

Rising to the Challenge of Diversifying STEM Fields

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MAA Project NExT
NEW EXPERIENCES IN TEACHING

**Electronic Mathematics Education Seminar
September 18, 2018**



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NEW EXPERIENCES IN TEACHING

New Fall application cycle!
Applications due October 15, 2018

projectnext.maa.org

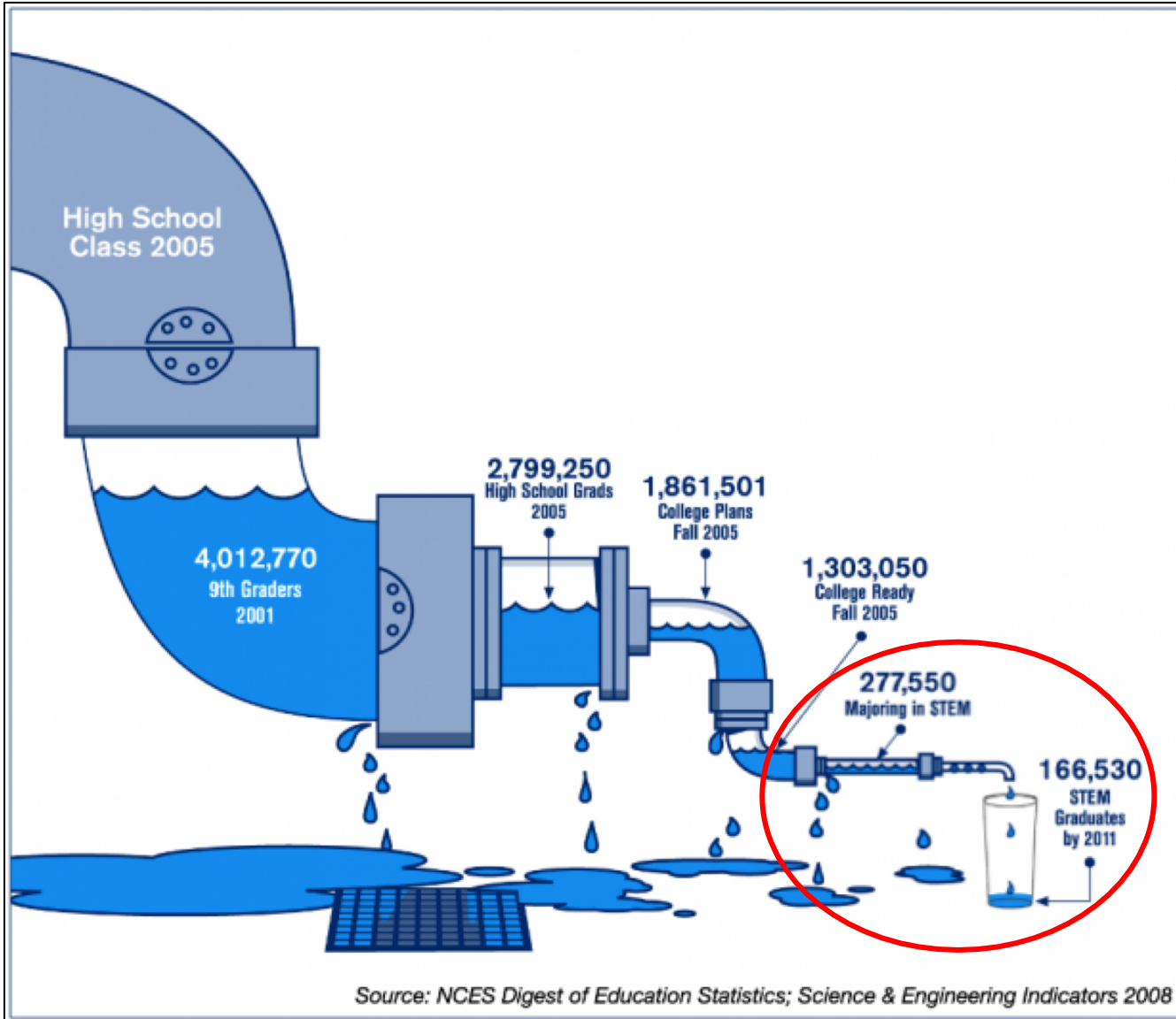
Questions? projectnext@maa.org

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

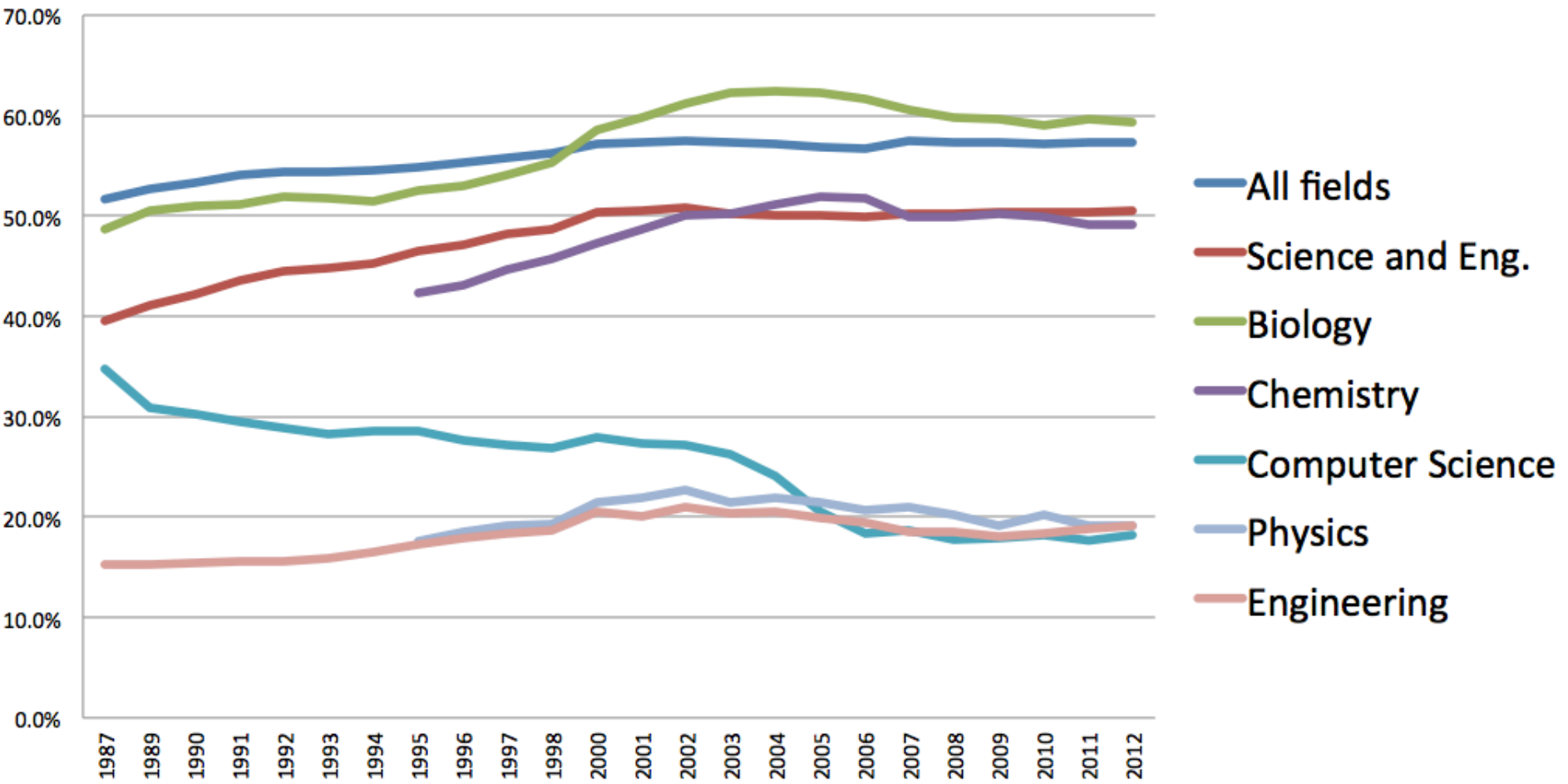
STEM pipeline: Leaky



**Leaks
worse for
women &
minorities**

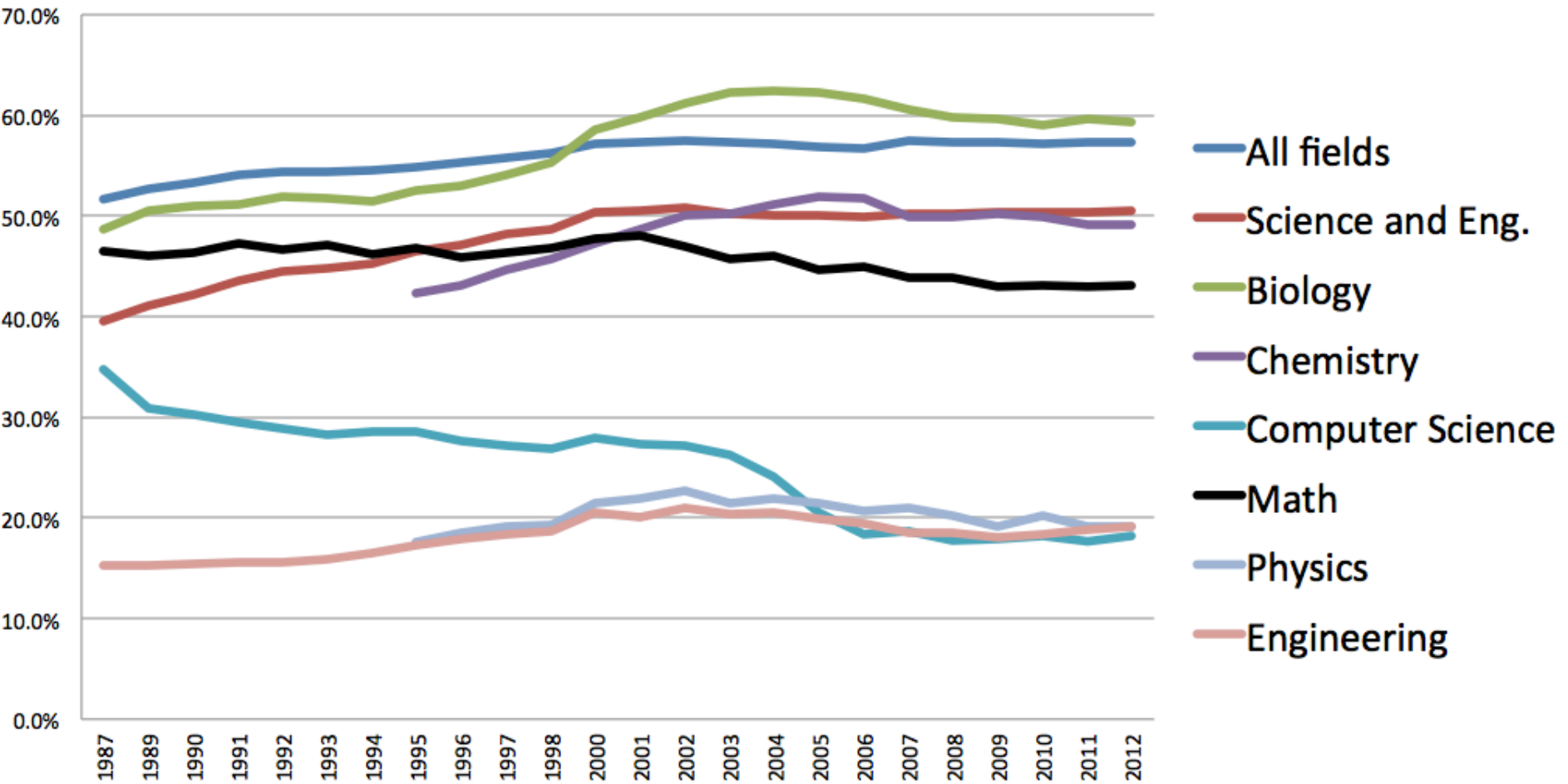
Women in STEM?

% of Degrees to Women, By Discipline



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

Challenging Scenario:

