Building Geoscience Workforce Skills and Awareness in your Courses and Programs

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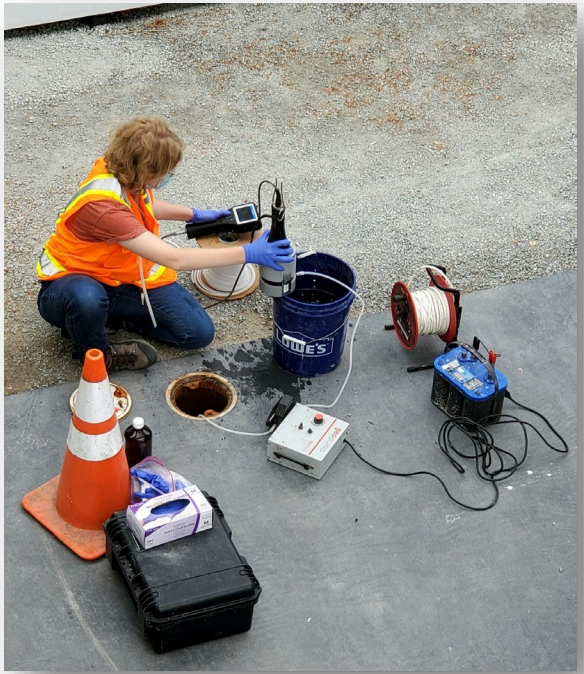
Despite talking about workforce preparation….

We don’t think the only purpose of a college education is to train students for jobs.

But… most students will need and want to have jobs.

- We want our students to be prepared and successful.
- The planet needs a well-trained geoscience workforce.



We will focus on undergraduate students entering the workforce, but the same ideas apply to preparation for graduate school, and to students in graduate programs

Questions about **your** experience in and with the geoscience workforce

Raise your hand in Teams if:

- … you have had a geoscience job *outside* of academia?
- … you have had *more than one* geoscience job outside of academia?
- … collaborate with geoscientists who work outside of academia?

Type in the chat:

What percentage of your students who graduate with a bachelors degree in geoscience go on to academic jobs or graduate school?

Why focus on the geoscience workforce?

- Students (and faculty) have **little awareness of career opportunities** and what skills and abilities are needed in the workforce
- Bachelor-level geoscientists represent **the majority of the current geoscience workforce,** and bachelor-level **positions are forecast to increase** by as much as 5% in the next decade (U.S. Bureau of Labor Statistics, 2024)
- Geoscience **jobs pay well** (median annual pay ~$100K) and are available across sectors and across the country, which can help attract students to the geosciences (U.S. Bureau of Labor Statistics, 2024)
- The geoscience community can do better **attracting and supporting** students– geoscience is one of the least diverse STEM fields (Bernard & Cooperdock, 2020; Gonzales & Keane, 2020)

U.S. Bureau of Labor Statistics. (2024). Geoscientists: Occupational Outlook Handbook. U.S. Bureau of Labor Statistics: https://www.bls.gov/ooh/life-physical-and-social-science/geoscientists.htm (accessed October, 2024).
Bernard, R.E., Cooperdock, E.H.G. (2018) No progress on diversity in 40 years. *Nature Geoscience* v.11, p.292-295.
Gonzales, L., Keane, C. (2020) Diversity in the Geosciences. *Geoscience Currents*, American Geosciences Institute. https://www.americangeosciences.org/sites/default/files/DB_2020-023-DiversityInTheGeosciences.pdf
Karen Viskupic, Julianne A. Wenner, Claire O. Harrigan & Gregory Shafer (2022): A mixed methods study of the challenges for geoscience majors in identifying potential careers and the benefits of a career awareness and planning course, Journal of Geoscience Education, DOI: 10.1080/10899995.2022.2147383

How can we help prepare students for success in the workforce?

Understand the landscape of career opportunities and desired workforce skills

Reflect on learning opportunities and adjust as needed

Help students reflect and plan

What skills are employers currently seeking in bachelor-level geoscientists?

Research: Analysis of job advertisements and interviews with employers to determine most sought-after skills.

Shafer, Viskupic, Egger (2023) *Geosphere*
Shafer, Viskupic, Egger (2022) *GSA Today*
Viskupic, Egger, Shafer (in review) *JGE*

How well do we help students develop the skills and dispositions they need?

Resources and Ideas: A collection of resources and strategies to help instructors and mentors.

