Diversity, Equity, and Inclusion: SAGE 2YC Resources for the Geoscience Community

Carol J. Ormand, SERC, Carleton College
R. Heather Macdonald, Geology, College of William and Mary
Eric Baer, Geology, Highline College
Rachel Beane, Earth and Oceanographic Science, Bowdoin College
Jan Hodder, OIMB, University of Oregon
John McDaris, SERC, Carleton College
Kristin O'Connell, SERC, Carleton College

Overview

- The *SAGE 2YC: Faculty as Change Agents* project
- Project resources for the geoscience community
  - Materials for professional development workshops
    - Diversity in action: Broadening participation through strategies for inclusion
    - Supporting students' sense of belonging
    - Building students' science identity
  - SAGE Musings
    - Growing collection of >50 posts, 18 of which are relevant to broadening participation in STEM

SAGE 2YC: Faculty as Change Agents project goals

- Build a **sustainable national network** of 2YC leaders (change agents) who catalyze change at multiple levels from their courses to institutions in their local regions and within the community of practice;
- Implement high-impact evidence-based instructional and co-curricular practices that **support the academic success of all students, broaden participation, and promote students' professional pathways** into geoscience; and
- **Investigate models of professional development** for full-time and adjunct 2YC geoscience faculty that promote the cycle of innovation, where faculty learn from the research of others, make changes in their own practice, and share what they have learned with the education community.
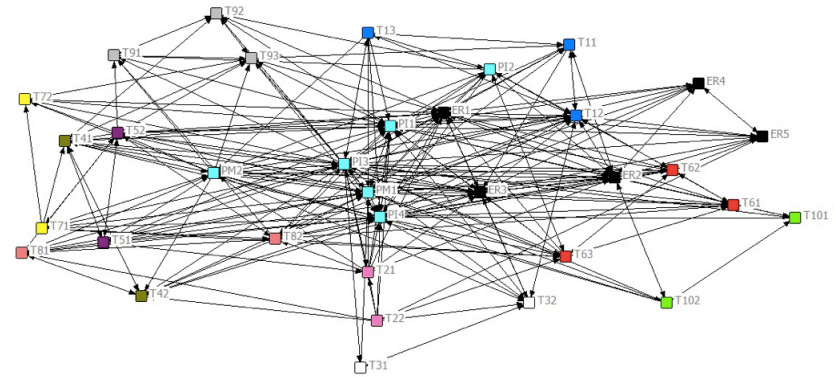
SAGE 2YC project resources

- Incorporate research into practice
  - Promote and support the participation, success, and continuation of a diverse population of students in geoscience courses, programs, and careers
- Promote a culture of diversity, equity, and inclusion at institutional and national scales
- Model transformative change in academia
- Are designed for re-use

Materials for professional development workshops

Developed for our SAGE 2YC faculty workshop sessions

- Diversity in action: Broadening participation through strategies for inclusion
- Supporting students' sense of belonging
- Building students' science identity

Follow the principles of **effective workshop design:**
- Session activities follow directly from the goals
- Participants are actively engaged in learning
- Materials and activities are evidence-based
- Sessions are planned to the minute, including time for reflection and action planning

Diversity in action: Broadening participation through strategies for inclusion

Session goals: Participants will

- **Learn about the research** on issues of broadening participation;
- **Explore strategies** to design an inclusive classroom and geoscience program; and
- **Develop ideas for implementation** of inclusion strategies in their work.

