ANNUAL REPORT

Collaborative Research: GP-EXTRA: Geo-Launchpad: Preparing Colorado Community College Students for Geoscience–Focused Careers

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Program-track: IUSE-GeoPaths - Engaged Student Learning: Exploration
Accomplishments

What are the major goals of the project?

The IUSE program: The Geo-Launchpad Program (GLP) is a collaborative effort between Front Range Community College and UNAVCO, a non-profit, university-governed consortium that facilitates geoscience research and education, to provide community college students in Colorado with experiential learning opportunities in geoscience through summer internship programs that impart technical knowledge and development of students’ soft skills for advancement along career pathways in the geosciences. The project also builds curriculum and new instruction materials to support these and other internship/employment opportunities, career exploration and workshops, and a mentorship program. The project has three overall goals:

GOAL 1: Build students’ interest and capacity to engage in geoscience-focused STEM (science, technology, engineering, mathematics) career pathways.

GOAL 2: Professional development of community college STEM faculty as mentors to students in geoscience focused careers.

GOAL 3: Increase the number of students from community colleges that transition to geoscience-focused careers.

What was accomplished under these goals?

Major Activities

Two tracks of primary activity took place. The first of these activities was to provide academic pathways for students to learn, engage, and pursue further academic, research, and career opportunities in STEM related fields. The second of these activities involved a summer internship for students at UNAVCO in Boulder, Colorado.

Academic Pathways

The primary academic activity of the Geo-Launchpad program is the development of curriculum to help students learn about internship opportunities for two-year students, current research and research techniques, and careers and career paths in the STEM related fields, with an emphasis on the geosciences. Other activities included on campus seminars to learn about the Geo-Launchpad internships and other career opportunities, and professional development activities for faculty at two-year colleges.

Curriculum Development – a pilot project course, “Exploration of Internships/Careers in the Geosciences” was offered as a one credit course at the Larimer Campus of Front Range Community College. Following are expectations that were established for the course:

Upon completion of this course, students should have a better understanding of the geosciences, the scientific method, and be able to use the tools and techniques of spatial analysis to:
• Identify and provide information on current outside internship opportunities in geosciences, environmental science, atmospheric sciences, and related fields open to Colorado community college students
• Explore research in geosciences including literature, research tools, techniques, and terminology
• Discuss career opportunities in the geosciences.
• Discuss careers suited to students in the geosciences in professions outside the geosciences
• Explain coursework best suited for careers in the geosciences
• Identify four year colleges with degree programs in related fields
• Develop writing and critical analysis skills of scientific papers
• Prepare resumes or curriculum vitae for internships or job opportunities

The course included presentations of internship opportunities (including but not limited to the Geo-Launchpad internship opportunity), student investigation of current research in the geosciences, information on transfer opportunities to four year colleges, expectation of courses required for admission to four-year colleges and future careers, a field trip to UNAVCO, and guest speakers. Guest speakers included a representative from the Research Experience for Community College Students (RECCS) at the Cooperative Institute for Research in the Environmental Sciences (CIRES), a retired hydrologist from the United States Geological Survey (USGS), a geographer from the University of Northern Colorado, and a former intern with the RECCS program.

Upon completion of this pilot course, a permanent course, renamed “GEO 210 Careers/Research in the Geosciences,” was presented and to and approved by the Front Range Community College curriculum committee, and presented to and approved unanimously by the State Faculty Curriculum Committee (SFCC) for inclusion in the Colorado Community College Common Course Numbering System (CCNS). The course is now available for adoption by community colleges throughout the state.

Seminar – Seminars were presented at the three main Front Range Community College campuses, the Westminster Campus, the Boulder County Campus, and the Larimer Campus. These seminars were led by UNAVCO personnel and Front Range Community College faculty. Both students and faculty were welcome to attend. These seminars included information on UNAVCO, information on the Geo-Launchpad internship, recommended coursework for internships like the Geo-Launchpad internship, and a question and answer session.

Professional Development for Faculty – In addition to professional development offered through the faculty mentor program associated with the UNAVCO internships (discussed later), faculty were offered opportunities to learn of internships, careers, and recent research in the geosciences for the purpose of passing this knowledge on to students. Faculty were invited to the above noted seminars. Further, earth science faculty and college administration were invited to attend an end of internship poster session, which included UNAVCO interns and research from students through multiple REU opportunities provided by Boulder, Colorado area research related institutions.
The primary activity for the Geo-Launchpad program is a summer internship for Colorado community college students. The focus of the internship is to help develop research ready skills, rather than conducting scientific research. Interns spent eight weeks of the summer working at the UNAVCO facility in Boulder, Colorado. Their experience included the following major activities:

1. **Team-Building Workshop.** During orientation week, interns participated in an afternoon of activities emphasized in team-building. Through the various activities, interns were able to explore each-others' skill sets, personalities, and work ethics by collaborating as a team to problem-solve and complete the exercises. Interns reported participating in this workshop helped to 'break the ice' and gain familiarity of their teammates early on in the program.

2. **Research Support Project.** Interns worked collaboratively in teams on a research support project under the direct supervision of UNAVCO technical staff. Students were provided office space within the UNAVCO facility and any required computing resources and supplies. Technical training was provided throughout the experience.

