Broadening diversity and inclusiveness in a quantitative, computational world
Strategies for becoming more diverse & inclusive

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Why does diversity matter?

Higher rates of diversity help institutions evolve, innovate, problem-solve & be more efficient.

Highly diverse, equitable & inclusive workplaces offer employees/students a better sense of community, increased engagement & more positive culture.

A geoscience community that pulls from the greatest breadth of society will gain from diverse life experiences and perspectives

- unique insights & solutions to geoscience-related problems facing society
- effective engagement with all affected communities
- engage entire student/employee population, greater range of talent, compete for best minds
Develop robust diversity, equity & inclusion plans

• Engage in uncomfortable conversations

Faculty, students & staff need

• Professional development
  – Cultural sensitivity
  – Implicit bias
  – Micro-aggressions
  – Lonely onlies, imposter syndrome, stereotype threat
  – Effective mentoring
  – Power Imbalance

• Guidelines for behavior; expectations

Build & nurture positive departmental/institutional culture & sense of community
Geoscience enrollments are the least diverse in sciences – we need to recruit, retain & promote success of all students with an emphasis on those underrepresented in the geosciences

% Science & Engineering Degrees Awarded to Underrepresented Minorities

Ph.D.’s

Bernard & Cooperdock (2018)
Broadening Diversity – building the pipeline

Challenges:

• Overall lack of awareness of geosciences
  – As an occupation
  – Types of professions
  – Impact on society

• Acceptance of the geosciences as a viable occupation to underrepresented minority families

• Lack of diversity!
Perceptions & Negatives

- Low Pay
- Low Prestige
- Low Tech
- Easy Science
- Manual Labor
- Travel

Need better marketing!
Pathways for attracting students into geosciences careers

Marketing positives:

• Emphasize ability to make a difference by solving problems of societal importance
• Stress ties to the local community/culture & societal aspects of problems
• Leverage interest in innovation & high tech fields
• Provide information on salaries, careers & employment rates
  – Geoscience occupations are well-compensated
  – Have robust employment opportunities
  – 4-8% employment growth in next decade
  – Most geoscientists work on computers or in labs
• Recruit from other disciplines
  – More diverse demographics
  – Chance to use quantitative/computational skills to solve societal problems

Geoscience Employment Increase 2019-2029

<table>
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<th>Occupation</th>
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<th>1%</th>
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Promoting success & retention of underrepresented students

- **Mentoring** – peer mentoring (student to student); faculty to student, mixed cohorts; intrusive mentoring

- **Formative early experiences**
  - Authentic research, disciplinary projects or contests
  - Summer research experiences; internships; fieldtrips
  - Summer math and chemistry bridge programs – engineering successes

- **Social & community building activities, spaces**
  - Involvement in student groups or chapters
    - Develop a sense of strong belonging
    - Become more motivated & confident academically

- **Support networks, safety nets, tutors**
  - Academic, financial & social support
• Use effective pedagogy -- supports retention and student success
  – Collaborative & active learning
  – Experiential learning

• Integrate math, chemistry, physics & computational science into all levels of geoscience courses
  – Students can address these topics in a geoscience context
  – Understand their application & importance to their degree

• Encourage & financially support student attendees/presenters
  – Regional & national scientific conferences
  – SACNAS; NABlackGeoscientists and GeoscienceAlliance meetings and student conferences
  – Builds student self-efficacy as emerging geoscience professionals
Use available resources

• On campus multicultural centers
• InTeGrate webpages on diversity and examples
  (https://serc.carleton.edu/integrate/programs/diversity/index.html)
• Department of Education funded programs
  – Trio: 8 programs for low income, first-gen &/or disabled students
  – McNair Scholarships
  – Gear Up
• LSAMP - Louis Stokes Alliances for Minority Participation
  – NSF program to assist universities/colleges in diversifying the nation's (STEM) workforce
  – Example: Western Alliance to Expand Student Opportunities (WAESO) at ASU
• REUs – NSF supported
Research Experiences for Undergraduates (REU)

UNAVCO
- **RESESS** - Research Experiences in Solid Earth Science for Students - undergraduate research internship, learning community, and mentoring program
- **USIP** - UNAVCO Student Internship Program, paid internship on various aspects of geodesy research & education

University of Maryland Baltimore County Interdisciplinary Program in High Performance Computing
- REU in scientific, parallel, and statistical computing

University Corporation for Atmospheric Research (UCAR)
- **SOARS** - Significant Opportunities in Atmospheric Research and Science – 10 week summer research internship at NCAR
- **SUPER** - Summer Undergraduate Program for Engineering Research - NCAR
- **TIP** - Technical Internship Program – students from 2YC & vocational/technical institutions
Research Traineeship Experience (RTX)
GeoVISION: Geosciences Visualization, Simulation and Imaging in Online Networks

