Helping Students Engage and Thrive
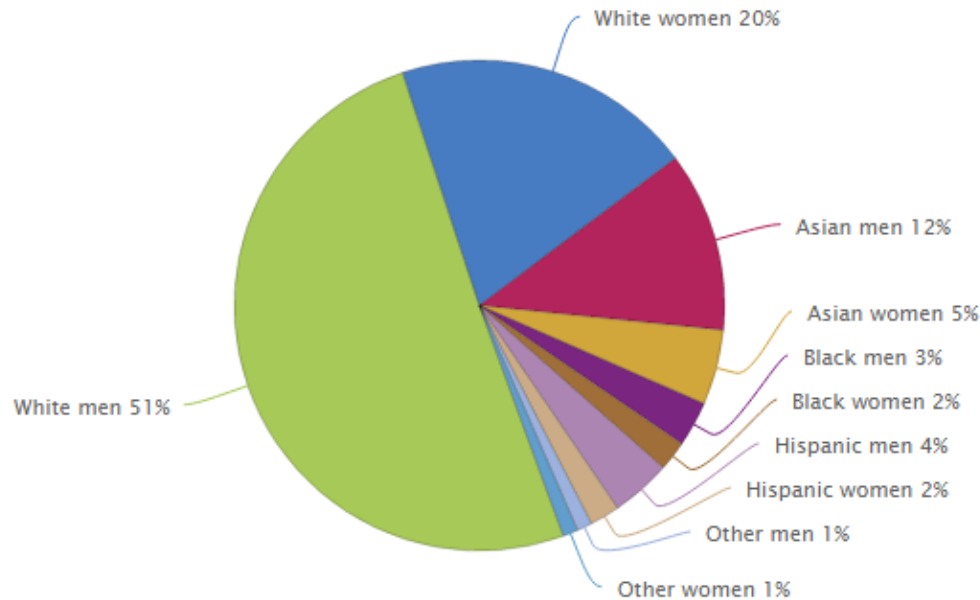
Active STEM Classrooms

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Spring 2017

Who are our students and how can we best help them thrive?

Underrepresentation in STEM

Scientists and engineers working in science and engineering occupations: 2013

View: Chart | Table

- White women 20%
- Asian men 12%
- Asian women 5%
- Black men 3%
- Black women 2%
- Hispanic men 4%
- Hispanic women 2%
- Other men 1%
- Other women 1%
- White men 51%

NOTE: Hispanic may be any race. Other includes American Indian or Alaska Native, Native Hawaiian or Other Pacific Islander, and multiple race.

National Science Foundation | National Center for Science and Engineering Statistics (NCSES) | Contact Us
Women, Minorities, and Persons with Disabilities in Science and Engineering | Arlington, VA | NSF 15-311 | January 2015

Women in STEM fields: the numbers
https://www.nsf.gov/statistics/2015/nsf15311/digest/theme2.cfm#economics

