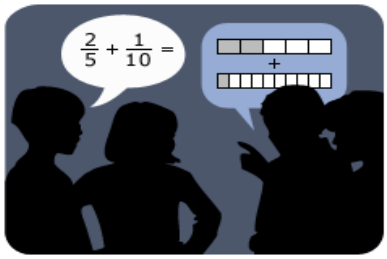


NUMBER TALKS AT-A-GLANCE

1. THINK

→ Say and write the expression on board (horizontally)

→ Wait until most students have a thumb up (a total)

2. LISTEN/SHARE

→ Call on 4-5 students to share **answers only;** write answers on the board

→ Students use "same" signal if they had the same total

→ Accept all answers (even incorrect ones) without saying if they are correct

→ Ask: can both/all these answers be correct? *(this isn't an everyday step, just once in awhile as a reminder that there can only be one correct answer for each equation)*

3. EXPLAIN/DEFEND

→ Select a student to share his/her solution to the equation

→ Chart student thinking on board—try to chart exactly what students say, even if they are incorrect; give them opportunities to correct/clarify their own thinking before jumping in to "save" them

→ Take time to name the strategy used (i.e. counting on, making a ten, using friendly numbers)

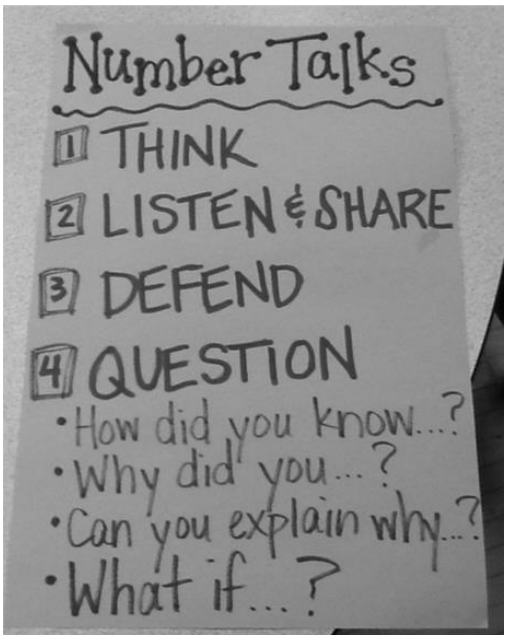
→ Students use "same" signal if they had the same total

→ Repeat the process with another student's strategy

4. **QUESTION** *[this may come later with younger students, after they have grown more comfortable with the Number Talks routine]*

→ Allow students to question each other about their thinking or the strategy they chose

→ Have students identify similarities/differences between strategies



Silent Signals

- READY → closed fist on chest
- I HAVE AN ANSWER → put thumb up
- I HAVE ANOTHER STRATEGY → put out a finger for each additional strategy
- SAME THINKING → move hand back and forth to show agreement

COMMON ADDITION STRATEGIES

1. Counting All
2. Counting On
3. Doubles/Near Doubles
4. Making Tens
5. Making Landmark/Friendly Numbers
6. Compensation
7. Breaking into Place Value
8. Adding Up in Chunks

(Parrish, 59-66)

COMMON SUBTRACTION STRATEGIES

1. Counting Back
2. Adding Up
3. Removal
4. Using Place Value and Negative Numbers
5. Adjusting One Number to Make an Easier Problem
6. Keeping a Constant Difference

(Parrish, 171-180)

COMMON MULTIPLICATION STRATEGIES

1. Repeated Addition or Skip Counting
2. Making Landmark or Friendly Numbers
3. Partial Products
4. Doubling and Halving
5. Breaking Factors into Smaller Factors

(Parrish, 245-252)

COMMON DIVISION STRATEGIES

1. Repeated Subtraction
2. Multiplying Up
3. Partial Quotients
4. Proportional Reasoning

(Parrish, 254-260)

RESOURCES:

- Parrish, Sherry. 2010. ***Number Talks: Helping Children Build Mental Math and Computation Strategies***. Math Solutions.
- Humphreys, Cathy and Parker, Ruth. 2015. ***Making Number Talks Matter: Developing Mathematical Practices and Deepening Understanding, Grades 4-10***. Stenhouse Publishers.
- **Number Talks K-5: http://schoolwires.henry.k12.ga.us/Page/37070**
- **Number Talk Video: https://mathsolutions.wistia.com/medias/0v5002j2zh**

Middle School Number Talk Resources

- **http://fawnnguyen.com/mathtalks-net/**
- **http://www.svmimac.org/images/Cristo_Rey_-_Middle_Level_Bank.pdf**
- **http://www.mathtalks.net/teachers.html**

Math Talk vs. Number Talks…They are NOT the same!