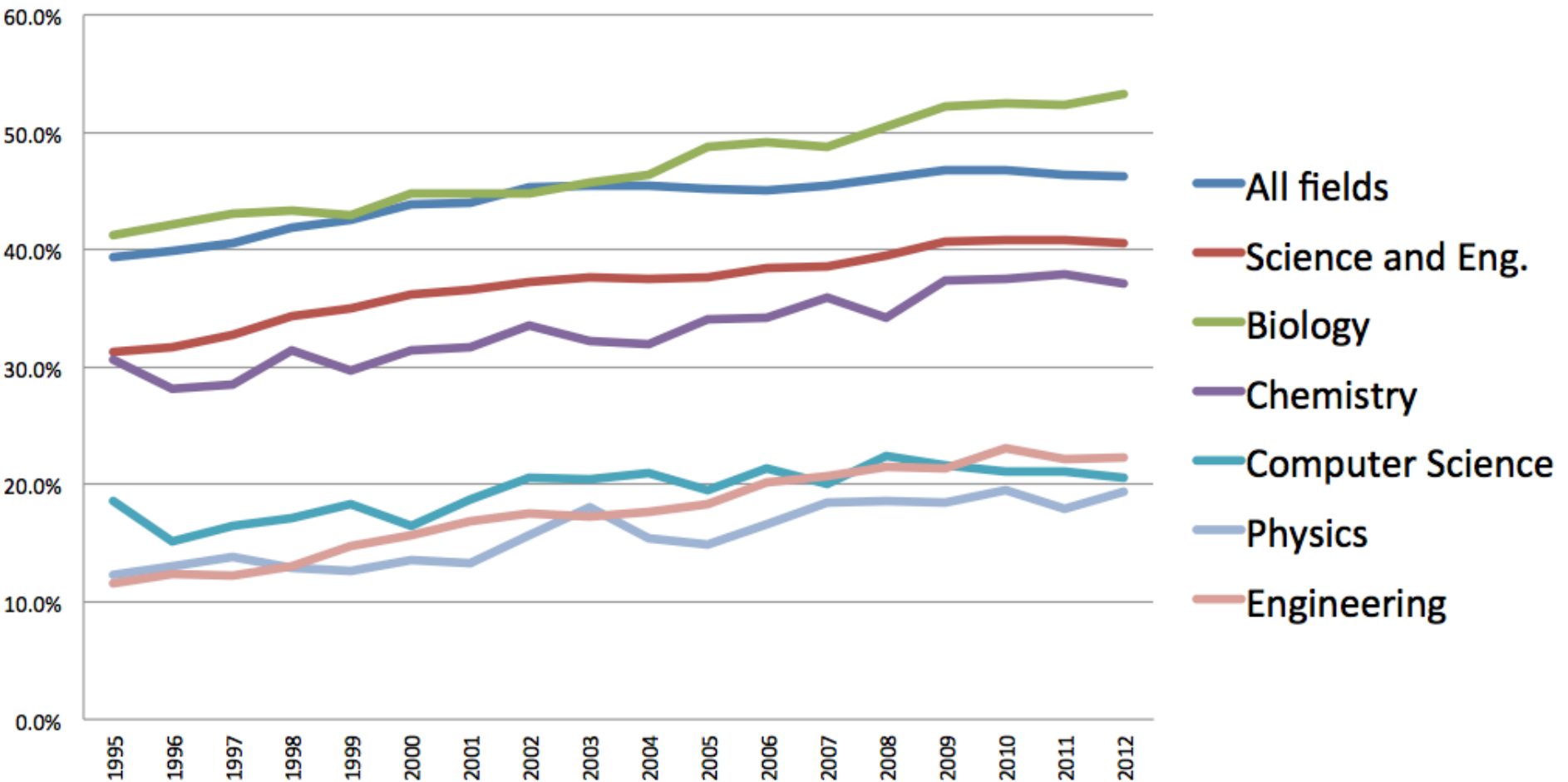
Scenario #1

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)

