# Lesson 2: Human Centered Education: "Design to the Edges"

by Vivian Shell

## Grade Level(s)

12th grade students enrolled in "Mathematical Decision Making for Life"

## Lesson Overview

Students will collaborate to review big ideas of place value and number. Students will gain an understanding of the choices possible in designing school experiences by observing a TED talk. Students will begin to develop a profile space for human-centered design in a math classroom, which includes mathematical features and pedagogical features.

## Learning Objectives

Students will broaden their perspectives about the complexity of understanding place value. Students will be exposed to the idea of designing learning experiences with the flexibility to address the needs of different learners with different learning profiles rather than basing their designs on a "one-size-fits-all" model.

## Standards

- How to understand and communicate statistical information. In particular, how to:
    - Identify uses and misuses of statistical analyses. (MDMFL III.1c)
- How to construct, analyze, and interpret flow charts. In particular, how to:
    - Construct flow charts to describe processes or problem-solving procedures. (MDMFL IV.3a)
    - Analyze flowcharts and follow procedures to solve problems. (MDMFL IV.3b)
    - List requirements and restrictions needed for a suggested algorithm. (MDMFL IV.3d)
- How to construct viable arguments and construct the reasoning of others. In particular, how to:

    - Use stated assumptions, definitions, and previously established results to construct an argument. (MDMFL IV.1a)
    - Recognize and use counterexamples. (MDMFL IV.1c)
    - Justify and communicate conclusions, and respond to the arguments of others. (MDMFL IV.1.d)
- How to evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used. (SL 11-12.3)

## Preparation

- TED Talk ready for viewing: "The Myth of Average: Todd Rose at TEDxSonomaCounty" http://tedxtalks.ted.com/video/The-Myth-of-Average-Todd-Rose-a

## Materials and Resources

- Projector connected to the internet
- "I have…, Who has…?" cards (download "Lesson 2 Supplemental Materials")
- Base-10 Blocks and graphic organizer (below)
- Blank paper for each student.
- "Who is our student?" poster.
- Post-its, many for each student.

## Activity 1: "I have…, Who has…?" Circle Up (*20 minutes*)

- "I suspect when we start to work with our younger students, we will bump into their needs around understanding where our numbers come from. Let's do a community building activity that gives us a chance to appreciate the complexity and expandability of our number system. (And, gives us a chance to review for ourselves! Number concepts can be tricky!)"
- Give a quick review of Base-10 blocks, place value, scientific notation, and powers of ten, building from a cube to a super cube (make a cube worth one). If this is not already a poster on your wall, build a graphic organizer for students to refer to when they begin the activity. (~6-8 minutes)
- Explain how the cards will work: Each student (or pair of students) will receive one card. Read an example out loud. As a class, you will be creating a chain linking one card to the next by matching the picture on one card to the number stated on another card. You will select the first person to start. That person will read the "Who has…?" portion of the card, describing the picture using the vocabulary for the blocks that was just reviewed. The student whose card begins with the number just described stands next to the first person and reads the "I have…" statement. As a class, decide if this is a match. Then, this person finishes the card by reading the "Who has…?" portion, describing the picture. Continue in this way until all students have been included. The last person

reads the “Who has…” portion. The first student or pair fills in the number associated with this description, completing the circle.
- “As we can see, working fluidly with numbers is abstract and complex. It’s no wonder that a lot of us have a hard time really grasping so many of these concepts, like powers of ten, relative magnitude, and scientific notation. The students you will be designing for are somewhere along their journey of learning these concepts.”

## Activity 2: TED Talk (*25 to 30 minutes*)

- “Recall that we are going to design a learning experience for a student at _____ Elementary in order to impact their academic outcome. For that, we need to understand a little more about the human-centered design process in the context of education.”
- Pass-out blank paper and ask students to create a two-column chart. Explain that we will be watching a TED Talk titled, “The Myth of Average: Todd Rose at TEDxSonomaCounty” and taking notes about what we find interesting, what we find personally relevant, and what we find to be new ideas we have never considered about education. They are to record a headline of this note in one column and a rough time that it occurred in the talk in the other column. (This is practice in headlining, a skill they will use repeatedly in the interview process and brainstorming.)
- Run the video. (18 minutes)
- Debrief the video by asking students to discuss their observations in small groups, then as a class. If anyone would like to watch a particular part again, use their notes about the time to find the section and replay. (~5-10 minutes)