Math Talk (Learning Conversations)

- "A respectful but engaged conversation in which students can clarify their own thinking and learn from others through talk" (Chapin, p 5)
- Should be used within the daily lesson in all areas of math study
- Can be used in all academic areas
- Students discuss a concept, procedure, solution method, idea, or definition in order to understand more deeply and with greater clarity.
- Teacher uses 5 Talk Moves to move along the conversation.

5 Productive Talk Moves for Math Talk

- Revoicing: Teacher repeats some or all of what a student said.
- Repeating: Teacher asks someone to restate another student's comment.
- Reasoning: Teacher asks someone to apply their reasoning to someone else's reasoning.
- Adding On: Teacher asks students to add new thoughts to the conversation.
- Waiting: Teacher uses wait time.

Math Talk Example

Some students are engage in a discussion about the relationship between squares and rectangles.
Amanda: Squares have two sets of parallel sides, and we already said rectangles do, too. So squares and rectangles are the same.
Teacher: Luis, do you agree? Why or why not?
Luis: I'm not sure, because they have the parallel sides, but squares don't have long and short sides…but the angles are right angles.

Number Talks (Mental Math Computation)

- "Classroom conversations around purposefully crafted computation problems that are solved mentally" (Parrish, p xviii)
- Happen separately from the daily lesson
- May or may not connect to the lesson
- Last for 5 to 15 minutes
- Is quick paced
- Teacher poses problems, listens and charts students' strategies.
- Students share strategies and try out new strategies.

Number Talks Example

Students solve the following problems in succession in order to develop the "Making Friendly Numbers" strategy.

- 99 + 5
- 99 + 17
- 99 + 26

During the third problem, students share:
Ramiro: Oh, I can take 1 from 26 and give it to 99. That's 100 plus 25, which is 125.
Teacher charts: 99 + 66 = 100 + 25 = 125
Jimmy: Why 25? There is no 25.
Ramiro: I used 1 from the 26 to make that 100. Now the 26 is 1 less. It's only 25.
Teacher: Amaya, did you use the same strategy?
Amaya: No, I know 100 + 26 is 126. Then I just had to subtract 1. It's 125.
Teacher charts: 100 + 26 = 126
126 – 1 = 125
Teacher: You subtracted 1?
Amaya: Yes, because I added too much at first. I added 100 instead of 99.

While Math Talk refers to a way to structure discourse about any given topic, a Number Talk is a mini-lesson that supports computational fluency. A teacher may use some aspects of Math Talk, such as the talk moves, during a Number Talk, but Math Talks should be more fully employed during the main daily math lesson.

Sources

Chapin, S. H., O'Connor, C., & Cnavan Anderson, N. (2009). *Classroom discussions: Using math talk to help students learn, grades K-6.* Sausalito, CA: Math Solutions.

Parish, S. (2010). *Number talks: Helping children build mental math and computation strategies, grades K-5.* Sausalito, CA: Math Solutions.

Activities to Develop Number Facts and Number Sense

Teachers should help students develop math facts, not by emphasizing facts for the sake of facts or using 'timed tests' but by encouraging students to use, work with and explore numbers. As students work on meaningful number activities they will commit math facts to heart at the same time as understanding numbers and math. They will enjoy and learn important mathematics rather than memorize, dread and fear mathematics.

