Build Student Engagement, Mental Math, and Reasoning with “Math Talks”

Sendhil Revuluri
University of Illinois at Chicago
ICTM Annual Conference
Friday, October 21, 2011
Acknowledgements

• Thanks to David Foster and the work of the Silicon Valley Mathematics Initiative (SVMI)
• Thanks to many resources drawn from here
• Thanks to teachers who have welcomed me into their classrooms as part of, and my colleagues in, the South Cook Mathematics Initiative (SCMI)
• Support for SCMI is provided by the Searle Funds at The Chicago Community Trust, in partnership with the South Cook Intermediate Service Center and the UIC Learning Sciences Research Institute
Let’s try a math talk

• Facilitator presents prompt
• Participants generate multiple methods
• Signal number of methods with fingers
• Participants share methods
• Facilitator scribes
• Discussion
Find the number in the blank

\[3 \cdot ____ = 3 + 3 + 3 + 3 + 3 + 3\]

\[6 \cdot ____ = 6 + 6 + 6 + 6 + 6\]

\[8 \cdot 3 = 8 + 8 + ____\]

\[5 \cdot 4 = 4 + 4 + ____\]
Discuss in your table group

• What stood out to you about this math talk?

• What do you think are some potential benefits of this structure?

• What would it take to do a math talk in your class?
Math Talks

Math Talks are a daily ritual with the entire class to develop conceptual understanding of and efficiency with numbers, operations and mathematics, in about 10 minutes per lesson.

Math Talks are used to:

• Review and practice procedures and concepts
• Introduce concepts and properties about numbers
• Reinforce procedures and number concepts.
• Explore mathematical connections and relationships.
Math Talks can help develop

• Sense for numbers, relationships, operations
  – Intuition
  – Judgment
  – Foundation for fluency

• Fluency
  – Efficiency
  – Accuracy
  – Flexibility
Math Talks can help develop

• Communication and explanation

• Logical thinking, reasoning, and arguments

• Student engagement

• Conceptual understanding and sense-making

• Problem-solving
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.
Math Talk: Dot Patterns

How Many Dots?

How did you see it?
Some Varieties of Math Talks

- Number of the Day
- Number Lines
- Mental Math
- Sequences of Related Expressions
- More Computation Problems
- Relational Thinking
- What’s My Rule?
- Spatial Visualization
Math Talk: Number of the Day

36
Some Possible Responses

18 + 18

$6^2$

$2^2 \cdot 3^2$

$9 + 9 + 9 + 9$

25.65 + 10.35

$9 \div 1/4$

-15 + 51

$3\sqrt{144}$
Possible Constraints

- Two, three, four operations
- Exponents/roots
- Distributive properties
- Field properties
- Expressions or equations with variables
- Inequalities
- Consecutive numbers
- Integers
- Rational numbers
- Set of clue statements to identify the number
Math Talk: Number of the Day

3.25

Determine equivalent expressions/representations
Math Talk: Number Line

Place the numbers on the number line

- $\frac{5}{8}$
- 0.75%
- 0.45
- 67%
- $\frac{3}{6}$
- $\frac{2}{3}$
- $\frac{3}{4}$
- $\frac{5}{6}$
- 62.5%
- 0.65
Math Talk: Number Line

*Processing with the Class*

- Student use paper to create a number line.
- They place the number in the appropriate location on the line.
- Call on students to come forward and place the number on the line (post it notes).
- After all numbers are placed, ask class if anyone wants to re-arrange to be more accurate.
## Math Talk: Which Two Are Closer?

<table>
<thead>
<tr>
<th>Fraction</th>
<th>Mixed Number</th>
<th>Decimal</th>
<th>Exponential</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\frac{1}{4}$</td>
<td>$1 \frac{7}{8}$</td>
<td>0.03</td>
<td>$3^2$</td>
<td>66.6%</td>
</tr>
<tr>
<td>$\frac{1}{2}$</td>
<td>$2 \frac{1}{5}$</td>
<td>0.16</td>
<td>$2^3$</td>
<td>$\frac{2}{3}$</td>
</tr>
<tr>
<td>$\frac{3}{5}$</td>
<td>$1 \frac{3}{8}$</td>
<td>0.111</td>
<td>$\sqrt{72}$</td>
<td>0.67</td>
</tr>
<tr>
<td>$-4.4$</td>
<td>$2.1$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$2.1$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$-1.3$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Math Talk: Mental Math

