



EXTERNAL EVALUATION OF  
THE GEO-LAUNCHPAD  
INTERNSHIP PROGRAM, FRCC  
AND UNAVCO, 2018



Heather Thiry, Ph.D. & Heidi Loshbaugh, Ph.D.  
GOLDEN EVALUATION & POLICY RESEARCH

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## Executive Summary

Women and some minority groups are persistently underrepresented in geoscience. The Geo-Launchpad (GLP) summer internship program seeks to broaden participation in geoscience by engaging community college students in immersive, technical experiences while also providing mentorship, professional development and career guidance. The external evaluation of the GLP program used mixed-methods measures, including pre-post surveys and interviews to assess the impact of the program on students' aspirations, knowledge, and skills. In addition to the GLP internship, a geoscience careers course (GEO 210) is now offered at Front Range Community College in spring. The GEO 210 course was piloted in 2017 and was offered as an ongoing Geology course at Front Range Community College in spring, 2018.

Key evaluation findings are:

### **GLP internship**

#### ***Demographics of interns:***

- Three of the interns were women and one was a man.
- Two interns were white/Caucasian, one was Hispanic/Latino and one was mixed race/ethnicity: Hispanic/White.
- None of the interns was the first in their family to attend college.
- All four students plan to transfer to a 4-year degree program in the geosciences.

#### **Gains in Career Knowledge**

- Interns reported the most gains in knowledge of career options and career resources in geoscience
- 50% of incoming interns were aware of career resources in geoscience (including one intern who had enrolled in the GEO 210 course), and 100% of interns were aware of these resources at the end of the summer
- Interns also made strong gains in knowledge of career options in their field (moving from “not sure” to “agree” that they are aware of various geoscience career paths)
- From the Career Circles, interns learned about the non-linear paths taken by many professional scientists
- Interns learned about federal agencies and the variety of scientific paths within the federal government

#### **Gains in Career Preparation**

- Interns second highest area of gains was in career preparation, especially understanding the professional work of scientists.
- No students entered the internship with an understanding of the everyday work that scientists do, yet 100% left the internship with this understanding.

- Interns gained a better understanding of professional work environments, including the importance of organization, planning, teamwork, and trouble-shooting in professional, scientific settings.

### **Scientific Communication Skills**

- The third largest area of growth for interns was in scientific communication skills, especially preparing a scientific poster.
- At the start of the internship, only 25% of interns understood how to prepare a scientific poster, but 100% did at the end of the summer
- Interns received substantial coaching and mentoring in preparing their scientific posters from their scientist mentors.

### ***Technical gains***

- Because of the nature of their projects, interns did not make the same gains in instrumentation skills as they did in previous years; however, they gained computer science and programming skills to a larger extent than they did in past years.

### ***Career aspirations***

- Three out of the four interns were actively considering graduate school because of the GLP internship

### **GEO 210 course**

#### ***GEO 210: Student Demographics***

- Three students were women and one was a man.
- Three identify as white; one as Hispanic/Latino.
- All plan to receive an A.S. degree.
- All four students plan to transfer to a 4-year college or university. Intended majors varied: Geology, Geography, Anthropology, and Environmental Science.

#### **Gains in Career Knowledge and Preparation from GEO 210**

- Geo 210 students made the largest gains in understanding career paths and resources. In particular, students learned about career resources in geoscience (mean rose from 3.25 to 4.5, or from “not sure” to “strongly agree”).
- Geo 210 students also made strong gains in career preparation. For instance, 50% of students knew how to create a resume for a scientific position at the beginning of the semester, yet 100% of students could do so at the end of the semester.
- Geo 210 students also gained an understanding of the skills required for a geoscience career (moving from “not sure” to “strongly agree”).

### **Gains in Scientific Communication Skills from GEO 210**

- Geo 210 students made gains in their ability to write scientific reports and understand research articles.
- 50% of Geo 210 were confident in their scientific writing abilities at the start of the semester, but 100% were confident at the end of the semester.
- Students also gained confidence in their ability to critically analyze a scientific paper.

## **Introduction**

The geosciences have persistently low participation rates of women and underrepresented minority groups. To provide equitable access to STEM careers and to meet national workforce needs, participation in the geosciences must be broadened to women and students from traditionally underrepresented minorities. Geo-Launchpad is an 8-week summer internship program for Colorado community college students that has been offered for the past three years. Some of the important goals of the Geo-Launchpad internship program are to: 1) engage students in an extended technical project, 2) introduce students to instrumentation in the geosciences, 3) provide students with an overview of geoscience careers, 4) develop students' professional networks and skills, and to 5) enhance students' mentoring relationship with a faculty member at their home institution. In addition to technical field experiences at UNAVCO and USGS, the GLP internship program offered career seminars (Career circles), communication seminars, technical seminars, and opportunities to network with working scientists and student researchers from the Research Experiences in Solid Earth Science for Students (RESESS) program, also housed at UNAVCO. In 2018, Front Range Community College offered a 1-credit course (GEO 210) focusing on geoscience internships and careers as another mechanism to boost the career knowledge and professional skills of community college students in the geosciences. The course introduced students to current research and tools in the geosciences and provided an overview of various career paths and internship opportunities in the discipline. The course was offered in spring, 2018 and has been approved by the Colorado Department of Higher Education to be delivered at community colleges in the state of Colorado.

## **Evaluation Design and Methods**

The external evaluation of the Geo-Launchpad program contains formative and summative elements. Formative evaluation is designed to provide recommendations to modify the program for future implementations, and summative evaluation is designed to assess whether the program has met its goals and milestones. The evaluation uses mixed-methods measures, including pre-post surveys and interviews.

## **Evaluation Questions**

The external evaluation was guided by the following questions:

1. Has students' interest in geoscience careers, their knowledge about career options, and their capacity to pursue these careers increased from their participation in the GLP internship?
2. Have students' technical, networking, and scientific communication skills increased from their participation in the GLP internship?

3. What are the essential program elements that contributed to desired outcomes, and which elements might be modified in the future, if needed, to improve outcomes?

## Evaluation Instruments

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 the Geo-Launchpad internship is not strictly a research experience, items were adapted to better fit the technical, scientific and field work 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 networking/collaboration scale was added specifically for the Geo-Launchpad internship to align with the program focus on professional networking and scientific collaboration. The survey also measures other aspects of the internship experience, including the impact of the internships on students' educational and career aspirations. The survey was further adapted for use with students in the FRCC GEO 210 course.

The survey was administered to students in the FRCC course and in the summer internship. Surveys were administered at the beginning and the end of the course and the internship. Surveys were sent to students' e-mails through SurveyMonkey. E-mail reminders were sent every four days to students who had not responded. Reminders were sent twice. All students in the course and the internship responded to the pre- and the post-survey. GLP internship students were also interviewed in a focus group format at the end of the summer program. The interview protocol addressed the scientific and professional benefits from participating in the GLP internship, mentoring, networking, and advice for future implementation.

Scientific mentors from USGS were interviewed in a focus group at the end of the summer internship to triangulate students' self-reports about their gains from the program, to learn more about the mentorship provided in the program, and to assess the impact of the program on scientific mentor's careers and professional abilities. Intern and mentor focus groups lasted for 60 minutes. Interviews were recorded and transcribed for data analysis.

