

## State Standards

- NCLB required states to develop grade-by grade leaming outc omes for K-12 students.
- The process of developing state standards va ried a c ross states
- Procedures used to develop mathematics standards
- Outside influences
- Official role of standards



## Issues Surrounding State Standards

- Variation on:
- topicsstudents are expected to leam
- when topicsare expected to be leamed
- how content should be developed across grade levels
- Diffic ulty creating coherent and wella ligned textbook materials
- Inequitable opportunities to leam mathematics across states


Common Core State
Sta nd a rds Initia tive (CCSSI)

- Launched by the National Govemors Association and Council of Chief State School Officers
- Led by representatives from 48 states and the District of Columbia, Puerto Rico, and the Virgin Islands
- Mathematics, mathematic seducators and school representatives worked together to develop a set of common mathematics standards (CCSSM)


In what ways have states "augmented" CCSSM?


## Achieve (2010)

- "... states who adopt the Common Core State Standards (CCSS) are expected to adopt them in their entirety. While states will not be considered to have adopted the common core if any individual standard is left out, states a re allowed to augment the standards with an additional $15 \%$ of content that a state feels is imperative."
(http://www.achieve.org/files/15PercentGuideline.pdf)



## Augmentation of CCSSM

- Three ways that states have augmented

1) Added (or moved) some standards
2) Added examples and/or clarifying annotations
3) Modified format of standards


Example of "augmentation"
Maryland - "Essential Skills and Knowledge" statements added through the document to clarify standards

- CCSS: Understand a fraction 1/b as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction $\mathrm{a} / \mathrm{b}$ as the quantity formed by a parts of size $1 / \mathrm{b}$.
- MD Essential Skills and Knowledge (added below this standard):
Knowledge of the relationship between the number of equal shares and the size of the share
Knowledge of equal shares of circles and rectangles divided into or partitioned into halves, thirds, and fourths Knowledge that, for example, the fraction $1 / 4$ is formed by 1 part of a whole which is divided into 4 equal parts $1 / 4+1 / 4+1 / 4$ ( 3 parts of the whole when divided into fourths)

Example of "augmentation"
Califomia - Added, moved or modified language of the standards

- Add - Gr. K: Demonstrate an understanding of conceptstime (e.g., moming, aftemoon, evening, today, yesterday, tomonrmow, week, year) and tools that mea sure time (e.g., clock, calendar).


## State Initiatives to Support Implementation of CCSSM

- Move: Gr. 7 6: Draw (freehand, with ruler and protractor, and
- Developed "crosswalk" summary, comparing state standards and CCSSM
- Developed "bridging" documents, including timeline for transition to CCSSM.
with tec hnology) geometric shapes with given cond itions.
Collaborating on common assessments. or sides, noticing when the conditions determine a unique
- Disseminating information, organizing professional development activities.
- Modify: HS - Understand that polynomials form a system analogous to the integers, namely, they are closed under the
aperations of addition, subtraction, a and multiplication; add, subtract, a a multiply polynomials, and divide polynomials by monomials. Solve problems in and out of context


Implementation 2011-2012

- Standards for Mathematic al Content: Grade K: $\quad$ AZ, IN and FL
Grades $\mathrm{K}-2$ : $\quad \mathrm{AR}, \mathrm{NV}, \mathrm{NH}, \mathrm{NJ}$ and OR
Grades K-8: MS
Grades6\&9: UT
Grades K-12: KY
- Standards for Mathematic al Practices:

Grades K-12: IN

How is the K-8 mathematics content asdescribed by the state standards similar to or different from the leaming expectations outlined in CCSSM?

Basic Facts Addition


Basic Facts Multiplic ation


Basic Facts Multiplic ation



## Computation with Whole

 Numbers- Differences in Language:
- SS: Multi-digit numbers
- CCSSM: Addition and subtraction within .. 20 or 100
- Development trajectory:
- SS: Typic ally was 2-3 years
- CCSSM: At least one additional yearfor each operation




## - Mathematical Properties

- Understand that multiplication is extended from fractionsto rational numbers by requiring that operationscontinue to satisfy the properties of operations, particularly the distributive property, leading to products such as $(-1)(-1)=1$ and the rules for multiplying signed numbers. Interpret products of rational numbers by describing realworld contexts. (Grade 7)
- Relationships between operations
- Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction. (Grade 3)


When do Algebra GLEs occur?