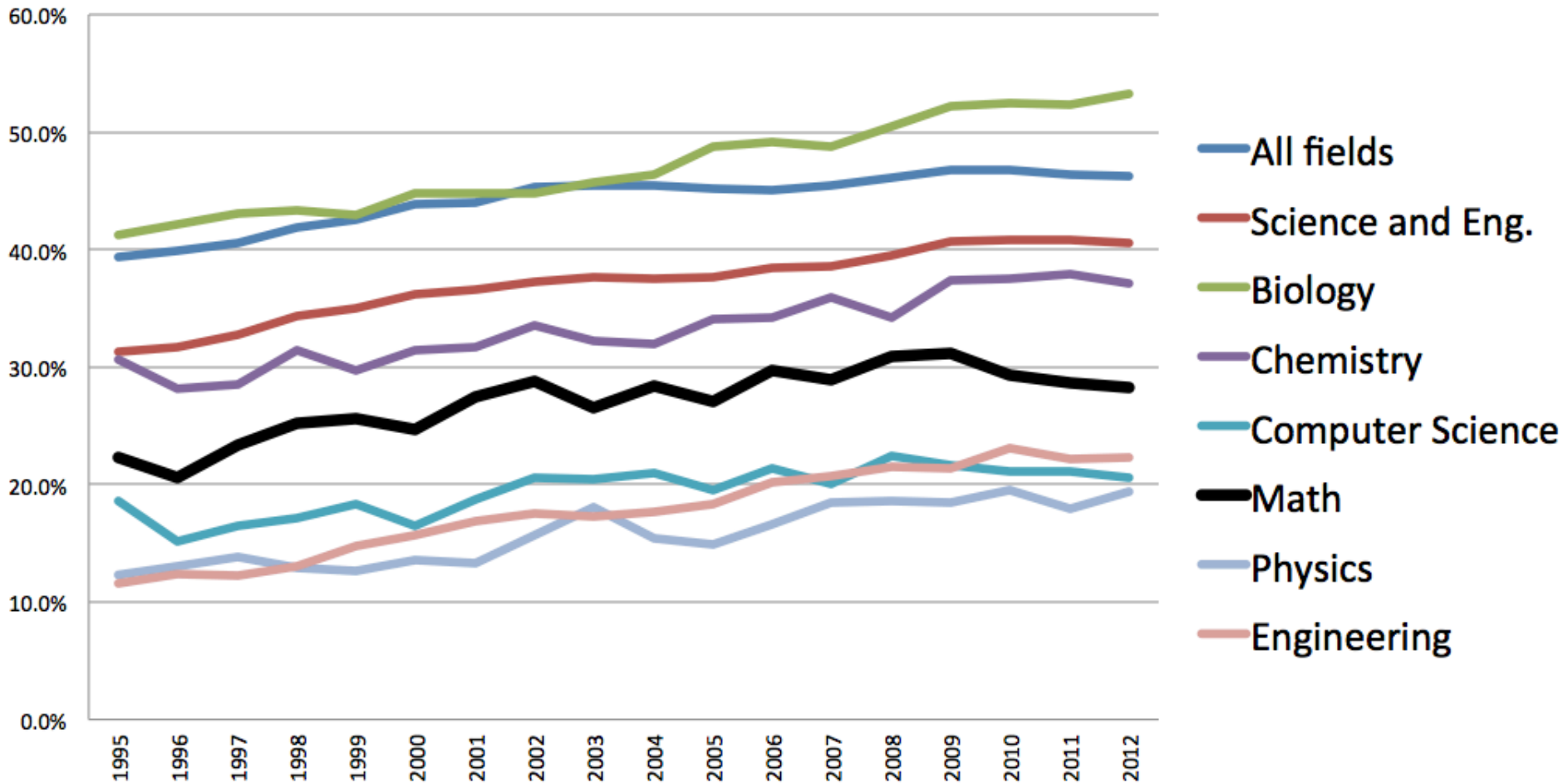
Worse at Ph.D. level – women?

% Female Doctoral Recipients by Discipline



Worse at Ph.D. level – women?