3. **Geology Field Trips.** Interns participated in two geoscience field trips. Early in the summer, Geo-Launchpad interns visited Rocky Mountain National Park along with upper-division undergraduate interns, graduate interns, and postgraduate interns. The field trip focused on the geological history of the Rocky Mountains and included a tour from an environmental geoscience volunteer. The interns also joined students from the RESESS (Research Experience in Solid Earth Science for Students) internship program for an overnight field trip to the University of Colorado (CU) Mountain Research Station, led by CU faculty and graduate students. Both field trips provided interns the opportunity to interact with other students in varying levels of their geoscience education while learning about the local geology.

4. **Communications workshop.** Interns participated in weekly workshops for non-academic, formal, and informal communications as a student and a scientist.

5. **Geoscience Career Circles.** Guest speakers from various geo-workforce sectors joined the interns over lunch every Wednesday for an informal discussion about their jobs and career paths. Sectors included industry, research, academia, government, non-profit, and consulting. Students from other internship programs within UNAVCO also participated which led to a broad scope of discussion during the question and answer period. The interns reported the Geoscience Career Circles as one of the most beneficial elements of the internship experience.

6. **Skills Seminar.** Interns met weekly for a skills seminar that provided training on topics including organization, time management, email etiquette, and basics of select software packages including Microsoft Excel, Google Earth, and Adobe Illustrator.

7. **Communication with Faculty Mentors.** Interns communicated with faculty mentors throughout the summer sharing work highlights and internship summaries. This allowed their faculty mentors to stay abreast of the intern’s experiences.

8. **Project Dissemination.** Students presented their work in a poster session at the end of the summer. Interns from similar geoscience summer programs also participated, totaling over 65 posters presented.
Faculty Mentorship. The Geo-Launchpad Program includes faculty mentorship to develop a supportive relationship with a faculty member from the intern’s home institution in order to ensure they continue on a path to a career in science, technology, or engineering. All interns applied with a Faculty Mentor who provided support before, during, and after the internship. Faculty mentors were asked to:

- Write a letter of recommendation for the student as part of the application process.
- Regularly communicate with the intern about their work/research throughout the summer internship.
- Travel to UNAVCO in Boulder on July 27 and 28 to participate in a workshop on mentoring students and attend the intern’s poster presentation.
- Conduct one formal meeting with the student in the Fall 2016 semester to discuss career paths, opportunities on campus, how to stay connected to the scientific community, and any other advice that will help the student in pursuit of their academic and professional goals. The student is required to submit a report of this meeting, and faculty will receive an honorarium for their support of the UNAVCO interns. Faculty are also encouraged to set up additional meetings with the student to maintain a mentoring relationship with the student.

Specific Objectives

Data were collected by an external evaluator using both formative and summative elements utilizing mixed-methods measures including pre-post intern surveys and student and faculty interviews. Student evaluations of the special topics course were also collected from students who participated in this course. Overall, first-year benchmarks were met.

Five students participated in the special topics course addressing internship opportunities, careers, and research in the geosciences. All five completed the course. Student feedback forms (standard to the college) were completed by four of the five students. Three students strongly agreed that they were challenged to think in new ways from the course, with one student agreeing that he was challenged to think in new ways. Nearly every student specifically noted value in the course and specifically identified an increase knowledge of careers in geosciences. Students’ only compliant about the course is that it was not longer.

The internship also proved to be highly successful, adding to UNAVCO’s success with the Geo-Launchpad pilot internship run in summer 2015. The five interns selected were highly enthusiastic (one intern was unable to complete the internship), as were UNAVCO staff working with the interns and four faculty mentors. Key evaluation findings are summarized below. Data were collected using a modified version of the Undergraduate Research Student Self-Assessment (URSSA) instrument (Hunter, Weston, Laursen & Thiry, 2009). The URSSA was developed with funding from the National Science Foundation to assess students’ personal, professional, and intellectual outcomes from participating in undergraduate research, including REU experiences. Because Geo-Launchpad is not strictly a research internship, items were adapted to better fit the technical and fieldwork of the Geo-Launchpad internship. The survey gains scales items are rated on a 5-point Likert scale (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree). Survey scales include networking/collaboration, intellectual gains, scientific
communication, organizational skills, technical skills, career knowledge and career preparation. The survey also measures other aspects of the internship experience, including the impact of the internships on students’ educational and career aspirations.

**Career knowledge and preparation**

- Students displayed the most growth in career knowledge (survey mean on career knowledge scale rose from 3.0 to 4.19 on a 5-point scale).
- All 4 students reported that the GLP program had strengthened their commitment to their pre-existing goals, including pursuing a bachelor’s degree and/or graduate study in geoscience and a future geoscience career.
- All students reported that their knowledge about geoscience career options increased substantially (e.g., survey mean increased from 2.75 to 4.25 on a 5-point scale).
- All students felt more prepared to study geoscience at a 4-year institution (e.g., survey mean increased from 3.75 to 4.25 on a 5-point scale).
- Three students reported that they are more interested in pursuing graduate school because of the GLP internship.

**Technical and research skills gains**

- Students made very strong growth in technical skills/instrumentation (survey mean rose from 2.62 to 3.38 on a 5-point scale).
- Students benefited from working side-by-side with UNAVCO scientists on real world, engaging projects that involved trouble-shooting and problem solving.

