

Building a Nurturing Math Talk Teaching-Learning Community

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For more information and videos of classrooms, see Publications about Math Talk and the Math Talk Part 1 and Part 2 Teaching Progressions at karenfuson.com

Levels in Building Your Math Talk Community

Hufferd-Ackles, K., Fuson, K. C., & Sherin, M. G. (2015). Describing levels and components of a Math-Talk Learning Community. In E. A. Silver & P. A. Kenney (Eds.), *More lessons learned from research: Volume 1: Useful and usable research related to core mathematical practices* (pp. 125-134). Reston, VA: NCTM.

Find this in the section on Publications at karenfuson.com



Advice from Teachers Who Use a Math Talk Community with Students Learning English

Fuson, K. C., Atler, T., Roedel, S., & Zaccariello, J. (2009). Building a nurturing, visual, Math-Talk teaching-learning community to support learning by English Language Learners and students from backgrounds of poverty. New England Mathematics Journal, (May) XLI, 6-16.

Find this in the section on Publications at karenfuson.com

Learning Path Teaching-Learning: Differentiating within Whole-Class Instruction by Using the Math Talk Community

Bridging for teachers and students
by coherent learning supports

Learning
Path



Phase 3: Compact methods for **fluency**

Math Sense-Making
Math Structure



Math Drawings
Math Explaining

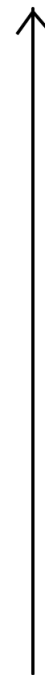
Phase 2: Research-based mathematically-desirable and accessible methods in the middle for **understanding and growing fluency**

Math Sense-Making
Math Structure



Math Drawings
Math Explaining

Phase 1: Students' methods elicited for **understanding** but move rapidly to Phase 2



Common Core Mathematical Practices Used in a Math Talk Community

<p>Math Sense-Making: Make sense and use appropriate precision</p> <p>1 Make sense of problems and persevere in solving them. 6 Attend to precision.</p>	<p>Math Drawings: Model and use tools</p> <p>4 Model with mathematics. 5 Use appropriate tools strategically.</p>
<p>Math Structure: See structure and generalize</p> <p>7 Look for and make use of structure. 8 Look for and express regularity in repeated reasoning.</p>	<p>Math Explaining: Reason, explain, and question</p> <p>2 Reason abstractly and quantitatively. 3 Construct viable arguments and critique the reasoning of others.</p>

Figure 2

The Math Practices in action

A teacher asks every day:

Did I do math sense-making about math structure using math drawings to support math explaining?

Can I do some part of this better tomorrow?



The Math Practices are used in
ALL of Phase 1 and Phase 2
and sometimes in Phase 3

NOT just at the beginning of class (e.g., not like Number Talks)

NOT just in special more difficult tasks

In ALL of Phase 1 and Phase 2 and sometimes in Phase 3



Solve and Discuss Classroom Structure

Solve	Explain	Question	Justify
<p>All students solve. Some solve at the board, and the rest at their seats.</p>	<p>One student at the board explains and then asks, “Are there any questions?”</p>	<p>Other students ask questions to clarify or extend.</p>	<p>The original explainer responds to the questions by explaining more (justifying the original explanation).</p>

Any student at any time can ask for help from anyone.

For more practice, Solve and Discuss can take place in pairs or small groups.

An Instructional Conversation

Solve and Discuss is not just taking turns to show your way.

It is an instructional conversation that highlights the math and helps all students move forward in the learning path.

Typically another student explains, so the class loops through Explain, Question, Justify again.

The discussion can now also contrast and compare the first and second solutions as well as others in the past.



Extending the Conversation

Usually only 2 or 3 students explain because students get impatient with listening much longer.

Go on to the next problem and repeat Solve and Discuss.

Send to the board students who had an interesting solution to the first problem and ask them to use the same method again.



The Four Components of Math Talk Community

Questioning	Explaining	Source of Math Ideas	Responsibility for Learning
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All 4 components shift from only the teacher to the teacher and students.

The teacher becomes a conductor of Math Talk Community.