Viskupic & Egger (n.d.) Building Geoscience Workforce Skills, National Association of Geoscience Teachers

How do we help students recognize and claim the skills and dispositions they develop?

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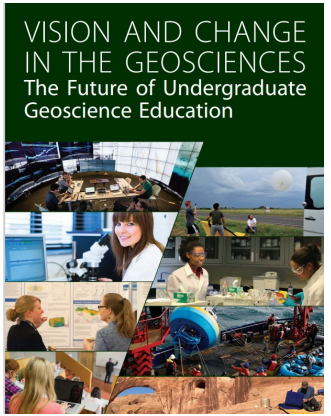
What skills do geoscientists need?



Vision and Change in the Geosciences (Mosher & Keane, 2021):

Identified by geoscience professionals (industry and academic) as part of the Future of Undergraduate Geoscience Education survey (n=436) and employers workshop (n=46)

- Geologic reasoning & synthesis
- Data collection & interpretation
- Evaluation of data quality
- Manage uncertainty
- Apply skills in new scenarios
- Systems thinking
- Quantitative skills
- Evaluation of literature
- Written communication
- Oral communication
- Work as part of a team
- Temporal thinking
- Spatial thinking
- Field skills
- Understand societal relevance

http://www.jsg.utexas.edu/events/future-of-geoscience-undergraduate-education

https://www.americangeosciences.org/change/

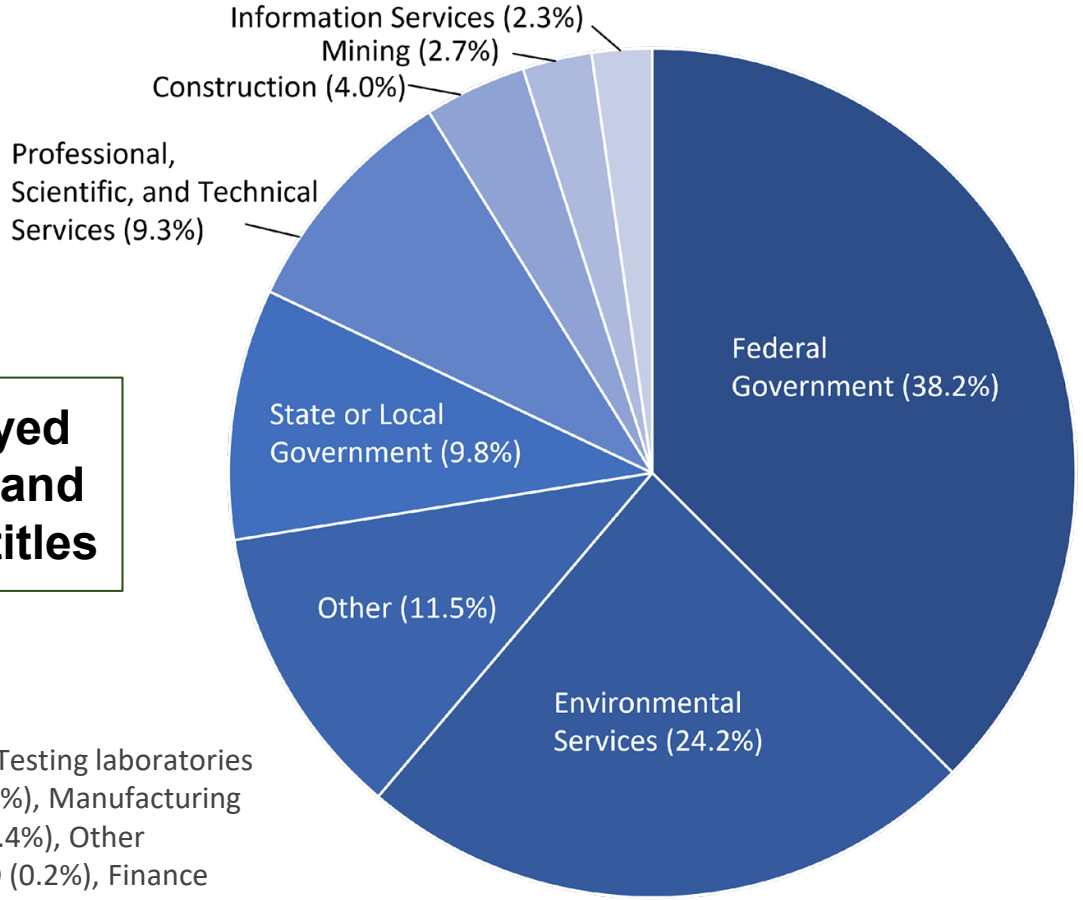
What skills do geoscientists need?