Underrepresentation in STEM

Employment status

Reasons for not working among scientists and engineers: 2013
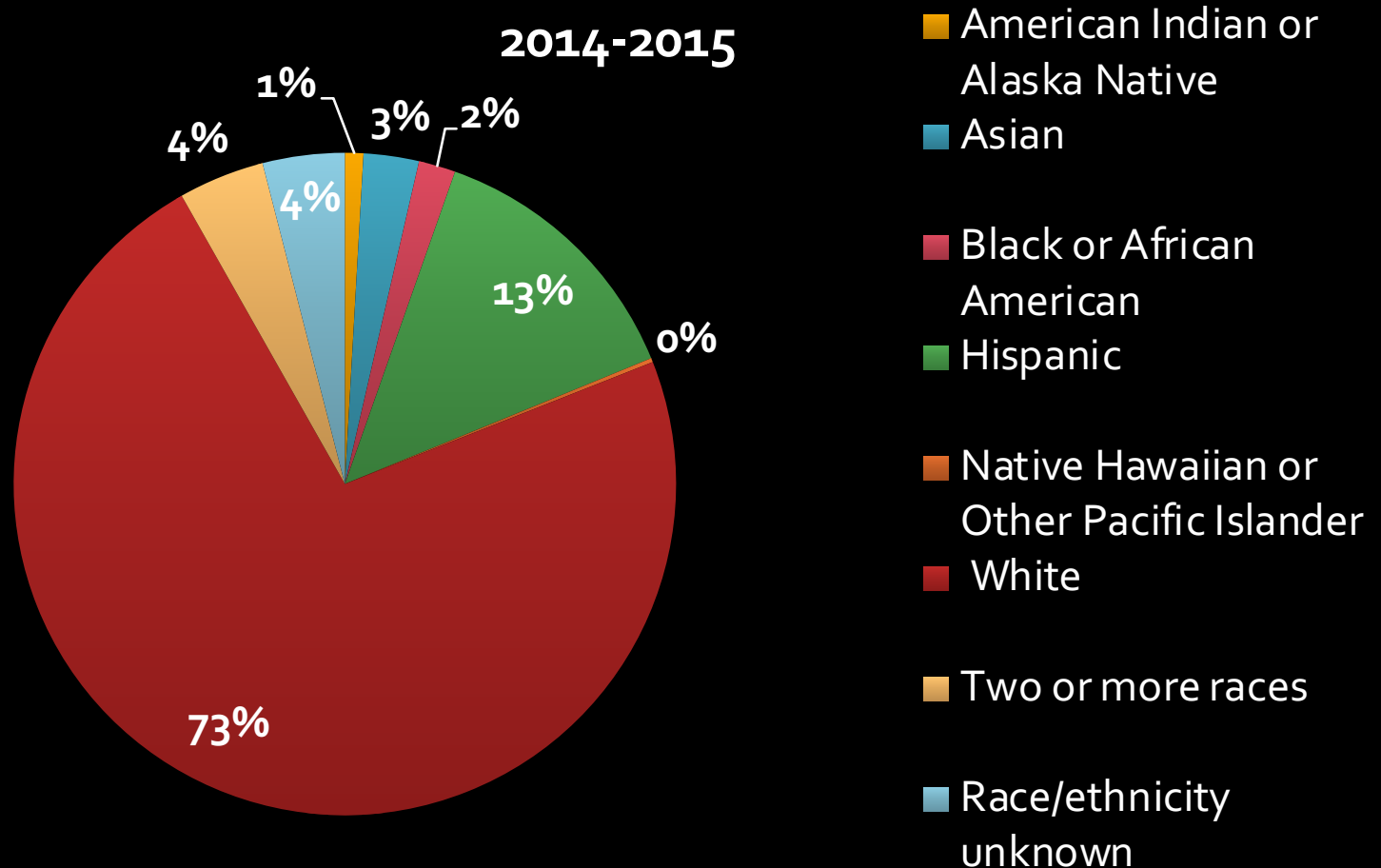
View: Chart | Table

URM = underrepresented minority.
NOTE: Not all reasons are shown; respondents could select more than one reason.

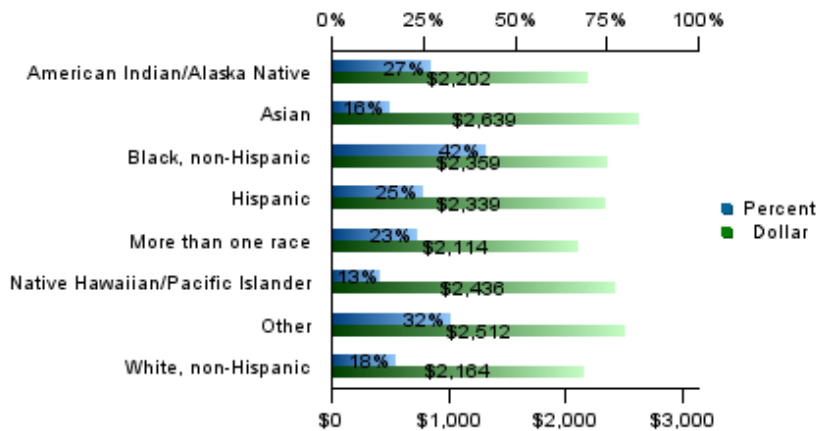National Science Foundation | National Center for Science and Engineering Statistics (NCSES) | Contact Us