56 + 38 =

63 + 27 =

29 \cdot 31 =

-23 - (-48) =

\frac{36 \cdot 21}{14 \cdot 27} =
Math Talk: More Mental Math

\[3^2 - 2 \cdot 5\]

25% of 80

\[0.4 \times 30 + 12\]

\[23 - 32 + 1\]

\[3 \cdot 2 - 6 \div 2\]

\[\frac{3}{5} \cdot 60\]
Math Talk: Number Strings

\[
\begin{align*}
6 \cdot 8 &= \\
60 \cdot 8 &= \\
60 \cdot 80 &= \\
0.6 \cdot 8 &= \\
0.6 \cdot 0.8 &= \\
0.06 \cdot 0.8 &= \\
0.06 \cdot 0.08 &= 
\end{align*}
\]
Math Talk: Estimation

9.8 + 8.7
Math Talk: Compensation

59 + 37
Math Talk: Compensation

6.3 - 2.7
Math Talk: Relational Thinking

7 + 6 = x + 5
43 + 28 = x + 42
28 + 32 = 27 + x
67 + 83 = x + 82
12 + 9 = 10 + 8 + x
345 + 576 = 342 + 574 + x
46 + 28 = 27 + 50 − x
Math Talk: Relational Thinking

$43 + 28 = \boxed{61} + 42$

$28 + 32 = 27 + \boxed{60}$

$67 + 83 = \boxed{61} + 82$
Math Talk: Relational Thinking

\[3 \cdot ____ = 3 + 3 + 3 + 3 + 3 + 3\]
\[6 \cdot ____ = 6 + 6 + 6 + 6 + 6\]
\[8 \cdot 3 = 8 + 8 + ____\]
\[5 \cdot 4 = 4 + 4 + ____\]
Math Talk: What’s My Rule
Math Talk: Spatial Visualization

• Dot Patterns
• 2-D Geometry
• 3-D Geometry
Math Talk: Guess the Shape

• I am a closed figure.
• I have only straight sides.
• I have an even number of sides.
• An opposite pair of my sides are parallel.
• The other pair of opposite sides are not.
• My non-parallel sides are congruent.
Math Talk Jigsaw

• Groups examine different problems
• Meet with all others who have your same problem to prepare for your presentation
• Present in mixed groups
• Return to your preparation group to debrief presentation and reflect
Math Talk Jigsaw

• In like groups, brainstorm as many different strategies and solution paths you can come up with for your particular problem.

• Share ideas about how you will record “student” strategies and solutions.

• Share ideas about how to handle potential pitfalls in the presentation and recording of your particular problem.
Math Talk Jigsaw Prompts

- 35% of 120
- $3\frac{1}{3} \times 18$
- What’s My Rule
Devising Our Own Math Talks

• Think of an important idea or a common issue your students face in terms of conceptual understanding or fluency
• Think of a possible prompt for a math talk for that idea or issue
• Run your prompt by your partner and brainstorm possible student responses
Some Math Talk Techniques

- Individual think time
- Signals
- Organized scribing and juxtaposition
- Pair and share
- Whole-group share
- $3 \times 5$ card follow-up question
- Continuation or extension over days or a week
- Written formative assessment: multiple strategies
Some Math Talk Tools

- Overhead transparencies
- Charts
- Butcher paper recordings
- White boards
- Document camera
- Smart boards
- 3 × 5 cards
- Daily logs
Some Math Talk Tips

- Let students practice similar problems and routines
- Create a safe environment and encourage sharing
- Meet their needs: ways of sharing, ramp of difficulty
- Start where they are, have a goal, plan sequences
- Press students to make sense, clarify thinking
- Press students to explain and justify methods
- Purposefully choose, sequence strategies & sharers
- Record thoughtfully
- Ask questions to help students connect methods
- It’s the math (not answer or variety of strategies)
- Keep them short
Sources and References

• A gold mine of examples: Secondary Number Sense Routines (San Diego) — http://goo.gl/MPp0y

• More resources on Math Perspectives, Math Solutions sites (search for Ruth Parker, Cathy Young)

• *Number Talks: Helping Children Build Mental Math and Computation Strategies, Grades K-5* (Parrish)

• Two great articles from *MTMS*: “Never Say Anything a Kid Can Say” and “Orchestrating Discussions”
Integrating Math Talks

• How do you think math talks can benefit your students?

• What are some issues you might face as you try math talks?

• What will you try in your classroom in the next ...week? ...month? ...year?
Thank You!

Please contact me for these slides or any other information.

sendhil@gmail.com