California's Standards for Mathematics and Literacy

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Goals

1. Experience instructional shifts that engage all students in practices of reasoning and sense making.
2. Develop deeper knowledge of measures of center (statistics).
3. Increase awareness of uses of technology to support student academic discourse and engagement.

New Standards for Mathematics Expect that Students…

- Understand the concepts behind the calculations.
- Develop skills in reasoning and communicating mathematically.
- Have flexibility to solve non-routine problems.

Beliefs

- Math makes sense. (*And if it does not, ASK!*)
- All students can make sense of math.
- Learning should be coherent.
- Students learn best through active engagement: thinking, reasoning, connecting, communicating, critiquing, revising, and extending knowledge.
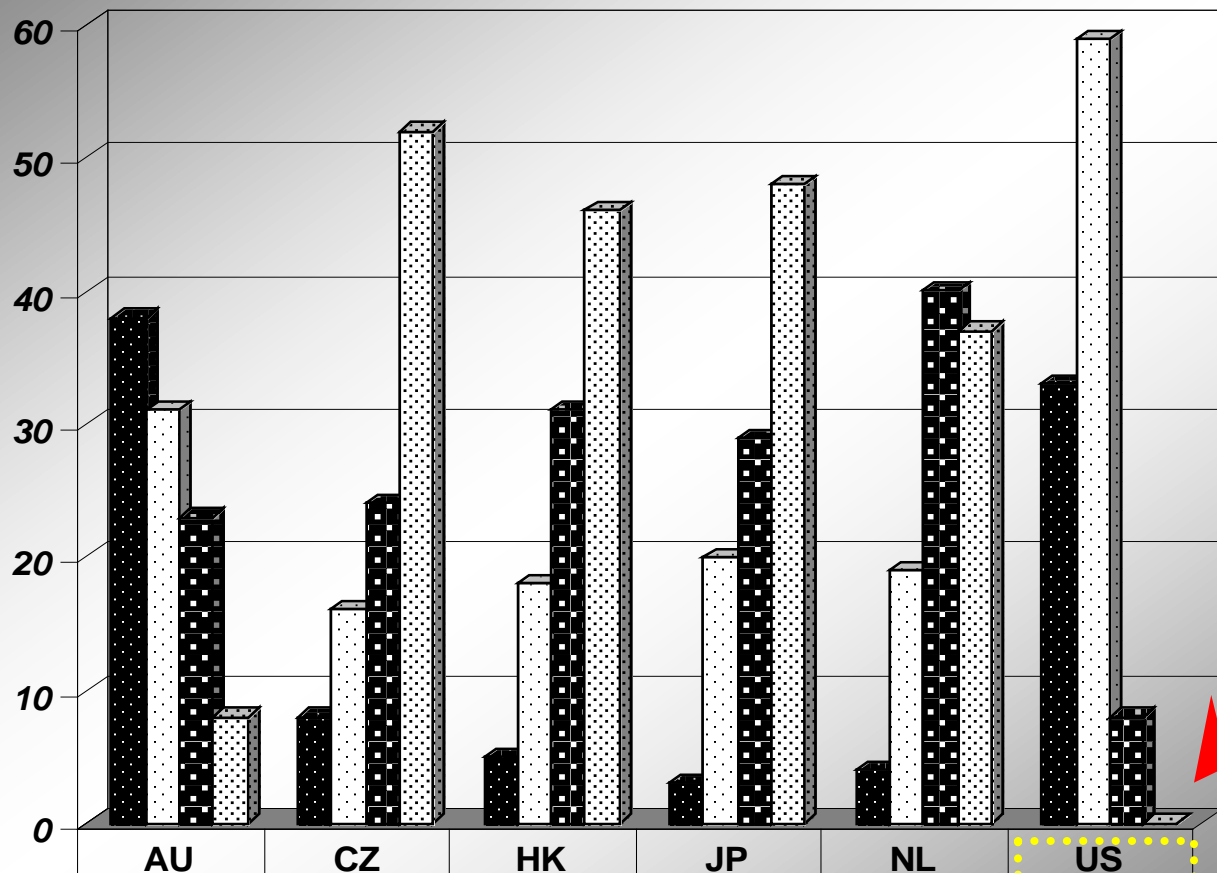
Guiding Question for Teachers

How does my instruction support all students in developing mathematical authority?