## Analysis Methods

The analytic methods described in this section apply to all data collected for this report. The quantitative data were organized in a Microsoft Excel spreadsheet where descriptive statistics were computed. Frequencies and means are reported for most of the items. Groups of items were clustered into scales to assess student outcomes in a given domain. The average of the individual items that comprise each scale was computed for the scale mean. Items were rated on a 5-point Likert scale. Tests of statistical significance, such as t-tests or one-way ANOVAs, were not conducted due to the small sample of participants.

Write-in responses to open-ended survey questions and interview transcripts were entered into *NVivo* qualitative analysis software and coded using procedures developed by Spradley (1980). Each new idea raised in a written response was given a unique code name. As these same ideas were raised by later respondents, each segment was added to an existing code reflecting that idea. At times, participants' responses were brief and represented a single category, but more frequently, responses contained ideas that fit under multiple categories, and these were coded into each category separately. Codes were organized into larger, descriptive categories, or "domains." Domains were generated deductively, from the program goals, and inductively, from the data itself. The domains and codes within them reflect the major themes that manifested in the interviews.

## **Evaluation Findings**

This section reports findings from the data collected from the GLP program in 2017-18. The section first describes the demographics of student participants in the GLP internship and the GEO 210 course. Next, outcomes for GLP interns and mentors are reported. Finally, outcomes for GEO 210 students and advice for implementation are discussed.

### **Student Demographics**

#### *Demographics of GLP interns*

Four students were summer interns at the United States Geological Survey (USGS) for the Geo Launch Pad program in 2018. Their demographic backgrounds are as follows:

- Three of the interns were women and one was a man.
- None of the interns was the first in their family to attend college.
- All four students work outside their studies, at least 15 hour a week.
- All four were full-time students.
- All four students plan to transfer to a 4-year program in the geosciences.
- Two interns were white/Caucasian, one was Hispanic/Latino and one was mixed race/ethnicity: Hispanic/White.

#### *Demographics of students in GEO 210*

Four students enrolled in the GEO 210 course in spring of 2018. Their demographic information is as follows:

- Three students were women and one was a man.
- Three identify as white; one as Hispanic/Latino.
- All attend college full-time.
- All plan to receive an A.S. degree

- All four students plan to transfer to a 4-year college or university. Intended majors varied: Geology, Geography, Anthropology, and Environmental Science.
- Three out of the four students work outside their studies, all who work do so for at least 15 hours a week of outside employment

### Students' motivations for participating in the internship

All students reported that they chose the GLP internship to learn more about geoscience careers and the nature of the work in the discipline. Students also wanted to see if geoscience was the right career path for them. Two students (50%) noted that they applied to the GLP program because they were strongly encouraged by a faculty member. In one case, the student applied to and chose the GLP internship from competing internship options because of the encouragement of a faculty mentor. Thus, interest in geoscience careers coupled with faculty support and encouragement were the primary motivations for students to pursue the GLP internship. For example, one student wrote on the survey:

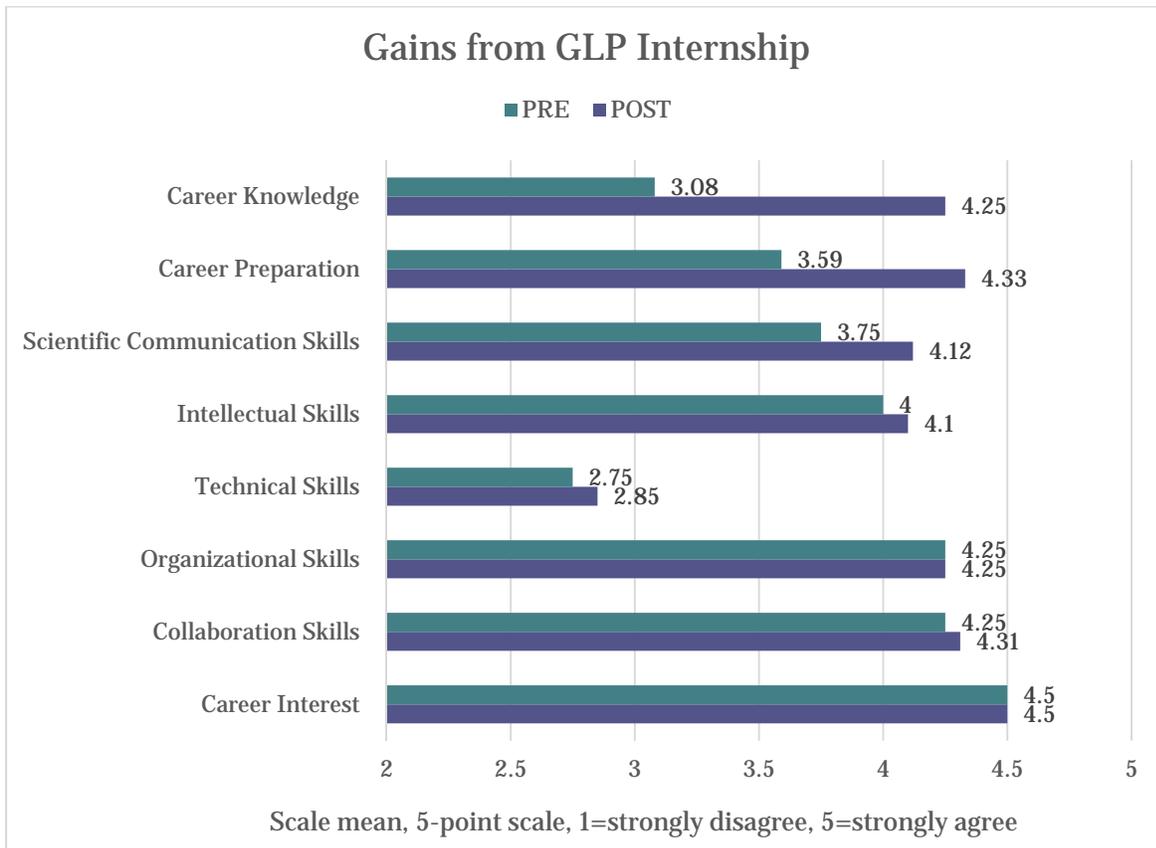
*The passion my teachers have in the geoscience fields was what motivated me to apply for the Geo-launch pad internship. The internship is a perfect opportunity to explore how passionate I am about the Geosciences and if a career in this field would be a good fit.*

## Student Outcomes

### GLP Summer Internship

Interns made especially strong learning gains in some of the areas targeted by the GLP internship, such as career knowledge of career pathways, scientific communication, and preparation for geoscience careers. Still, interns held steady in their skills in other areas, such as technical skills, as the projects that the interns worked on this past summer did not require the instrumentation expertise that past projects emphasized. Thus, interns were introduced to the variety of career paths within geoscience that do not necessarily use technical instrumentation, but rather rely on software, computer programming, and other technical skills. Students demonstrated lower growth in areas in which they entered with already strong skills, such as collaboration/teamwork, project management, self-efficacy, or interest in geoscience careers.

