



SAGE 2YC

2YC Faculty as Agents of Change

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

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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

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Materials for Faculty Development Workshops

The materials on this page were developed by the SAGE 2YC: Faculty as Change Agents project team or in collaboration with our team, for the workshops run by the project. We envision these materials being used by and for faculty in professional development workshops, in parallel with our page on [effective workshop design](#). We expect they will be useful to people leading professional development workshops for faculty members, departments, and programs. We hope that these materials will be adopted or adapted, and that they will also be useful as models for developing presentations and session plans for faculty professional development on other topics.

Broadening Participation in the Geosciences / STEM

Broadening participation in STEM, and particularly in the geosciences, is one of the primary goals of the SAGE 2YC project. The geosciences are tied with physics for the least diverse field in the STEM disciplines: science, technology, engineering, and mathematics (e.g. [Huntton and Lane, 2007](#) and [Jodder, 2017](#)). We need to [diversify the geoscience workforce](#), both to strengthen the geoscience workforce and for the benefit of our society as a whole. Faculty members can lead the way, especially when they understand the challenges and the solutions surrounding issues of diversity, equity, and inclusion in STEM.

Diversity in action: Broadening participation through strategies for inclusion

This workshop session is designed to deepen faculty members' knowledge of evidence-based strategies for inclusion. In particular, our goals are to for participants to

- 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.

The strategies highlighted in these materials are applicable across all STEM disciplines. A few of the materials refer to examples in geosciences, but could easily be adapted to other STEM fields. The workshop session is designed to take half a day and includes a think-pair-share discussion of three scenarios, a presentation of research data, a gallery walk with posters highlighting evidence-based inclusive teaching practices, small group discussions, and individual action planning.

[Strategies for inclusion session details and materials](#)

Supporting students' sense of belonging

This workshop session is designed to familiarize faculty members with the research literature on sense of belonging. In particular, at the end

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SAGE Musings: the SAGE 2YC Project Blog

The SAGE Musings blog features bi-weekly posts that address topics related to supporting students' academic success, facilitating students' professional pathways in the geosciences, broadening participation in the geosciences, and catalyzing change. Although written for geoscience faculty at two-year colleges, most posts are relevant for any STEM faculty member. Check out the growing collection of posts and share them with your colleagues.

Sign up here to [receive the blog posts as email messages](#).

SAGE Musings: Who Has the Capacity to Succeed in STEM?

Posted: Oct 11, 2018 by Carol Ormand, SERC, Carleton College

I had an epiphany many years ago. It was in a workshop for geoscience faculty members in their first few years of teaching. One of the workshop leaders told us about a study conducted by Uri Treisman at the University of California, Berkeley. He had noticed that the minority students in his calculus course performed considerably better (Asian students) or considerably worse (Black and Hispanic students) than White students. Rather than assuming that this was a function of their ability to learn calculus, he set out to find out why. And find out he did. It wasn't about their capacity to learn calculus; it was about their study habits. [Read](#)

SAGE Musings: Using Exams to Promote Deep Learning

Posted: Sep 27, 2018 by Christopher D'Leonardo, De Anza College

Over my years of teaching, I have learned two lessons:

1. We don't teach; students learn. All real learning is active and a biologic process that occurs in the brain. What we do is create educational environments and experiences that foster learning.
2. Though we should never teach to the test, (most) students learn to the test.

In my Introductory Geology class, I leverage these lessons to engage my students in deep learning via case-based, partially collaborative, multiple-choice exams. I know that using multiple-choice exams to promote deep learning might sound impossible. Bear with me; let me describe how this model works for me and show you some examples, and you can judge for yourself. [Read](#)

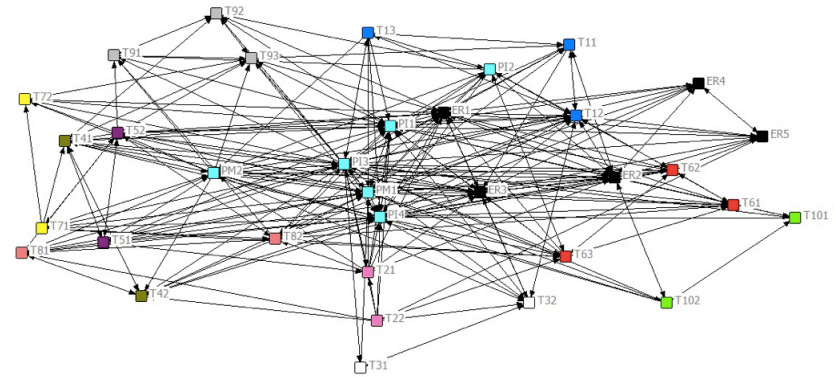
SAGE Musings: Making the Most of Office Hours