Analysis of job advertisements (Shafer et al., 2023)

- Ads collected from online job search engines using a defined set of keywords; one year of ad collection
- Ads included in dataset: request or require a geoscience-related bachelor's degree and minimal experience; jobs in the United States
- **3,668 unique ads from 1,125 different employers**

Shafer, G.W., Viskupic, K., and Egger, A.E., (2023) Critical workforce skills for bachelor-level geoscientists: An analysis of geoscience job advertisements: *Geosphere*, v. 19, no. 2, p. 628–644, https:// doi.org/10.1130/GES02581.1.

Distribution of Ads by Industry Sector



Geoscientists are employed in a variety of industries and have many different job titles

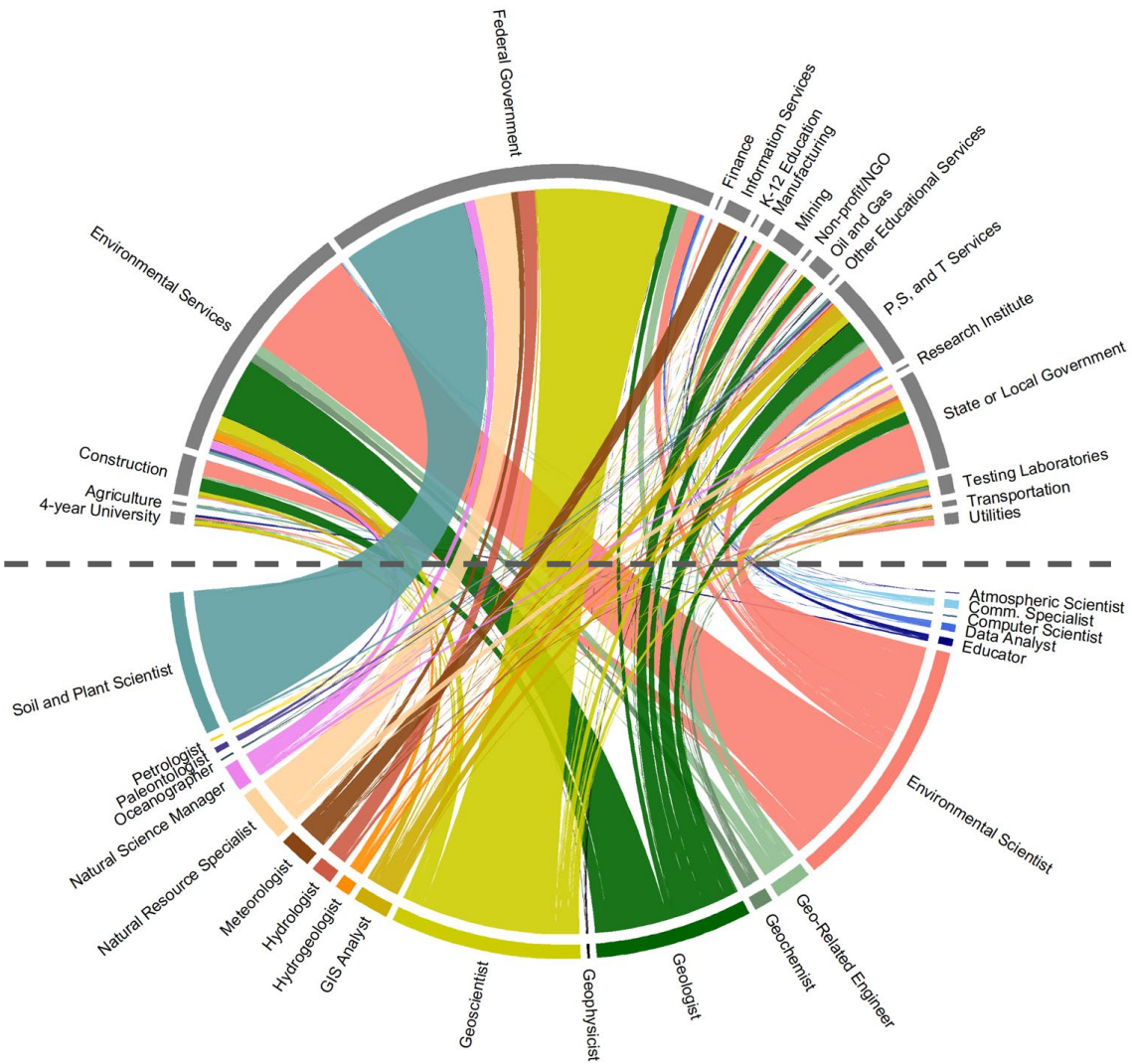
Other category includes Oil and gas (2.0%), Testing laboratories (1.9%), 4-year university (1.2%), Utilities (1.1%), Manufacturing (1.1%), Transportation (0.5%), Agriculture (0.4%), Other educational services (0.3%), Non-profit/NGO (0.2%), Finance (0.2%), Research institute (0.2%), and K-12 education (0.2%).

