## Introduction:

In this lesson students will be helped to see numbers through a dot card number talk, which helps students understand that mathematics can always be seen in many different and creative ways. Students will also investigate squares inside a rectangle, a lovely low floor, high ceiling task.

Agenda for the day:

| Activity	Time	Description/Prompt	Materials
Mindset Video	5 min	Play the mindset video, *Brains Grow and Change* https://www.youcubed.org/wim2-day-1/	Mindset Video day 1, *Brains Grow and Change*
Dot Card	15 min	1. Show the dot card visual to students. Put it away before they have time to count and ask them how many dots they saw and how they saw them. See this video for more detail. https://www.youcubed.org/jo-dot-card-number-talk/ 2. Draw as many examples of student representations as possible.	1 copy of the dot card visual for display, page 5
Good Group-work	15 min	1. Reflect on the things you do not like people to say and do when you are working on math in a group. 2. Reflect on the things you do like people to say and do when you are working on math in a group.	• Paper, pencil/pen • 2-4 pieces of large poster paper to collect the students' ideas
Fewest Squares	15 min	If you have time this is a great activity! 1. Have students draw an 11x13 rectangle. 2. Ask them to figure out what is the fewest number of squares they can draw in the rectangle.	• Graph/grid paper • Pencil/pen • Colored pencil/markers
Closing	5 min	As the lesson closes remind students of the video messages they heard – that there is no such thing as a math brain or a math person and anyone can learn any level of math with hard work and effort.	
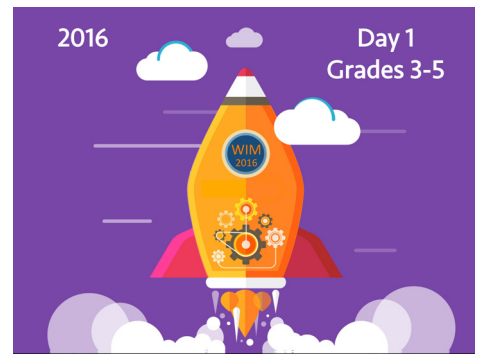
Activity: Dot Card

A dot card number talk is a really nice activity that people of all ages enjoy. It is a short but powerful teaching activity and it shows students:

•   the creativity in math
•   the visual nature of math and
•   the many different ways people see math.

This lesson is based around this dot card:
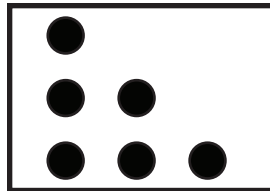
First show the dot card to students - but show it for a very short amount of time. The goal is for students to work out how many dots there are without counting. I usually hold the card or show it on a screen for a few seconds only, to stop students counting one by one. Ask students to tell you how many there are without counting one by one. This grouping of dots involves an important brain area. After they have seen the dots ask the whole class: "Does anyone want to tell me how many dots there are?" Then record the number of dots people saw on the board. Usually most students will see there are 6 dots. Then tell students the intersting part is how they see 6 dots, and ask indivisuals to tell you how they saw the 6. Record each way of seeing with the students name, as I do in this example from WiM 1 with a different dot card: - https://www.youcubed.org/jo-dot-card-number-talk/ . I have also used dot cards with kindergarten students, high school students and undergraduates. When you record the different ways students see the collection of dots you can record visually, or also add numbers, For example:
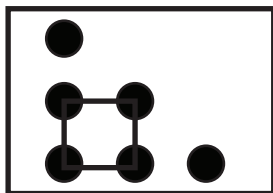

4 + 2
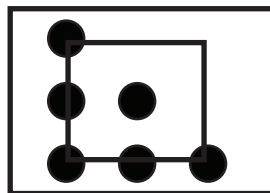
9 - 3
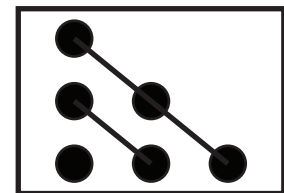
3 + 2 + 1

For more detail on teaching a dot card number talk or a regular number talk, see https://www.youcubed.org/category/teaching-ideas/number-sense/, Humphreys and Parker (2015), Parrish (2014).

References:
Boaler, J. & Humphreys, C. (2005) Connecting Mathematical Ideas: Middle School Cases of Teaching & Learning. Heinneman: Portsmouth.
Humphreys, C. & Parker, R. (2015). Making Number Talks Matter: Developing Mathematical Practices and Deepening Understanding, Grades 4-10. Portland, ME: Stenhouse.
Parish, S. (2014). Number Talks: Helping Children Build Mental Math and Computation Strategies, Grades K-5, Updated with Common Core Connections. Math Solutions.
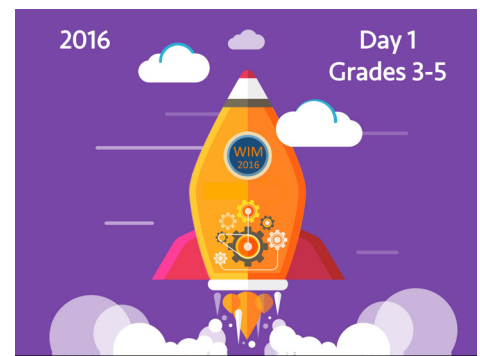
Activity: Good Groupwork

I always use this activity before students work on maths together as it helps improve group interactions and shape classroom norms for the school year. Teachers who have tried this activity have been pleased by students' thoughtful responses and found the students' thoughts and words helpful in creating a positive and supportive environment. First I ask students to reflect on things they don't like people to say or do in a group when they are working on maths together. Students come up with quite a few really important ideas, such as not liking people to give away the answer, or to rush through the work, or to ignore other people's ideas. After they have thought of a few of the ideas I ask them to think of the converse – what DO they like people to do and say when working in a group. When students have had enough time in groups brainstorming, the teacher then collects the ideas. I usually do this by making a "What we don't like" list/poster and asking each group to contribute one idea, moving around the room until a few good ideas have been shared (usually about 10). Then I do the same for the "what we do like" poster/list. I usually present the final posters to the class as our agreed upon classroom norms that we will refer back to through the year. If any student shares a negative comment, such as "I don't like waiting for slow people" do not put it on the poster, instead use it as a chance to discuss the issue. This rarely or never happens and students are usually very thoughtful and respectful in the ideas they share.

Activity: Fewest Squares

This is a really worthwhile activity that we taught last summer in our youcubed maths camp. It is a mathematical investigation that students may explore together.

To get students started ask them to draw an 11x13 rectangle on their paper, and then pose the question, *What is the fewest number of squares you can draw inside of your 11x13 rectangle?* Make sure the class has an idea about what the question is asking before they start working. Answer clarifying questions but be careful not to do any of the thinking for them. Encourage students to use their group to ask questions and wonder together about how to draw the fewest number of squares in an 11x13 rectangle. Provide plenty of graph/grid paper so students feel like they can try the activity more than once.

Extensions for the activity:
• Determine the fewest number of squares in a 12x15 rectangle.
• What is the size of the rectangle you can find using 9 squares? Can you find more than one rectangle?