The Improving Undergraduate STEM Education: Pathways Into Geoscience (IUSE: GEOPATHS) Working Group Results

EFFECTIVE STRATEGIES FOR . . .

Increasing the number and diversity of students entering Geosciences

- Summer Math/STEM programs on campus the summer before Freshman year with possible college credit attached
- Professional Development for K-12 educators in Earth Science and curriculum development to increase GEO opportunities in high school
- Recruitment strategies which appeal to family, acknowledge financial obligations, include personal invitations
- Strong transfer options between 2 and 4 year institutions

Retaining undergraduates in geosciences

- Development of systems to collect data and track retention
- Professional development for faculty focused on resilience, hardiness, failure, adversity
- Individual student attention, mentoring, advising
- Bridge Programs in place to assist transfer from 2-year to 4-year institutions
- Flexibility with course scheduling and field experiences for non-traditional students; early Math support for all students.
- Student community/culture building: informal recurring gatherings, student cohorts, "lunch and learn," geology clubs

Preparing undergraduates for the geoscience workforce

- Invite a diverse group of guest speakers from industry including alums from underrepresented groups and professional organizations.
- Include employer expectations (specific to region) in coursework and curriculum.
- Prepare students for licensure early on and provide opportunities for professional credentials through start courses
- Offer service learning opportunities off campus to connect students with community issues and needs.
- Connect students with local professional organizations.
- Offer GIS courses, provide projects requiring students to learn technical skills in addition to research skills.

Increasing the number and diversity of non-science undergraduate majors into GEO post-baccalaureate degrees

- Offer multi-disciplinary research opportunities, recruiting outside of GEO
- Offer geoscience courses as electives in other majors and recruit from those departments to take courses
- Program flexibility to offer undergraduate-level GEO to GEO grad students who don't have a geosciences background.
- Market in departments interdisciplinary in nature; use peer recruiting
- Field Trips, Service learning courses (i.e., STEAMseas)
- Removal of prerequisite barriers
- Diversify faculty in terms of discipline
- Offer transdisciplinary courses that count for other majors.

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PARTICIPANT CHALLENGE EXAMPLES

- Timeline: Students decide "last minute" to attend community college, so high school recruitment doesn't necessarily yield benefits.
- Research commitments and prioritization, dropouts/ghosting
- Fear of travel far away or home obligations interfere with residential programs
- Time commitment and corresponding loss of income
- Not knowing the spectrum of careers in geoscience hampers recruitment and may impact career tracks.
- Field geology is not a sufficient incentive and may limit students' experience of what geoscience ecompasses

ADDRESSING PARTICIPANT CHALLENGES

- Community-building prior to residential programs
- Include families in decisions; meet with parents and families to hear concerns
- Ensure programs include activities that reflect a range of tasks that geoscientists may perform (field, lab, programming, administration, technical, science planning)
- Invite professionals to talk about experiences through geology clubs, faculty informal gatherings, career center opportunities
- Offer time management workshops: prioritization and value of extracurricular activities
- Use social media to advertise for recruitment
- Allow flexibility in budget that may be used for child care; provide stipends

EVALUATION/ASSESSMENT CHALLENGES

- Institutional Review Board (IRB) can be challenging in terms of state laws or potentially another partner does not have an IRB (independent consultants)
- Some 2 Year colleges have trouble finding evaluators in grant offices with minimal knowledge of NSF
- Selection bias (who decides to participate in research components of study)
- How to administer surveys: different people may not necessarily be experienced with data collection.
- How to define and measure impact
- Data management
- Some evaluators lack understanding of geoscience/GEOPATHS goals
- Survey fatigue of participants

ADDRESSING EVALUATION/ASSESSMENT CHALLENGES

- Include access to procedures for IRB approval for grantees or partners that are not colleges (thus may not have IRBs)
- Provide incentives for participation in the survey, free admission to a museum, gift certificate to campus book store, etc.
- Build in basic half day workshop to develop internal data collection team either onsite or online.
- Invite evaluators for 1 day field trips for projects and pay for their travel, approach GEO community for recommendations, respect evaluators expertise, know they can learn the goals, & design applicable level
- Ask NAGT or GSA, etc. to hold workshops on IRBs, reach out to IRB folks in advance of submission/establish relationships, learn about procedures, get required training

