Under the hood of IRIS's Distributed REU Site

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Abstract

Since 1998 the IRIS Undergraduate Internship Program has provided research experiences for up to 15 students each summer. Through this 9 to 11 week internship program, students take part in an intensive week-long preparatory course, and work with leaders in seismological research, in both lab-base and field-based settings, to produce research products worthy of presentation and recognition at large professional conferences. The IRIS internship program employs a distributed REU model that has been demonstrated to bond students into a cohort, and maintain group cohesion despite students conducting their research at geographically distributed sites.

Over the past 16 years the program has encountered numerous anticipated and unanticipated challenges. The primary challenges have involved exploring how to modify the REU-system to produce outcomes that are better aligned with our programmatic goals. For example, some questions we have attempted to address include:

- How might you find, interest, and recruit under-represented minorities into a geophysics program?
- Can the program enable mentors to raise the level of their mentoring?
- What influence does the program have on alumni career choices?

How might you interest, and recruit under-represented minorities into geophysics?

The IRIS/UNAVCO Minority Recruitment Speaker Series has been designed to icrease the number of minority applications and interns accepted into the IRIS & RESESS (a program dedicated to increasing the diversity of students entering the geosciences run by UNAVCO) Internship Programs. The program targets physics departments at Historically Black Colleges and Universities or a predominately Hispanic Serving Institutions. The speakers are minority alumni of the IRIS and RESESS internship programs that are early career scientists or PhD students in geophysics. This series differs from a traditional departmental seminar, which are generally pure research talks aimed at faculty in the department. Instead, our lectures focus on connecting the presenter's research to core physics content students encounter in their coursework. Talks also include the presenter's personal story and career data provided by the American Geological Institute and the Bureau of Labor and Statistics. The program also provides funding for post lecture pizza to allow the students to interact more socially with the presenter.

- Estimate of cost per trip - ~$1100 per venue
- Estimated average attendance - ~15 students (varies)

Year	Venues	Applications to IRIS	Accepted IRIS	Applications to RESESS	Accepted RESESS
2013	9	7	2	13	1
2012	3	0	0	9	1
2011	7	2	0	1	1
2010	5	3	1	5	5
2009	4	2	0	–	–
TOTAL	28	14	3	28	8

Table 3. Applications and interns recruited to the IRIS and RESESS Internship Programs

Discussion

- Cost per recruited intern is roughly $2500 per intern.
- Minority students apply to RESESS (an minority focused internship program) at a rate 2x higher than to the IRIS Program.
- Applicants and interns are all candidates that otherwise would not have applied.
- Developed strong connections several institutions that may "feed" qualified and interested applicants
- Established a network of connections to leverage for other, related efforts.

Can the program foster some degree of consistency to mentoring?

The IRIS internshi program is developing a 13-item rubric measuring research skills, and a protocol of training and intern-mentor meetings to discuss progress. The goal of the intervention is to both increase the extent to which the mentoring relationship is centered on the intern, and to enable interns and mentors to feel more effective monitoring interns' personal/professional growth. This intervention was piloted in 2011 and 2012 refined and fully implemented in 2013 and 2014.

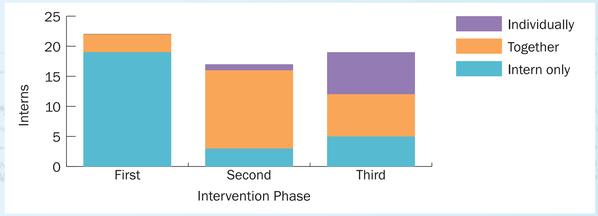

Figure 4. Rubric completion method in the first, second and third phases of the protocol. The highlighted boxes indicate the prescribed protocol for each phase of the intervention. 90% of intern/mentor pairs adhered to the initial protocol by completing the rubric independently. In the third phase, only 37% of intern/mentor pairs adhered with the protocol by each completing the rubric individually and then meeting to discuss. It is unclear why they don't follow the protocol more closely in the third phase but it could be that they are uncomfortable with it, they didn't understand the instructions, or other methods more efficient.

A survey of the participants (28 mentors and interns) was conducted to assess perceptions of the intervention. Neither interns (18%) nor mentors (14%) looked forward to completing intervention protocol. However, interns perceived more "value" in the intervention than the mentors did. For example,

- 50% of interns, versus 36% of mentors agreed or strongly agreed that the mentoring rubric was a beneficial resource for the mentoring process,
- 64% of interns, versus 36% of mentors agreed or strongly agreed that the mentoring meetings, to discuss the rubric with my mentor were beneficial for the mentoring process,
- 79% of interns, versus 36% of mentors agreed or strongly agreed that the mentoring rubric helped illuminate areas that needed improvement and areas where growth occurred.

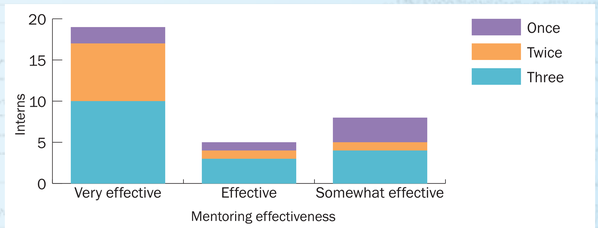

Figure 5. Intern perception of mentoring effectiveness versus rubric completion. The number of times the rubric was completed by the intern/mentor pairs did not have a significant effect on interns perception of the mentoring they received at the p<.05 level for the three conditions [F(2, 29) = 1.75, p = 0.19].

