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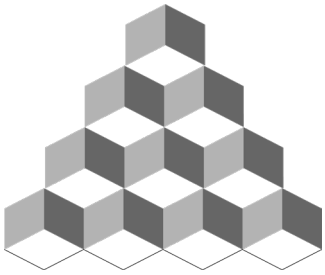

Number Talk

Setting up a productive class culture of multidimensional mathematics and equitable group work

#3

Introduction

Number talks are a short but powerful learning activities that shows students:

- creativity in maths
- many different ways people see maths and
- flexibility in numbers

They are a really good way of developing students' number sense. Students often struggle in algebra because they struggle with number sense. We recommend spending 5 - 10 minutes per day on a number talk.

Connection to CCSS

MP 3
MP 6
MP 7

Agenda

Activity	Time	Description/Prompt
Launch	5 min	• Introduce students to the purpose of the number talk. • Explain that students will see a number problem and be asked to determine the answer without paper or pencil. They will be asked to share their answer and to describe how they completed the calculation.
Explore	2 min	• Show the number problem 17 x 15. You may also choose to start with a two-digit number multiplied by a one-digit number like 21 x 3. • Ask students to quietly place their thumb at chest level to signal when they have come up with at least one solution.
Discuss	8+ min	• Students share their thinking • At first just ask for answers and put these on the board. If there is more than one, ask if someone wants to defend one of them by explaining their reasoning. As discussions ensue students often ask to take wrong answers off the board. • Carefully represent your students' thinking on the board. Continually checking in with the student who is sharing to verify that you are accurately representing their thinking.
Extend		• Choose one of the student strategies on the board and illustrate it with a sketch. Ask students to pick a different strategy and make a visual representation of it. • -or- • Have students solve a new problem using one of the strategies shared.
Reflect	5 min	What is something you learned you could do with numbers that you did not know before?

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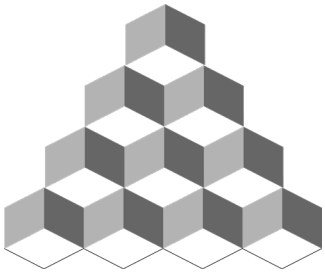


To the Teacher

We give number talks to all groups we work with including students, teachers, administrators, superintendents, and more. We use them to honor the fact that we all see maths differently and that these differences are interesting and should be respected. Number talks also help students learn flexibility with numbers and how to calculate without paper and pencil.

Number and dot card talks are organized in the same way with the same goals. The activities are mostly the same except for one is about a collection of dots and the other is about number problems.

With number talks, students have a chance to think through their understanding of numbers and explain their reasoning. In the number talks we used did with our students (18x5 and 12x15) they had a chance to think about a multiplication problems. The problems allowed for students to think flexibly about multiplication and develop number sense through their reasoning and the reasoning of their classmates.

We love when there is more than one answer because making and discussing mistakes lead to much more learning, and it also allows us space to give mindset messages about mistakes. When we did the 12x15 number talk, there was a student who got 168 and as she was explaining her thinking, she stopped and said, "Oh, wait! I made a mistake." Jo's response was, "That's great! That means you have synapses firing in your brain because you made that mistake." Jo then invited her to explain her thinking when she made the mistake so that the class could understand what she did. This was an important moment because the student who was sharing, and the rest of the class, saw that her thinking was respected and her mistake was celebrated.

Remember to value mistakes and say things like "This is great we have three different answers, we will have a really good discussion.

If you would like to learn more about number talks here are some great videos:

- For an example of a teacher doing a number talk with a class go to https://www.youcubed.org/resources/cathy-humphreys-teaching-number-talk/
- For an excerpt from Jo's online course "How to Learn Math for Teachers" go to https://www.youcubed.org/resources/stanford-onlines-learn-math-teachers-parents-number-talks/
- For an example of a student making a mistake during a number talk at youcubed summer camp go to https://vimeo.com/265666922/23377db40d

Launch

Let students know that you will be giving them an arithmetic problem. When they have an answer, they should quietly put their thumb up at chest level for only you to see. This is a better way of signaling to you than raising their hand. Hands shooting up can be intimidating and/or distracting to other students. .