**Scientific communication skills**

- Students also made strong gains in scientific communication skills (survey mean rose from 3.6 to 4.25 on a 5-point scale).
- Students’ knowledge of how to prepare a scientific poster increased markedly (survey mean rose from 3.0 to 4.5 on a 5-point scale).

A discussion of specific objectives follows.

**Goal 1: Build students’ interest and capacity to engage in geoscience-focused STEM career pathways**

*Objective 1.1: Increase student awareness of academic and career opportunities in geoscience-related fields via a website and electronic media, workshops/seminars, webinars and annual mini-symposia at UNAVCO.*
Objective 1.2: Increase students’ knowledge and skills in geoscience fundamentals, methods, and techniques to prepare for internship experience through workshops, symposia, and a special topics course in geoscience.

Seminars and class visits were conducted at all three campuses of Front Range Community College. Several students participating in these seminars applied for the UNAVCO internship and/or enrolled in the special topics course. Of the 16 completed applications received by UNAVCO for the internship, all but one was from Front Range Community College, suggesting that the seminars may have played an influence in students’ participation in the Geo-Launchpad internships. At least one faculty mentor learned of the internship from a Geo-Launchpad seminar and shared the opportunity with his/her students.

Five students participated in the special topics course, with students reporting an increased awareness of careers and internships. Of these five students, three applied for internships at both UNAVCO and other REU programs. Two students have since transferred or applied and been accepted for geoscience related programs at four year universities.

Goal 2: Professional development of community college STEM faculty as mentors to students in geoscience focused careers.

Objective 2.1: Increase faculty knowledge of existing private sector and government geo-STEM careers via workshops, networking and symposia

Objective 2.2: Develop partnerships between faculty and UNAVCO staff to support students

Objective 2.3 Develop resources for faculty mentoring and instruction

According to the external evaluation, the GLP internships had a positive impact on the faculty mentors themselves, expanding their awareness of the different types of projects undertaken by the geoscience workforce and keeping them apprised of current work in the field. Several faculty members noted that this knowledge will influence their teaching and work with students. Faculty mentors also reported that they had become better mentors from the experience because the formal mentoring arrangement within the GLP program prompted them to be more intentional in their mentoring. Faculty also felt that they had received helpful mentoring resources.

Goal 3: Increase the number of students from community colleges that transition to geo-focused careers.

Objective 3.1: Provide students with authentic and experiential opportunities in geoscience-related work through internships at UNAVCO involving its science and technology consortium members.

Student surveys and interviews demonstrate moderate to strong growth in all areas, with especially strong learning gains in the areas targeted by the GLP internship, including communication skills,
technical/instrumental skills, and knowledge of geoscience careers. Students’ strongest reported growth on the pre-post survey was in knowledge of geoscience careers (see figure 1 on tables document). Students also reported strong growth in technical/instrumentation skills and communication skills. Students made moderate growth in other areas, such as organizational skills, intellectual gains, and career preparation, largely because they entered the program with stronger views of their skills/knowledge in these areas, as demonstrated by the high pre-survey means in those areas.

**Significant Results**

Of the five students participating in the special topics course, three of the students applied for internships at both UNAVCO and other REU receiving a total of four internship invitations. At least one student successfully transferred to the University of Northern Colorado to pursue a degree in geography, with an emphasis in physical geography and GIS. Another student participating in the class has been accepted to Colorado State University in Ecosystem Science and Sustainability. Student who completed the course identified an increase in knowledge of geoscience careers. Following is a list of comments by students when asked to identify a strength of the course:

- *This is the most useful class I’ve had this year.*
- *This will help me pursue internships, careers, and education in my field much better. I feel much more prepared.*
- *Challenged my way of thinking. Learned about new option for my future. Provide job internship opportunities.*

Students’ strongest growth over the summer internship was in their knowledge of the career options available in the geosciences. One of the primary goals of the GLP internship is to introduce students to the range of careers available to geoscientists and to provide students with the resources to learn more about those careers. Students reported their highest gains from the internship in career knowledge, particularly in understanding geoscience career options and their ability to find the resources needed to learn more about careers (see figure 2 in Tables document). Students also reported strong gains in understanding the daily activities and work of geoscience professionals.

Faculty mentors and students both thought that one of the most valuable aspects of the GLP internship was the interaction that students had with a variety of geoscience professionals and the opportunity to learn more about their work and career paths. Mentors felt that students’ career options had been broadened and that students might be encouraged to pursue career paths that they may not have previously considered. Comments from mentors included:

*She has been exposed to something different, she might have had an idea of what she wanted to do with her degree, but now that’s been broadened a little bit. When she goes to look for a job, she knows that she can look farther and wider for a job and she has a little bit more experience to be able to do that.*
It sounds like she’s starting to learn more about career options and thinking more about what comes after her Bachelor's degree. Right now, that's the immediate goal. After that, it sounds like she's been networking really well and learning more about those options beyond.

Students also felt that they benefited the most during the internship from the opportunity to learn about geoscience career paths during the Career Circles and to work side-by-side with the engineers at UNAVCO. The students particularly appreciated gaining a better understanding of the breadth of geoscience careers available and the often indirect paths that professionals followed to their current careers, as demonstrated by the following exchange during the focus group interview.