Workshop session structure and materials:

30 minutes	**Think-pair-share** discussions: **scenario**
20 minutes	**Presentation: research** on the lack of diversity in geoscience & STEM
50 minutes	**Gallery walk: Posters about strategies for inclusion**, followed by
60 minutes	In-depth small group discussions
40 minutes	Action planning

Diversity in action: Broadening participation through strategies for inclusion

Think-pair-share discussions about **scenarios**

Demoralized by my colleagues

Our college is recognized as a Hispanic–serving Institution but rarely do we see Hispanic students in the geoscience courses. Knowing that diversifying the geoscience work force is a national priority I asked to have this topic added to the agenda of our upcoming departmental meeting. I presented some information on this issue that I found on the AGI website and suggested that we think of ways to encourage Hispanic students to take our courses. *[Colleagues' responses were less than enthusiastic….]*

Diversity in action: Broadening participation through strategies for inclusion

Presentation: research on the lack of diversity in geoscience & STEM

Six-Year Outcomes and First Completion for Students Who Started at Two-Year Public Institutions in 2010 by Race and Ethnicity (N=1,089,776)*
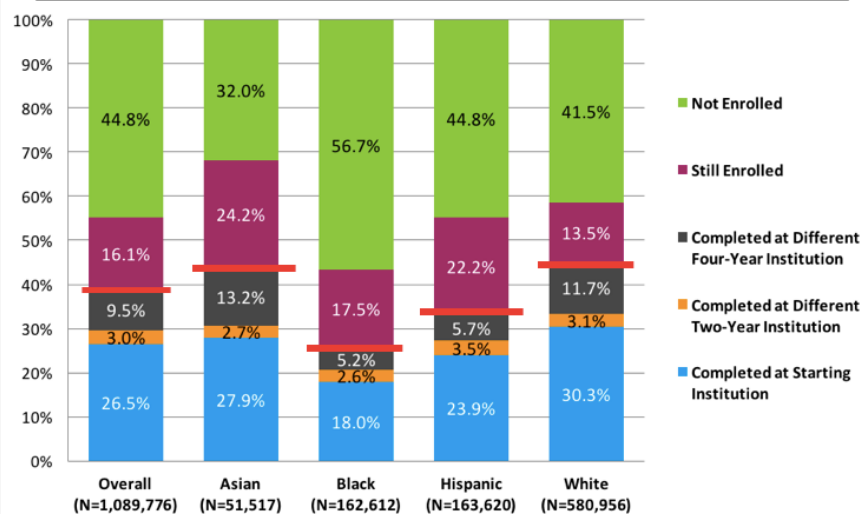
Shapiro, D., Dundar, A., Huie, F., Wakhungu, P., Yuan, X., Nathan, A & Hwang, Y., A. (2017, April). Completing College: A National View of Student Attainment Rates by Race and Ethnicity – Fall 2010 Cohort (Signature Report No. 12b). Herndon, VA: National Student Clearinghouse Research Center.

Diversity in action: Broadening participation through strategies for inclusion

Gallery walk: Posters about strategies for inclusion

Develop an Inclusive Community

Goal: Consistently communicate to all students that they are welcome and can succeed in the geosciences.

Advantages:
- Gives students a sense of belonging
- Promotes student engagement and success
- Allows multiple voices to be heard

Strategies

Make implicit rules visible: Be explicit about your expectations for classroom participation, preparation for class, help-seeking, office hours, group work, and interactions with you and between students.

Recognize implicit biases: Develop your own and students' awareness of implicit biases and how they can impact interpersonal interactions. Make a habit of considering the possibility of bias in your own decision-making.

Affirm multi-cultural perspectives: Explicitly ask students to consider the perspectives of different cultures in relation to the human dimensions of the geosciences.

Community values statement: Post a statement in your classroom and/or department about valuing the perspectives and contributions of all students and stating the expectation that all members of your community will treat each other with respect.

Develop an "asset model" mindset: Look for evidence of students' capabilities. Assume that all students have the capacity to succeed in your course, given appropriate opportunities and support.

Offer micro-validations: When students persist in the face of difficulty or act like scientists in training (e.g., generate hypotheses or ask what data they could use to test a hypothesis), point out that these are the behaviors that will make them successful as students and as scientists.

Implementation
- Post your community values statement in your department and refer to it in your syllabus.
- Describe your expectations and explain terms and policies that may have different meanings in other cultures (e.g., what constitutes plagiarism).
- Take an interest in your students' perspectives.