Women, Minorities, and Persons with Disabilities in Science and Engineering | Arlington, VA | NSF 15-311 | January 2015

Full NSF Report 2015
https://www.nsf.gov/statistics/2015/nsf15311/nsf15311.pdf

Addressing Diversity in STEM:
Financial aid indicators

Total Community College Students Receiving Federal Pell grant by Race\-Ethnicity

Race/Ethnicity	Percent	Dollar
American Indian/Alaska Native	27%	$2,202
Asian	16%	$2,639
Black, non-Hispanic	42%	$2,359
Hispanic	25%	$2,339
More than one race	23%	$2,114
Native Hawaiian/Pacific Islander	13%	$2,436
Other	32%	$2,512
White, non-Hispanic	18%	$2,164

Source: NPSAS Note: Negative values indicate insufficient sample size.

Total Community College Students Receiving Federal Pell grant by Gender

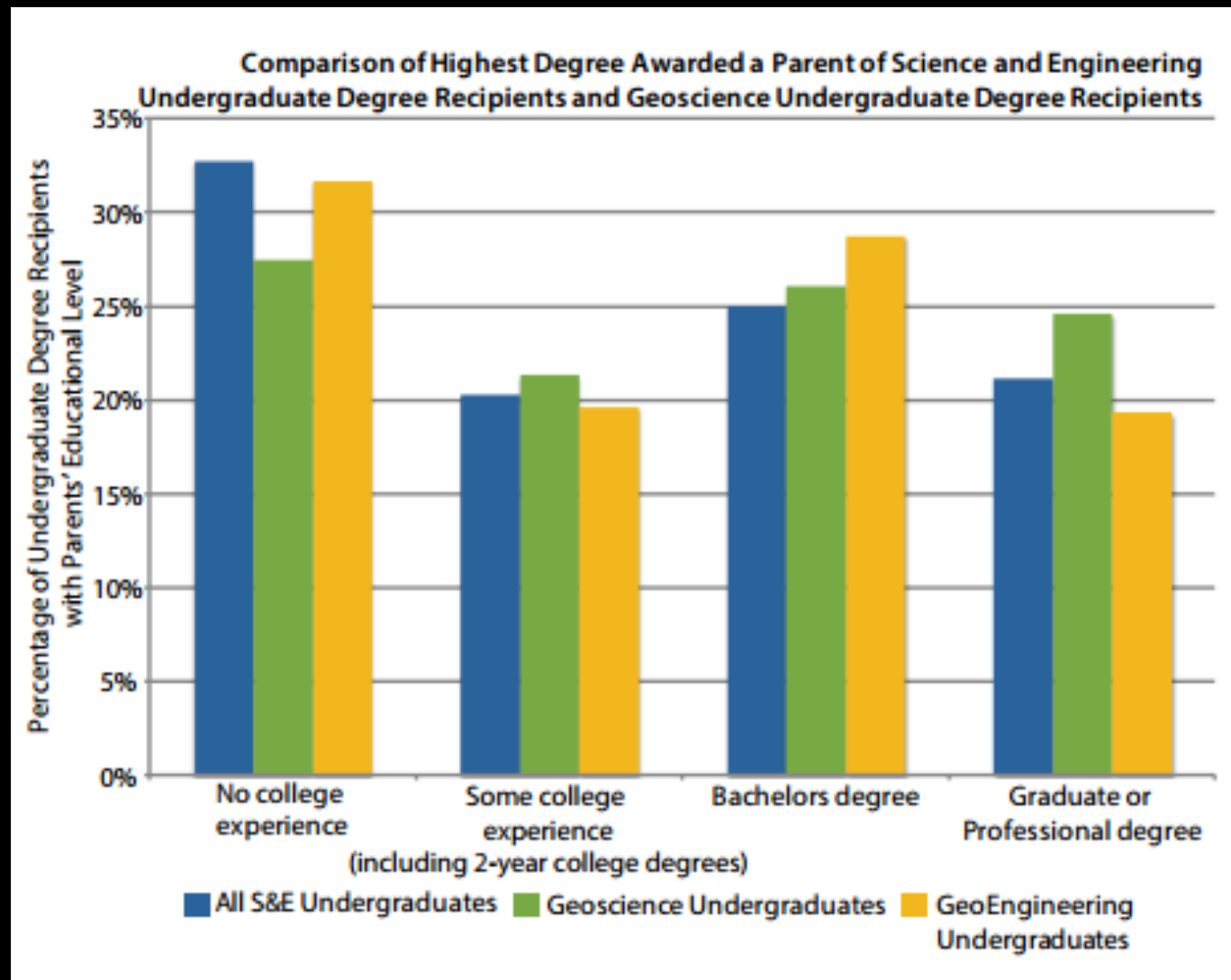| Gender	Percent	Dollar
Female	27%	$2,264
Male	17%	$2,291
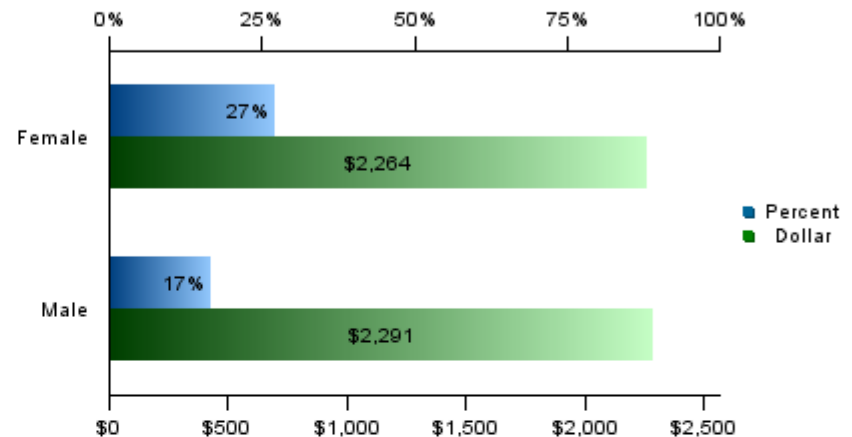
Source: NPSAS Note: Negative values indicate insufficient sample size.