The classroom community grows to support students acting in central or leading roles and shifts from a focus on answers to a focus on mathematical thinking.

Math sense becomes the criterion for evaluating.



A Functioning Math Talk Community

Questioning

- The teacher **expects students to ask one another questions** about their work.
- Questions by the teacher **still may guide** the discourse.
- Student-to-student talk is **student-initiated**, not dependent on the teacher.



Explaining

- The teacher **follows along closely** to student descriptions of their thinking, **encouraging and helping** students to make their explanations more complete.
- The teacher stimulates and supports students to **think more deeply** about strategies and **to relate them**.

A Functioning Math Talk Community

Source of Math Ideas

- The students contribute their ideas as the teacher or other students are teaching, confident that **their ideas are valued**.
- The students spontaneously compare and contrast and **build on ideas**.
- The teacher is **still engaged and deciding what is important** to continue exploring.

Responsibility for Learning

- The students listen to understand, then **initiate clarifying other students' work** and ideas for themselves **and for others**.
- The students **assist each other** in understanding and correcting errors.
- The teacher **supports students** as they help one another.



Teacher and students assist learning by all

Three Main Types

1. Engage and involve

- invite all students to share ideas and questions,
- promote analysis and discussion,
- expect all students to participate in developing understanding together in the community.

2. Manage

- help students monitor, be responsible for, and take ownership of their own learning.

3. Coach



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Three Main Types

1. Engage and involve

2. Manage

3. Coach



Coach

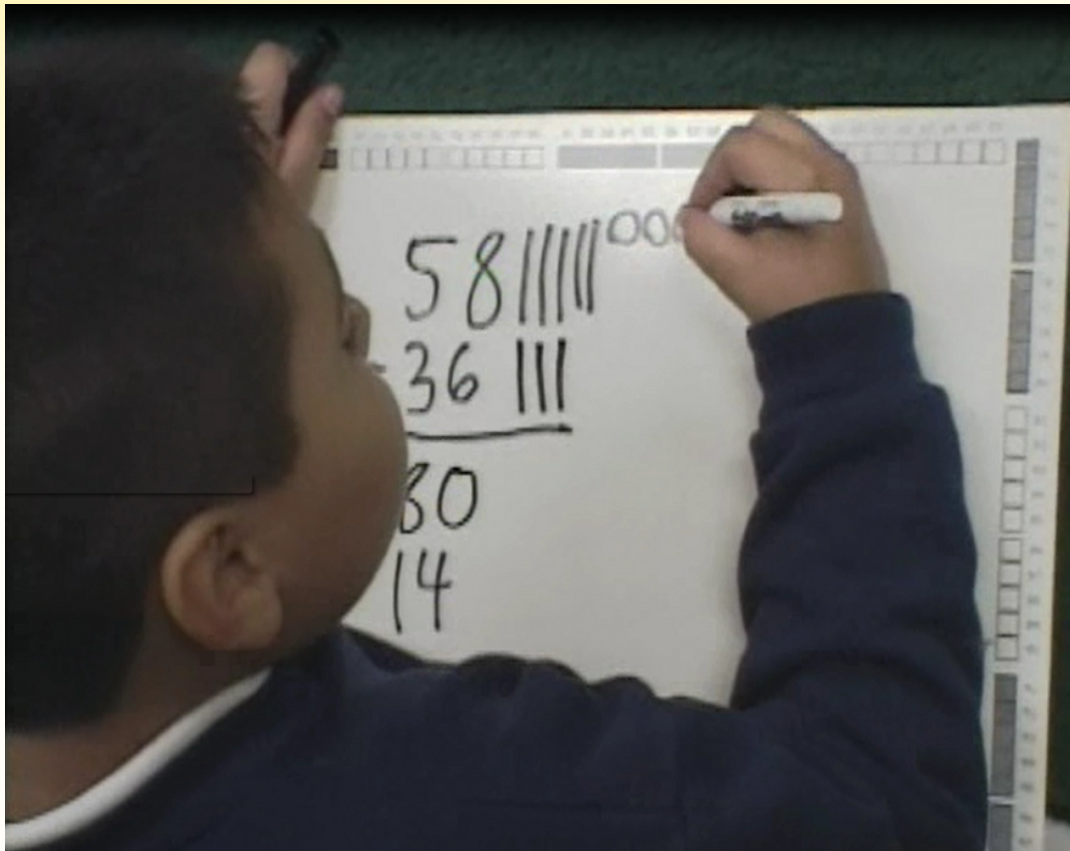
Show/explain

- model (as a student)
- instruct/explain (as a teacher)