Speaker #1: I think what was really beneficial was the ability to just, like, ask people who worked in their fields, all kinds of questions from their education to day-to-day, and it gives you a better idea of, maybe you knew about the job, vaguely, but now you know more details.

Speaker #2: How they got there, the complex and indirect routes that they took to get where they're at. It's not a straight line.

Speaker #3: But I definitely learned more about what each one of them did. They talked about everything that they do, and it was very enlightening, and that's where you would want to go if you'd want to pursue that.

Students’ second strongest gains were in their ability to use instrumentation in geosciences. Students felt that they also gained a better awareness of the major instruments that are used in geoscience. Thus, students became more aware of the common instrumentation used in the discipline and gained the confidence and ability to use it (see figure 3 in Tables document).

**Technical Skills/Instrumentation**

Technical skills were students’ second largest gains according to the survey, and students extensively discussed their growth in technical skills and abilities during the focus group interview. Students reported that working with the instrumentation available at UNAVCO provided a real-world context for the science that they had learned about in coursework. Most importantly, the GLP internship offered opportunities that they would not have in their coursework to apply their geoscience knowledge, as mentioned in the following comment from a faculty mentor.

I guess being exposed to such a highly technical field, which is very different from what we did in the intro GIS class this fall. Being exposed and having this opportunity to learn all these techniques that can be used for pretty complex research. We never do anything like that in any of our classes really. Having this opportunity gave her the chance to learn things that she never could learn from us. How excited she was about it as well.
He talked about the survey he had been doing at Saint Mary's Glacier, which was really cool, and spending time in the shop here, working on things and learning how this technology works was totally exciting. We had talked about similar things in geology class so, he said that was good. Just the time being around these folks who are so knowledgeable. He'd never had any experience with that, so that was a great opportunity for him.

Students reported that the opportunity to learn about a variety of instruments and to actually use them in the field was the most beneficial aspect of the GLP internship.

I learned an awful lot about a wide variety of instrumentation, it's applicable for any field I go, any direction I go from here. We had the opportunity to help the field engineers quite a bit in preparing for their upcoming season, so we got a lot of hands on with a wide variety of the different things that they will use out there.

Another student commented on the value of working on the TLS team because it offered the opportunity to not only learn new instrumentation but to learn how the data are used and applied in a real-world context.

I was on the TLS team which was the Terrestrial Laser Scan team, and learning about that instrument was really interesting. We also used differential GPS, so we were working with several different types of GPS, and one of the really interesting parts was working with Trimble, seeing how they gather all the GPS data, and actually work with it and turn it into something they can use. That was really cool.

Students appreciated the trust that the field engineers had in them to use important and valuable equipment. This, in turn, boosted their confidence that they could use such equipment in the future and be successful in a geoscience career.

The actual hands-on research helps you, at first you're like ‘this is a really expensive piece of equipment,’ but working with it and they trusted us with it, and you just prove to yourself that you can figure it out and get there and get some self-confidence. And just the value of working with the field engineers and hearing their stories was great.

**Communications Skills**

Students reported very strong growth in communication skills from the GLP internship, especially in areas most related to the activities that they engaged in during the GLP internship. Similar to last year, students’ highest reported communication gains were in their ability to prepare a scientific poster (see figure 4). Students also reported strong growth in using data to discuss ideas in geosciences and understanding journal articles in geoscience.

Although students’ gains in scientific communication skills were one of the most robust outcomes from the student survey, they discussed scientific communication much less during the focus group, even when prompted. Nevertheless, students commented that learning the processes of developing a
scientific poster, communicating scientific findings, and using Adobe Illustrator were beneficial professionally, as noted in the following comment from the focus group.

*I feel like we got a very, very good look at a lot of different aspects of being professional, from communication to how to make our posters, to how to present things, and it was definitely something that will help each and every one of us, no matter what level of exposure we've had to that before.*

**Organizational and Project Management Skills**

Students entered the GLP internship with strong beliefs in their organizational skills, however, their skills still increased slightly over the summer. Students reported the most gains in general project organizational skills and time management skills. Students felt that their ability to work independently remained consistent over the summer, although they entered the internship with strong beliefs in their abilities in this area (see figure 5). In the focus group interview, one of the teams noted that they struggled with project management as they fell behind in data collection due to weather delays, thus, losing time to work on their poster.

**Career Preparation**

Students reported moderate gains in feeling prepared for future education and careers in geoscience. Students felt quite well prepared already for their future in geoscience when they started the GLP internship. However, they still reported some gains on the survey in their beliefs and confidence that they could succeed in the field of geoscience. Similar to last year, students showed the most growth in feeling ready to study geoscience at a 4-year institution (see figure 6). Surprisingly, students’ belief that they could succeed in future geoscience courses decreased. Nevertheless, students increased their confidence that they could have a successful geoscience career and they became more interested in geoscience careers.

Faculty mentors noticed that their students had solidified their educational plans as a result of the GLP internship, and had begun to think about career plans.

*I think this summer seems to have helped her focus in on, that her major is the right choice for her. I think she's not second-guessing herself on that as much anymore.*

Some faculty mentors commented that the internship had boosted students’ confidence that they can have a career in the geosciences. One of the faculty mentors noted the career benefits from the internship for community college students, in particular.