Higher percentages of women and minorities receive Pell Grants at the Community College level

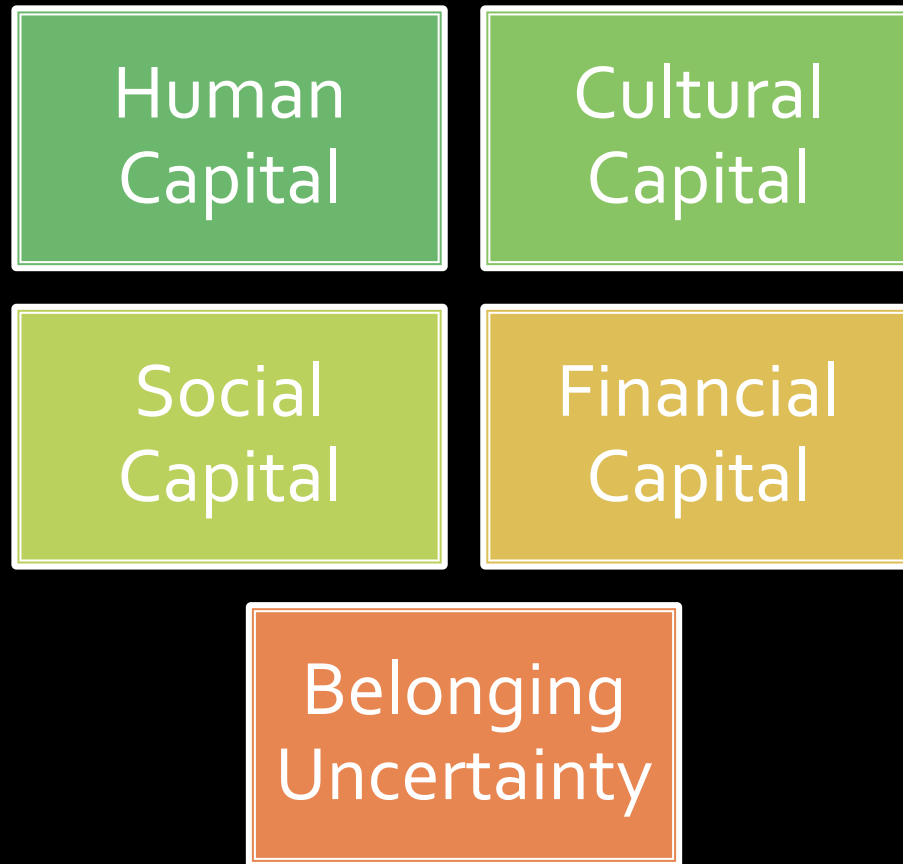*Data from AACC and AGI Status of the Workforce reports