Sense-Making, Discourse, and Culture in Mathematics Learning

Students must have opportunities to...

- Learn mathematics through reasoning and sense-making. (Ellis, 2007)
- Build procedural knowledge from conceptual understanding. (Baroody, Bajwa, & Eiland, 2009; Fuson, Kalchman, & Bransford, 2005)
- Engage in meaningful mathematical discussion. (Staples & Colonis, 2007)
- See themselves in mathematics and mathematics as part of themselves. (Nasir, Hand, & Taylor, 2008)
- Use language and culture as tools for mathematics learning. (Irizarry, 2007)

Focus of Typical U.S. Math Lessons

	AU	CZ	HK	JP	NL	US
■ Giving Results Only	38	8	5	3	4	33
□ Using Procedures	31	16	18	20	19	59
■ Stating Concepts	23	24	31	29	40	8
▦ Making Connections	8	52	46	48	37	0

http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2003013

Struggle with Statistics: Skills without Concepts

The median number of points scored by 9 players in a basketball game is 12. The range of the numbers of points scored by the same basketball players in the same game is 7.

Which statement is true based on the given information?

Ⓐ   At least one player scored 12 points.

Ⓑ   The greatest number of points scored is less than 19 points.

Ⓒ   The mean number of points scored is greater than 12 points.

Ⓓ   If the greatest number of points scored is 16, then the least number of points scored is 4.

Reviewing Measures of Center

- With a partner:
  - Write definitions for **median** and **mean.**
  - Note: *This is not the same as explaining how to find the median and mean.*
- Discuss as a class.

Brooding about Measures of Center

The data below represent the number of ducklings in several broods in a neighborhood park.

6, 2, 3, 3, 10, 4

First, <u>find the median and mean</u>. Explain how you found each. Then try each of these tasks:

A. Create two different sets of 6 broods with the <u>same median</u> as the original but a <u>different mean</u>.

B. Create two different sets of 6 broods with the <u>same mean</u> as the original but a <u>different median</u>.

*Share your data sets for A and B:

http://tinyurl.com/p6qo22s

Summarizing our Findings

Using words, symbols, and images:

1. **Describe what changes in a data set affect the <u>mean</u> but not the median.**