Posted: Sep 13, 2018 by Carol Ormand, SERC, Carleton College

Do you ever wish that your students would take better advantage of your office hours? Do they apologize to you for "interrupting" on those rare occasions when they do come to your office, even during office hours? Some students feel that going to a professor's office hours is both an admission that they are struggling

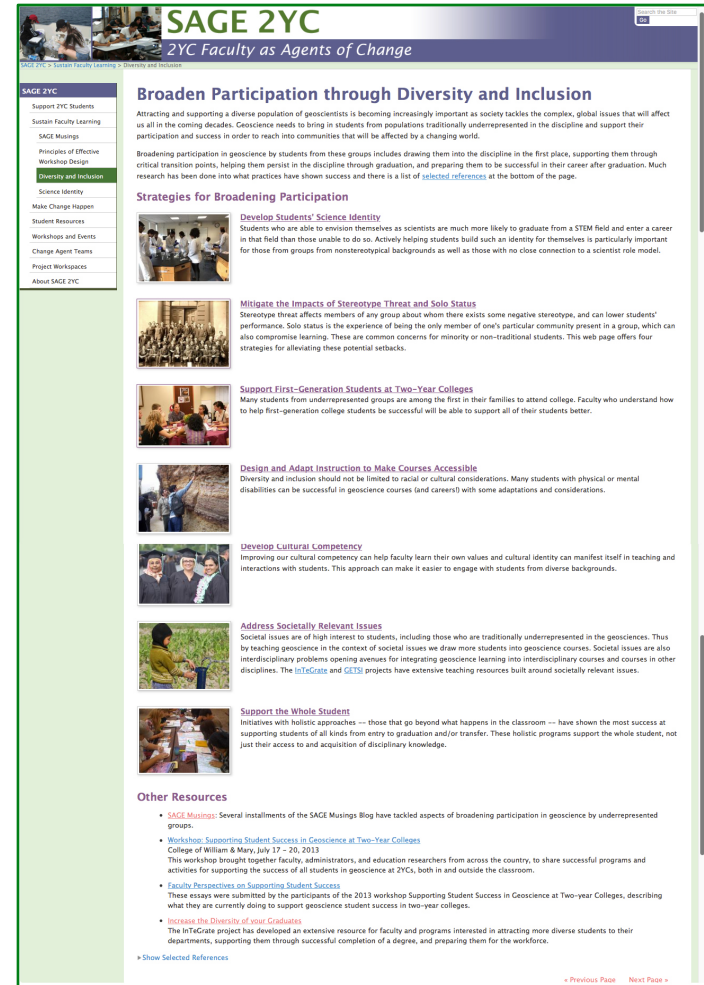
SAGE 2YC: Faculty as Change Agents project goals

- 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



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Broaden Participation through Diversity and Inclusion

Attracting and supporting a diverse population of geoscientists is becoming increasingly important as society tackles the complex, global issues that will affect us all in the coming decades. Geoscience needs to bring in students from populations traditionally underrepresented in the discipline and support their participation and success in order to reach into communities that will be affected by a changing world.

Broadening participation in geoscience by students from these groups includes drawing them into the discipline in the first place, supporting them through critical transition points, helping them persist in the discipline through graduation, and preparing them to be successful in their career after graduation. Much research has been done into what practices have shown success and there is a list of [selected references](#) at the bottom of the page.