References
1. Alber, R. 2013. Tools for Teaching: Ditching the Deficit Model. Online at https://www.edutopia.org/blog/teaching-tool-ditching-deficit-model-rebecca-alber.
2. Bartlett, T. 2017. Can We Really Measure Implicit Bias? Maybe Not. Chronicle of Higher Education, available at http://www.chronicle.com/article/Can-We-Really-Measure-Implicit/238807?cid=trend_right_a.
3. Greenwald, Anthony G.; McGhee, Debbie E.; Schwartz, Jordan L. K. 1998. Measuring individual differences in implicit cognition: The implicit association test. Journal of Personality and Social Psychology, Vol 74(6), pp. 1464-1480.
4. Ladson-Billings, G. 1995. Toward a Theory of Culturally Relevant Pedagogy, American Educational Research Journal, v. 32, n. 3, pp. 465-491.
5. Nelson-Barber, S. and Trumbull Estrin, E. 1995. Bringing Native American Perspectives to Mathematics and Science Teaching, Theory Into Practice, v. 34, n. 3, pp. 174-185.

This poster was developed by Carol Ormand, SERC at Carleton College, for SAGE 2YC: Supporting and Advancing Geoscience Education at Two-Year Colleges.

Make implicit rules visible to all students

Goal: Academic culture contains many "hidden" or implied expectations for classwork and student behavior that may be clear to some students but not all. Making these expectations more obvious can help level the playing field for all students.

Advantages: Even among those with some understanding, these unwritten rules for academic success can vary by course, by program or by institution, so making them clear is helpful for all of your students.

Strategies

Illuminate the implicit rules for:
- student preparation for class
- participation in class
- group work
- office hours

Starting with the syllabus, describe your expectations and explain terms and policies that may have different meanings in other cultures (e.g., what constitutes plagiarism).

Give concrete examples
Before leading class discussion, offer samples of specific phrases that students can use to make their point, to respond to another student, to change the topic, and so on.

Encourage help-seeking
Students may view asking for help as a sign of weakness. Encourage students to view office hours as an opportunity to confirm understanding of course content, learn about helpful resources, clarify expectations for assignments, and explore research opportunities.

Disagreement is okay
Some students may feel that it is disrespectful to challenge authority, whether critiquing a published article or asking questions about a presentation by the instructor. Be explicit about the value we place on a respectful exchange of differing perspectives. Underscore that there is often more than one way to approach a problem or interpret findings and we are eager to hear multiple perspectives. As one example, provide sample phrases that students can use to introduce differing ideas: "It is possible to approach this problem from another angle" or "We might consider an alternate explanation" or "I interpreted the issue in a (slightly) different way…"

Social behavior is part of the equation
Social aspects of common interactions in an academic setting are often unspoken. Students may benefit from guidance on how to write emails to their professors, make an appointment for extra help, interact with other students in labs or study groups. These initial points of contact can have a direct impact on the success of these interactions.

Implementation
- Describe expectations on the syllabus.
- Talk about implicit rules for your course with your students. Give a short presentation and/or distribute a handout.
- Give an assignment that requires meeting with the instructor as a model for office hour meetings.

References
1. Burk JA, Zeman JL, Wulf KA, Robison JE, Dickter CL (2015) Supporting neurological differences on college campuses: The Neurodiversity Initiative at the College of William and Mary. Presented at the Society for Neuroscience Meeting. http://www.wm.edu/sites/neurodiversity/resources/forfaculty/index.php
2. Deussen, T, E. Autio, B. Miller, A. Lockwood, and V. Stewart (2008). What Teachers Should Know About Instruction for English Language Learners: A Report to Washington State.
3. Burk J and LeBlanc, PH (1993) Implicit Nonverbal Rules in the Classroom: A Study of Gender and Status Differences. Presented at the Annual Meeting of the Speech Communication Association
4. http://communication.utsa.edu/leblanc/articles/art02.pdf

This poster was developed by Heather Macdonald, College of William and Mary, for SAGE 2YC: Supporting and Advancing Geoscience Education at Two-Year Colleges.

