Breakout Discussion – Day 2

Group 1 (A, B, C)

- How do we increase the skilled workforce and expand the quantitative skillset in geophysics? What are the workforce needs?

Group 1A

Main Points

- Need critical mass of geophysicists to have a dept to have curriculum to build the skills – recruiting is critical, geophysics is not known
- Placement – how to get students jobs, building connections with industry, do students see where they are going
- Application orientation with our teaching (how it ties into society, quant skills tie to science)
- Employer perspective- students don't know what options are available to them, where to look for jobs in addition to developing skills,
- Recruit engineers and other types of majors (have better quantitative skills) as an option; but also think about access and preparation of our own geoscience majors.
- Faculty attitudes about how they portray quantitative content in their courses – demographics of the faculty (many have old fashioned perspective) – potential for shared envisioning at the departmental level

Future Needs

- Improve our image and do a better job of marketing what we do
- Do a better job sharing what geophysicists do, where they work; making connections between courses/academia and jobs/topics
- Re-envision curriculum (apply for NAGT Traveling Workshop leadership to help work through that);
- Description of what a powerful or successful geophysics department/program look like – Portrait of a department (grad level and undergrad level) – for current and future needs
- What is in the strategic national need – are educational institutions preparing for that? What are the skills needed by feds, employers – find the gaps/disconnects and find recommendations - way to frame a future report/study, using report as a leverage at institution

Breakout 1B Group Report

- What is the workforce? Geophysics workforce really is MS+. Look at other groups with domain experts vs. geophysics as a tool.
- What are the needs?
  - NGS doing ongoing education to build skills because of the specialization. Cross-training from other domains to address demand needs.
  - Resources industry- quantitative maturity better equipped to engage new techniques and enhanced critical thinking skills
- What are the black box – varies by context and application
  - Cycle of advanced training
- Linear algebra, orbital mechanics, core geoscience to recognize problems, etc for base geodesy skills
- Need to have data manipulation skills; model improvement (physics/math); researcher to extract meaningful results
- Is the lack of geodesy programs and courses at undergrad inhibiting attracting students – improving the storefront
  - How to energize programs (more $$ but flat budget)(yet demand > supply)

Group 1C

- Better assessment of what are the workforce needs (AGI style) for geophysics more specifically
- Strong geoscience with strong data analytics - students with this combination are so valuable
- Need a balance between broad foundation (curriculum) and specific discipline knowledge/experience (research/internship/capstone project)
- Soft skills are so important for career: communication (present, write), collaboration, self-efficacy
  - Need to be careful about the balance between hard vs soft skills in knapsack
  - Can we get this better infused into the undergrad curriculum
- Math/Stat/Data/Compute methods for Geoscience undergrad course makes sense to incorporate key concepts/techniques they would potentially work on in grad school

Breakout Discussion – Day 2

Group 2 (A, B)

- What actions could universities take to increase quantitative skills? Where are the resources to do this?

Group 2A

- University roles
  - Advising – making students aware of importance of quantitative skills for their career
    - Concern that 1st generation students and URM don't get this message in timely way
  - Providing a quantitative path through university core curriculum (common base the different STEM programs can build on)
  - A core-credit Python course and/or data course
- Role of textbooks or shared modules that teach specific skills
  - Embedding specific quantitative skills in specific courses
    - One quantitative skill per course in the standard path in curriculum?
  - How to help faculty (even new faculty) who lack the expertise to teach quantitative units

Breakout #2B - What actions could universities take to increase quantitative skills?

- **Making students feel welcome**, DEI and disciplinary perspective
  - Expect interdisciplinary student population and reward broad outlook for faculty
- **Focus on core skills** and how to build on those from disciplinary perspectives
  - Python, linear algebra, problem solving
  - geospatial analysis and data processing vs. classes (GIS, programming, time series analysis)
  - Work toward establishing bilingual zones (shared theoretical and hands on expertise)
  - Gray box, modular approach
- **University wide** integrated curricular revisions (QE not just geo problem)
  - *School-level perspective* (credits, enrollment, coordination)
    - Partnerships between departments, shared priorities and common standards
    - Building connections between departments, reduce silos, coordinate
    - Reuse existing courses across departments (geo, CS, eng., appl. math., etc.)
    - CS programs oversubscribed – but don't want geo- bio- chem-math
  - *Department perspective*
    - Dialog between chairs and deans, implement and reward shared values
    - Making JEDI efforts part of job description (evaluation and tenure)
    - Continued support for professional development
  - Approaches
    - Flip classroom
    - Interdisciplinary courses at the undergraduate level
    - Require major/minor combinations
- Industry partnerships

Breakout Discussion – Day 2

Group 3 (A, B)

- How do we interest more students (particularly diverse voices) to the field, train them, and prepare them for careers?

Breakout Group 3A. How do we interest more students (particularly diverse voices) to the field, train them, and prepare them for careers?

- Scientist Spotlights (this has been successful in intro classes at 2-year colleges)
- Conferences that target a specific audience (ex. Grace Mary Hooper Celebration of Women in Computing Conference)
- Once you get a critical mass- the problem goes away
- Challenge of maintaining initiatives
- Minority Faculty
- Resources for training opportunities need to be sufficient
- Internally funded opportunities may arise, but not always optimal/practical
- Be time sensitive: Re-structure opportunities (i.e. distribute throughout the academic year)

Group 3B

Faculty constraints to address

- How to provide more faculty credit for engaging and retaining a diverse student population
- How provide faculty support for non-R1 institutions
- How to define and provide for “discretionary time” for running open workshops/cross-university workshops - not usually paid

Future needs

- Find a way to centralize resources and best practices for engaging and retaining a more diverse audience
  - Showcase university models where engagement is led by university-wide experts, not just individual faculty

Group 3B

How to interest students

- Demonstrate societal and local relevance
  - Public exhibits showing the value of geophysics (Smithsonian example)
- Need to attract students from other STEM disciplines at an earlier point in student career
- Target 2YC audience

How to train students and prepare them for careers

- Need alternatives to REUs (e.g. for students can't afford the time/have other commitments)
- Expand connections with federal agencies and industry, e.g. internships
- Retention is critical, not just initial engagement
  - Be inclusive, both in environment and options
- Raise level of awareness of careers