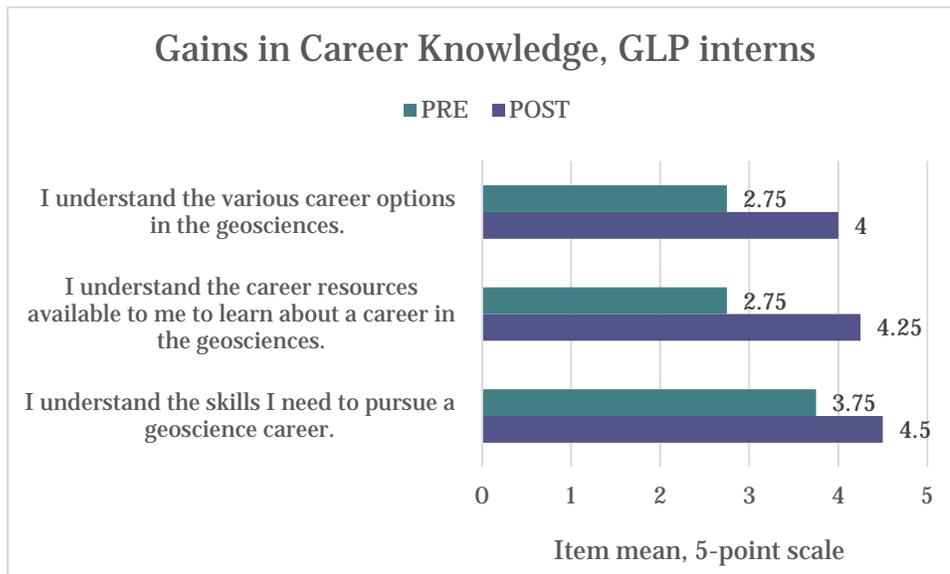
**Figure 1. Skill and Knowledge Gains, GLP interns**



### **GLP interns: Career Knowledge**

Across the board, interns learned about career paths in the geosciences and gained resources for navigating their own educational and career pathways. Interns benefited from the focus on career paths in the GLP program. Interns learned about the career options that are available in the geosciences and the educational background or credentials needed to enter those careers. Students made the most gains in their ability to access resources to learn about geoscience careers. For instance, at the beginning of the internship, only 50% of internships felt that they knew about geoscience career resources, yet 100% did at the end of the internship. Interns also gained a better understanding of the wide variety of career paths in the geosciences.

**Figure 2. Gains in Career Knowledge, GLP interns**



In interviews, GLP interns stated that they gained an overall understanding of career paths in the geosciences as well as an appreciation of the non-linear trajectory of most professional careers. They also gained understanding of the importance of a community of scientists; this is clear from their engagement with their scientific mentors, UNAVCO graduate students, and the role their faculty mentors played. The recognition that professional life is neither linear nor pre-determined was a significant takeaway--even a source of relief:

*Student #1: One thing I liked is nobody had a completely straight path. It's not like they went to school, they graduated, they got a job. They had multiple jobs that might not have fit them as well but it led to their next job and then up until they got their career and they were happy.... You have a lot of different jobs and that was nice because none of them really knew what they were doing, which is refreshing to hear because you think everybody's got it together, but they don't.*

*Student #2: That was definitely, definitely helpful.*

*Student #3: Because it's daunting being an undergrad and seeing professionals. It's like, "How can I get there?"*

*Student #1: Yeah, how successful they are. It's like, "Am I ever going to get there?"*

In this way, interns learned from the Career Circles and from their other interactions with professional scientists to view their career as non-linear and to approach it as a process of discovery and to be open to opportunities.

Interns also learned about the vast array of career options within the geosciences, including professional scientist positions, academe, and federal agencies. Interns gained a better

understanding of the nature of work within these different career paths. Interns also learned about career options from their experience at USGS, and also from their interactions at UNAVCO and the other interns in programs at UNAVCO, as described in the following exchange.

*Intern #3: Yeah, so it kind of opened up the options because I had never really thought of a federal science job as ... I don't know, I just really didn't know what to think of it or what it was. It kind of gives scientists opportunity to do research but without the academia aspect of it because I really thought you could only do research if you are also teaching. I just wasn't aware that there were other options of just doing the research, like working for the government, essentially. And kind of learning those differences of working for academia, like doing research that way in your own grants, and working for the government which is more you have to publish and then you will keep your job, essentially. And so just learning how the different ones work was super helpful, kind of eye-opening to what I would want to do in the future.*

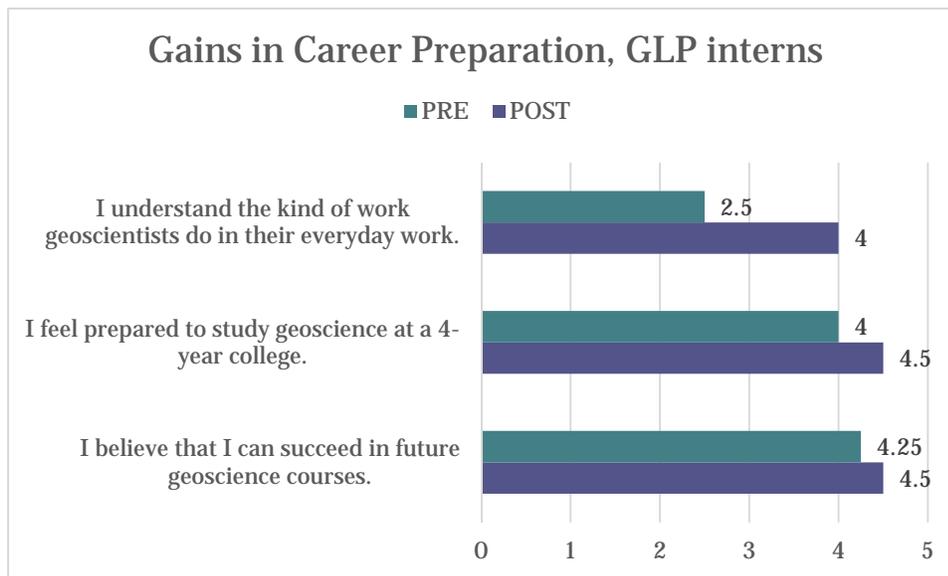
*Intern #2: To see the projects that the RESESS interns are working on and also what we're doing, there's so many different avenues and paths you can take within geoscience. I mean, I think it's really important to hone into what excites you the most. I think I've taken that away. There's a lot options. It's good to try different things to see what fits best.*

Overall, students gained a better understanding of the variety of geoscience opportunities available and the reassurance that a non-linear career path is typical.

### **GLP interns: Career Preparation**

GLP interns demonstrated strong gains in career preparation, although they entered the internship feeling already prepared in some areas. Interns already felt prepared to study geoscience at a 4-year university, but still gained some confidence in this area from the internship. Students also gained a bit of confidence that they could succeed in advanced geoscience coursework, however, they also entered the internship with a strong belief that they would be successful. Students made the most gains in understanding the everyday work of geoscientists and understanding the nature of professional environments. In fact, no students entered the internship with an understanding of the actual work that geoscientists do, yet 100% had this understanding at the end of the internship.

Figure 3. Gains in Career Preparation, GLP interns



In interviews, GLP interns discussed specific learning gains in understanding the everyday work and practice of professional scientists, such as awareness of federal regulations, the organization of government agencies, as well as learning to use technical tools, including software. Interns came to a better understanding of the scientific, as well as the non-scientific aspects of professional work in the sciences. For example, one intern stated in the interview:

*“Well, we got to explore through, just our own research, looking at federal protections. We kind of dove a little bit into state protections. We got a lot of knowledge on that. We also got knowledge on programs like Python, QGIS, which I had never had an experience with before....let alone knowing what it is, so it was super helpful.”*

One significant experience identified by interns was learning about the intersection of science and the federal government. Students were struck with the substantive role the federal government plays in geosciences and even adopted jargon they learned during the internship. Finally, for students of science, experiencing the magnitude of resources available through a government agency was eye opening; for instance, the scientific mentors were pleased with their ability to introduce interns to these resources, as noted by one of the mentors in the focus group interview.