Focus and Extend

- cognitive structure and clarify
- question
- give feedback

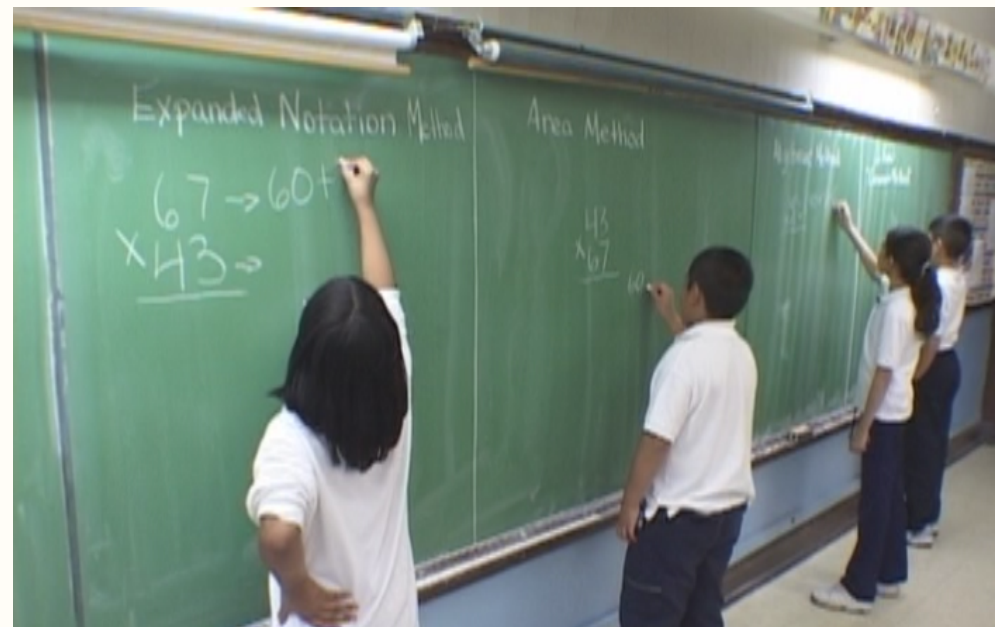
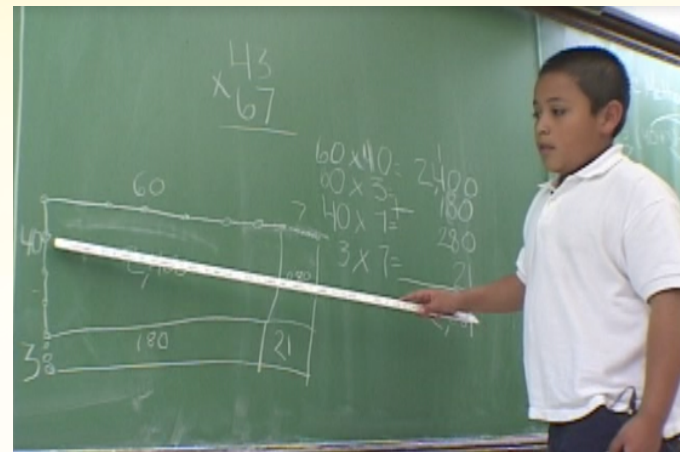
Make the math thinking visible



- Students must make some kind of math drawing related to the math symbols to show their thinking.
- This supports understanding by the listeners and promotes meaning.

