Mathematical Mindsets

Our attitudes about math and learning

University of Utah, Math 1220-003, Summer 2018

Common Responses

“Math was never my strong suit”

“I like math when I understand it… I get frustrated when after a while I still don’t understand it”

“I love the feeling of solving a hard problem”

Growth vs. Fixed Mindset

“I have not failed. I have only found 10,000 ways that do not work”
---Thomas Edison

Carol Dweck

- Professor Dweck studied the ways students respond to failure
- Studied a group of 400 5th grade students
- Gave students three tests to take: easy, hard, easy
- After the first test, praised each student:
  - “You must be very smart!” vs
  - “You must have been trying very hard!”
- They were meant to fail the second test
- Compared their scores on the first test and third test

Results

- Students praised for their hard work:
  - Enjoyed the difficult test more
  - They scored higher on the third test than on the first
- Students praised for innate intelligence:
  - Were miserable during difficult test
  - Scored lower on third test than on the first
- What are your thoughts on this? Does this agree with your experiences?

Fixed Mindset/Growth Mindset

Dweck introduced the terms “Fixed Mindset” and “Growth Mindset”

- Fixed Mindset: your ability is something you’re born with
  - “I’m not a math person” “I’m not very smart” “She’s a genius”
- Growth Mindset: your ability is something you can change and improve
  - “I don’t know that yet” “I learned a lot this year”
- Dweck shows that students with a growth mindset tend to be more persistent and perform better

Discussion

How would you explain Dweck’s results?

What are some examples of times when you had a growth mindset about something and when you had a fixed mindset about something? How did it affect your experience?

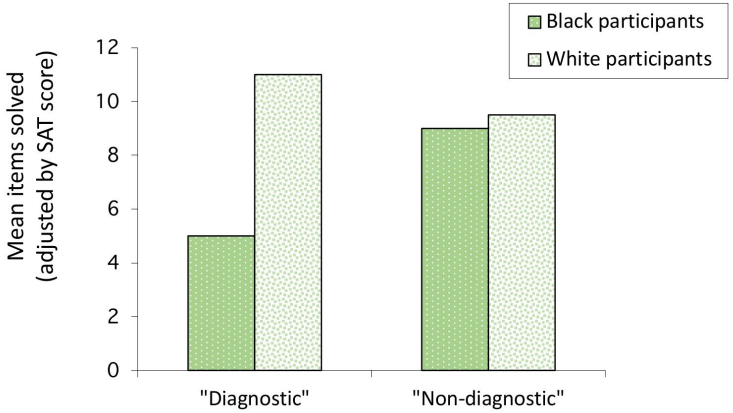
Where did you learn these mindsets from?

Stereotype Threat

Women and underrepresented minorities are especially affected

Mean performance on a difficult verbal test as a function of race and test characterization

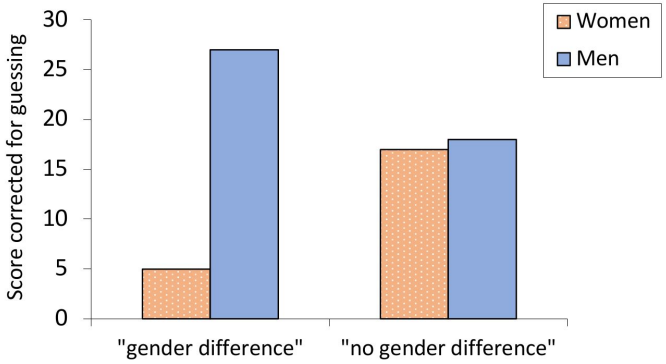
(Steele & Aronson, 1995)



Graphic by Professor Ozlem Ayduk, UC Berkeley. Used with permission

Mean performance on a difficult math test as a function of gender and test characterization

(Spencer, Steele, & Quinn, 1997)