*“So I think with them being fairly new to the field and not knowing exactly what they want to go into, I feel like they, at least my students, saw a lot of different things at USGS we're doing. And I think that goes for both groups. We try to even get them into a few tours and things, to show them a few other things like the ice core lab...Students were a little blown away at what actually happens within USGS. So they got a little bit of flavor of what the agency does.”*

Yet, not only were GLP students introduced to cutting edge interdisciplinary science, they also gained experience with the contemporary work environment for many professionals. For instance, interns were exposed to a real-world problem when a piece of technology did not work, despite multiple interventions over several weeks. Although unplanned as part of a summer “curriculum,” the troublesome tool proved a useful teaching experience for how professionals cope with the reality of professional and scientific tools.

*We had one particular scanner where we had swapped the computer out just before the students came and it created a lot of problems for us. So throughout the project they got to see us struggle with finding the right software, and the right drivers to get this thing going, and it was like two days before the project was over. Well, we really didn't get a chance to work with this particular machine. But, you know, that's just kind of the way it went. – Mentor*

The GLP internship also fostered a better understanding of the geosciences workplace and the variety of work environments within geoscience. For instance, the internship project this past summer emphasized work at a computer. Two interns noted that a balance of office and field work in their future career would best suit their professional satisfaction. One of the interns noted that it was “very helpful to realize” that a mix of deskwork and fieldwork would suit her temperament and interests more than a strictly office environment. And yet within the office-based projects they conducted over the summer, the interns discovered what good professionals all must do: to succeed in the “real world,” one must develop and apply flexible, creative, and persistent capacities to address real constraints in real time. Therefore, interns gained a better understanding of geoscience workplaces, as well as valuable professional skills and understandings that could transfer to almost any professional career.

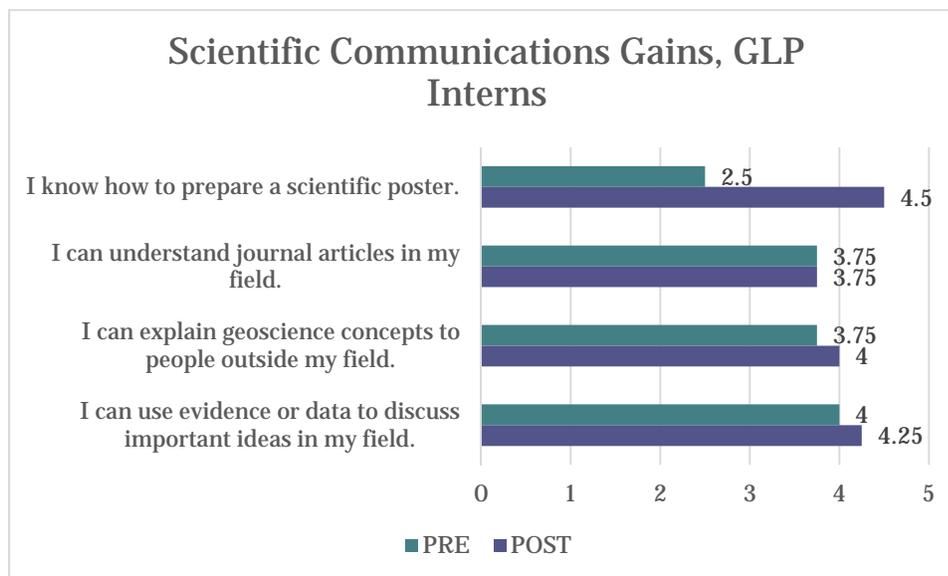
Finally, the GLP internship helped students to learn and refine their professional skills, such as resume development, networking, or interviewing. Students developed their skills through the workshops offered at UNAVCO, as described in the following comment from an intern.

*I really liked the career workshops and the skill seminars at UNAVCO because they just taught us a lot of skills from elevator talks, and interviews, and CVs, cover letters, resume building, all of that. I think that was something that I would definitely take away from this internship.*

### **GLP interns: Communication Skills**

Interns’ third strongest gains were in the development of their scientific communication skills. Interns displayed the strongest growth in the areas specifically targeted by the Geo Launch Pad program, such as preparing a scientific poster. At the start of the program, only 25% of interns had an understanding of how to prepare a scientific poster, but 100% of interns did so at the end of the program. Students showed less growth in areas that were not emphasized as much by the GLP program, such as reading journal articles.

**Figure 4. Scientific Communication Gains, GLP interns**



This year's internship also includes attendance and presentation at a professional conference in the fall. The interns were very eager to attend the conference and share their work. Developing a scientific poster provided a valuable experience in communicating findings in a concise manner and the process of selecting which findings to focus on from many possibilities, as described in the following exchange.

*Intern #3: And we have a lot of data that we were working with and a lot of different applications and there were many different paths we could have gone down, but I think deciding what we wanted to do and putting it in a clear way was the biggest lesson learned, I think.*

*Intern #4: And challenge too in some ways.*

During the summer, interns received useful coaching from their mentors on the preparation and presentation of scientific posters. For instance, part of this coaching focused on striking a balance between professionalism and perfectionism, as described in the following comment from an intern.

*Yesterday, our mentor saw us working on it and he was like, "Guys, just stop looking at it because the more you look at it, the more you're going to find to change. It looks great, it's fine." That was also a lesson learned: don't look at your poster for too long because you'll find a lot of things.*

As mentors worked to nurture experiences for the interns, they themselves were reminded of the value of perspective and end goals, particularly for novices. Being able to communicate

effectively for those not deeply immersed in the work was one key takeaway. The mentors found this to be true not only in their day to day work with interns, but also in thinking about the value of scientific communication through common tools such as abstracts and posters. The scientific poster provided an opportunity for the interns to step back and communicate the big picture, while the experience of having interns, provided that same opportunity to think about and communicate the big picture for the mentors themselves.

*Mentor #1: And then the other opportunity, maybe this is common in science, but being able to tell others what you're doing is always a struggle. So having new fresh minds and faces involved in that gave me an opportunity to think about how we're explaining things. Something that I would've never really thought too much of. But, definitely its always good to have those experiences, and kind of a sounding board.*

*Mentor #2: As far as that, I would say there are times during the project when we're sort of buried in tech stuff and process stuff. But, then for the poster they're thinking about why is this important? Why is this work important? How does it fit in? Who is it serving? And some of those basic questions. It helps us to articulate that better. I think some of those things we rewrote the abstract and things like that to communicate with others in the future.*

### **GLP interns: Technical Skills/Instrumentation**

In contrast to prior years, students remained steady over the summer in their knowledge of and ability to use technical instrumentation in the geosciences. Students held steady on both of the survey items measuring their knowledge of instrumentation. Interns declined slightly in their general understanding of the variety of instrumentation used in geoscience, yet they increased slightly in their understanding of how to use major instrumentation in their discipline. Because the projects did not emphasize instrumentation as much as projects in previous years, students did not show the same amount of growth in this area. However, students gained technical expertise in areas not measured on the survey, such as computer science and programming. In this way, technical skills acquired on the job and used in support of career scientists became an important feature of the interns' experience, as described in the following quote from an intern. In this way, interns developed an appreciation for the importance of computer programming in the geosciences, and developed a commitment to learn more about it in their future education.