Addressing Diversity in STEM:
First generation (FG) Students

Comparison of Highest Degree Awarded a Parent of Science and Engineering Undergraduate Degree Recipients and Geoscience Undergraduate Degree Recipients
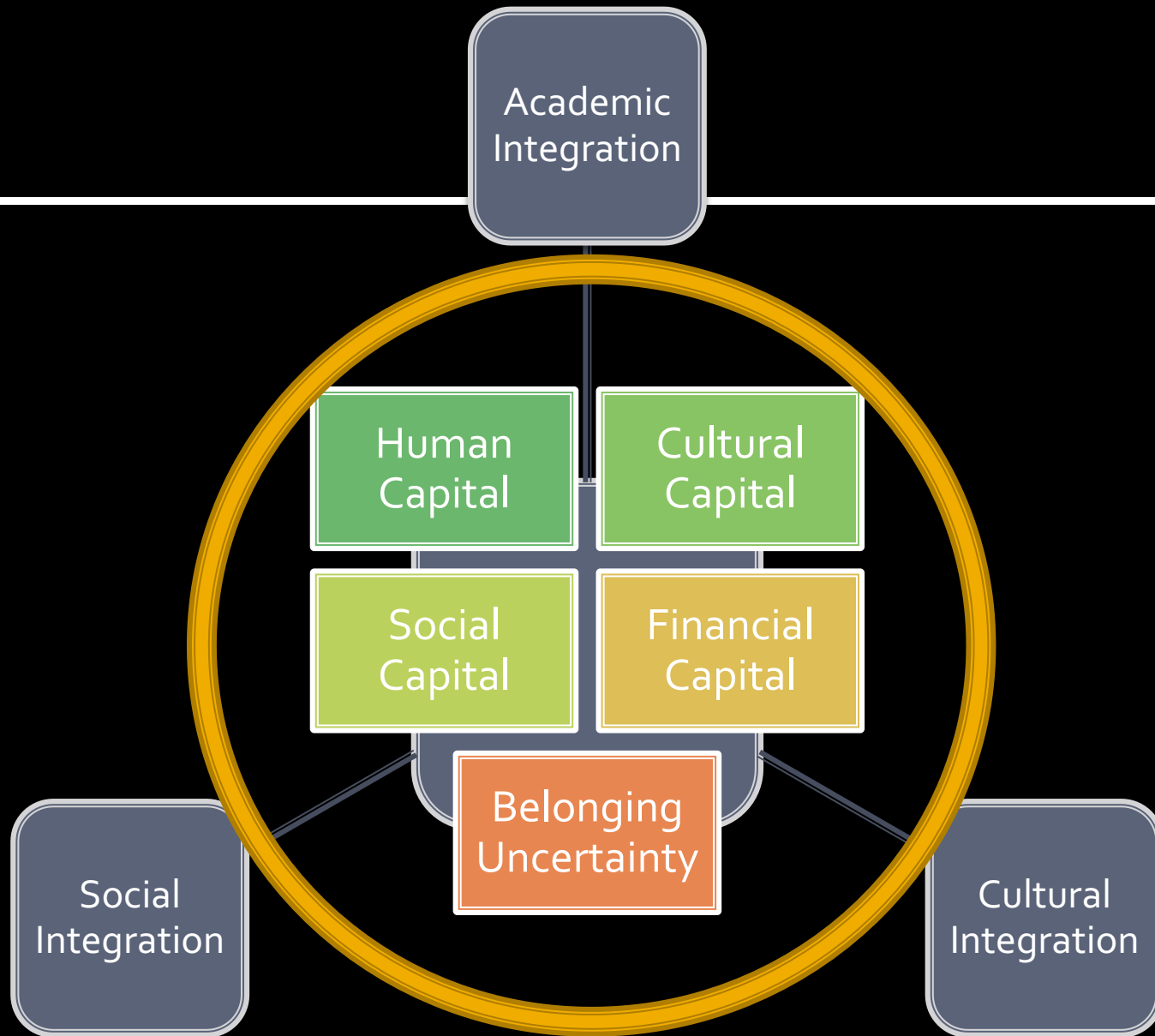
LIFG Students in STEM