INSTITUTIONAL CHALLENGES

- Non-R1 institutions do not have grants offices to support pre/post award and during-project implementation
- Need for release time and other incentives for outreach limit the number of faculty participants.
- Institutional rules for transfer of student financial aid.
- Different models within a single project (different partners may pay participants differently within a project)
- Lack of infrastructure to complete all necessary paperwork
- State legislature requirements, cultural fear of "messing up", lack of trust in faculty who know the requirements
- Leaders disconnected, particularly at community colleges
- Upper level administrative support
- Lack of experience by 2 year colleges in grant submission

ADDRESSING INSTITUTIONAL CHALLENGES

- Appeal to the institution's strategic plan to obtain steady funding to provide administrative support for grants
- Implement workload credits for student oriented programs @ system level (U.T.)
- Get administrators involved in projects, e.g. by inviting them to symposiums
- Involve admin/HR/business partners in proposal process early
- Project faculty ask questions early about policies and procedures they deal with and why; build 2-way dialogue and collaboration before new questions arise
- For institutional memory: document more than you think you should and share that documentation and the responsibility for it
- Establish staff/personnel continuity plan with an institution for duration of grant (i.e. commitment to designate a new liaison if someone leaves)
- Develop relationships with admin staff at partner institutions

LOGISTICAL CHALLENGES

- Learning how to write a successful grant, navigate Fastlane, etc.
- Travel, access to facilities, field trips, paperwork, scheduling, getting groups to field sites, organizing between campuses.
- Communication with partners, students, families, schools (for bridging programs), etc.
- Scheduling classes and activities with enough lead time
- Administrative constraints/ barriers to getting new curriculum approved in a timely fashion for the grant
- Differences in professional cultures/expectations w/external participants such as industry even 2y v 4y
- Distributing financial incentives to students (e.g. internal v. external participants)
- Accommodating individual special needs/circumstances so they can participate (e.g. rooming, service animal)
- Criminal background checks for student employees
- Getting bids for project evaluators – state laws required bids over a certain amount
- Faculty who don't know all of the procedures/policies navigating program development

ADDRESSING LOGISTICAL CHALLENGES

- Communicating required more face to face, personal, social media, and less reliance on email
- Identify clean lines of responsibility for team members
- Include a coordinator/event planner in budget, more money in award
- PI team researches practical aspects of job titles/classifications (so a person can be hired and at decent pay) i.e. engage HR in grant development and budget
- Faculty – orientation workshops, prior and during projects, cultural sensitivity training
- Start early. Regular check ins of individual responsibility (are people getting paid or applications going out)
- Flexible meeting times that vary frequency/length with amount of activities/responsibilities (balance including ppl w/not wasting time)
- Buyout admin if not part of the IDC-ensure sufficient admin support for grant
- Last minute changes can be a teachable moment: explain to students that such things happen and that scientist often adapt and change plans (logistics not research)

PARTNER CHALLENGES

- Industry consultant partners' OSHA requirements creating an obstacle in getting students onto job field sites.
- Finding mutually beneficial curricular pathways for 2 and 4 year college partners
- Industry sponsors withdraw or diminish support as their goals change
- Maintaining consistent student experiences with different collaborating partners
- Potential for 4 year institutions taking advantage of 2 year colleges in the search for funding and diverse students.
- Balancing mentoring 2 year partners while meeting goals.
- 2 year college, high school teacher/administrator comprehension of what to do in terms of grant budgets, expectations, and purchasing.

ADDRESSING PARTNER CHALLENGES

- Request funding to cover cost for student certification/training (OSHA) to access work sites.
- Establish and follow up regularly in communicating with partners during grant perparation and after awarding of grant.
- Anticipate issues and do not assume partners know what to do; creat a liaison with each institution.
- Include partners in planning at every stage.
- Respect Partner's culture, respect boundaries, exercise gratitude and positivity
- Develop rubric with partners that describes expectation for student work/research experience and mentoring.
- Use collaborative proposals rather than sub-contracts to prevent one institution from taking advantage of another
- Invite current and potential partners to the end-of-project symposium