Supporting Students' Sense of Belonging

Session goals: Participants will

- **Be able to define "belonging uncertainty"** and describe how it undermines student academic success;
- **Know about several key strategies** for fostering students' sense of belonging; and
- **Have a plan** to implement at least one new strategy to foster students' sense of belonging in one or more courses.

Workshop session structure and materials:

3 minutes	Reflection
20 minutes	**Presentation**, including a **think-pair-share discussion about an intervention**
50 minutes	**Jigsaw** using excerpts from research literature
10 minutes	Action planning
5 minutes	Wrap-up discussion / Q&A with session leaders

Supporting Students' Sense of Belonging

Presentation summarizing key points from the research literature

Key Findings from the Research on Sense of Belonging

- **Everyone** is susceptible to concerns about social belonging

- **Belonging uncertainty** – is especially strong at transition points, such as moving from high school to college or from a 2YC to a 4YCU (Aguilar et al., 2014, Stephens et al., 2014).

- Underrepresented students (including socioeconomic, race, gender, disabilities) are **disproportionately susceptible** to concerns about social belonging, and these concerns may negatively affect their academic performance (e.g. Aguilar et al., 2014; Walton & Cohen, 2011)

  - Academic and social setbacks, which are a normal part of transitioning to college, can instead feel like evidence of not belonging. This can be compounded by stereotype threat and personal stress.

- There are many tools to **foster belonging** and **normalize transitions** have proven effective, including mentoring, peer cohorts, active learning, incorporating examples of diverse scientists, connecting content to careers, infusing societal relavance as well as noncognitive interventions.
  - Short activities in the classroom
  - Can **dramatically** mitigate belonging uncertainty
  - Positive GPA impacts
  - Benefit all students

Supporting Students' Sense of Belonging

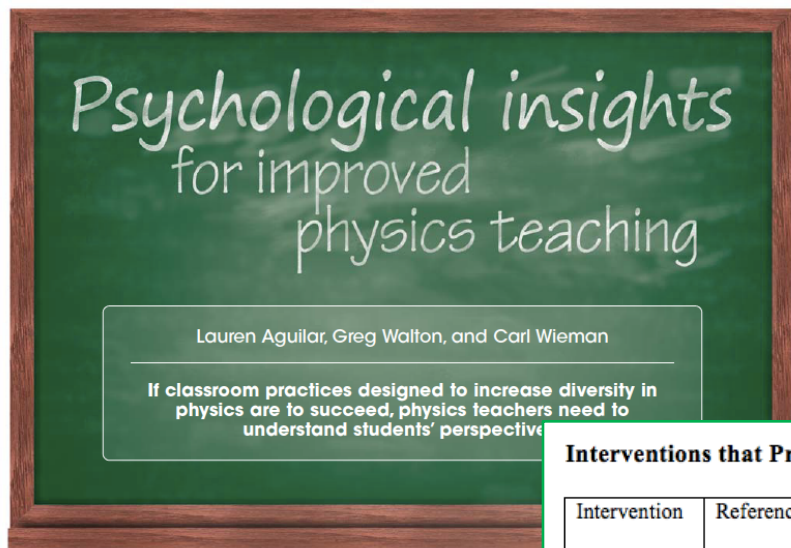**Presentation**, including a **think-pair-share discussion about an intervention**

Is this an effective social-psychological intervention? Why or why not?

Professor Jones wants all her students in a class for potential majors to succeed, and she hopes to increase the diversity of geoscientists. So she schedules a weekly help session for students who might be having difficulty, and she personally invites all the women and minority students to attend. (Modified from Aguilar et al., 2014, which has additional examples)

Supporting Students' Sense of Belonging

Jigsaw using excerpts from research literature

Psychological insights for improved physics teaching

Lauren Aguilar, Greg Walton, and Carl Wieman

If classroom practices designed to increase diversity in physics are to succeed, physics teachers need to understand students' perspective.