Strategies for Broadening Participation

- Develop Students' Science Identity**
Students who are able to envision themselves as scientists are much more likely to graduate from a STEM field and enter a career in that field than those unable to do so. Actively helping students build such an identity for themselves is particularly important for those from groups from nonstereotypical backgrounds as well as those with no close connection to a scientist role model.
- Mitigate the Impacts of Stereotype Threat and Solo Status**
Stereotype threat affects members of any group about whom there exists some negative stereotype, and can lower students' performance. Solo status is the experience of being the only member of one's particular community present in a group, which can also compromise learning. There are common concerns for minority or non-traditional students. This web page offers four strategies for alleviating these potential setbacks.
- Support First-Generation Students at Two-Year Colleges**
Many students from underrepresented groups are among the first in their families to attend college. Faculty who understand how to help first-generation college students be successful will be able to support all of their students better.
- Design and Adapt Instruction to Make Courses Accessible**
Diversity and inclusion should not be limited to racial or cultural considerations. Many students with physical or mental disabilities can be successful in geoscience courses (and careers) with some adaptations and considerations.
- Develop Cultural Competency**
Improving our cultural competency can help faculty learn their own values and cultural identity can manifest itself in teaching and interactions with students. This approach can make it easier to engage with students from diverse backgrounds.
- Address Societally Relevant Issues**
Societal issues are of high interest to students, including those who are traditionally underrepresented in the geosciences. Thus by teaching geoscience in the context of societal issues we draw more students into geoscience courses. Societal issues are also interdisciplinary problems opening avenues for integrating geoscience learning into interdisciplinary courses and courses in other disciplines. The [InTEG](#) and [GEO](#) projects have extensive teaching resources built around societally relevant issues.
- Support the Whole Student**
Initiatives with holistic approaches — those that go beyond what happens in the classroom — have shown the most success at supporting students of all kinds from entry to graduation and/or transfer. These holistic programs support the whole student, not just their access to and acquisition of disciplinary knowledge.

Other Resources

- SAGE Musings**: Several installments of the SAGE Musings Blog have tackled aspects of broadening participation in geoscience by underrepresented groups.
- Workshop: Supporting Student Success in Geoscience at Two-Year Colleges**
College of William & Mary, July 17 – 20, 2013
This workshop brought together faculty, administrators, and education researchers from across the country, to share successful programs and activities for supporting the success of all students in geoscience at 2YCs, both in and outside the classroom.
- Faculty Perspectives on Supporting Student Success**
These essays were submitted by the participants of the 2013 workshop Supporting Student Success in Geoscience at Two-Year Colleges, describing what they are currently doing to support geoscience student success in two-year colleges.
- Increase the Diversity of your Graduates**
The InTEG project has developed an extensive resource for faculty and programs interested in attracting more diverse students to their departments, supporting them through successful completion of a degree, and preparing them for the workforce.

[Show Selected References](#)

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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

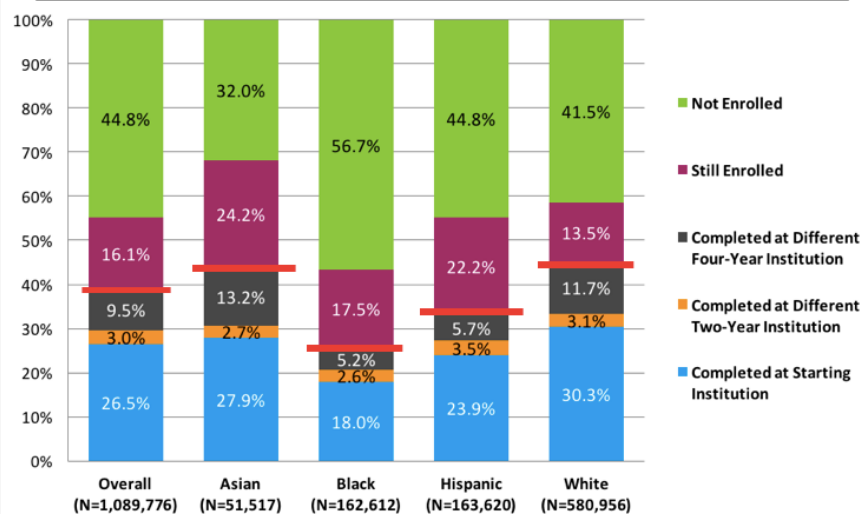
Our college is recognized as a Hispanic-serving Institution but rarely do we see Hispanic students in the geoscience courses. Knowing that diversifying the geoscience work force is a national priority I asked to have this topic added to the agenda of our upcoming departmental meeting. I presented some 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., Dunder, 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.