- Pattems
- Identify a rithmetic pattems (including pattems in the addition table or multiplic ation table), and explain them using properties of operations. (Grade 3)


## - Functions

- Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. (Grade 8)
- Expressions, equations and inequalities (EEI)
- Identify when two expressionsare equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). For example, the expressions $y+y+y$ and 3y are equivalent because they name the same number regard less of which numbery stands for. (Grade 6)

Algebra sub-strands by grade-band


## Algebra

## Sample Level 3 GLEsfrom CCSSM

- 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. (Grade 1)
- CCSSM hasdecreased the emphasis on Patteming standards a cross grade-bands
- Understand that attributes belonging to a category of twodimensional figures also belong to all subcategones of that category. For example, all rec tangles have four night angles and squaresare rectangles, so all squares have four night angles. (Grade 5)
standards in CCSSM
- CCSSM has increased the emphasis on
- Use informal argumentsto establish facts about the angle sum and extenor angle of triangles, about the angles created when parallellines are cut by a transversal, and the Mathematic al Properties standa rds a cross the K-2 and 3-5 grade-bands. angle-angle cnterion for similanty of tiangles. For example
- Between 2.5-3.5 times more Relationships ane-angle chon sum the three angles appears to form a line, and give an argument in temsof transversals why this is so. (Grade 8)


## Geometry

Geometry GLEs analyzed in comparison to the van Hiele levels of geometric thinking:

- Level 1: student perceivesa figure as a whole, recogniza ble by its visual form, but properties of a figure are not perceived
- Level 2: student perceives properties of figures, but they are isolated and unrelated.
- Level 3: student understands definitions of figures, with relationships being perceived between properties a nd between figures.
- Level 4: student can construct proofs, understand the role of axioms and definitions, and know the level 5 sudent undertandstcient deduction. (Maybemy, 1983, p. 59)


## Measurement

GLEs analyzed in reference to an adapted framework for $1-, 2-$, and 3 dimensional measurement:

1. The child shows awareness of the attribute and its descriptive language.
2. The child compares, orders and matches objects by the attribute.
3. The child chooses/uses non-stand ard units and tools
for estimating and measuring.
4. The child chooses/uses standard units and tools for estimating and measuring.
5. The child solves a range of problems involving important mea surement concepts/skills. (Newton \& Kasten, 2011, p. 16)


Mea surement GLEs

| Themes | State Standards | CCSSM |
| :---: | :---: | :---: |
| Attribute awareness | $12 \%$ | $27 \%$ |
| Compare by attribute | $8 \%$ | $5 \%$ |
| Non-standard units | $14 \%$ | $7 \%$ |
| Standard units | $20 \%$ | $25 \%$ |
| Problem solving | $50 \%$ | $66 \%$ |



Comparing Experimentaland
Theoretical Probability


7.SP.7. Develop a probability model and use itto finind
probabilities of events Compare probabilities from a mod
observed frequencies, if the agreement is not good, explain
possible sources of the discrepancy. Develop a unifom

probability model by a ssigning equal probability to all outco and use the model to detemine probabilities of events.

Sta tistic s

## Statistic s GLEs - Type I \& Type II - Type I

- Students expected to do the process (e.g., construct a bargraph).
- Type II
- Students expected to evaluate the process (e.g., select the most appropriate representation for a given set of data).



## Sta tistics

Statistic s GLEs - GAISE Framework (4 major components)

- Formulate Questions
- clarify the problem at hand
- formulate one (or more) questions that can be answered with data
- Collect Data
- design a plan to collect appropriate data
- employ the plan to collect the data
- Analyze Data
- select appropriate graphical and numerical methods
- use these methodsto analyze the data
- Interpret Results
- interpret the analysis
- relate the interpretation to the original question


## Sample Type II GLEs from CC SSM

- Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. For example, "How old am I?" is not a statistic al question, but "How old are the students in my school?" is a statistic al question because one antic ipates variability in students' ages. (Grade 6, Formulate Question)
- Summarize numeric al data sets in relation to their context, such as by: (d) relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered. (Grade 6, Collect Data, Analyze Data)


## Disc ussion of C ritic al

Differences between State Standards and CCSSM

- Mathematical content will shift to earlier orlater grade levels
- Earlier: Fraction computation
- Later: Statistics and Probability
- Developmental trajec tory of partic ular content will be altered.
- Expanded number of grade levels: Whole numbercomputation
- Contracted Trajectory: Probability


## Implic ations-What should teachers look for in Textbooks

- Not all states have adopted CCSSM
- Greater consensus a c ross states should lead to strongly aligned curic ulum materials.
- How wasthe textbook created?
- Developing conceptually-oriented textbook series requires piloting and revising which takestime.
- Do textbooks conta in higher-order thinking problems?


Questions?
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