- The "Invisible" minority
- RRCC is rapidly becoming a predominantly LIFG institution
- Students sense of belonging is often impeded*

Student Barriers to Success - URM/LIFG

Human Capital	Cultural Capital
Social Capital	**Financial Capital**

Belonging Uncertainty

Walton and Cohen (2007), Ward, et al (2012), Schwalbe (2007)

Walton and Cohen (2007), Ward, et al (2012), Schwalbe (2007)

Communication works!

- Talk to your students
- Explain your reasoning to your students
  - Why do you do things the way you do ?
- Make expectations clear, but also that you believe they can achieve them
- Outline clear paths for success

Active Learning Works!

Why Active Learning?

- Alignment with research on how students learn
- Addresses the changing nature of students (info access)
- Supports a transdisciplinary shift
- Employers also want non-cognitive skills
- Balance depth vs. breadth of material

Active learning

Active techniques include:
- Group work
- Activities
- Project based Learning
- Inquiry activities
- Discussions that engage students in problem-solving and deep processing of information.

Active learning works

- Group work: Assigned or self-selected groups
- Lecture options: Traditional ,Flipped, Hybrid
- Interactive lectures (clickers or other input)
- Discovery activities – inquiry labs
- Design projects
- Problem Based Learning (PBL)
- Case Studies
- Service learning projects

Common Student Barriers to Engagement in the Classroom

- No sense of belonging
- Lack of self-advocacy
- Difficulty making social connections
- Time management
- Preparation for class

What closes the achievement gap?

- Increasing student engagement
- Connecting the student to community
- Understanding cultural context
- Creating a multi-contextual environment

Group work in the classroom

- New whiteboards allow space for student groups to work
- Ideas:
  - Warm-up activities or problems
  - Context rich problems
  - Brainstorming
  - Think, pair, share problems

Group work in the classroom

- Group selection
  - Students self-select into groups of 3-4
  - Instructor selection – need to do student surveys to gather info about background/level in math
- Groups
  - Same all semester (works well for self selected)
  - Mix it up every 3-4 weeks (works well for instructor selected)
- Interaction between groups and instructor is crucial for success

Lecture class time

- Traditional lecture
  - Find ways to directly engage students – Clicker questions, Socratic method
- Hybrid lecture – active classroom
  - Mixture of lecture and active learning strategies
  - Additional content online
- Flipped model
  - Most background material covered in an online format
  - 80% of class time used for activities and problem solving

Flipped classroom strategies
Best practices

- 3-12 minutes for video segments (7 minutes is optimum for student engagement)
- Direct Engagement: Some interaction with the video content (multiple choice question, short response)
- Screen capture seems to be preferred
- Maximizing class time for strategic problem solving and student/teacher interaction
- Train the student on HOW to interact with the online content
- Feedback cycle

ENGAGE and INSPIRE

Activity 1:
Student Engagement Inventory

Student Research Opportunities

- Opportunities for all classes:
  - STEM Expo 4/26-4/27
  - Claro/RedTalks submissions
  - History WWI day (1910-1925) 4/6

- Opportunities for Students
  - STEM Scholars REU placements
  - National internship opportunities
  - Local internship opportunities

STEM EXPO

Presentations available on writing abstracts and posters:

http://www.rrcc.edu/science

Students submit abstracts online and sign up for a time:

http://www.rrcc.edu/science

Student Poster Session – students are present at one of the two times

Posters will be left up both days

- Wednesday April 26 10-12pm
- Thursday April 27 1 – 3pm

Grants and STEM

STEM initiatives http://www.rrcc.edu/stem

- Idea Lab
- STEM Scholars
- Engineering Club, Geology Club, Robotics Club
- NASA Space Grant
  - DemoSat Team (April 9th launch)
  - Robotics Competition (April 16th)
  - Eclipse Team (August 21, 2017 eclipse)

Resources: InTeGrate

- http://serc.carleton.edu/integrate/in

Activity focus

- Short lecture sections to connect content
- Weave in activities/group work
- Group problem solving
- Invite discussion
- Mix it up!

