MESPA Institute 2014

Focus Session
February 6, 2014

Today's Session and Other Resources

- MCTM website www.mctm.org
- SciMathMN Frameworks www.scimathmn.org/stemtc go to resources

Look for MESPA Presentation/Conference

Why do we need to shift?

2007 Academic Standards Assessed in 2011 for the first time.

Year	Proficiency
2011	52.6%
2012	60.7%
2013	57.3%

If content has been taught, why the weakness?

- **Achievement Level Descriptors (ALDs)**

What Are They?

- ALDs describe the student achievement on the OLPA/MCA-III exam.
- They describe the progression of complexity of math skills and concepts.
- They are specific to each strand in each grade

Look at the ALD Sample Provided

Chat with someone near you about these questions.

- What differences do you see between the levels?
- What verbs do you see?

You can use this activity at a staff meeting or PLC.

Cognitive Complexity

- You can see from the sample ALD that the complexity changes. In order for students to reach the highest level of achievement, students must consistently do activities at highest cognitive levels.
- There are 4 levels of questions (based on Norm Webb's Depth of Knowledge)
  - Level 1 Recall
  - Level 2 Skill/Concept
  - Level 3 Strategic Thinking
  - Level 4 Extended Thinking

The MCA/OLPA test specs describe the minimum distribution of test questions

- **ALL students will receive approximately…**
  - Level 1 items for 20% of the test.
  - Level 2 items for 30% of the test.
  - Level 3 items for 5% of the test.
  - Level 4 items are not on the MCA.

This only adds up to 55%. What about the other 45% of the test?

The MCA/OLPA is cognitively adaptable

-All students will be given approximately 55% of the test at the stated distribution of levels.

-Based on performance on those levels, **the test will adapt to give students questions at the appropriate level**. (the other 45%)

-If a student is unsuccessful with Level 2 and 3 questions***, the MCA/OLPA will adapt to give them Level 1 questions***. If they are consistently successful, it can adapt to give them more challenging questions at other levels.

Notes about the Lower Levels

- The **Does Not Meet the Standard** questions on the OLPA/MCA are skill and rote process repetition based.
- **It would be easy to assume that students scoring at this level are getting every question wrong. But that would be inaccurate.**
- **They CAN do math, but the math they are successful at *involves lower-level thinking skills*.**

Key Points

- Students who are spending a greater percentage of time learning skills at Level 1 have a lower chance of passing the MCAs/OLPA with proficiency because the test cognitively adapts based on the answers they give. **Translation: Focusing on “the basic facts” with the “low kids” doesn’t help those kids develop the skills then need to become proficient on the MCA**
- If we want students to pass the MCAs/OLPA with proficiency we must teach consistently at level 2, 3, and 4.

What we've traditionally done doesn't work.

So now what?

Higher Order Thinking

Students whose teachers emphasized higher-order thinking skills in the classroom outperformed their peers by what percent of a grade level?

40% of a grade level

Source: Wenglinsky, H. (2000) *How teaching matters.*
Bringing the classroom back into the discussion of teacher quality.
Princeton, NJ, Educational Testing Service and
The Milken Family Foundation

Common Core State Standards
Standards for Mathematical Practice

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

http://www.corestandards.org/math

Helpful Instructional Shifts

The following instructional shifts must occur in order to support our students in improving achievement.

KEY Shift #1 to Productive Struggle

People learn and remember best when there is some struggle.

Cognitive Science

- Cognitive science shows that what ends up in memory is not the material presented, but **what the learner thought about** when the material was presented.
- This also explains why much learning is only shallow knowledge with poor retention.

- There is a fine art to knowing how long to allow any student to struggle before counterproductive frustration sets in

Constructive Struggling

effective and skillful teachers

- give engaging yet challenging problems
- present students with problems that call for more than a superficial application of a rote procedure
- provide guiding questions but stop short of telling students

Cathy Seeley, “Constructive Struggle” in *Faster Isn’t Smarter,* Math Solutions, 2009. http://www.mathsolutions.com/documents/9781935099031_message17.pdf

International Achievement Data

Researcher James Stigler studied instruction in high achieving countries as part of the TIMSS video study.

Findings indicate:

- teachers expect students to struggle before the teacher explains
- teachers see the main point of a lesson as encouraging thinking

Stigler & Heibert. "Teaching is a Cultural Activity," *American Educator*, Winter 1998 and *The Teaching Gap*, Simon and Schuster, 2007, 2009

TIMSS: In high achieving countries ...