## Activity 3: Beginning of Learner Profile (*10 Minutes*)

- “I believe that this video suggests a mindset to develop in relation to learning. I remember when I became aware of this shift in mindset for myself near the beginning of my teaching career. I realized that I was limiting what I offered my students because I felt that I had to be sure that I offered the same thing to every kid; I felt I had to make anything I created universal and available to everyone. As I learned more about my students and who they are and what they need, this limiting mindset became outdated to me, and I began looking at every kid and asking myself, ‘what does this kid need’. This shift has led to an increase in creativity and joy, and I hope that you will experience the same. We can engage in this mindset if we start to define just what ‘edges’ we see when we look at our students.”
- Display poster to represent elementary students (either title the poster “Who is our user?” or sketch a picture of a younger child to represent our user).
- Ask students to stand around the poster and give students a stack of post-its. Ask them to first reflect on their own experiences as an elementary student and write down descriptors of themselves as learners at that time. Include strengths, challenges, characteristics of activities they enjoyed, characteristics of activities they did not enjoy, examples of what helped them learn, etc. Allow 1-2 minutes for this silently, then ask

students to share an idea on a post-it, one student at a time, and stick it to the poster. Encourage many post-its. They may write additional ideas as the share-out continues.
- Second, ask them to reflect on the ideas from the video and write down additional descriptors of learners in our educational system. They may refer to their notes. Allow 1-2 minutes for this silently, then ask students to share an idea on a post-it, one student at a time, and stick it to the poster. Encourage many post-its. They may write additional ideas as the share-out continues.
- Third, ask them to reflect on the ideas from the "Framing Equity" article and write down additional descriptors of learners in our educational system, paying attention to the dimensions of Access, Achievement, Identity, and Power. They may write additional ideas as the share-out continues.
- "We have started to build an understanding of the needs of individual users, our students, in our schools. We are going to provide some sort of solution for the unique needs of a younger student as our way of designing for the edges. This collection of descriptors will help us think about the edges and nurture the potential in that kid."

## Troubleshooting

- It is a good idea to prepare ahead of time your own descriptors of learners in light of your own educational experience, the 'edges' you have seen in students throughout the years, and the dimensions of equity from the article. Pay attention to out-of-the-box examples that can serve to shift thinking from typical 'stories' about education (i.e. "I was always bored in math." or "My teachers were mean.") to other ways to view learning (i.e. "I remember the inequality shark made sense for helping me select the right direction of the inequality symbol, but I was confused by the name of the symbol." or "I had a teacher who was really excited about history and that made me excited.") Also, this is where students may need some modeling of headlining. Do this by stating succinctly a few of your own descriptors but writing a much more succinct headline on your post-it. Be prepared to reinforce norms for stating things cleanly. Refer to the standards for this lesson for suggestions about what these norms may be. Part of your job as a teacher of 12th graders is to guide their transition to adulthood. This includes learning the skills of owning strong emotions (such as those associated with their own math education!) while finding a way to talk about these emotions clearly and openly.
- It would be worth becoming clear with yourself about the language associated with success in school and "being smart" and the way that students talk about these things. In the video, Todd Rose talks about the "brightest" kids and uses the word "genius". This language could detract from cultivating a growth mindset. On the other hand, his framework for nurturing individual potential (the jagged learner profile) and his discussion about broadening the talent pool can help to debunk the myth that only a select few have the ability to be successful. This is nuanced and worth close attention. You may want to give students the prompt to think about and discuss what his message has to do with growth mindset and address this directly.
- In the end of the video, Todd Rose discusses using technology to address individual needs. This may imply a solution pathway as students continue to work. You may want to address this directly, as well. In particular, you could ask students to talk about how that type of solution might work for them but also bring up other types of solutions for comprehending mathematics, such as using manipulatives, group work, informed drawing, service learning, teaching through problems, graphic organizers, and music.

Perhaps a review of Howard Gardner's multiple intelligences could inform this discussion.

## Assessment

The circle up activity should be used as formative feedback for the general numeracy of your class. In the process of completing the circle, your class will have encountered the following big ideas about place value and number:

- Order of digits
- Various uses of zero
- Scientific notation
- Significant digits
- Collecting like terms
- Order of magnitude
- Regrouping

This is a good time to watch for students making connections between the idea of a jagged learning profile and equity.

| MILLIONS | | | THOUSANDS | | | ONES | | |
|---|---|---|---|---|---|---|---|---|
| Hundred | Ten | One , | Hundred | Ten | One , | Hundred | Ten | One |
| 100,000,000s | 10,000,000s | 1,000,000s | 100,000s | 10,000s | 1,000s | 100s | 10s | 1s |
| Super Flat | Super Stick | Super Cube | Big Flat | Big Stick | Big Cube | Flat | Stick | Cube |
| | | Mega - M | | | Kilo - k | Hecto – h | Deka – da | UNIT |