Building Bridges to Belonging: Mindsets That Increase Participation, Achievement, and Learning in the Face of Stereotypes

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“In the perception of society my athletic talents are genetic; I am a likely mugger-rapist; my academic failures are expected; and my academic successes are attributed to others. To spend most of my life fighting these attitudes levies an emotional tax that is a form of intellectual emasculation.”

-Dr. Neil de Grasse Tyson

One reason for the lack of women at the highest professions in STEM is because of “…different availability of aptitude at the high end.”

-Dr. Larry Summers

Occupational segregation thrives on essential difference.
Stereotype Threat
Steele & Aronson, 1995

Unpleasant apprehension arising from the awareness of a negative ability stereotype in a situation where the stereotype is relevant, and thus confirmable.
Stereotype Threat Effects on Black Students’ Performance

- "Measuring your ability"
  - Blacks
  - Whites

Steele & Aronson, 1995
Stereotype Threat Effects on Black Students’ Performance

Measuring your ability

Not measuring your ability

# of items solved

Steele & Aronson, 1995
Additional Studies Finding Performance Effects

- Women taking math tests (Good, Aronson & Harder, 2008; Spencer, Steele, & Quinn 1999).
- Latinos taking verbal tests (Aronson & Salinas, 1997).
- Low SES students taking verbal tests (Croizet & Claire, 1998).
- Blacks and miniature golf (Stone, 2002).
- White males taking math tests when compared to Asians (Aronson, Lustina, Good, Keough, Steele, & Brown, 1999).
What about learning?
If the figure above is a rectangular solid composed of cubes, each with edge of length 4 centimeters, what is the volume of the rectangular solid in cubic centimeters?

(A) 100  
(B) 256  
(C) 400  
(D) 5120  
(E) 6400
Performance feedback
Correct Answer

(E) 6,400
Math Tutor

Answer: (E) 6,400

Step 1:

Step 2:

Step 3:
Math Tutor

Answer: (E) 6,400

Step 1: Label figure with edge length of each cube and length, width, and height.

Step 2:

Step 3:
Math Tutor

Answer: (E) 6,400

Step 1: Label figure with edge length of each cube and length, width, and height.

Step 2:

Step 3:
Math Tutor

Answer: (E) 6,400

**Step 1:** Label figure with edge length of each cube and length, width, and height. (more)

**Step 2:** Find the values of the length, height, and width of the solid. (more)

**Step 3:**
Answer: (E) 6,400

Step 1: Label figure with edge length of each cube and length, width, and height.

Step 2: Find the values of the length, height, and width of the solid.

Step 3:

Length = 4 + 4 + 4 + 4 = 16
Width = 4 + 4 + 4 + 4 + 4 = 20
Height = 4 + 4 + 4 + 4 + 4 = 20
Math Tutor

Answer: (E) 6,400

Step 1: Label figure with edge length of each cube and length, width, and height.

Step 2: Find the values of the length, height, and width of the solid.

Step 3: Find the volume of the solid.

Length = 4 + 4 + 4 + 4 = 16

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Answer: (E) 6,400

**Step 1:** Label figure with edge length of each cube and length, width, and height.

**Step 2:** Find the values of the length, height, and width of the solid.

**Step 3:** Find the volume of the solid.

**Volume of a Rectangular Solid:**

\[ l \times w \times h \]

Volume = 20 \times 16 \times 20

= 6,400
Stereotype Threat Undermines Learning

Percent of errors corrected after learning opportunity

Non-threat: $F(1, 122) = 2.06, p = .15, \eta^2 = .02$

*Stereotype Threat: $F(1, 122) = 4.62, p = .03, \eta^2 = .04$

*2-way ANOVA: $F(1, 121) = 6.45, p = .01, \eta^2 = .05$

Good, Mangels, & Evelo, 2015
Strategies that Reduce Vulnerability to Stereotype Threat

• Encourage Growth Mindsets
• Encourage Belonging Based on Effort/Engagement
Growth Mindsets
Dweck, 1999

**Entity Theorists**
- Intelligence is fixed
  - Trait largely determined by nature

**Incremental Theorists**
- Intelligence is malleable
  - Quality that can be increased through nurture

Desire similar outcome
- achieving good scores, doing “well”

Different *motivation* for pursuing this outcome
- **Performance goals**
  - “The main thing I want when I do my school work is to show how good I am at it.”