Research in the Classroom

- Think about data oriented research projects
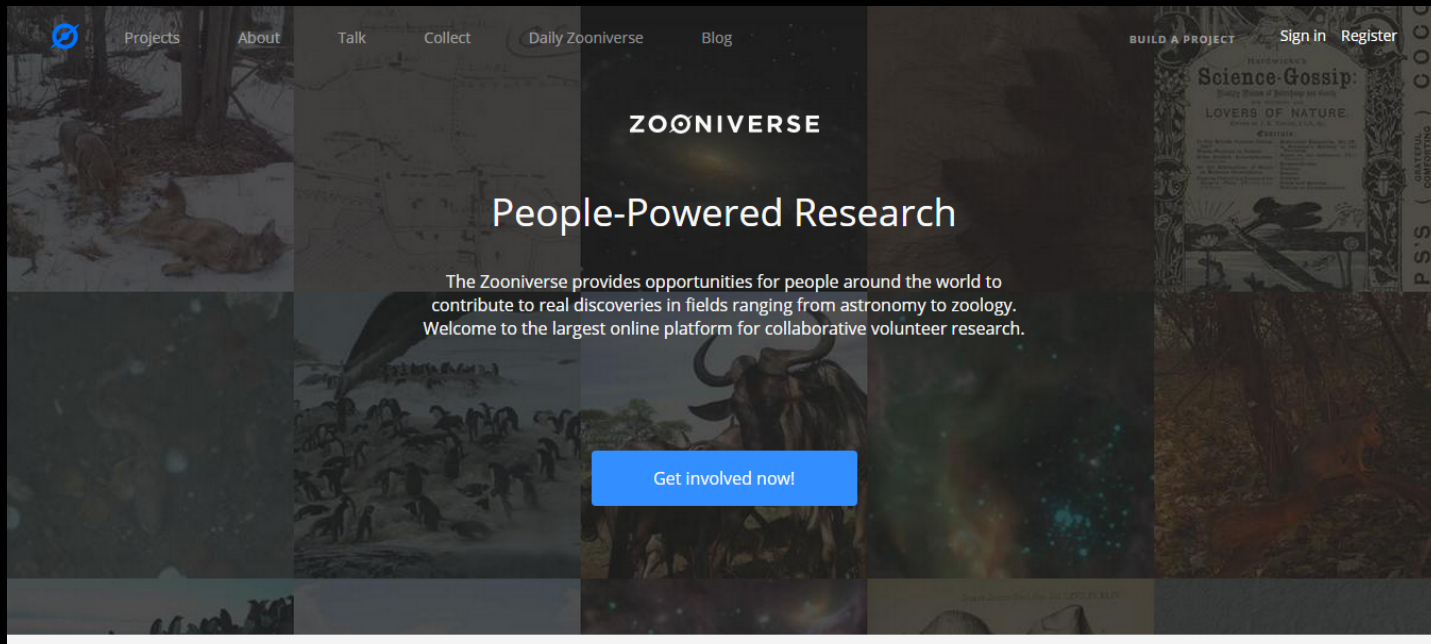- Lots of free data available
- Interdisciplinary projects

Access to Data

Lots of free, federal information:
- www.data.gov
- Examples:
  - http://coastwatch.pfel.noaa.gov/erddap/index.html
  - http://www.ncdc.noaa.gov/
  - http://opendata.cern.ch/?ln=en
  - https://data.nasa.gov/
  - http://serc.carleton.edu/sp/library/google_earth/activities.html

Citizen science projects

- https://www.zooniverse.org/#/

Activity 4: Survey and Action Plan

- https://goo.gl/forms/vqu7FiHVArS8NxZg1