*I think overall it’s a great program. I’m really happy that it got up and running, and has helped to show some of our community college students that they are good enough, they are smart enough to work in science or work professionally or continue on to all those tracks. Sometimes students at our level don’t have that. That’s not a part of their vision.*
Faculty mentors observed that students would be more competitive for future internships or transfer to 4-year institutions because of their experience with the GLP program.

*I think it's a great experience for him. It's a good start in itself, and then hopefully he's gained some skills that will directly apply to his goals. Right now, it's kind of a resume builder, and a pathway to getting into a 4-year program.*

Students reported that the GLP internship provided them with the tools and knowledge to be competitive in geoscience education and careers, and also provided them with valuable career skills and resources. Students were particularly appreciative of the skill-building seminars, such as the resume workshop, as a student commented in the focus group interview.

*I think one of the most helpful parts of [the seminars] was the resume writing, and specifically we were able to have members of the staff look at our resumes and give us feedback, which I actually used all of their feedback.*

Perhaps more importantly, students gained confidence that they belonged in geoscience and could succeed in geoscience from the GLP program. One of the interns described her lack of confidence and her uncertainty at the beginning of the internship and how she gained confidence that she could persevere in the face of challenges in her education or career.

*Intellectual Gains*

Students reported fewer intellectual gains than they did in other skills domains, as their cognitive understanding of the discipline remained relatively steady over the summer. However, interns demonstrated the most growth in understanding how the GLP internship related to their college geoscience coursework and in their ability to formulate a question that could be answered with data. Students remained steady in their problem-solving skills, readiness for research, and understanding of important concepts in geoscience. As with some of the other domains measured by the survey, students entered the internship with strong beliefs in their intellectual abilities in geoscience.

Faculty and students alike observed how the activities and projects within the GLP internship built upon and expanded foundational concepts and skills that students had learned in their coursework, as noted in the following faculty mentor comment.

*She was so excited to do the internship. She would go on and on about how much she loved the program and how much she was learning. They were quantifying the accuracy of the scanner, so she did need to know about coordinate systems and all that stuff. She was like "I'm not making maps, but I'm using the things that I learned in class for this other thing that's not exactly what the class was about." For her, I think it was really great because she took a class and learned some concepts that are being applied in something real and slightly different.*

Mentors observed that their students had gained knowledge about the discipline and the technical terms associated with geoscience fields.
He's probably learned some more geology and learned about all the nomenclature related to it, and those kinds of things that he probably didn't have before, so he's a step ahead of the other students.

Students also perceived that they had made progress in their understanding of the discipline and their understanding of the research process, especially the iterative nature of the process of scientific research.

The TLS, we learned pretty intensely, but still probably only scratched the surface, but we worked with it in a functional capacity. We didn't just do a little part of it, and then hand it off to somebody else who was more familiar with everything. We learned how to employ it, and then we learned how scientists approach a problem, and develop a solution, just through the scientific method, so that was probably the biggest takeaway, was how scientists in the field answer questions so that their hypothesis and testing method. Is this test going to give us the data that we need to answer the question, developing a way to test, physically testing, gathering the data, interpreting the data, and then explaining the data, so it was like a full science project and it's what they do on a daily basis.

Students also developed problem-solving and trouble-shooting abilities, and gained confidence in their ability to handle challenges.

Definitely [gained] confidence in myself in being able to approach a problem, and just knowing like, there's a way around this, or a way through it, and I'm going to find it.

Preparation for research

Mentors and students reported that the GLP internship had helped to prepare students for future research experiences in the geosciences. Although students’ response to this item on the survey remained flat, faculty mentors noticed that their students were more prepared for future research endeavors. Mentors have more knowledge of the skills, knowledge, and aptitudes that are needed to successfully engage in research or other extended inquiry in geoscience. For example, the following quote highlights’ mentors observations of the way in which the GLP internship prepared students for research experiences.

All the skills of working as a team, using GPS and technology that way, fiddling around and working with all that kind of stuff would potentially prove effective, and he will be a viable assistant to some professor doing research in the field. He actually got some experience testing something and going through the methodology.

Collaboration and Networking

Students made the least gains in collaboration and networking skills, primarily because they entered the internship with very strong confidence in their ability to network with scientific professionals. Thus, students’ beliefs about the importance of networking and their comfort in networking with geoscientists
remained steady throughout the GLP internship. However, students did gain a better understanding of why networking is important and how it might benefit them professionally in the future (see figure 8).

Students’ survey responses showed that they became more comfortable with networking and gained a better understanding of how networking can benefit them professionally. Students did not discuss networking and collaboration very much during the focus group interview, but they mentioned that they had worked very well with one another over the summer, as demonstrated in the following comment.

No, we really did have, at least in my opinion, we had an amazing GLP team this summer. I mean I honestly could not have asked for better teammates. It was such a wonderful experience.

Mentoring

A core element of the GLP internship is the provision of an external faculty mentor to guide and advise the student during the summer, and especially, in the coming year. Most students and mentors reported that they communicated relatively frequently over the summer. Two pairs communicated every few weeks, one pair communicated several times over the summer, and another pair did not communicate during the summer. Mentors and students primarily communicated through email. Students provided updates about what they were doing in the program and sent pictures.