Institution	Fall 2015 Data													2014-2015 12-month unduplicated headcount (2014-2015)
	Registered as students with disabilities	Race/Ethnicity							Gender	Enrollment				
		Native Hawaiian or Other Pacific Islander	Black or African American	Hispanic/Latino	White	Race/ethnicity unknown	Nonresident Alien	Two or more races		TOTAL URM	Women	Total enrollment (Fall 2015)	% Part time	
Daytona State College	4%	2%	0%	13%	14%	66%	2%	0%	2%	31%	61%	14292	59%	20113
De Anza College	4%	35%	0%	3%	27%	20%	1%	10%	4%	69%	49%	22512	49%	34248
Highline College	<4%	15%	1%	10%	12%	32%	11%	8%	10%	48%	59%	6560	43%	10346
Illinois Central College	<4%	2%	0%	11%	5%	78%	0%	0%	3%	21%	55%	9704	64%	15156
J Sargeant Reynolds Community College	<4%	5%	0%	33%	5%	50%	1%	1%	4%	47%	60%	10889	72%	17742
Lone Star College System	<4%	6%	0%	15%	35%	33%	3%	5%	3%	59%	59%	70724	74%	104272
Mt Hood Community College	<4%	7%	1%	4%	12%	56%	15%	0%	5%	29%	51%	8758	62%	16579
Mt San Antonio College	5%	17%	0%	4%	62%	11%	1%	2%	3%	86%	52%	28991	64%	37771
Nassau Community College	5%	7%	0%	23%	24%	40%	4%	1%	0%	54%	50%	21558	40%	31168
Pasadena City College	<4%	24%	0%	4%	50%	7%	1%	4%	11%	89%	52%	27050	59%	36212
Portland Community College	5%	7%	1%	5%	11%	59%	7%	3%	6%	30%	54%	29003	60%	48056
Suffolk County Community College	8%	3%	0%	8%	21%	58%	8%	0%	1%	33%	53%	26829	45%	33644
Thomas Nelson Community College	4%	3%	0%	34%	7%	48%	1%	0%	6%	50%	59%	9316	67%	15122
University of Wisconsin Colleges	<4%	4%	0%	3%	6%	83%	0%	0%	2%	15%	53%	13454	51%	18110
Wake Technical Community College	<4%	3%	0%	24%	9%	50%	3%	8%	3%	39%	54%	21003	65%	30895
Waubesa Community College	4%	3%	0%	7%	35%	49%	4%	0%	2%	47%	55%	10511	70%	18978

Gallery walk: Posters about strategies for inclusion



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 relevance 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**

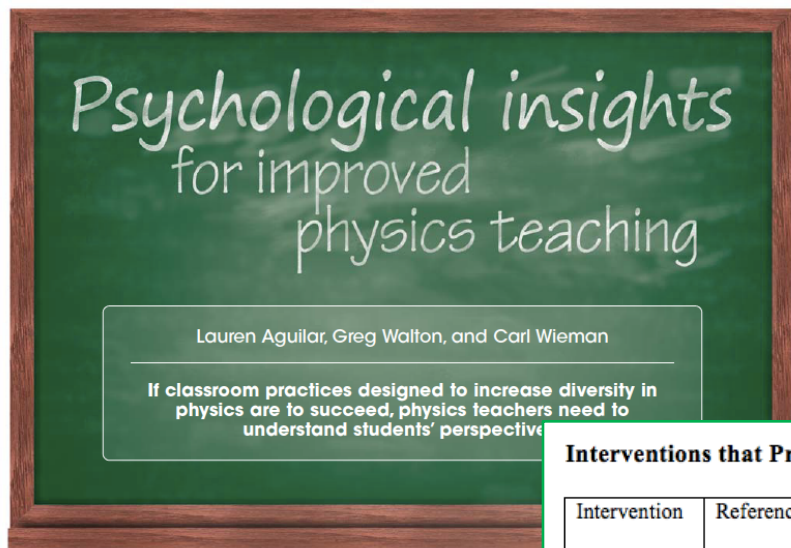
Is this an effective social-psychological intervention? Why or why not?

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

Review of Educational Research
June 2011, Vol. 81, No. 2, pp. 267–301
DOI: 10.3102/0034654311405999
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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

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 underrepresented groups.