*I didn't really think programming was for me before because I just didn't think it was ... I thought you had to be super, super smart to do it and just didn't think I could do it. After this internship, it kind of taught me that anyone could do it; you just have to learn it, practice it. It's definitely created a new path for me to want to continue my education with programming and just kind of showed me that I can do computer stuff and it's not as daunting and scary as it seems, in my own head at least.*

Mentors also discussed this secondary area of technical, professional knowledge that interns were exposed to that fell outside of strictly “science” instrumentation. Mentors described how students gained skill in computer programming and database management, skills that are useful in the geosciences but may be transferable to other fields as well.

*Mentor #1: I think one of the things we found along the way was how useful knowing a programming language might be as part of their coursework.... It wasn't something we really planned on directly for the project, but we had an opportunity to learn some things that I can see would be very useful for us in the future. So that came out along the way.*

*Mentor #2: Yeah, we had that same thing when we first initially put forth our project. They asked what skillsets would be good, things like that. That was something that we had put on there because everything that we do seems like it touches upon computer programming or database management.*

### **GLP interns: Intellectual Gains**

Interns entered the GLP program with strong self-reported problem-solving skills and understanding of the important concepts in geoscience. Thus, interns did not demonstrate dramatic growth in scientific thinking during the internship. Interns made slight gains in problem-solving skills and in understanding the important concepts in geoscience. On the other hand, interns remained constant in their ability to formulate a question that can be answered with data and in feeling prepared for research. The projects this past summer were less research-oriented than in the past, so interns made fewer gains in their research abilities and capacities.

In interviews, interns and mentors discussed students’ burgeoning understanding of important disciplinary concepts and the intersection of geoscience with other disciplines and skill sets. As novice scientists, the GLP interns were exposed to forward-leaning science that crossed disciplinary boundaries and relied on multiple data sets and analytical approaches. In addition to working with USGS staff in Colorado, one team of interns interacted directly with field scientists across the US. These researchers revealed that data can take many different forms as federal scientists used the products of their research to construct a geospatial framework. In this case, photographs taken at different points in time served as data to allow analysis of how environments change based on use and climate, as described by a mentor in the following quote.

*During our project we were actually working with a couple of different researchers. One in the Grand Canyon and one at the water center in Idaho. So the students had a chance to interact a little bit with researchers and ask them some questions about the photos, and what they were doing with them, and how they were using them, and why they were important. So I think that was really good direct experience.*

The use of data and its interface with technology were also prominent in the interns' exposure to science in the USGS. Thus, interns gained a better understanding of the way that data and technology are used in geoscience, apart from pure research, as mentioned by a mentor in the focus group interview.

*But, I think they had an eye opener, at least [on our use of] data and focus around data, and tech side of things. We use that in everyday situations, so I try to help push them on getting engaged and learning a little bit more about some opportunities there. Actually learning some of the software and just thinking about how that might play into their future. It's everywhere, a lot of that stuff. So I think there's ... I feel like they grew a lot and in a lot of different ways, but those were just a few that really stood out. -Mentor*

### **GLP interns: Collaboration/Networking**

Similar to some other areas, interns entered the GLP internship with strong collaborative skills and a reasonable comfort level with networking with scientists. Thus, interns remained steady on almost all of the items on this survey scale. Yet, in the focus group interview, interns discussed the benefits of collaborative learning in the internship. Teamwork as an essential component of professional scientific practice was a clear takeaway for the GLP interns. Interns were appreciative of the collaboration and teamwork that they experienced on their summer projects, as described in the following exchange.

*Intern #3: I would have struggled with it personally if I wouldn't have had my partner. One of the really good things was having a partner. I liked that.... We could struggle through together and then learn together.*

*Intern #4: Yeah and then we each had our own strengths and weaknesses that go well with each other.... That helped a lot.*

*Intern #1: I think it was same for [my partner and me]. [Our mentor] split up some of the work so sometimes, [so we] would be doing our own thing, but then it would come back together. We, I feel like, had a good mix of both.*

*Intern #2: And a good support system for each other. If one of us was having trouble with the thing we were working on, we'd come together and work on that one thing.*

### **GLP interns: Mentoring and Project Selection**

Interns described highly positive, productive relationships with their mentors and the mentors themselves described the personal and professional benefits they received from working with summer interns. All interns discussed in the focus group interview how their mentors had

taken an interest in their career paths and made efforts to discuss career options with them and introduce them to others who could help facilitate their professional development,

*She helped us with the poster, but then beyond that, she wanted to further our careers in the future, which was really awesome. She wanted to show us every single opportunity that she thought would benefit us. We had a great relationship.*

Interns observed and were appreciative of the many efforts that their mentors and professional staff took on behalf of their internship, as described in the following exchange.

*Student #2: [Our mentor] definitely had a game plan the whole way. We didn't quite understand it, but he was guiding us. Every morning we meet with him, so he's set aside a lot of time to help us, especially with the poster. All last week, I think he spent three days, full days out of his-*

*Student #1: Daily work schedule.*

*Student #2: To be with us. He has been very hands-on.*

*Student #1: And even when he's not with us directly, he's editing our stuff for us on Google Docs and working. He's put in a lot of time and it's been much appreciated, especially with the level of data that we were working with. It sometimes was kind of confusing and so he was always there to shed a light on what was happening. He set up multiple ways that we could network, like options.... He just really set us up for success and made sure we had the resources we needed.*

The mentors themselves described the benefits of working with summer interns. For one, mentors were able to take on projects that they did not have the resources or staff to complete. The interns thus contributed to the work of the units that they were housed in, as shown in the discussion below. Mentors and their staff were also engaged in USGS in a broader way than they typically may be because they introduced the interns to the variety of facilities and opportunities within USGS that the mentors themselves did not typically interact with.

*Mentor #1: We ended up doing some things that we probably wouldn't have done over the summer or haven't done in the past. So part of what I would describe is an enrichment experience like a tour of the nuclear reactor here. My staff hadn't done that so arranging that for the students and my staff was really good for team building.*

*Mentor #2: Some things that have been continually pushed back, or off, actually got done because of this. We had to, in some ways, just kind of get our act together in preparation for the students. Like setting up a workstation that we've been*

*wanting to set up and those kind of things. Just kind of put us into a different gear or some of our operations, which was very helpful.*

The mentors also noted that it was productive for their own scientific team members to have summer interns. The teams themselves collaborated closely because of the interns and, thus, laid the groundwork for future projects. That students came to the agency with “fresh eyes” meant that seasoned employees needed to see their roles in a new way. The internship program allowed USGS mentors and their teams to re-engage with their work and peers.

*Mentor #1: I think the team building stuff was important. There is a lot of times when others in the group willingly offered some time and effort. I think overall the groups are pretty good helping each other out and stuff, anyways. But, just another opportunity for that and it's always encouraging to see that happen in the workspace.*

*Mentor #2: For us, this actually created an effort that will be helpful into the future. But, it's something that we probably wouldn't even have thought to have our staff work on. Mostly because of time and commitments. So it gave us a little bit of freedom to explore some new stuff.*

Mentors also gained valuable experience in mentoring and supervision:

*For myself, I haven't supervised many people, in recent years, anyways. So it was a good opportunity to interact [on how to take a] project forward, and learn a lot of things along the way. That was something that I enjoyed a lot and got a lot out of.*

Mentors also discussed the importance of project selection in defining the scope of work for interns and ensuring that they identified a project that can be successfully achieved within the timeline of the internship. For instance, one of the USGS teams thoughtfully shaped the project they had outlined to UNAVCO from an open-ended concept to a more focused project to ensure the interns could be successful. Even so, mentors found themselves learning as they went how to better structure the experience.