% Female Doctoral Recipients by Discipline



Challenging Scenario:

Scenario #2

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?”

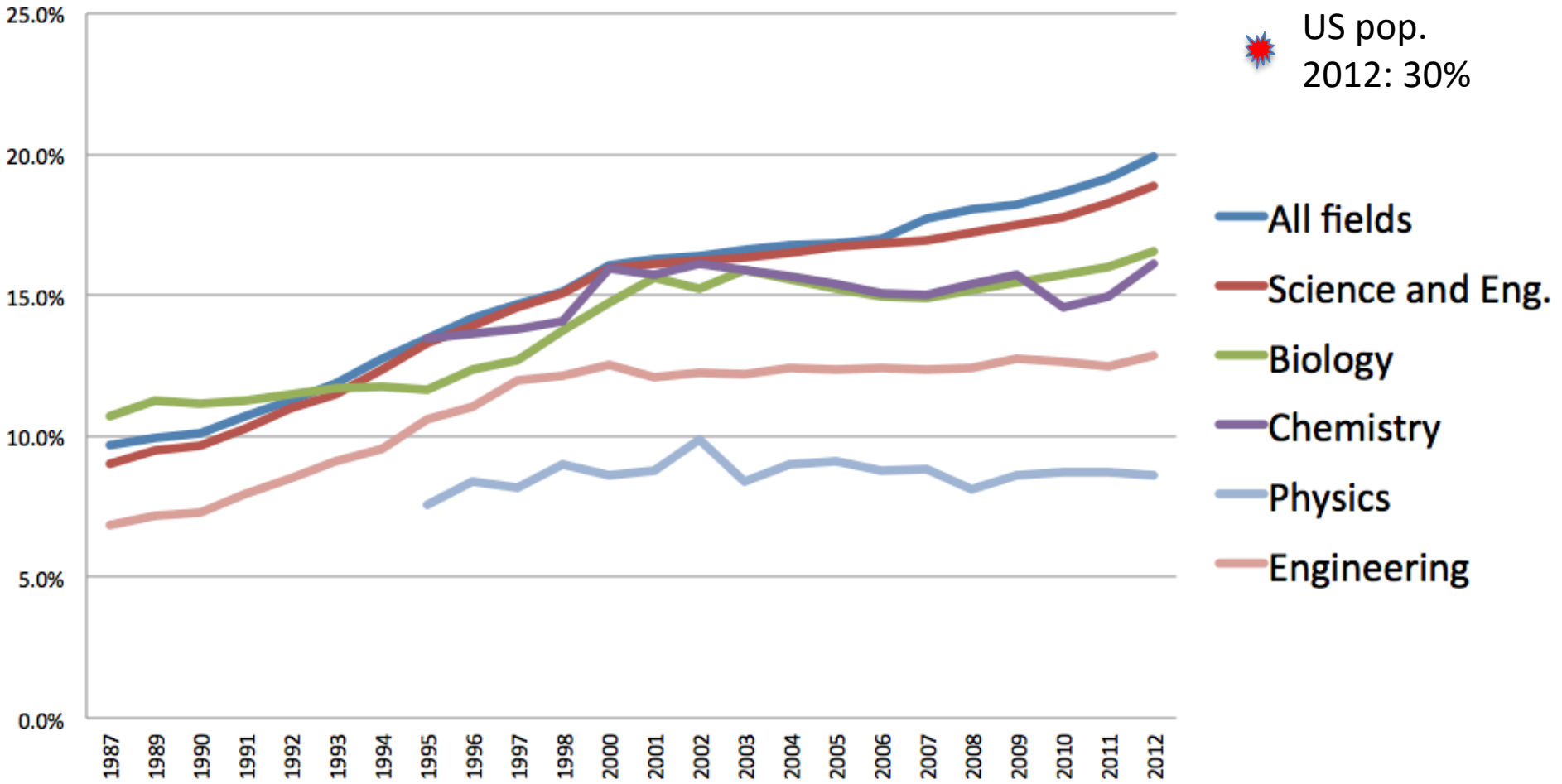
What do you do?

(Type, Wait, Enter, Read)

Minorities in STEM?