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

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:

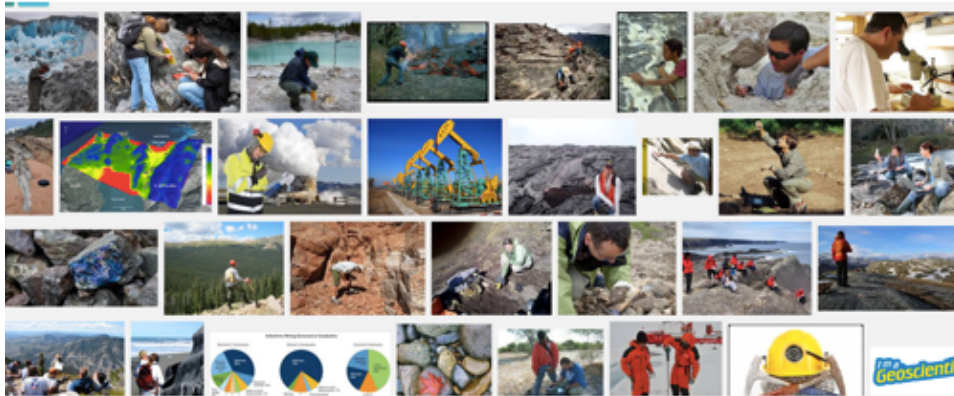
- | | |
|------------|--|
| 20 minutes | Presentation about science identity , images of geoscientists, and an example of a "geoscientist profile," modeled after Schinske et al.'s "scientist spotlights" |
| 50 minutes | Gallery walk about what we can do to help our students build their science identities |

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"

Google image search for GEOSCIENTIST

What messages do you think these images convey to our students?



Dr. Karletta Chief is an assistant professor and extension specialist in the Department of Soil Water and Environmental Science at the University of Arizona. In her extension specialist work she brings relevant science to Native American communities in a culturally sensitive manner by providing hydrology expertise, transferring



Dr. Joseph Montoya is a biological oceanographer at the Georgia Institute of Technology. He studies the marine cycle and has been involved in studies of the impact of Deepwater Horizon oil spill on offshore ecosystems of the Gulf of Mexico.



Dr. Adrienne Block is a Ph.D. student at the University of Arizona. She studies the impact of climate change on the Antarctic ice sheets. Since graduating with her Ph.D. she has worked in various capacities, including as a research scientist at the University of Arizona.

Resources you could

- Her web page at the work: <https://swes>
- One of her links is to <http://arizonaaisles>
- An 2.5 min video at <https://www.youtube.com/watch?v=...>
- She co-authored the <https://climatickw>
- A 5.5 min video that discusses the Deepwater Horizon oil spill (Indige <https://www.youtube.com/watch?v=...>)

Resources you could

- Webinar for the National Science Foundation overview of the marine cycle discusses the Deepwater Horizon oil spill on natural resources <https://www.youtube.com/watch?v=...>
- Web page about his river input to the ocean <http://mlp.ldeo.columbia.edu/>
- Dr. Montoya is involved in the Secret Life of Scientists and Engineers site on Adrienne Block's ocean science. A block <https://stemseas.wisc.edu/>

Resources you could use:

- The Secret Life of Scientists and Engineers site on Adrienne Block's Ph.D. student, it includes several short videos about her life <http://www.pbs.org/wgbh/nova/blogs/secretlife/earth-sci>
- Her linked in profile that shows the positions she has held <https://www.linkedin.com/in/adrienneblock/>

Building Students' Science Identity

Gallery walk about what we can do to 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

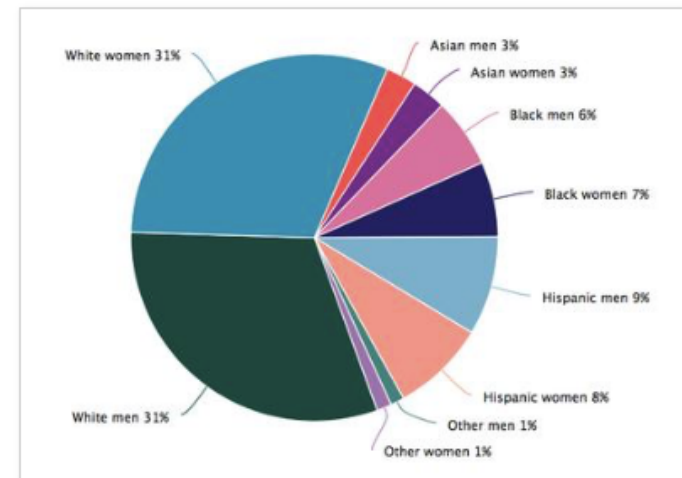
There's a lot of talk these days about the importance of broadening participation in the STEM disciplines (science, technology, engineering and mathematics). But how much of a problem is there, and how do the geosciences compare to other STEM fields? What subpopulations are under-represented in the geosciences? 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>





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