Many physics faculty in the US are looking for ways to increase the diversity of the physics community to enhance the long-term health of our field in an increasingly diverse society. They attempt many things to help their students—particularly from historically underrepre-

backfire, undercutting the [...] ment of many students, esp[...] derrepresented groups. For [...] a profoundly nonintuitive fi[...] Many factors contribute[...] in physics, including larg[...] which an individual faculty[...]

Social-Psychological Interventions in Education: They're Not Magic

David S. Yeager and Gregory M. Walton
Stanford University

Recent randomized experiments have found that seemingly "small" social-psychological interventions in education—that is, brief exercises that target students' thoughts, feelings, and beliefs in and about school—can lead to large gains in student achievement and sharply reduce achievement gaps

Interventions that Promote Students' Sense of Belonging

Intervention	References cited	What psychological concern does it address? What message does it deliver to address that concern?	Brief description: Who does what, when?	Results: What is the impact on student academic performance?
Normalizing difficulty with transitions				

Building Students' Science Identity

Session goals: Participants will learn about and share strategies to

- **Infuse career information** in class, on-line, and outside of class;
- **Develop our students' awareness** of the breadth of careers in geoscience; and
- **Help our students to identify as scientists**.

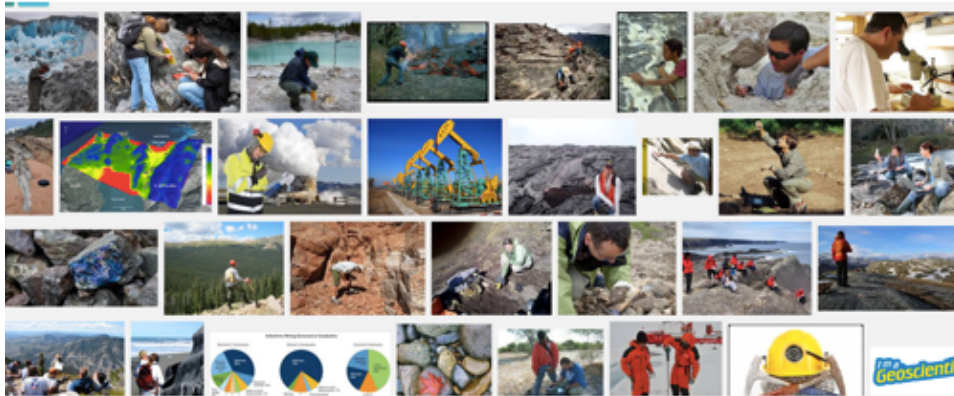Workshop session structure and materials:

20 minutes   **Presentation about science identity**, images of geoscientists, and an example of a "geoscientist profile," modeled after Schinske et al.'s "scientist spotlights"

50 minutes   **Gallery walk** about what we can to do help our students build their science identities

Building Students' Science Identity

Presentation about science identity, images of geoscientists, and an example of a "geoscientist profile," modeled after Schinske et al.'s "scientist spotlights"

Building Students' Science Identity

Gallery walk about what we can to do help our students build their science identities

Science Identity questions:
- What can we do in class (seated or online) to develop science identity in our students?
- What can we do outside of class to develop science identity in our students?

Science Self-Efficacy questions:
- What can we do in class (seated or online) to increase a student's science self- efficacy?
- What can we do outside of class to increase a student's science self-efficacy?

Questions about what Geoscientists do:
- What can we do in class (seated or online) to develop an understanding of what a geoscientist does?
- What can we do outside of class to develop an understanding of what a geoscientist does?