Discussion

- Revise the mentoring rubric to make it more meaningful to mentors based on qualitative feedback
- Build reflection on the mentoring rubrics into intern blogging assignments
- Develop strategy to ensure all intern/mentor pairs consistently complete the rubric
  - Conveying to mentors that interns' value the process more than mentors
  - Create online system for pairs to submit completed rubrics, and "remind" pairs that have not yet completed the protocol.

What influence does the program have on alumni career choices?

Data collection - Between 1998 and 2013, 144 undergraduates participated in the IRIS internship program. A tracking survey was conducted in the fall of 2014 with a response rate of 69%. To increase the data available for this analysis, 2014 data was compared to an identical survey conducted in 2011.

- 20 alumni who did not respond to the 2014 survey were identified
- 2011 data for these 20 additional alumni was incorporated with the 2014 data set for a total response rate of 83%.
- While this approach provided a larger sample, it also introduced several weaknesses. For example, the data below may underestimate the number of alumni currently in the work force, over estimate the number of students currently pursuing degrees, and not represent each individual's current situation.

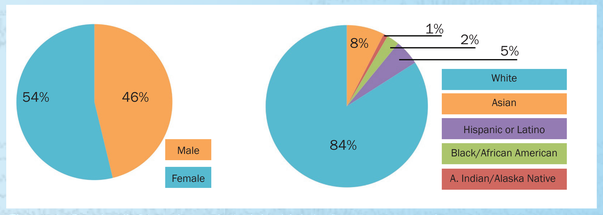

Figure 1. Gender (left) and race/ethnicity (right) of survey respondents.

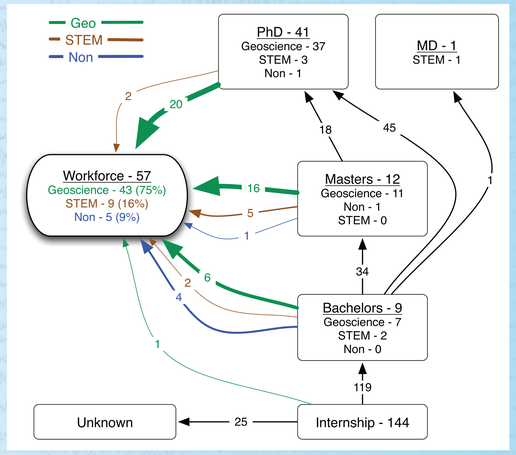

Figure 2. Alumni career paths post IRIS internship. From 1998 to 2013 the IRIS Undergraduate Internship Program facilitated opportunities for 144 undergraduates. Solid lines indicate pathways, labeled with the number of interns who completed that pathway. Boxes indicate the number of interns in that stage of their career (e.g. 45 alumni completed undergrad degrees and enrolled directly into a PhD program, while 9 alumni are earning their bachelors).

- 83% of alumni are employed in a geoscience career or are actively pursuing an advanced geoscience degree
- 75% of alumni are employed in a geoscience career. The majority of these alumni are split between careers in the energy sector (53%) and employment in academia and federal and state governments (44%)
- 50% of students who do not go to graduate school transition away from geosciences

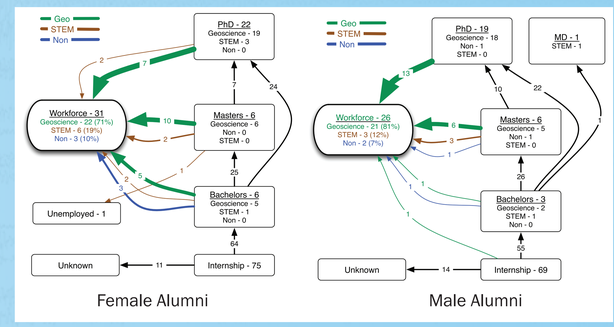

Figure 3. Alumni career paths post IRIS internship sorted by gender.

- Women departed the academic pipeline for the workforce, post bachelors degree, at a slightly higher rate (16%) than men (5%)
- Men remained in the geosciences at a higher rate (81%) than women (71%). However, men and women who received an advanced degree remained in the geosciences at a relatively equal rate, 83% and 81%
- 50% of students who do not go to graduate school transition away from geosciences

Employment Sector	All	Women	Men	Racial/Ethnic Minorities
Academic	13	6	7	3
Energy/Natural Resources	23	14	9	5
Federal/State Government	6	1	5	0
Other	1	1	0	0

Table 1. Employment sectors for IRIS alumni employed in geoscience careers.

	Degree (Achieved or currently pursued)		Employment Sector		
	Masters (n=45)	PhD (n=62)	Geo (n=45)	STEM (n=8)	Non (n=3)
Very Influential	40.0%	59.7%	53.3%	0%	0%
Influential	40.0%	29.0%	31.1%	50%	33.3%
Moderately Influential	15.6%	9.7%	13.3%	50%	0%
Of Little Influence	4.4%	1.6%	2.3%	0%	66.7%

Table 2. Perceived influence of the internship program on interns sorted by advanced degree and employment sector.

Discussion

A frequent criticism of REUs is that the majority of participants are already set on their career paths before they participate. We certainly find this, as 86% of our interns enter considering an advanced degree. This would suggest that an REU experience might have only moderate influence on their career paths. Instead we find that over 80% of our alumni who either earn a PhD or are employed in a geoscience career report the program was influential or very influential in their career development.

It seems likely that the IRIS REU program provides an opportunity for students to "try on" the role of a geophysics graduate student. This is well aligned with entrance data we collect regarding what factors are important in their decision to participate in the program. For example, 77% report that the opportunity to find out if geophysics is for them was fairly or extremely important in their decision to participate in the program. Additionally, 89% reported that the opportunity to learn more about what is like to be a researcher was fairly or extremely important in their decision to participate in the program.