Number Talks

One of the best methods for teaching number sense and math facts at the same time is a teaching strategy called 'number talks', developed by Ruth Parker and Kathy Richardson. This is an ideal short teaching activity that teachers can start lessons with or parents can do at home. It involves posing an abstract math problem such as 18 x 5 and asking students to solve the problem mentally. The teacher then collects the different methods and looks at why they work. For example a teacher may pose 18 x 5 and find that students solve the problem in these different ways:

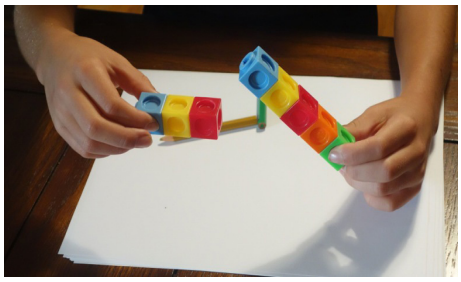
20 x 5 = 100 2 x 5 = 10 100 - 10 = 90	10 x 5 = 50 8 x 5 = 40 50 + 40 = 90	18 x 5 = 9 x 10 9 x 10 = 90	18 x 2 = 36 2 x 36 = 72 18 + 72 = 90	9 x 5 = 45 45 x 2 = 90

Students love to give their different strategies and are usually completely engaged and fascinated by the different methods that emerge. Students learn mental math, they have opportunities to memorize math facts and they also develop conceptual understanding of numbers and of the arithmetic properties that are critical to success in algebra and beyond. Parents can use a similar strategy by asking for their children's methods and discussing the different methods that can be used. Two books, one by Cathy Humphreys and Ruth Parker (in press) and another by Sherry Parish (2014) illustrate many different number talks to work on with secondary and elementary students, respectively.

Research tells us that the best mathematics classrooms are those in which students learn number facts and number sense through engaging activities that focus on mathematical understanding rather than rote memorization.
The following five activities have been chosen to illustrate this principle; the appendix to this document provides a greater range of activities and links to other useful resources that will help students develop number sense.

Addition Fact Activities

Snap It: This is an activity that children can work on in groups. Each child makes a train of connecting cubes of a specified number. On the signal "Snap," children break their trains into two parts and hold one hand behind their back. Children take turns going around the circle showing their remaining cubes. The other children work out the full number combination.

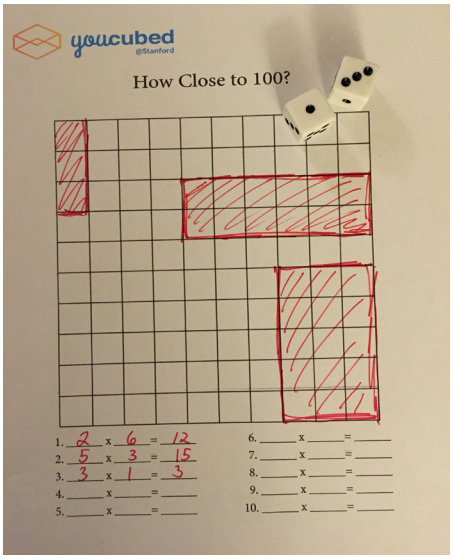


For example, if I have 8 cubes in my number train I could snap it and put 3 behind my back. I would show my group the remaining 5 cubes and they should be able to say that three are missing and that 5 and 3 make 8.

How Many Are Hiding? In this activity each child has the same number of cubes and a cup. They take turns hiding some of their cubes in the cup and showing the leftovers. Other children work out the answer to the question "How many are hiding," and say the full number combination.

Example: I have 10 cubes and I decide to hide 4 in my cup. My group can see that I only have 6 cubes. Students should be able to say that I'm hiding 4 cubes and that 6 and 4 make 10.