SAGE Musings

Growing collection of more than 50 blog posts, 18 of which are relevant to broadening participation in STEM. For example:

- Who has the capacity to succeed in STEM?
- How social-psychological interventions change academic trajectories
- Supporting women in STEM
- The power of affirming your values
- Cultivating students' voices
- Geoscientist biographical sketches
- Women and minorities in science and engineering

- Evidence-based strategies for mitigating stereotype threat
- Involving students in authentic research
- Micro-validation

SAGE Musings: Women and Minorities in Science and Engineering

Carol Ormand, SERC, Carleton College
published May 17, 2017

There's a lot of talk these days about the importance of broadening participation in the STEM disciplines (science, technology, engineering and mathematics). But how much of a problem is there, and how do the geosciences compare to other STEM fields? What subpopulations are under-represented in the geosciences? How under-represented are they? As Huntoon and Lane noted (2007), citing data from the National Science Foundation, "graduates from bachelor's, master's and doctoral degree programs in the geosciences have lower ethnic and racial diversity than do graduates from any other science, technology, engineering, and mathematics (STEM) field." Moreover, the racial and ethnic diversity of people earning geoscience PhDs in the U.S. has not improved since 2004 (Sidder, 2017). Likewise, while women make up more than half of the undergraduate student population, we earn far fewer than half of the undergraduate degrees in STEM disciplines (NSF, 2017) and we comprise only 23% of the geoscience workforce (Sidder, 2017).

Demographics of the U.S. Population, 2014

In 2014 (the most recent year for which I could find data), the U.S. population between the ages of 18 and 64 was 62% White, 17% Hispanic, 13% Black or African-American, 6% Asian, and 2% all other racial and ethnic groups combined (including, for example, American Indians, Alaska Natives, Native Hawaiians, other Pacific Islanders, and individuals who report more than one race and are not Hispanic) (NSF, 2017). Of course, student populations differ from the overall U.S. population, whether you consider specific institutions or the student population as a whole. In general, however, undergraduate student populations are becoming more diverse. "Most notably, underrepresented minorities, Hispanics in particular, are an increasing fraction of undergraduate students, and whites are a decreasing fraction. In all racial and ethnic groups, more women than men enroll in college" (NSF, 2017).

Racial and Ethnic Diversity in Science and Engineering, 2014

People who identify as Hispanic, Black or African-American, Native Americans, Pacific Islanders, or multi-racial constitute about one-third of the U.S. population, and are under-represented minorities in the STEM disciplines. What we mean when we say that they are under-represented
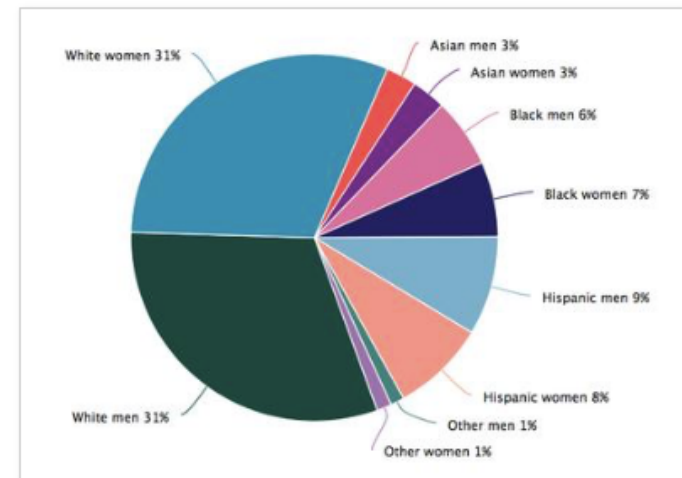
Resident population of the United States ages 18-64, by race, ethnicity, and sex: 2014. Data from the National Science Foundation, 2017.

Resources for the Geoscience Community

- Materials for professional development workshops
  - Diversity in action: Broadening participation through strategies for inclusion
  - Supporting students' sense of belonging
  - Building students' science identity
- SAGE Musings
  - Growing collection of >50 posts, 18 of which are relevant to broadening participation in STEM
- and more on the project website: https://serc.carleton.edu/sage2yc/index.html

https://serc.carleton.edu/sage2yc/index.html