Students received mentoring not only from the faculty mentors who were part of the formal mentoring aspect of the GLP internship, but also from UNAVCO staff who provided informal day-to-day mentoring by supporting the interns in their scientific work.

And it wasn't just strictly our mentors, we had some wonderful experiences with many of the staff here like [male UNAVCO staff person – name removed for confidentiality] where he came in and he would explain to us the why behind things. And it was just such a friendly environment and [female UNAVCO staff] was absolutely phenomenal with us. It was such an eye opening experience to work with so many people that truly enjoyed what they do, not like anything I've ever experienced before.

Another student commented on the benefits of working side-by-side with UNAVCO staff. Students felt that they were treated like equals during the internship and that they were able to provide input into their work.

Working with the field engineers was far and above my favorite part about it, working hand-in-hand with them and like, they didn’t tell us what to do. They worked with us. If we had a problem on TLS, I mean some of this stuff on the whiteboard is from me and [my teammate] and our mentor, each equally putting in contribution to solving the problem, not just her telling us, this is how we're going to do it. Our mentor was a phenomenal teacher. The field engineers aren't just engineers, they're amazing teachers.
and I think they get some practice at it through here because she goes and teaches TLS, but she was a wonderful teacher.

Overall, interns felt that the environment at UNAVCO and the internship were very supportive, as highlighted in the following quote.

*The way they've built this internship, it's so supportive, and so the staff and then our mentors, and, it's just, it's really been a very supportive and wonderful environment.*

**Influence on Career Intentions**

Students reported that the GLP internship had not necessarily changed their career path, but confirmed that they were on the right track. Students noted that they had strengthened their commitment to geoscience and that they had chosen the right field. Mentors also noticed that the GLP internship had influenced students’ career paths by providing information about future careers and education in geoscience and solidifying their educational decisions.

*He is very much in sort of an information collecting stage right now. In that regards, I think that this is just a piece of his information that he’s getting to decide what it is he wants to do when he’s ready to graduate. When we talked last semester he was not 100% confident in that line that was going to. In talking with him now he's pretty confident that that’s the path he wants to go in, so I've seen him recognize that he is really interested in pursuing a degree in his chosen major.*

Students also affirmed that the internship had cemented their commitment to their field of study. As one student noted:

*I learned I'm in the right field. That's the sentence I would use to sum it up.*

Students also felt that the internship had broadened their career options by introducing them to new careers and fields of study. As one student commented, she was confident that she would be able to find a field of study and career within geoscience that was the right fit for her.

*I think it was very enlightening to see how much I had an interest in what so many of them did, that I hadn't really thought of before, and being able to learn more about each one. Because we were fortunate enough to have somebody from geography, geology, atmospheric science, EPA, teaching. It was such a wide variety that definitely made me feel a little bit more comfortable about my chances of finding something that I'm going to be just absolutely passionate about.*

Students also reported that the internship had spurred them to think more strategically about their future and their overall career trajectory, as noted in the comment below. The speakers during the Career Circles served as role models for thinking about and planning for careers in geoscience fields.
It definitely influenced my thinking, but more like, I am thinking like one step ahead now, more than like where I'm at now and just finish my bachelor's degree. I'm kind of like, well, I need to start thinking about what I'm going to do after my bachelor's degree. I actually have a plan ahead of time because that seemed to be like what they all, they were all focused on what they were doing, but had an idea of what they wanted to do after, consistently, throughout their career.

Three students also reported that they are more likely to pursue graduate school because of the GLP internship. Students not only learned more about graduate school as an educational option, but became more interested in pursuing that path, as indicated in the following comment.

*It has helped inform me on graduate school options. Before the internship I was not really considering graduate school. Now I believe it is something I will likely pursue.*

**Faculty Outcomes**

The GLP internship also had a positive impact on the faculty mentors themselves, expanding their awareness of the different types of projects undertaken by the geoscience workforce and keeping them apprised of current work in the field. Several faculty members noted that this knowledge will influence their teaching and work with students. As one faculty member commented:

*One of the things I love about teaching is that I also learn from them and that goes on in class and this summer, too. Learning about what she's been doing and the types of things that are really happening in research and the types of tools and instruments they're using and projects that they're working on. I learned a lot yesterday [at the RESESS presentation]. I will use that and plug it into my classes like "Hey this is what people are really doing. This is how you can apply the knowledge from class. You can do projects like this." I'm always soaking all that in and incorporate it into my classes.*

Faculty mentors also reported that they had become better mentors from the experience because the formal mentoring arrangement within the GLP program prompted them to be more intentional in their mentoring. Faculty also felt that they had received helpful mentoring resources.

*I think professionally it's been great to learn a lot more about mentoring and be able to be more intentional with these relationships that crop up with students. Now, having more resources on the mentoring side, I think will benefit me greatly in my career as a teacher, to be more intentional with how I give advice or how I talk with students or build a rapport. Giving more than just, "Oh, take this class, take this class," but more to, "What's your ultimate goal?" Then figuring out the best way to reach that goal.*
Key outcome and other achievements

As experienced in a pilot project by UNAVCO in summer 2015, students continue to demonstrate that a lack of formal quantitative background is not hampering their performance in the summer internships, provided projects are designed at the appropriate level. Perhaps the biggest achievement of the seminars, special topics course, and internships, is building confidence in the student that this type of work is indeed something they can do. We learned, however, that getting students to apply to the internships does not always lead to students accepting the internship opportunity.

