Rising to the Challenge of Diversifying STEM Fields

Alissa S. Crans  
Loyola Marymount University

Dave Kung  
St. Mary’s College of Maryland
@dtkung

MAA Project NExT
New Experiences in Teaching

Electronic Mathematics Education Seminar  
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New Fall application cycle!
Applications due October 15, 2018

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Questions? projectnext@maa.org
The Challenge of Diversifying STEM fields

I. State of Diversity (STEM, math)
II. How inclusion issues arise
III. What we can all do better

Throughout: Challenging Scenarios
STEM pipeline: Leaky

Leaks worse for women & minorities

Source: NCES Digest of Education Statistics; Science & Engineering Indicators 2008
Women in STEM?

% of Degrees to Women, By Discipline


- All fields
- Science and Eng.
- Biology
- Chemistry
- Computer Science
- Physics
- Engineering
Women in STEM?

% of Degrees to Women, By Discipline
Challenging Scenarios

• Type what you would do in chat (but don’t hit enter)
• Wait
• When prompted, hit enter.
• Read others’ responses.
(Type, Wait, Enter, Read)
Let’s practice: Name & Institution
Challenging Scenario:

Scenario #1
Your calculus students work in groups of 3. Tori’s an outgoing – and very good – student, but one day she’s in a group with two guys. You notice that she isn’t as active as usual. After class, she tells you they kept interrupting her and ignoring her ideas – so she just worked by herself.

What do you do? (Type, Wait, Enter, Read)
Worse at Ph.D. level – women?

% Female Doctoral Recipients by Discipline

- All fields
- Science and Eng.
- Biology
- Chemistry
- Computer Science
- Physics
- Engineering
Worse at Ph.D. level – women?

% Female Doctoral Recipients by Discipline

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- Math
- Physics
- Engineering

Years: 1995 to 2012
Challenging Scenario:

Scenario #2
You are serving on a hiring committee. During a lull in a dinner conversation, Paul, your older, male, chair asks the candidate: “So, are you married? Do you have kids?”

What do you do?

(Type, Wait, Enter, Read)
Minorities in STEM?

% of Degrees to Under-rep. Minorities

US pop.
2012: 30%
Minorities in STEM?

% of Degrees to Under-rep. Minorities

US pop.
2012: 30%

- All fields
- Science and Eng.
- Biology
- Chemistry
- Computer Sci.
- Math
- Physics
- Engineering
Challenging Scenario:

Scenario #3
You ask your students to pair up. You turn to see that the only two black students in the class are in opposite corners. You watch as people mull about - everyone else pairs up and the two of them eventually find each other.

What could you have done to lessen (rather than highlight) the marginalization of the two students? (Type, Wait, Enter, Read)
Minorities in mathematics?

Under-rep. Minorities in Mathematics

- All Underrepresented Minorities
- Black, non-Hispanic
- Hispanic

16.9% in '12
12.3% in '12
Minorities in mathematics?

Under-rep. Minorities in Mathematics

- 16.9% in '12
- 12.3% in '12

18% of black coll. students
32% of black math majors
Challenging Scenario:

Scenario #4
Challenging Scenario:

Scenario #4

A few minutes before class you’re getting materials ready. Ashanti walks in wearing a #BlackLivesMatter shirt. Ben, a white student, is clearly annoyed. “Don’t you mean All lives matter?”

What do you do?

(Type, Wait, Enter, Read)
Challenging Scenario:

Scenario #5
Delores is struggling – hardly talking to anyone in class. Her disrespectful email from early in the semester (addressing you as “Mrs. [last name]”) still annoys you. After a test, you say that anyone with a C or worse should talk with you ... she doesn’t.

What do you do?
(Type, Wait, Enter, Read)
Why do (college) minority students fail in Calculus? (Treisman, UC-Berkeley, 1970’s)

Common guesses:

- Poor preparation
- Lack of motivation
- Lack of family support
- Socio-economic forces
Why Are We Failing?

Why do (college) minority students fail in Calculus?

(Treisman, UC-Berkeley, 1970’s)

Common guesses:

– Poor preparation
– Lack of motivation
– Lack of family support
– Socio-economic forces

Data: These guesses are all wrong!
(and all about the students.)
Why Are We Failing?

Flip the Deficit Model:

The problem is **them**

Good place to start: Teaching for Inclusion.
Why Are We Failing?

Flip the Deficit Model:

The problem is **us**.

Good place to start: Teaching for Inclusion.
I teach...

...students

...math
I teach... students... math

Individualized instruction speaking the content
I teach...

...students

individualized instruction

discovery learning

...math

speaking the content

interactive problem sessions

group work on rich tasks
I teach... students... math

Where are you?

individualized instruction

discov. learning

interactive lectures

speaking the content

group work on rich tasks
Where are you?

I teach...

...math

...students

Where is your department?

The content

Interactive lectures

Work on rich tasks

Discovery learning
I teach...

- Pedagogy – Diversity Connection
- Why more interaction works.
- Challenges to change.
more interaction
more learning

“Worst Way to Teach” (Bressoud)
Physics Education (Mazur, Hestenes)
Nat. Academy of Sciences (Freeman)
greater equity

Interaction closes gaps!

- Emerging Scholars (Treisman)
- Physics Education (Mazur)
- Inquiry-Based Learning (Laursen)
- “Are Lectures Unfair?” (Paul, NYT)
I teach... math

students

growth mindset  fixed mindset

more inclusion  more exclusion

work/struggle visible  work/struggle hidden
...students

I teach...

...math

more opportunities to challenge biases (yours and students’)

Implicit Bias Test
I teach... more opportunities to challenge biases (yours and students’)

Implicit Bias Test

Your Result
Your data suggest a strong automatic preference for Light Skin compared to Dark Skin.

Your Result
Your data suggest a strong association of Male with Science and Female with Liberal Arts compared to Female with Science and Male with Liberal Arts.

Your Result
Your data suggest little to no automatic preference between Straight People and Gay People.
What can help move us left?

- knowledge of teaching methods
- knowledge of student thinking
- supportive community of dedicated, committed teachers
Challenging Scenario:

Scenario #6
Challenging Scenario:  

Scenario #6

Steve is gay - and everyone in class knows it. Tom comes to your office hours and says that working with Steve makes him uncomfortable - according to his religious beliefs, homosexuality is a sin. He asks you to avoid putting the two of them in the same group.

What do you do?
Teach students ...
Teach students...

not the ones you want, not the ones you “deserve,” not the ones you think you have, ... teach all of your actual students.
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