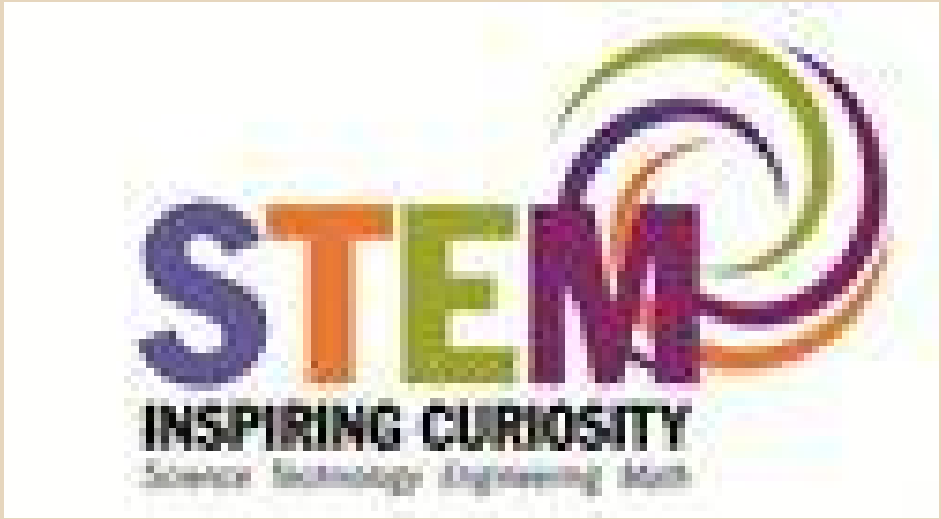
- more time was spent on working on new content than reviewing old
- teachers paid more attention to concept development

In the United States 40% of the lessons were undeveloped – students gave little reasoning for their results for a problem.

Models of Effective Mathematics Instruction. Educational Research Newsletter,Sept. 2003.

Struggling with solving problems . . .

. . . is what mathematicians, scientists and engineers actually do



How does this teacher use productive struggle with students?

4th Grade Bilingual Classroom

Video Snapshot (DVD 1.3) (CD 2.3) 10'19

Equations given to students:

8 + 4 = ? + 5	5 = 5
7 = 3 + 4	5 = 4 + 1
6 = 6 + 0	6 = 3 + 3
6 = 6	15 + 4 = ? + 11

How does this teacher scaffold understanding among her students?

What do you see this teacher doing and NOT doing during the lesson?

George Polya - Problem Solving

Pólya worked in probability, analysis, number theory, geometry, combinatorics and mathematical physics while at the University of Budapest, Brown University, and Stanford University.

A problem is not a problem if the answer is immediately apparent.

How to Solve It © 1945

Coaching on Productive Struggle

- What might be some benefits of allowing students to engage in productive struggle? What might it look like in a specific lesson?
- What are some ways that you challenge students to persevere on mathematical tasks?
- In your classroom, how do you deal with multiple approaches to solving tasks?

Adapted from McGatha & Bay-Williams, "Making Shifts Toward Proficiency," *Teaching Children Mathematics,* October 2013, p. 169 www.nctm.org.

Key Shift #2 to Making Connections within Mathematics and to Prior Knowledge

- The teacher in the video took her students back to 6 = 6 to connect to their understanding of equality.
- She used students' prior understnading and a variety of formats for equations to make connections and bridge to thinking about the equal sign in new equation formats.

Effective Lesson Design:
LESA - Mathematical Learning Cycle

Launch

Explore

Summarize

Apply

Primacy Effect

PRIMACY:

What is remembered best and longest is what happens in the beginning. It is the content most likely to be stored in long term memory

What are your teachers doing in the first 10 minutes of a lesson?

Primacy Effect

PRIMACY Implications:

- Begin lesson with effective LAUNCH, introducing key concepts
- Plan and organize the beginning of your lessons to avoid being trapped in management tasks

Recency Effect

RECENCY:

The next most remembered thing is what happens last, or most recently

Do you observe teachers and students summarizing a lesson to emphasize key points or just cleaning up in a hurry for the next task?

Recency Effect

Recency implications:

- Stop lesson at least 10 minutes before the end to leave time for summary and closure
- Specifically plan for closure - What questions, compare/contrast statements or sentence frames will be used?

Coaching on Making Connections

- What might be some benefits for students in making connections between mathematical ideas? What are some for you, the teacher?
- How will you access students' prior knowledge in either the context or the content in today's lesson?
- How do you plan to close your lesson, allowing time for students to summarize the key ideas?