Students and faculty were very positive about the format of the GLP internship and its benefits for students. Students and faculty expressed a lot of positive feedback about the implementation of the GLP internship. Some of the highlights from interviews and survey written responses were:

• The internship overall was well designed and well organized.
• UNAVCO mentors (including educational and technical personnel) were very supportive, helpful, and available when needed.
• Students felt that working side-by-side with field engineers was one of the highlights of the program and they were able to learn more about the nature of work in geoscience careers.
• The Career Circles and communications seminars provided many benefits for students and gave them a better understanding of career options in geoscience along with valuable professional advice.
• The poster session provided a glimpse into the scientific communication process and students learned a lot about communicating scientific results.
• Students appreciated the team-building activities at the beginning of the program. They also appreciated the field trips and interactions with RESESS students.

What opportunities for training and professional development has the project provided?

Training and professional development was implemented with three distinct groups: students, interns, UNAVCO staff, and faculty mentors.

Student professional development. Students in the special topics course met and interacted with professionals from a number of related fields. Further, students were required to prepare a resume, where instructed and differences between a resume and a curriculum vitae, and students were introduced to technical papers.

Intern professional development. A significant element of the Geo-Launchpad program was structured professional development for interns. A weekly 1.5-hour skills seminar was implemented to provide interns basic training in applications such as Excel, Google Earth, and Adobe Illustrator. Soft skills such as time management, digital organization, and email etiquette were also addressed. Interns also received training on how to develop a professional resume/CV and cover letter.
Formal program application. Interns applied to the program through the UNAVCO online application portal, the same portal used for all hiring at the UNAVCO. This provided students with experience in submitting formal work applications. Program staff followed up with interns on their experience.

Communications skills. A weekly 2-hour communications workshop helped students develop and refine mechanisms for communicating their work to non-technical audiences. Tips on effective networking were also discussed. This workshop was joint with the RESESS interns, allowing opportunity for near-peer interactions.

Geoscience Career Circles. Weekly informal lunchtime discussions with professionals working in various sectors of geosciences provided students with an opportunity to practice their communication and networking skills. Professionals discussed their career trajectory and students were given the opportunity for Q&A.

Technical skills. Interns learned technical skills while working with UNAVCO staff on their summer projects. Skills included GPS basics, types of GPS instruments, surveys and campaigns, Terrestrial Laser Scanning (TLS) basics and uses of TLS and range error and accuracy determination. They periodically worked in the warehouse where they were introduced to various power tools, received safety training, and operated them as necessary.

Faculty mentors. Four faculty members participated in the Geo-Launchpad program. They were brought to UNAVCO Headquarters in Boulder for two days of training and participating in the intern final poster session. Faculty members were given training on best practices in mentoring including differences in mentoring versus advising, mentoring students from minority populations, and different types of mentoring strategies.

UNAVCO staff mentors. Three UNAVCO technical staff worked daily with the Geo-Launchpad interns. Prior to the start of the summer, these staff and their two managers met with program staff. During these meetings technical staff were provided with guidance on how to develop a project appropriate for the interns, tips on how to manage undergraduate interns, and general tips on managing others’ work. The three staff involved in the program are engineers (field and data) and do not manage people as a part of their normal duties. This was an opportunity for them to develop and practice managerial skills.

The results of student internships were shared with faculty mentors at the end of the internship, as were posters presented at an annual REU event hosted by local organizations. Faculty and administrators from Front Range Community College attended this event. Results of the work of interns is available on subsets of the UNAVCO website. Front Range Community College Larimer Campus is also planning to display posters for students and faculty on campus. Presentation also have been made at the Geological Society of America annual meeting in Denver and at the annual meeting of the Great Plains/Rocky Mountain Division of the Association of American Geographers.

What do you plan to do during the next reporting period to accomplish the goals?

The first year of the program focused on Front Range Community College students. The next year will focus on expanding the program to other community college students around the state of Colorado. That will include encouraging adoption of GEO 210 at other colleges, informing faculty and administrators at other colleges about the internship opportunity at UNAVCO, creating promotion materials (flyers, digital flyers, videos, etc.) for dissemination at other colleges, and offering seminars at
other interested colleges. Some concern regarding the recruitment of faculty mentors was expressed in the independent evaluation due to concerns of time commitment and the fact that many faculty are off-contract at that time. As such, we plan to put more effort into faculty recruitment through outreach at local conferences and CCCS meetings and by creating informational materials targeted to faculty to demonstrate some of the professional development benefits of being a faculty mentor. Confidence in ability by students also remains a concern. We hope wider implementation of the special topics course will provide greater familiarity, hence increased confidence in students interested in geosciences careers. We also plan to ask our intern alumni, when possible and their schedule permits, to meet with students during seminars or visit classes to provide peer encouragement.

The programmatic elements of the 2017 internship will be implemented in a similar way to 2016, based on the positive evaluation data. Significant efforts will be made to inform community college faculty across the state of Colorado about the internship program including contacting individuals from geology, geography, and physics departments. Within UNAVCO, the program structure will be reviewed and modified as needed to ensure the technical staff working with interns are receiving the support and training they need. We will review the student summer project design process to ensure both students and technical staff receive benefit from the experience.

