

# Relationship with Math Challenge

by Vivian Shell

## Students will be designing...

...math lessons for students in lower grades.

## Through engaging in this challenge, students will learn...

- How to understand and communicate statistical information. In particular, how to:
  - o Identify uses and misuses of statistical analyses. (MDMFL III.1c)
- How to construct viable arguments and construct the reasoning of others. In particular, how to:
  - o Use stated assumptions, definitions, and previously established results to construct an argument. (MDMFL IV.1a)
  - o Recognize and use counterexamples. (MDMFL IV.1c)
  - o Justify and communicate conclusions, and respond to the arguments of others. (MDMFL IV.1.d)
- How to construct, analyze, and interpret flow charts. In particular, how to:
  - o Construct flow charts to describe processes or problem-solving procedures. (MDMFL IV.3a)
  - o Analyze flowcharts and follow procedures to solve problems. (MDMFL IV.3b)
  - o List requirements and restrictions needed for a suggested algorithm. (MDMFL IV.3d)
- How to initiate and participate effectively in a range of collaborative discussion with diverse partners on *grades 11-12 topics, texts, and issues*, building on others' ideas and expressing their own clearly and persuasively. In particular, how to:
  - o Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed. (SL 11-12.1b)
- 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)
- How to present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. (SL 11-12.4)
- How to adapt speech to a variety of contexts and tasks, demonstrating a command of formal English when indicated or appropriate.

## Lesson 1

Students will read an article about equity in math education and discuss the issues it raises. Students will record the main points of the article in a graphic organizer and supply their own examples of these points. The objective is to develop a framework and vocabulary for discussing equity and to begin to contextualize each student's experience with mathematics into this framework.

## Lesson 2

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. The objective is to broaden student perspectives about the complexity of understanding place value and expose them to the idea of designing learning experiences to address the needs of different learners with different learning profiles rather than basing their designs on a "one-size-fits-all" model.

## Lesson 3

Students will use an activity based on Mayan/Egyptian math to talk more concretely about place value and numeracy. This activity will help the class further develop the learner profile that was started in the previous lesson. They will use this information to develop interview questions for the next stage. The objective is for students to analyze big ideas of place value while constructing their own arguments and critiquing the reasoning of fellow classmates in preparation for critiquing the reasoning of younger students.

## Lesson 4

Students will walk to the neighboring elementary school and conduct the interviews. They will then pin down their insights in an empathy map, produce a needs statement, and brainstorm solutions for this need. A solution will be selected for prototyping in the next few days. The objective is that students will now be working with a specific user in the space of educational equity and contextualize the ideas, conversations, and problem-solving experiences ahead of them within the needs of this younger student.

## Lesson 5

Students will create a prototype of a math experience that addresses a need they discovered in the interview process. The objective is that students will deepen their own understanding of mathematics by designing a learning experience for a younger student.

## Lesson 6

Students will test their initial prototype, then reflect on its effectiveness with their users. After this reflection, they will iterate their solution to include the feedback they received from their users. This iteration will be tested later. The objective is that students will receive feedback about the solutions they have designed, gain more insight into the complexity of mathematical understanding, and deepen their own understanding of the concepts they are trying to help the younger kids understand.