Adapted from McGatha & Bay-Williams, "Making Shifts Toward Proficiency," *Teaching Children Mathematics,* October 2013, p. 169 www.nctm.org

Key Shift #3- Changing the culture of the classroom in two fundamental ways…

- Toward a focus on explanation and understanding of mathematical relationships.
- Toward mathematical authority coming not from the teacher or text but from sound student reasoning.

Video Clip Observations

What do you notice about the interaction between the teacher and the large group? Between the teacher and individual students?

What do you believe were the teacher's instructional goals?

Is there evidence of scaffolding?

Important Math Talk “Moves”

- **Revoicing/Translating--** “So you are saying…”
- **Asking students to revoice-** “Can you explain what Max is saying?”
- **Asking students to agree or disagree** with one another’s thinking (not answer)
- **Prompting students to add on-** “Can someone add on it that?”
- **Using wait time--** “Take some time to think, we can wait…”
- **Playing Dumb--** “I don’t get it?”
- **Emphasizing reasoning vs an answer--** “Ok, now that we know your answer, lets get to the important part. How did you figure it out?”

Effective Warm Up Discussions

True False Sentences and Problem Strings

Adult Learning-- Turn to a neighbor and together decide whether these equations are true or false--without writing anything down. **Be ready to justify your answer - I will call on at least one of you to share your reasoning.**

$$56 - 17 = 60 - 21$$

$$5 \times 84 = 10 \times 42$$

Why do this? Shifting the culture of the instructional environment

Create a classroom culture where students see success in mathematics as being able to reason, think and solve problems efficiently, as opposed to seeing math as something you are good at if you are fast at getting answers.

Teachers **must** value this as well if students are going to buy in.

Coaching questions to ask teachers...

- What strategies have you used to encourage students to think and reason for themselves?
- What might get in the way of students thinking and reasoning for themselves?
- What might be some benefits of students explaining why and how they found their answers?
- What supports might students need in order to learn how to explain their thinking to others?

Adapted from McGatha & Bay-Williams, "Making Shifts Toward Proficiency," *Teaching Children Mathematics,* October 2013, p.168 www.nctm.org

Key Shift #4 to Differentiation within the Classroom

- Ability grouping is not effective in helping students overcome struggles in mathematics.
- Flexible grouping, when done across classrooms, doesn't turn out to be very flexible.
- Students in the low track classrooms do not get the benefit from hearing the thinking of their more skilled peers.
- There are typically lower expectations for students in the lower groups and decreased opportunities to learn.
- Students develop a "learned helplessness" caused by the message "You're not very good at math".

Tapper, J (2012). *Solving for why: Understanding, assessing and teaching students who struggle with math*. Sausolito, CA: Math Solutions

So what is a better model?

- Structure each lesson with whole class instruction as well as time for independent or small group work.
- The independent or small group work should be developed to meet the individual needs of students.
- This could include previously learned material or additional practice on the skills of the day.

Instructional Frameworks

- Guided Math
  - Whole Group Lesson on Defined Topic
  - Small Group/Math Workshop with Varied Topics
  - Conferring with Individual Students

Sammons, L (2010) *Guided math: A framework for math instruction*. Huntington Beach, CA: Shell Education

- Main Lesson Menu Lesson
  - Launch to Activate Prior Knowledge
  - Main Lesson on Defined Topic
  - Menu Lesson with Varied Topics
  - Closure

Tapper, J (2012). *Solving for why: Understanding, assessing and teaching students who struggle with math*. Sausolito, CA: Math Solutions

Simple Whole Group Differentiation Structure

“Just Right Numbers” Teachers select a range of number choices to meet the needs of different learners within a classroom.

Grade 1 Example

Max had some legos in a box. Then he put ____ more legos into the box. Now he has ____ legos in the box. How many legos were in the box to start?

(2, 7) (4, 8) (10, 13) (12, 30)

Coaching on Differentiation

- How do you currently differentiate instruction?
- What do you notice your students need connected to learning mathematics?
- How might you adapt this lesson to meet those learning needs
- How could you incorporate higher order thinking skills into this lesson, and scaffold that learning for all students?

Adapted from McGatha & Bay-Williams, "Making Shifts Toward Proficiency," *Teaching Children Mathematics*, October 2013, p. 166, www.nctm.org

5 4 3 2 1 Resources on websites

5 books

4 on a MCTM Symposium Team

3 Twitter feeds to follow

2 Apps

1 Curriculum Resource

Nurture talent once it surfaces.

Make more talent rise to the surface.

National Research Council. *Everybody Counts.* 1989

Common Core State Standards
Standards for Mathematical Practice

http://www.insidemathematics.org/index.php/commmon-core-math-intro