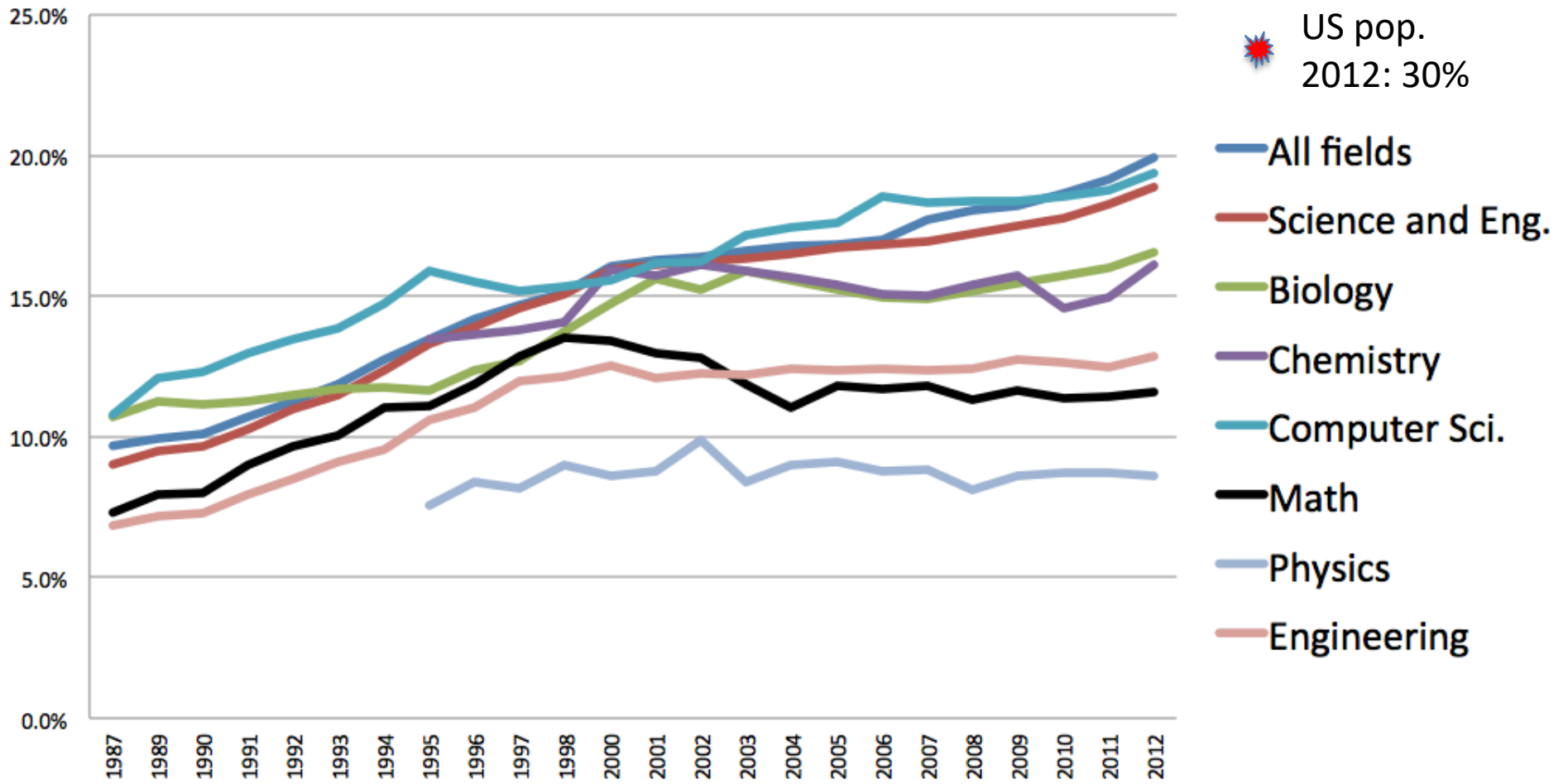


% of Degrees to Under-rep. Minorities



Minorities in STEM?

% of Degrees to Under-rep. Minorities



Challenging Scenario:

Scenario #3

Challenging Scenario:

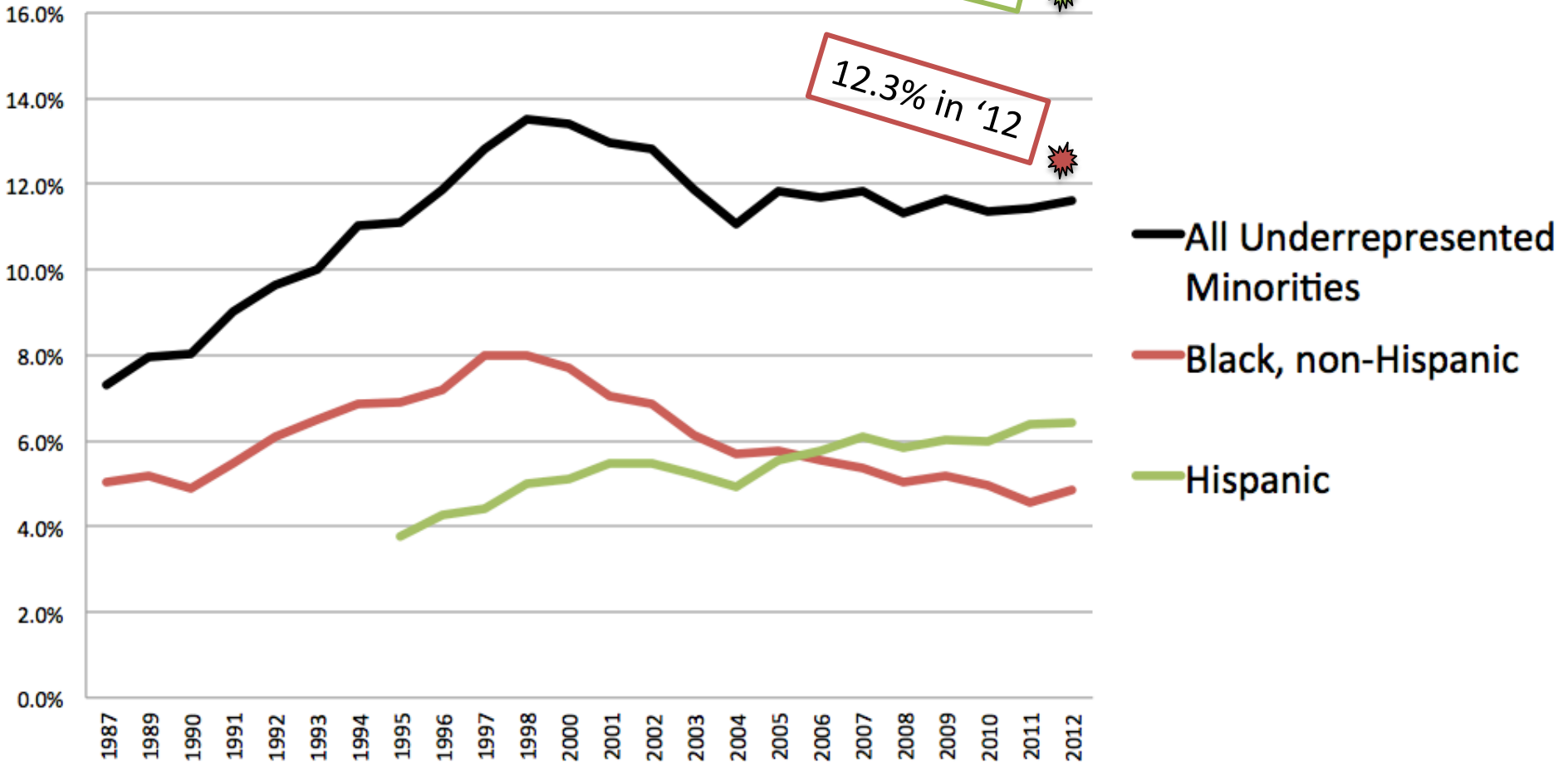
Scenario #3

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)

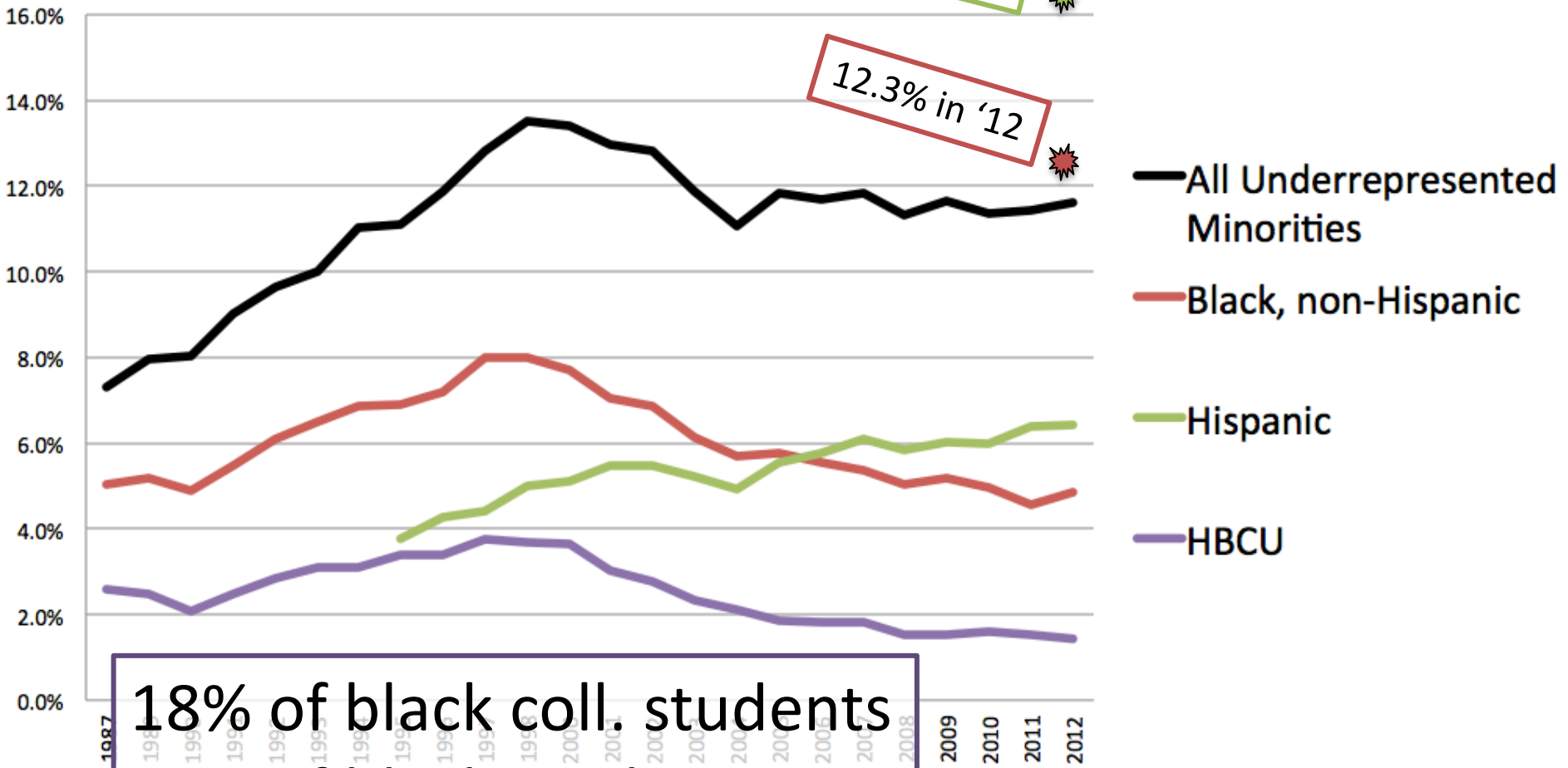
Minorities in mathematics?