- **Learning goals**
  - “In school I am always seeking opportunities to develop new skills and acquire new knowledge.”
Growth Mindsets
Reduce Stereotype Threat

Fig. 1. Average math scores on the TAAS test.

Good, Aronson, & Inzlicht, 2003
Culture of Talent and Female Underrepresentation in STEM

$r(10) = -0.64, p = 0.025$

Field-specific Ability Beliefs
High score = need brilliance

Leslie, Cimpian, Meyer, & Freeman, 2015
Teachers’ Theories of Intelligence Impact Pedagogical Practices

- When given an *entity* theory of math intelligence, participants endorse teaching practices that
  - Convey a fixed view of intelligence, such as implicating underlying intelligence, comfort for lack of ability
  - Reduce opportunities to work on challenging problems
  - De-emphasize the role of effort in outcomes

Rattan, Good, & Dweck, 2012
Teachers’ Mindsets Affect Pedagogical Practices

- Teachers who hold an **incremental** theory of math intelligence, endorse teaching practices that
  - Convey a malleable view of intelligence, such as focusing on strategies for outcomes
  - Emphasize the role of effort in outcomes
  - Increase opportunities to work on challenging problems

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**Provide him with challenging math tasks.**

![Bar chart showing the comparison between Entity and Incremental mindsets in terms of providing challenging math tasks.]

Rattan, Good, & Dweck, 2012
Reducing Stereotype Threat

• Reframe the nature of assessments

• Encourage malleable views of intelligence
  – Growth mindsets are important for instructors and students
Negative Stereotype

Questions about ability

Underperformance

Questions about belonging

Under-representation
Sense of Belonging

Feeling like an accepted member of the domain whose presence and participation is valued by peers.
Perceptions of Culture of Talent and Negative Stereotypes in Learning Environment → Sense Of Belonging → Math Grades

\[ X^2 (20) = 46.82, \ p < .001, \ CFI = .84, \ NFI = .77, \ RMSEA < .004, \ Pclose = .95 \]

(Good, Rattan, & Dweck, 2012)
Who Belongs?

• What student characteristics do you value most in your classroom?

• What are the foundations upon which students base their sense of belonging?
  – High achievement?
  – Quick, elegant solutions?
  – Perseverance?
  – Engagement?
  – Grit?

• Can effort-based belonging protect against stereotype threat?
How to fit in and belong to math: Hard work

By Alex Warren

WHAT HELPS STUDENTS to feel like they belong to math and why is it so important? On a recent June afternoon in a New Jersey school district, math teacher Michael Bolano stood in front of a group of 6th graders at a school assembly. “I was asked to come speak to you today to tell you about what can make students like you feel more like they belong to math.”

He explained, “Teachers talk a lot about students who easily do well in math, but in my math classes that easy achievement doesn’t matter that much. What really makes a ‘math person’ is success through hard work. The students who put in effort are the ones who truly belong to math.”

Some research shows that Mr. Bolano’s opinion might be correct. Several years ago, the school district asked a group of 6th graders like you how they felt about math. They also asked the math teachers about what kind of students they valued and respected the most in their classes.

Two years later, the school asked those same students were now in 8th grade, about their experience through middle school and high school. The researchers followed a student from the original 6th grade group. Wolfram said that they “were interested in seeing whether students who put in effort in 6th grade continued throughout high school.”

The students who “worked hard to get an A” were rated higher than those who put a lot of work into the class. The students who easily did well were less accepted by the math teachers than those who put a lot of work into the class.

What really makes a math person is success through hard work.

Students who passed the class with very little effort were less accepted by the math teachers than those who put a lot of work into the class.
Answer: (E) 6,400

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Effort-Based Sense of Belonging, Stereotype Threat, and Learning

2-way ANOVA:
Non-threat:
$F(1, 122) = 0.02, p = .90, \eta^2 < .01$
Stereotype Threat:
$F(1, 122) = 2.09, p = .15, \eta^2 = .02$
Belonging Mindsets Reduce Stereotype Threat

• Emphasizing effort (rather than ability) as a key determinant for belonging can
  – promote more learning engagement, improve learning
  – reduce stereotype threat
  – perhaps help eliminate the culture of “talent”
Research-based Strategies for Reducing Stereotype Threat

• Encouraging students and teachers to adopt a growth mindset.

• Encourage students to base their feelings of belonging on their efforts and engagement.

• Create a classroom learning environment that values effort and engagement as a path to belonging.

• Normalize effort as the path to success.