*Mentor #2: So when we submitted we actually had more of a broad, "Hey, we're gonna link additional information to this network and show some of the values behind that." And as we got closer.... I started thinking about, "Oh this is only eight weeks. I'd better give them a project versus give them a concept." ...It would've been pretty tough, I think, if we didn't have that narrowed focus.*

*Mentor #1: The things you might be able to get accomplished, will that get accomplished? Or what will come up along the way? It's kind of ... we found that out despite our best planning.*

The participation of UNAVCO from the outset was beneficial to the USGS mentors and staff. Through creating the structure of the project and also reviewing applications, the mentors began to invest themselves in the program.

*The outline was very helpful. I thought being part of the review process of actually determining who would be offered the internships was really valuable. Just to see the types of students that were potentially seeking these opportunities. And then after [that] I ended up being much more invested with the students that I said I wanted.*

Mentors also provided advice for structuring successful internships. For instance, mentors believed it to be essential that managers buy into future programs; without that active buy in, it could be possible for management to believe that mentors were slighting their work by participating actively in the internship program--which in and of itself was a demanding professional activity.

*Mentor#1: Yeah, I think that management involvement piece and management understanding what this is--*

*Mentor #2: --Is key.*

*Mentor #1: Yeah, and supporting it is really important. Especially since we were taking so much time. Rather than just saying, you know, "Oh we got some students and we're gonna dump them off." Which probably happens.*

As they reflected on whether or not they would consider participating in future programs, mentors appreciated the careful organization that UNAVCO brought to this project.

*Mentor #2: UNAVCO's being well structured made this a lot more successful than some programs.*

*Mentor #1: Yeah, I'll second that that. UNAVCO's being well structured made this a lot more successful than some programs that may not quite have things set up quite as well. It made it a lot easier in the end, and their staff was always there to answer questions, and things like that as well. And they had the program itself have an overarching goal at the end of it, which helped drive things forward, too.*

### **GLP Interns: Influence on Career Intentions**

The GLP internship helped students to discover the pathways and fields available to them in the geosciences, and thus to hone and narrow their own interests and aspirations. Based on their summer experience, interns clarified their professional goals, including interest in graduate school. Other scientists provided influence in the interns' decision making, particularly their views on pursuing graduate education, which previously had seemed uncertain. Three of the four were emphatically considering graduate studies as a result of the internship. Networking with

graduate students and professional staff provided navigational knowledge that had previously been unfamiliar to the interns, and provided vital information on pursuing future paths, such as graduate school, as indicated in the following exchange.

*Intern #2: I didn't know that people would pay for you to go to graduate school. I just thought, "I can't go to graduate school. That's too expensive." But, I didn't even consider it.*

*Intern #1: Everyone I've talked to this summer is like, "Do not pay for graduate school. Somebody will pay you to go." And I was like, "What? Nobody has told me this before. I had no idea." So that's definitely opened up my opportunities to wanting to expand my education, if I decide that's the path I want to go. But it's nice to have it as an option.*

Learning what they did not want to do was as powerful as gaining knowledge about what they did want to pursue professionally, as one intern noted: *"I didn't think I wanted to be a librarian, but now I don't want to be a librarian....So that's concrete now."*

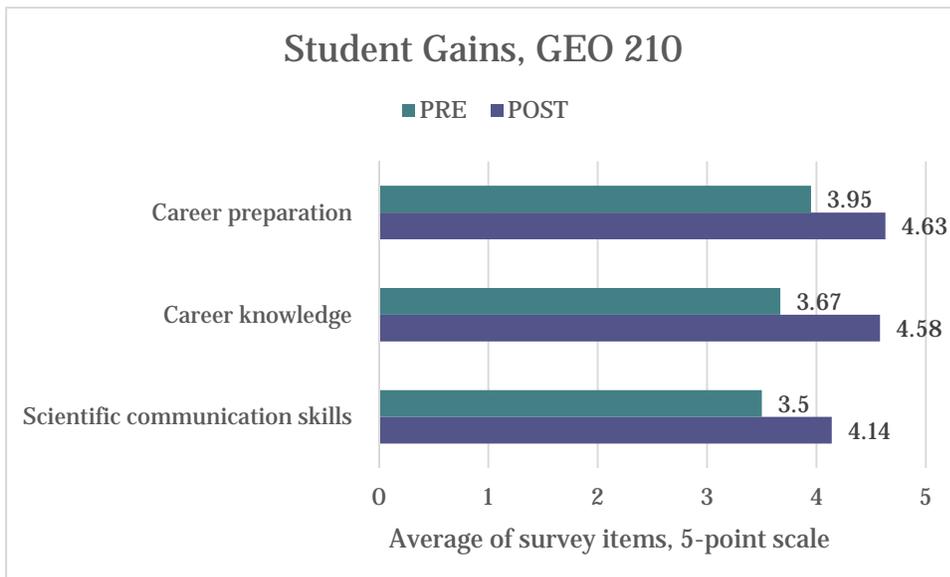
In general, interns also affirmed their commitment to geoscience and were comforted that they had chosen the right field.

*I think that for me it reaffirmed that geoscience is the field I want to go in to. I'm still unclear as to what within that field I'm thinking. Obviously environmental science, but within that, hydrology. I appreciated that project we were working on touched on that and gave me some exposure.*

## **GEO 210**

Overall, students in GEO 210 made gains in all areas, with the strongest gains in career knowledge, similar to the pilot year of the course. Students also gained knowledge about geoscience career paths and scientific communication skills, particularly understanding geoscience research and how to communicate research findings.