Multiplication Fact Activities



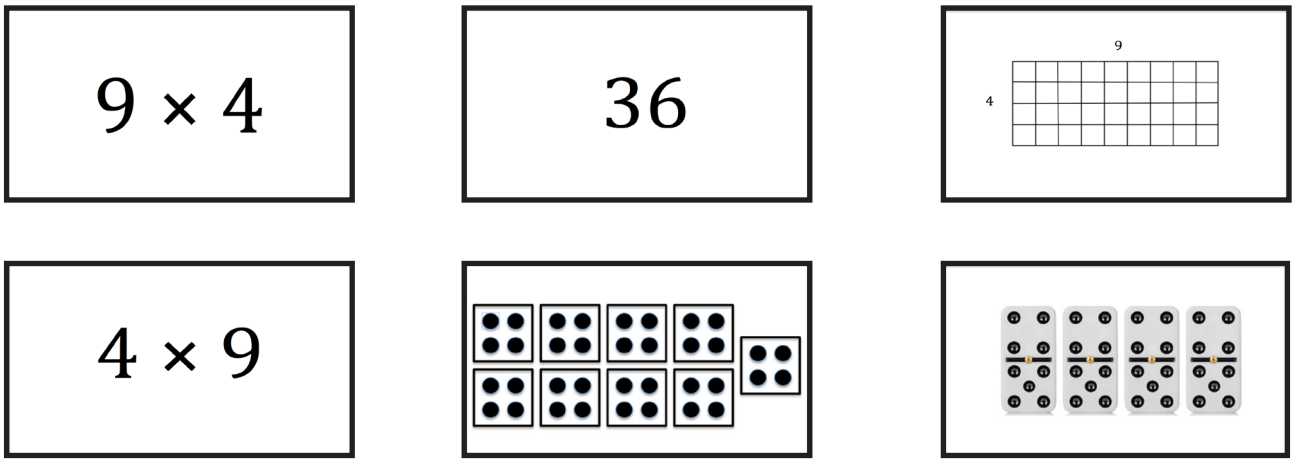
How Close to 100? This game is played in partners. Two children share a blank 100 grid. The first partner rolls two number dice. The numbers that come up are the numbers the child uses to make an array on the 100 grid. They can put the array anywhere on the grid, but the goal is to fill up the grid to get it as full as possible. After the player draws the array on the grid, she writes in the number sentence that describes the grid. The game ends when both players have rolled the dice and cannot put any more arrays on the grid. How close to 100 can you get?

Pepperoni Pizza: In this game, children roll a dice twice. The first roll tells them how many pizzas to draw. The second roll tells them how many pepperonis to put on EACH pizza. Then they write the number sentence that will help them answer the question, "How many pepperonis in all?"
For example, I roll a dice and get 4 so I draw 4 big pizzas. I roll again and I get 3 so I put three pepperonis on each pizza. Then I write 4 x 3 = 12 and that tells me that there are 12 pepperonis in all.

Math Cards

Many parents use 'flash cards' as a way of encouraging the learning of math facts. These usually include 2 unhelpful practices – memorization without understanding and time pressure. In our Math Cards activity we have used the structure of cards, which children like, but we have moved the emphasis to number sense and the understanding of multiplication. The aim of the activity is to match cards with the same numerical answer, shown through different representations. Lay all the cards down on a table and ask children to take turns picking them; pick as many as they find with the same answer (shown through any representation). For example 9 and 4 can be shown with an area model, sets of objects such as dominoes, and the number sentence. When students match the cards they should explain how they know that the different cards are

equivalent. This activity encourages an understanding of multiplication as well as rehearsal of math facts. A full set of cards is given in Appendix A.



Conclusion: Knowledge is Power

The activities given above are illustrations of games and tasks in which students learn math facts at the same time as working on something they enjoy, rather than something they fear. The different activities also focus on the understanding of addition and multiplication, rather than blind memorization and this is critically important. Appendix A presents other suggested activities and references.

As educators we all share the goal of encouraging powerful mathematics learners who think carefully about mathematics as well as use numbers with fluency. But teachers and curriculum writers are often unable to access important research and this has meant that unproductive and counter-productive classroom practices continue. This short paper illustrates both the damage that is caused by the practices that often accompany the teaching of math facts – speed pressure, timed testing and blind memorization – as well as summarizes the research evidence of something very different – number sense. High achieving students use number sense and it is critical that lower achieving students, instead of working on drill and memorization, also learn to use numbers flexibly and conceptually. Memorization and timed testing stand in the way of number sense, giving students the impression that sense making is not important. We need to urgently reorient our teaching of early number and number sense in our mathematics teaching in the UK and the US. If we do not, then failure and drop out rates - already at record highs in both countries (National Numeracy, 2014; Silva & White, 2013) - will escalate. When we emphasize memorization and testing in the name of fluency we are harming children, we are risking the future of our ever-quantitative society and we are threatening the discipline of mathematics. We have the research knowledge we need to change this and to enable all children to be powerful mathematics learners. Now is the time to use it.