8-week virtual program

• Prepare diverse undergraduate students for grad school/careers
• Focus on computational/technical applications
• Research experience & skills development
  – Data management & analytics, computer programming & spatial analysis – lectures/exercises/training modules
  – Guided independent research project
  – Attend multiple lab research group meetings – be exposed to the variety of geoscience disciplines
GeoVISION RTX

- **Participants**
  - 23 Trainees from 15 universities
  - 4 Training module instructors
  - 15 Research mentors - Faculty, Research Scientists, Postdocs, Graduate Students
  - 11 Research rotation hosts

- **Workshops (twice a week)**
  - Identity in STEM
  - Coping Skills
  - Reading Scientific Literature
  - Applying to graduate school
  - Internships in geoscience

- **Social & community building activities, such as**
  - Game nights, trivia competitions, virtual scavenger hunts
GeoVISION provides spaces for students
• Connected to STEM majors with similar backgrounds
• Learning environment where they aren’t the only one who looks like them
• Instills in students that sense of belonging

Please rate your...

How well do you know how to do the following?

Before GeoVISION  After GeoVISION
Increase diversity by working with 2YC’s Mirror of the community demographic

Build relationships with local 2YC

• Culture bias – underrepresentation doesn’t mean underprepared
• Build good communication between advisors at 2YCs & 4YC
• Build communities for transfer students – before and after
  - Students need support/bridge programs – integrate into community
  - Joint field trips / Upper classman collaboration
  - Research internships for 2YC students
  - Invite 2YC students to research talks/symposiums
  - Peer and vertical mentoring programs
  - Co-advising

• Results: Students more successful, academically & socially prepared
Work with HBUCs/HSI:
Fort Valley State University
Cooperative Developmental Energy Program (CDEP)

- 1993-2019: Dr. Isaac Crumbly
- Dual degree programs: engineering, geology, geophysics, health physics
- Graduates: 106 engineers, 40 geoscientists, and 9 health physicists
- Dual degree STEM programs
  - 3 years FVSU
  - 2 years partnering institutions
    - Georgia Institute of Technology
    - Pennsylvania State University
    - University of Arkansas
    - University of Nevada at Las Vegas
    - University of Texas at Austin
Broadening participation of Underrepresented Groups – Increasing the Pipeline

- Emulate & develop successful recruiting programs
  - Incorporate role models
  - Include mentoring
  - Provide financial support
  - Reach out to students in their communities
  - Involve members of the community (families, high school teachers, guidance counselors)

<table>
<thead>
<tr>
<th>Does your department have or plan on any systematic efforts to encourage broadening participation and retention of a more diverse student population?</th>
<th>2014 - 2015 survey</th>
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<tbody>
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<td>Yes</td>
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<tr>
<td>No</td>
<td>239</td>
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</table>

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Yes 181
No 239

2014 - 2015 survey
GeoFORCE Texas

High School program (2005-2020):
Southwest Texas & Inner City Houston

• Identify high achieving students – 8th grade
• 4 years of high school summer trips
  – Grand Canyon to Mt. St. Helens

~350 High School student participants

High School demographics

• ~59% Hispanic
• ~17% African American
• ~8% Asian
• ~60% female
GeoFORCE: A Complete Package

• Competitive
• Community Involvement
• Mentoring
• Must Gain Trust of Community
• Expensive! Successful!

>1300 completed high school program
100% graduate from high school
College degrees: 492 BS; 51 MS, 7 PhD
519 GeoFORCE graduates in college; 63 in grad school
~60% declare STEM major
Build & nurture positive departmental/institutional culture & sense of community

- Bring in diverse speakers, postdocs, faculty
- Sponsor faculty/researchers lectures at HBUC/HSI institutions
- Host EDGE: Enhancing Diversity in Graduate Education events
  - Graduate School Previews
    - College juniors/seniors & MS students

Participate in diverse conferences & advertise on diverse list-serves

- Job ads on SACNAS, NA Black Geoscientists and GeoscienceAlliance and other list-serves
- Post internal positions on Black & Hispanic Faculty/Staff organizations virtual “bulletin boards”
- Search committee training – implicit bias & diversity/inclusion hiring practices
For more information:

Vision & Change in the Geosciences

Extensive document containing results of a 6-year NSF-sponsored initiative:

• Robust academic & employer community vision for Future of Undergraduate Geoscience Education

• Key strategies/recommendations for transformative change

Represents input of ~1000 geoscientists

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Coming Fall 2020