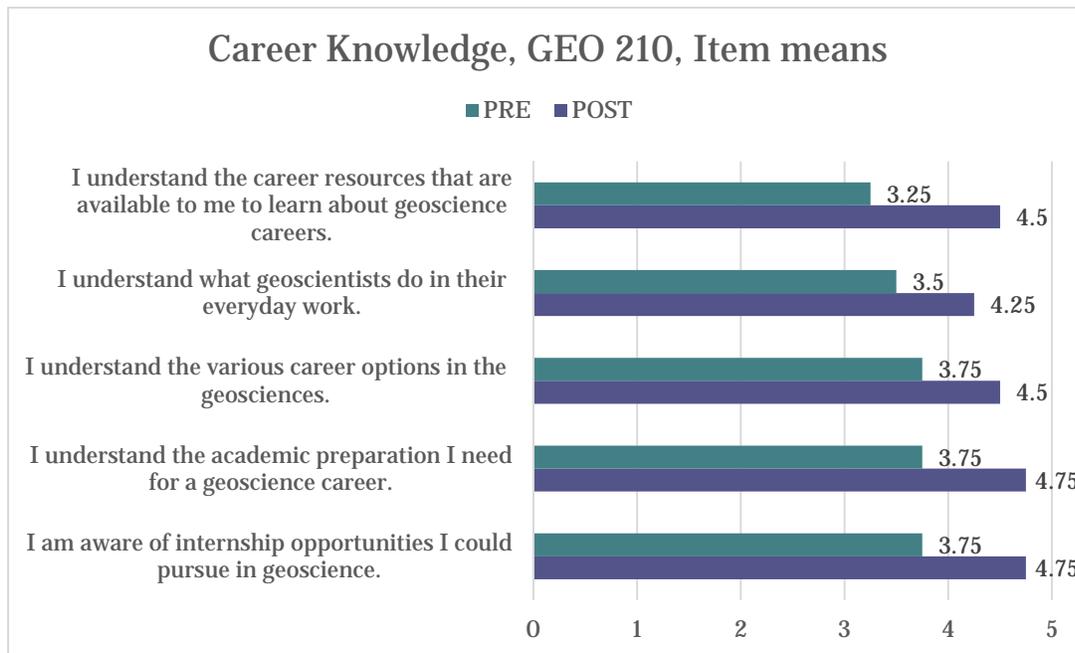
**Figure 5. Student Gains, GEO 210**



### **GEO 210: Career Knowledge**

Students gained the most from the GEO 210 course in their understanding and knowledge of geoscience careers. Students displayed the largest growth in learning about career resources that are available to them to learn about geoscience careers (e.g., the survey mean rose from 3.25 to 4.5 on a 5-point scale, or 50% of students agreeing to 100%). Students also gained a better understanding of the everyday work of geoscientists. Students became more aware of internship opportunities in their field and gained resources for learning about careers in the geosciences. Across the board, students learned about geoscience careers and gained a better understanding of the career paths available to them.

**Figure 6. Career Knowledge, GEO 210, Item means**



All four students stated that the most important thing that they learned from the course was about the wide variety of career options for geoscientists and about the many ways that they can gain professional experience in the geosciences. Students also gained awareness about the variety of ways that someone can navigate a career path in geoscience and felt comforted that there is not necessarily one way to do it. Students also appreciated the opportunity to learn about careers from actual geoscientists pursuing a variety of career paths. Typical comments from students were:

*“Aside from learning about all of the awesome internships, career opportunities, and Universities, I think the most important thing I learned is that no professional follows the same path to find the career they want or end up in. But along with that I now feel I have the skills and confidence to enter the field.” - GEO 210 student*

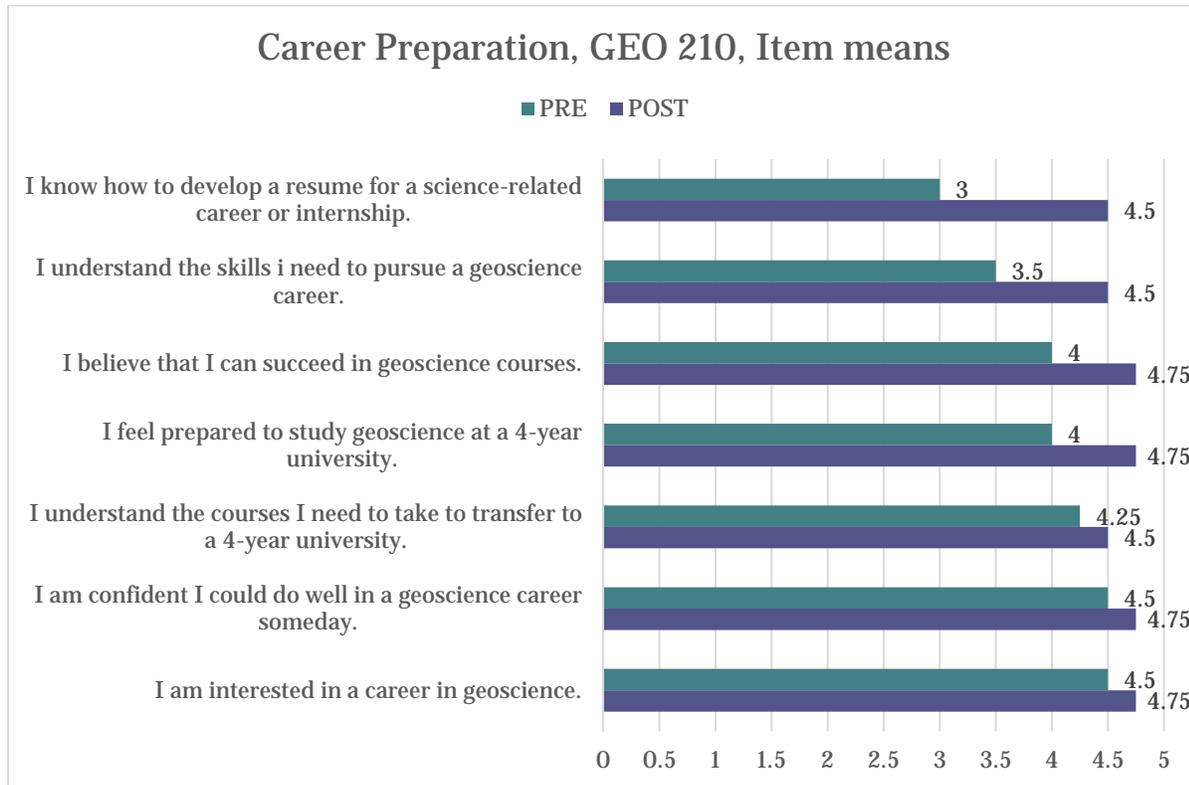
*“Learned from people who hold careers in geoscience in order to gain perspective on what they do for a living.” – GEO 210 student*

### **GEO 210: Career Preparation**

Students felt more prepared to navigate their educational and career pathway in the geosciences. Students entered the GEO 210 course with a higher level of career preparation than they did last year, yet they still demonstrated growth in their knowledge and preparation for geoscience careers. For instance, prior to the course, 50% knew how to develop a resume for a science-related internship or job, yet 100% could do so at the end of the course. Students also gained a better understanding of the skill set required to succeed in geoscience careers. Students also felt more confident that they could succeed in advanced coursework in geoscience. Students

demonstrated less growth in career interest or knowledge of transfer pathways in geoscience, but this was only because their incoming knowledge was so high.

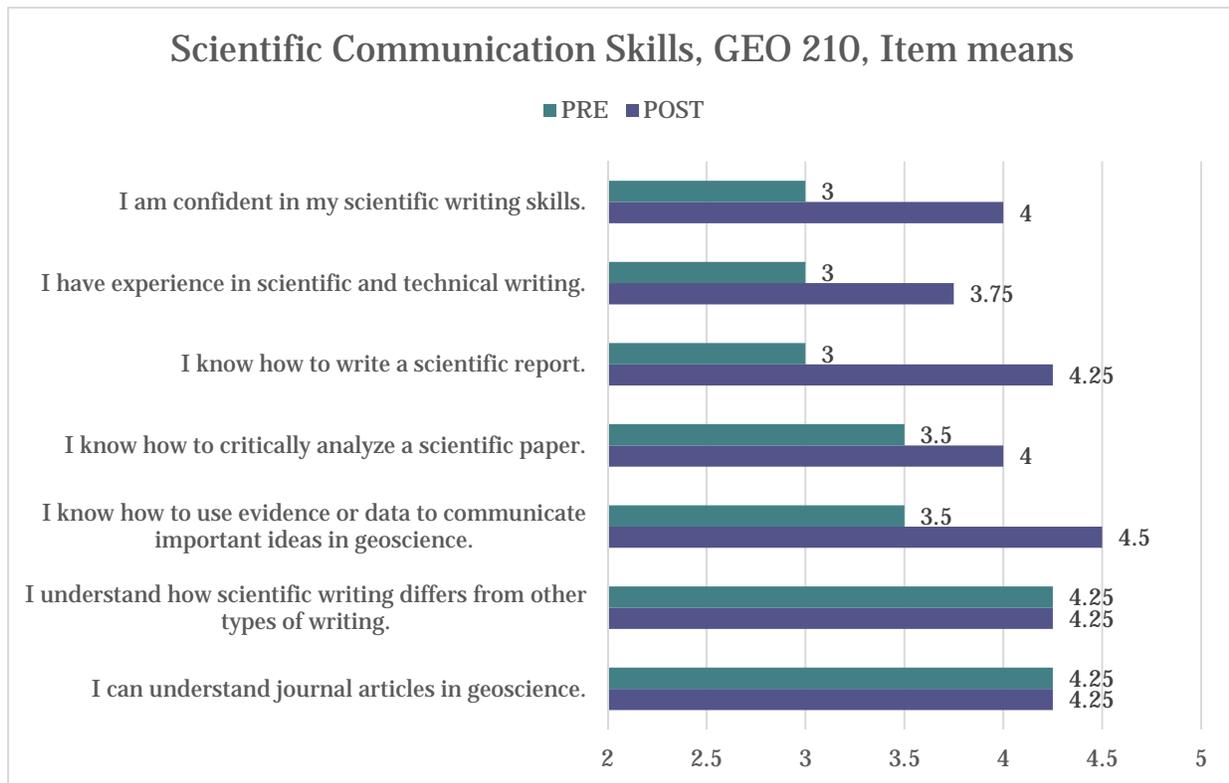
**Figure 7. Career Preparation, GEO 210, Item means**