From Shafer et al. (2023)

Distribution of Jobs by Industry Sector

Industry sectors above the dashed line

Occupations below the dashed line

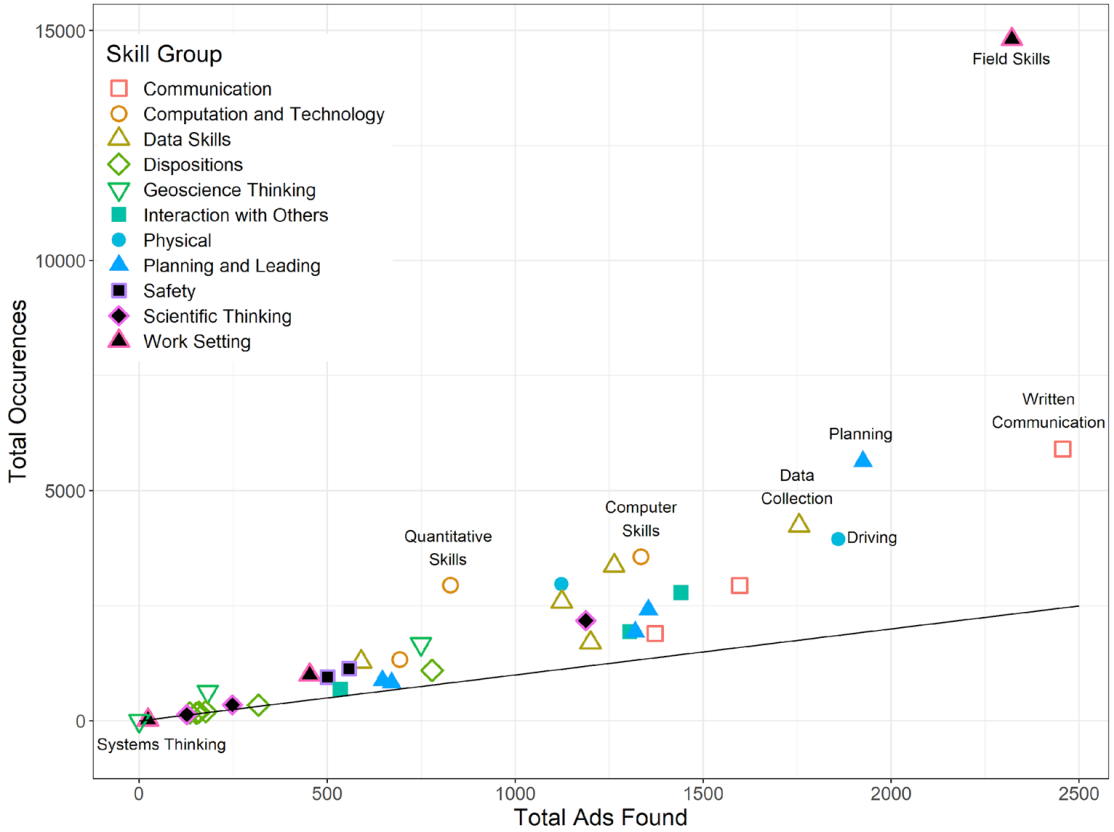


From Shafer et al. (2023)

Most frequently requested skills in job ads:

- Written Communication (67%)
- Field skills (63%)
- Planning (53%)
- Driving (51%)
- Data collection (48%)
- Oral communication (44%)
- Work as part of a team (39%)
- Project management (37%)
- Computer skills (36%)

29% of ads mentioned **dispositions** such as professionalism, desire to learn, and attention to detail



From Shafer et al. (2023)

Computer skills requested in job ads

Basic	Specialized Software	Coding
Microsoft Office	ArcGIS	MATLAB
Word	MODFLOW	Python
Excel	HEC-RAS	R

Skill	Number of Ads Found	Total Instances Found
Basic	1112 (30%)	2455
Specialized Software	469 (13%)	987
Coding	88 (2%)	122

From Shafer et al. (2023)

Geoscience workforce skills in your program

Waterfall question: Directions

1. We will put a question up.
2. We'll give you a minute or two to type your answer in the chat, but DON'T HIT RETURN.
3. Once enough time has passed, we'll tell you to hit return, and we will all read through and summarize the responses.