Explore

Show students the problem and ask students to solve the problem using as many strategies as they can think of without using pencil and paper. Once you have given students enough time to think on their own about strategies, ask students to share their answers as you record them on the board. If there are multiple answers, put all of them on the board and do not identify the correct answer or label any answer

as incorrect. The purpose of the number talk discussion is for students to share and justify their answers. Students will oftentimes identify and correct mistakes on their own during the discussion.

Discuss

Start by inviting students to share strategies by saying something like, "Who would like to justify their answer?" If there are different answers ask, "Who would like to defend one of these answers by sharing how you found it?" As students share, record their strategies and label their numerical representations with their name. Using the students name to label the representation of their thinking on the board allows students ownership over their particular strategy.

Capturing a student's method can be challenging. Make sure to ask clarifying questions if you do not understand. Number talks are about communication. It is a good time to model how to interact when you do not understand what is being said. This is a great time for students to see you struggle and work to understand what is being shared. This is important modeling and it is also the reason we do not ask students to come to the board to share their thinking.

If students are challenged with finding or sharing methods it is ok to introduce a method and share it with them. We recommend you do this by saying the method you are sharing is one you got from another student. This is an important message for them and a time when they should not see you as the expert in the classroom. By sharing a method created by another student you maintain the culture that you are a community of maths learners.

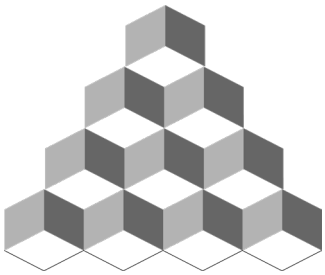
Record students work horizontally rather than the traditional vertical method that students are taught. This will help students make sense of the numbers rather than working from the traditional algorithm. If a student says they used the traditional algorithm ask the student to describe what they saw and record accurately. Then ask for other strategies.

It is also important to create visuals for student strategies. Choose a strategy and model how to draw a visual representation for the numerical calculations. Using color is helpful when creating visuals for student strategies. After creating a visual ask students to choose a different strategy and create a visual that represents the calculation.

Here are some examples of recorded student strategies to the problem 18 x 5:

To accurately represent students' thinking with your numeric and visual representations, continually check in with the student and ask them questions like:

- Is it like this? (Referring to a part of your representation)
- Is this what you saw?
- Is it a little bit like this other one? What was different about it?
- What did you do after that?



- Maybe we could draw this one out because that would be helpful. Does this look like what you did?
- Do you feel like this represents your thinking?

A main goal during number talks is to get as many students sharing as many strategies as possible. One of the things we do to encourage more students to share is to invite more strategies by asking, "Did anyone do it differently?" "Did anyone see it differently?"

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Extend

- Ask students to sketch the visual for a strategy.
- Ask students to solve a new problem using one of the strategies shared.

Look-Fors

- How are students engaging with mistakes? Multiple answers in number talks are an opportunity to honor and discuss mistakes. It is important to make sure that you keep your responses to right and wrong answers the same. When students recognize their teachers reactions and can connect them to right and wrong answers, they become fearful of their ideas being respected and will stop sharing.

- How are students taking numbers apart and putting them together? There are many ways to create equivalent expressions by composing and decomposing numbers. This is called number flexibility and it is very important for number sense and algebra. The more students experience number flexibility the more creative, confident and fluent they will become. When you start number talks for the first time you might notice students not sharing a variety of strategies and not breaking apart numbers beyond making 10s. This is likely connected to an absence of number flexibility. When students see different ways to compose and decompose numbers when doing a calculation, they often say, "We thought that wasn't allowed." Understanding that numbers represent quantities that can be redistributed and arranged is one of the reasons we love number talks.

- Which students are sharing strategies? While the number talk problem itself is often a simple looking arithmetic problem there are many ways of solving the problem. Like most activities some students participate vocally and others do not. This is not the kind of activity in which every student needs to share. There are many ways to think about engaging students who do not offer strategies. You might invite them to use one of the strategies shared on a new problem, create a visual for a strategy, or complete a reflection in their journal.

Reflect

Ask students to reflect on their experience in their journal with a prompt like, "What is something you learned you could do with numbers that you did not know before?"