Products

Conference Papers and Presentations:


Other Publications:

Websites:
“Geo-Launchpad,” www.unavco.org/geolaunchpad

“Stem Internships Open Eyes to Career Possibilities,” Front Range Community College Blog, https://blog frontrange.edu/2016/08/17/stem-internships-open-eyes-to-career-possibilities/


Other Products:
“Launch Your Career with a Paid Internship in Geoscience,” flyer for all Colorado community college students.

“Launch Your Career with a Paid Internship in Geoscience,” version 9/20 for Front Range Community College students.

“Launch Your Career with a Paid Internship in Geoscience,” for Front Range Community College students.

2017 UNAVCO Student Internship Calendar

Participants

What individuals have worked on this project?

<table>
<thead>
<tr>
<th>Name</th>
<th>Most Senior Project Role</th>
<th>Nearest Person Month Worked</th>
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<tbody>
<tr>
<td>Patrick L. Shabram</td>
<td>PI</td>
<td>2</td>
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<tr>
<td>Donna Charlevoix</td>
<td>PI</td>
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<tr>
<td>Aisha R. Morris</td>
<td>Co-PI</td>
<td>1</td>
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<tr>
<td>Shashi Unnithan</td>
<td>Co-PI</td>
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<tr>
<td>Kelsey Russo-Nixon</td>
<td>Program Assistant</td>
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<tr>
<td>Melissa Weber</td>
<td>Program Coordinator</td>
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<tr>
<td>Hannah Hovar</td>
<td>Administrative Assistant</td>
<td>3</td>
</tr>
<tr>
<td>Max J. Miller</td>
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</tr>
<tr>
<td>Mike Zawaski</td>
<td>Other Personnel</td>
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</tr>
</tbody>
</table>

What other organizations have been involved as partners?
Nothing to report.

Have other collaborators or contacts been involved?
Yes

David Barnes, Colorado Community College System, Denver, CO – Advisory Committee
Tahlia Bear, Geological Society of America, Boulder, CO – Advisory Committee
Impacts

What is the impact on the development of the principal discipline(s) of the project?
The geosciences, as STEM field, are noted for low participation by underrepresented groups. Geo-Launchpad has proven effective in engaging community college students (which is commonly the first postsecondary school for many underrepresented groups).

What is the impact on other disciplines?
Students participating in the summer internship learn about working in the field of engineering through their experience with technical instrumentation. Students are also exposed to scientific data management (a key aspect of data engineering).

What is the impact on the development of human resources?
The Geo-Launchpad program provided UNAVCO technical staff the opportunity to develop people management skills including time management, project management, and interpersonal skills. Interns were provided opportunity to develop skills helpful to working in a collaborative environment.

What is the impact on physical resources that form infrastructure?
Nothing to report.

What is the impact on institutional resources that form infrastructure?
Front Range Community College personnel have gained valuable experience on working with collaborative faculty led grants. Some of the departments touched by unique requests created by the Geo-Launchpad grant include Human Resources, Academic deans, and Fiscal. FRCC has made improvements to its processes to accommodate future projects.

Within UNAVCO GLP is executed by the Education and Community Engagement program in close association with the Business Affairs (BA) program. The processes within the BA program have been updated and adapted to accommodate the interns working at UNAVCO for eight weeks. Updated processes include the on-boarding of employees, method of payment for work, and IT support services tailored for students.

What is the impact on information resources that form infrastructure?
Nothing to report.

What is the impact on technology transfer?
Nothing to report.
What is the impact on society beyond science and technology?
The program has provided formal education of careers and research in the geosciences, has provided technical training of the future geoscience workforce, has taught valuable professional skills inside and outside of science, and has engaged students to seek future education. Faculty and students at both two-year and four-year colleges are now more aware of career opportunities open to students.

Changes/Problems

Changes in approach and reason for change:
The proposal for Geo-Launchpad was submitted prior to the execution of a pilot project (also referred to as Geo-Launchpad), grant #1359469 for the internship component of the project. This pilot project included a faculty mentoring program for interns. This faculty mentoring program proved to be so valuable to both faculty and students, the collaborators of this project felt it necessary to continue this faculty mentoring going forward. To accommodate the addition of the faculty mentoring program, the Geoscience Mini-Symposium has been revised to be more focused on individual faculty members. The mini-symposium was intended to be a one day workshop at UNAVCO for faculty and students to provide geo-focused information to aid in advising and mentoring students. While the objective of the symposium is still achieved for some faculty, the decision has been made to focus more information and mentorship training on a few faculty members each summer rather than cast a wide net that provide more limited information to many individuals.

Based on feedback from UNAVCO technical staff, modifications will likely be made to the way summer projects are procured from staff and the way in which students are assigned to work on projects.

Actual or Anticipated problems or delays and actions or plans to resolve them:
No actual or anticipated problems or delays exist at this time.

Changes that have a significant impact on expenditures:
No changes that have a significant impact on expenditures exist at this time.

Significant changes in use or care of human subjects:
Nothing to report.

Significant changes in use or care of vertebrate animals:
Nothing to report.

Significant changes in use or care of biohazards:
Nothing to report.