### GEO 210: Scientific Communication Skills

Through the GEO 210 course, students gained a better understanding of scientific research and how scientists communicate their work. Students made the greatest growth in their understanding of how to write a scientific or technical report and in their confidence in their scientific writing abilities. For instance, only 50% of students were confident in their scientific writing abilities at the start of the course, while 100% were confident at the end. Students also felt more comfortable in their ability to critically analyze a scientific paper. On the other hand, students entered the course with a strong perceived ability to understand geoscience journal articles, and this ability held steady over the semester. The course was most helpful in boosting students' confidence in their scientific writing and communication, providing experience in scientific reading and writing, and helping students to understand scientific and technical writing style.

**Figure 8. Geo 210, Scientific Community Skills, Item means**



#### GEO 210: Influence on Students' Educational and Career Paths

All four students reported that GEO 210 had influenced their educational or career path in geoscience. Students were motivated and inspired to continue on their geoscience path and to take advantage of opportunities. For instance, one student was inspired to add a minor in Physical Geography. Most of all, students stated that it reaffirmed their commitment to a geoscience career and helped them to realize that that they were on the right path. In response to an open-ended question about the influence of the course on students' career paths, typical comments were:

*This course was the push I needed to make Physical Geography my minor. It really helped influence me to take the path of a career in geoscience. – GEO 210 student*

*Gave me a much more clear understanding of the opportunities I have in the geoscience field. – GEO 210 student*

#### GEO 210: Student Advice for Implementation

Students were highly satisfied with GEO 210 and the career knowledge and preparation that they gained from the course. In an open-ended question, students were asked to comment on ways to improve the course. All four students responded that they would like the course to be longer to be able to go into even more depth about careers and what geoscience careers will

actually be like. Students suggested that the course run for more weeks or to lengthen class hours. Typical comments were:

*My only complaint is that [GEO 210] wasn't longer. I felt like we were just getting into some really interesting topics and the class was creating more valuable discussions. – GEO 210 student*

*More time, and perhaps more focus on actual careers and what they entail. However, this was an excellent course and I will highly recommend it to anyone who is considering a career in geoscience. – GEO 210 student*

## **Advice for future implementation**

As in previous years, students and faculty were very positive about the GLP offerings—internship and GEO 210—and the many benefits to students from these opportunities. The essential components of the GLP program continue to be exposure to career knowledge and pathways within the geosciences, professional development seminars and workshops, and exposure to scientific networking and professional skills. For the internship, in particular, students benefited greatly from the mentorship they received and the opportunity to create and present a scientific poster. All of these components help students to develop as future professionals and increase their ability to collaborate on a scientific project. Students and faculty provided the following advice for the program.

### **GLP internship**

- Interns and mentors had varying recommendations on the length of the internship according to the particular project undertaken. Interns and the mentor on one project, but not the other project, would have appreciated a longer internship, such as a 10-week internship. This particular project required more training and skill development, so interns and the mentor both stated that a longer time period, such as a 10-week internship, would allow interns to solidify their training and skill development while still providing time to complete the project and poster.
- Interns reported varying levels of interaction with their faculty mentors over the summer with one intern reporting no interaction. Students were very clear that having faculty support during the application process was crucial; however, the linkage during the project was not as strong. Despite their gains in knowledge of networking as a critical skill, the interns did not fully appreciate the potential for their community college faculty mentor to serve as part of their career development network, especially since most were anticipating transferring to a 4-year institution.
- Mentors noted that a project outline that they had created for GLP staff had not been shared with interns. Mentors suggested that this outline be shared with the interns in the future so that incoming interns would be more knowledgeable about the work that they would perform over the summer. This would also smooth the orientation and transition process for mentors and interns in the early days of the project.

- While personal relationships and the commitment of mentors were highly valued, communication across the various stakeholders in the GLP internship was not always clear. For instance, students did not realize the length of the commute they would undertake as part of the internship. Interns noted that they would have appreciated more up-front knowledge about the living and working arrangements for the summer.
- Additionally, future projects may want to address the time constraints placed on interns because of commutes. Project selection may consider the length of time that students are on site as opposed to participating in professional development at UNAVCO and/or commuting to the work site.
- Interns held some misperceptions about the setting in which the internship would be performed. These misperceptions led to some disappointment, even though all interns reported highly positive experiences. Nonetheless, interns had hoped to engage in some field work as part of the summer program.

## GEO 210

- GEO 210 students requested a longer course, whether in more class sessions during the semester or longer class sessions during the abbreviated course. Either way, students requested more time in GEO 210 to learn about more careers and to dive even more deeply into career pathways and resources in the geosciences.

## Conclusion

For the past three years, the GLP program has introduced students from Colorado community colleges to geoscience career pathways, mentoring, networking, scientific communication, and the professional practice of science. From the GLP internship in summer 2018, students gained an understanding of the daily work of federal scientists and an appreciation of the vast array of geoscience career options within the federal government. As a result, almost all interns increased their interest in pursuing graduate studies in geoscience. Supplemental programming, such as Career Circles and professional skill-building seminars, developed students' professional skills and heightened their awareness of career pathways and options within the geosciences.

Similar to the GLP internship, the community college course, GEO 210, focused on geoscience careers, scientific communication, and professional development, without the hands-on exposure to professional practice engendered within the internship. Still, the course provided similar benefits to the internship, including increased understanding of geoscience career options, enhanced feelings of preparation for geoscience careers, and increased scientific communication skills. The only area where GEO 210 did not produce the same gains as the internship was in understanding and producing a scientific poster, mentoring and networking, and in understanding the everyday work of professional geoscientists. Thus, the Geo 210 course provided similar outcomes in many areas to the internship model, especially in understanding career opportunities and pathways.

In conclusion, the GLP program has created two professional development experiences for Colorado community college students, an apprentice-style internship and a college course focused on careers. Each of these experiences has a different duration and activities, and slightly different goals. Evaluation results have shown that these experiences are both successful in introducing students to the wide variety of career options in the geoscience and in raising their awareness of career resources and opportunities to facilitate their pathway in geoscience.