2. **Describe what changes in a data set affect the <u>median</u> but not the mean.**
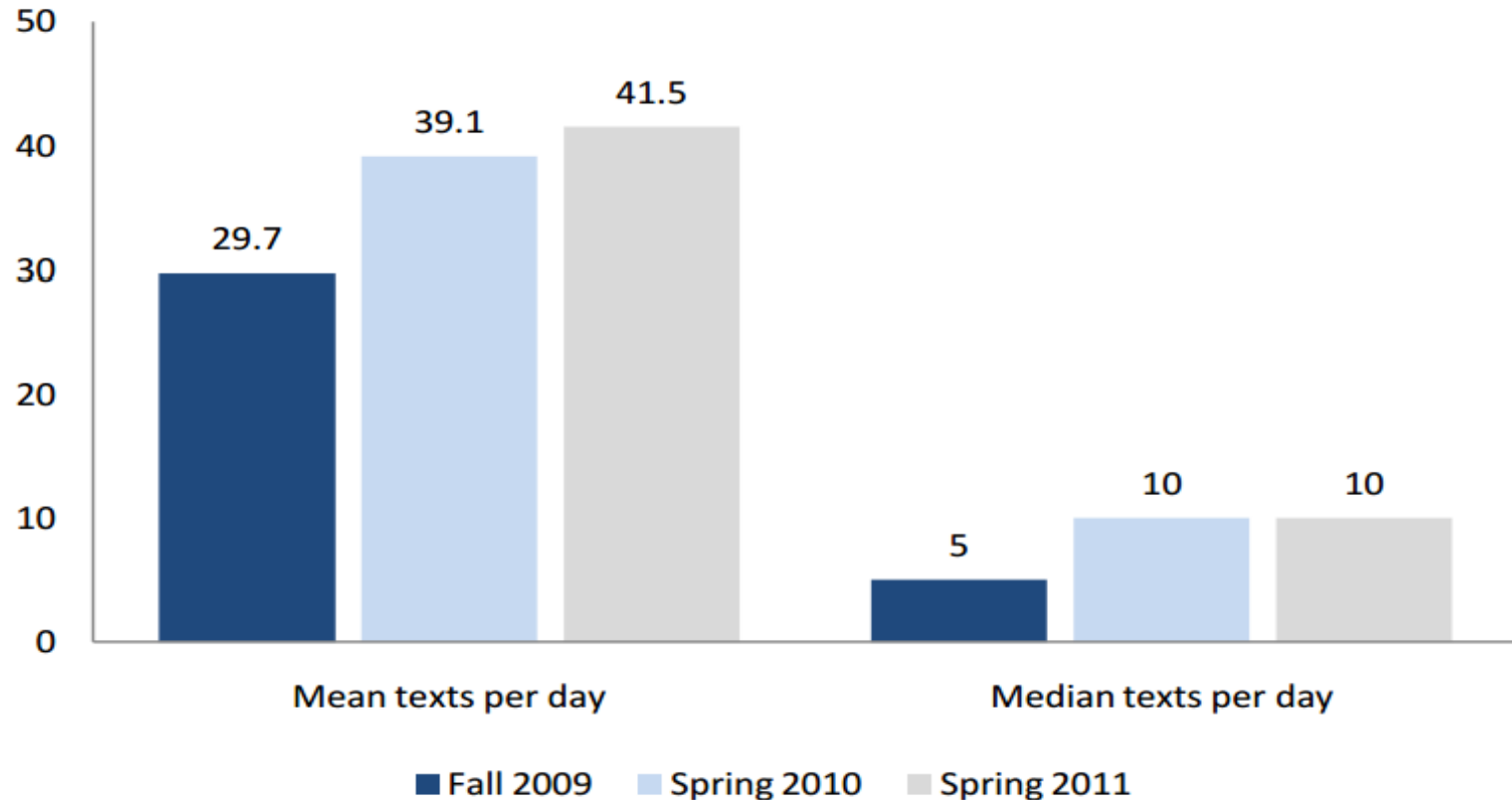
SHARE (choose one):

<u>padlet.com/ellismathed/meanmedian</u>

<u>www.socrative.com</u> Room = EllisMathEd

Real World Application

Based on adults who use text messaging on their cell phones

Mean texts per day:
- Fall 2009: 29.7
- Spring 2010: 39.1
- Spring 2011: 41.5

Median texts per day:
- Fall 2009: 5
- Spring 2010: 10
- Spring 2011: 10

■ Fall 2009   ■ Spring 2010   ■ Spring 2011

From Smith (2011), "Americans and Text Messaging"

Debrief

- What were you doing as you engaged in this activity to develop **academic literacy in mathematics**?
- What did the instructor do to foster your **engagement**?

Let's look at some instructional shifts that are needed to support this sort of learning.

Shifts in Instructional Practice

1: **Differentiated instruction**

2: **Community of learners**

3: Mathematical authority coming from **sound student reasoning**

4: Teacher communicating **expectations for learning**

5: Content **connected to prior knowledge**

6: Focus on **explanation and understanding**

7: Engaging students in **productive struggle**

21ˢᵗ Century Tools

- Make shared bulletin boards with Padlet.
- Have students create their own data sets, share with Google Docs, and comment on peers.
- Socrative and Edmodo for polling student understanding and sharing student work.

More Technology Ideas

Technology Ideas for Teachers of Mathematics

- www.padlet.com
- www.voicethread.com
- http://popplet.com
- www.socrative.com
- http://www.nctm.org/coremathtools [Free suite of tools for math exploration]
- http://www.geogebra.org [Geogebra]
- http://www.shodor.org/interactivate [Shodor Math Interactive Applets]
- http://www.nlvm.org [Nat'l Library of Virtual Manipulatives]
- http://www.wolframalpha.com/widgets/ [Wolfram Alpha widgets]

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