Under-rep. Minorities in Mathematics



Minorities in mathematics?

Under-rep. Minorities in Mathematics



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

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)

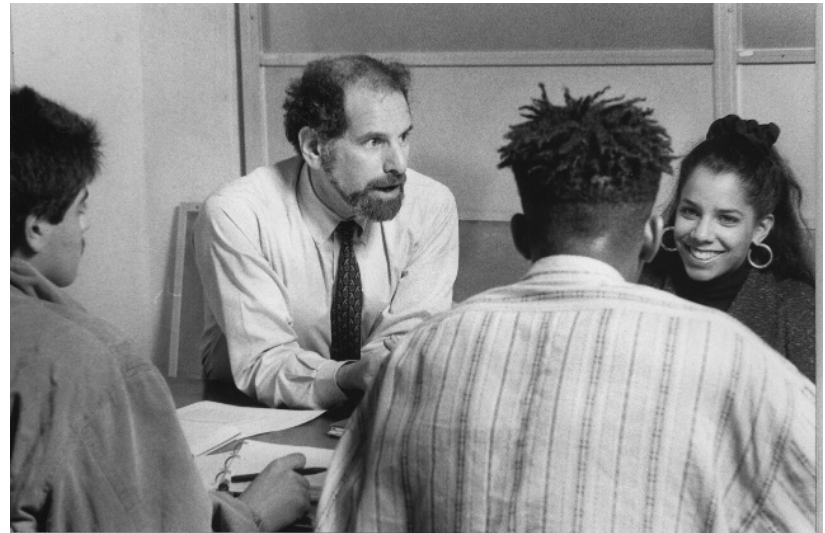
Why Are We Failing?

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



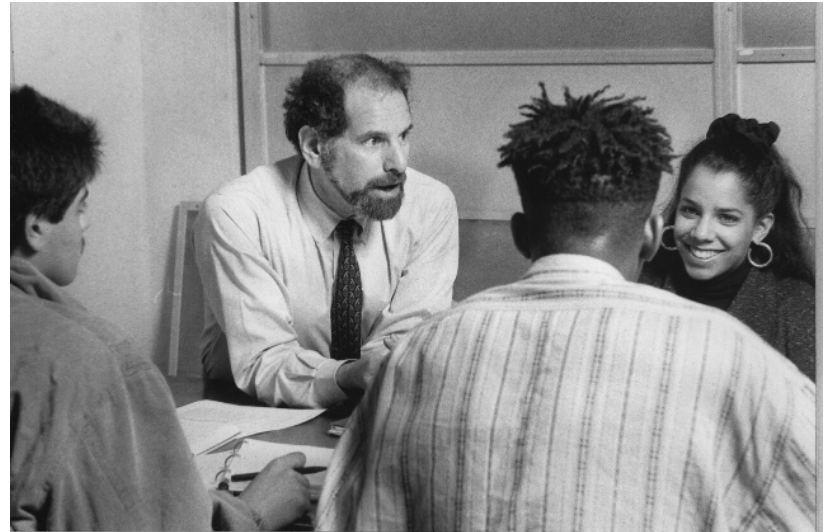
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Data: These guesses are all wrong!
(and all about *the students.*)

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

...students

I teach...

...math

**individualized
instruction**

**speaking
the
content**



...students

I teach...

...math

**individualized
instruction**

**discovery
learning**

**group
work on
rich tasks**

**interactive
problem
sessions**

**speaking
the
content**

...students

I teach...

...math

individualized
instruction

Where are you?

speaking
the
content

discov.
learning

group
work on
rich tasks

interactive
lectures

...students

I teach...

...math



Where are you?

Where is your department?

individual
instruction

the
content

discov.
learning

group
work on
rich tasks

interactive
lectures

...students

I teach...

...math



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

...students

I teach...

...math



more interaction



more learning



“Worst Way to Teach” (Bressoud)

Physics Education (Mazur, Hestenes)

Nat. Academy of Sciences (Freeman)

...students

I teach...

...math

greater equity

Interaction closes gaps!

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

...students

I teach...

...math



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

...students

I teach...

...math

← 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.

...students

I teach...

...math



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?



...students

...math

Teach students ...



...students

...math

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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