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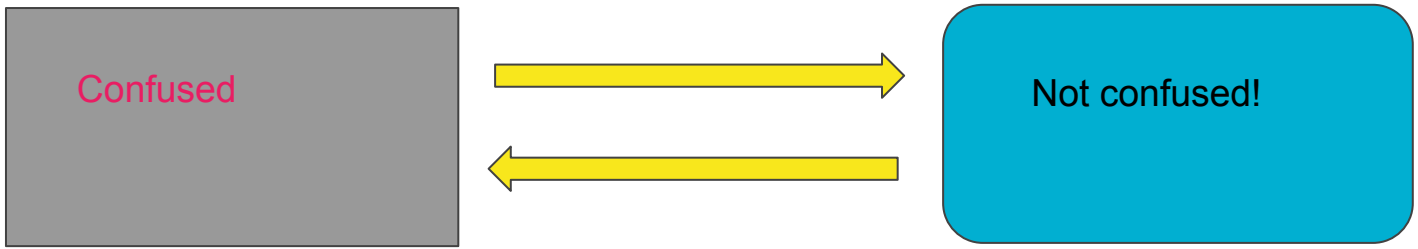
What your grade means

- Your performance in this class is not a measure of your intelligence
- It’s not a measure of your worth as a person
- It’s (hopefully) a measure of how well you understand the material listed in the Math 1220 curriculum

On Being Stuck

“I am in a charming state of confusion” ---Ada Lovelace, in a letter to Charles Babbage, 1843

The Learning Process



If you’re never confused, you’re not learning!

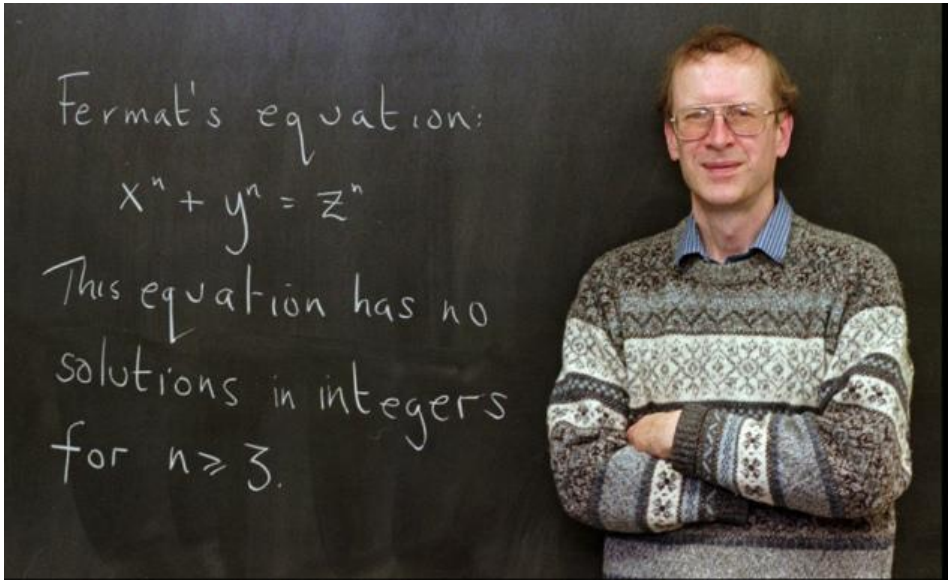
I totally relate to the experience of hating math when I don’t understand it

On Being Stuck

“What you have to handle when you start doing mathematics as an older child or as an adult is accepting the state of being stuck,” Wiles said. “People don’t get used to that. They find it very stressful.”

He used another word, too: “afraid.” “Even people who are very good at mathematics sometimes find this hard to get used to. They feel they’re failing.”

But being stuck, Wiles said, isn’t failure. “It’s part of the process. It’s not something to be frightened of.”



Being stuck is uncomfortable...

But it doesn't have to be *too* uncomfortable

- What are some ways we can address the discomfort?

Final thoughts

“I love the feeling of solving a difficult problem!”

> “There are times when I feel like I'm in a big forest and don't know where I'm going. But then somehow I come to the top of a hill and **can see everything more clearly**. When that happens it's really exciting."---Maryam Mirzakhani

> “Pursuing mathematics...cultivates the virtues of **transcendence** and **joy**. By joy, I refer to the wonder or awe or delight in the beauty of the created order. By transcendence, I mean the ability to embrace mystery of it all. There’s a transcendent joy in experiencing the beauty of mathematics.”---Francis Su