Make the math thinking visible

- This is important for **equity**: less advanced students and English Learners are helped by the math drawing linked to the explanation by pointing.
- Be sure that **important methods remain** on the board or can be made visible again (e.g. on a Math Board) so they can be compared with other methods.

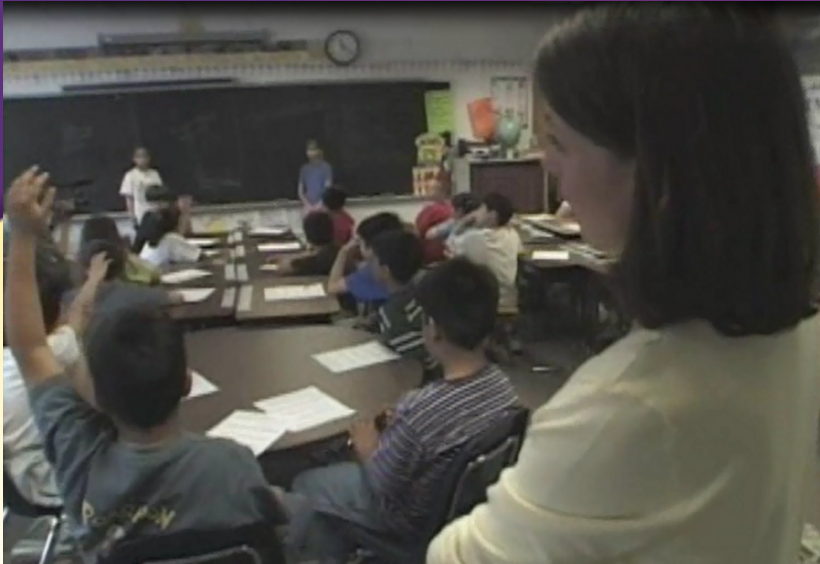


Mathematical Representations

In the new NCTM math talk book chapter, Kim Hufferd-Ackles, Miriam Sherin, and I added a new column to the table of levels of math-talk learning community components. Using visual representations to support the math explaining is crucial to the success of a math talk community.

Hufferd-Ackles, K., Fuson, K. C., & Sherin, M. G. (2015). Describing levels and components of a Math-Talk Learning Community. In E. A. Silver & P. A. Kenney (Eds.), *More lessons learned from research: Volume 1: Useful and usable research related to core mathematical practices* (pp. 125-134). Reston, VA: NCTM.

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2. “Bite your tongue” to provide wait time. Students will explain, ask questions, or add a comment if you wait.

Students must speak and not just listen

1. Structure opportunities to explain to a partner and repeat what the partner says, if needed. Students eventually find their own words, but may need the security of saying an explanation they know is correct.
3. Help students speak to classmates by moving to the side or back of the room. Later remind students with a silent gesture to address each other.

A nurturing meaning-making visual Math Talk Community:

is an inquiry-based teaching/learning environment, and has continual focus on sense-making by all participants.

Students are expected:

- to understand what they are doing,
- come to be able to explain their thinking,
- understand the thinking of other students,
- learn to seek help when they need it, and
- help others who need it.



Watch the Teaching Progression
Getting Started with Math Talk

**Find this in the section on Teaching
Progressions at karenfuson.com**



Districts Record Students Explaining These Key Milestones with Drawings and Share with Parents

Kindergarten: Ten in teens

G1: 2-d addition with new groups

G2: 3-d subtraction (e.g., $163 - 89$)

G3: 3-d addition (e.g., $387 + 259$)

with no drawing (fluency level) but use place value words for explaining

G4: 2-d x 2-d (e.g., 37×65)

G5: $3/4 + 2/5$

G6: $3/4 \div 2/5$
0.32)

Subtraction WP (e.g., $9 - 5$)

Unknown addend WP ($8 + ? = 14$)

Start unknown WP (e.g., $? - 6 = 8$)

3-d subtraction (e.g., $802 - 356$)

3-d \div 1-d with remainder (e.g., $293 \div 8$)

$3/4 \times 2/5$

division with decimals (e.g., $1.984 \div$



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