

1. Knowledgeable, well-supported, caring teacher workforce.
2. Teaching that engages students.
3. High quality curriculum.
4. Student attitude, beliefs, work ethic.
5. School leadership and parental support.



Thank you.

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