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Geoscience workforce skills in your program

Which **skills** do you think **your program** is doing a **great job** of helping students develop?

You can choose something from the list or say something else.

Which **skills** do you think **your program** could **do a better job** of helping students develop?

You can choose something from the list or say something else.

- Written Communication (67%)
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Are the most frequently requested skills the most important for applicants to demonstrate?

- Let’s ask employers!
- We conducted an interview study to test our assumption and the overall reliability of job ads
- We also wanted to determine how employers evaluate job applicants for the skills they think are most critical to success

Employer Interviews: Interviewees (n=16)

Participant	Sector	Position Held	Years in Position
1	Extractive industries (Mining)	Permitting manager	6
2	Scientific and technical services	Resources group manager	2
3	Government (State)	Program coordinator	4
4	Government (Federal)	Geophysicist	23
5	Scientific and technical services	Senior permitting manager	2
6	Scientific and technical services	Lead project manager	31*
7	Government (Federal)	Hydrologist	12
8	Government (Federal)	Program manager	8*
9	Scientific and technical services	Research director	2
10	Extractive industries (Mining)	Permitting manager	4
11	Extractive industries (Mining)	Senior permitting specialist	3
12	Scientific and technical services	Account manager, Wetland scientist	2
13	Extractive industries (Oil & Gas)	Geoscientist	23
14	Extractive industries (Oil & Gas)	Geoscientist	3
15	Extractive industries (Oil & Gas)	Geoscientist	4
16	Extractive industries (Oil & Gas)	Geoscientist	7

*Years with employer reported rather than years in position

Viskupic, Egger, & Shafer (in review, JGE)

Employer Interviews: Knowledge

Knowledge:

Broad background in geoscience

Expectation (and preference) for on-the-job training

"You have to have… just sort of a broad background in environmental science or geology and related fields."
P6 (scientific and technical services)

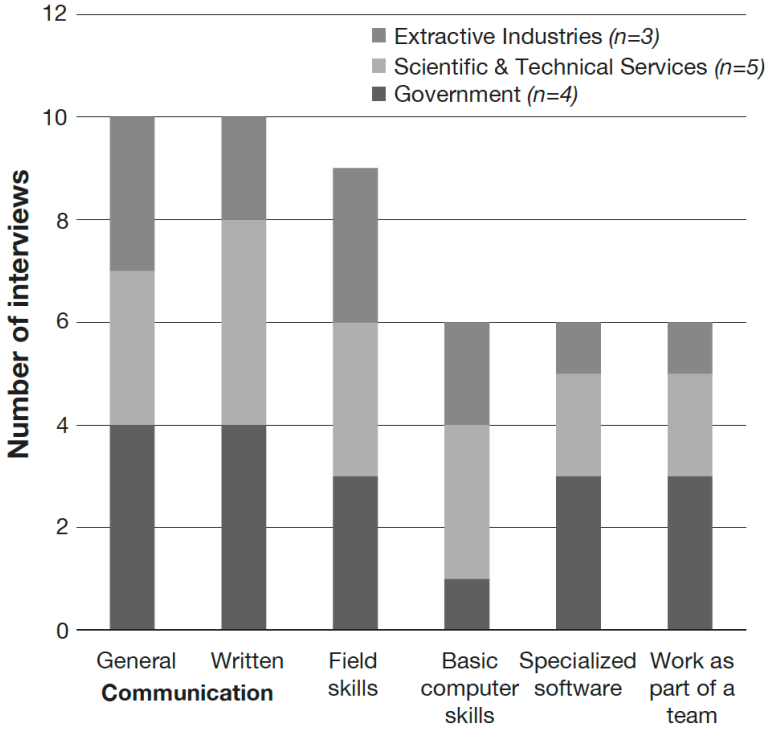
"As long as they have the degree and they understand the language, anything is trainable."
P3 (government)

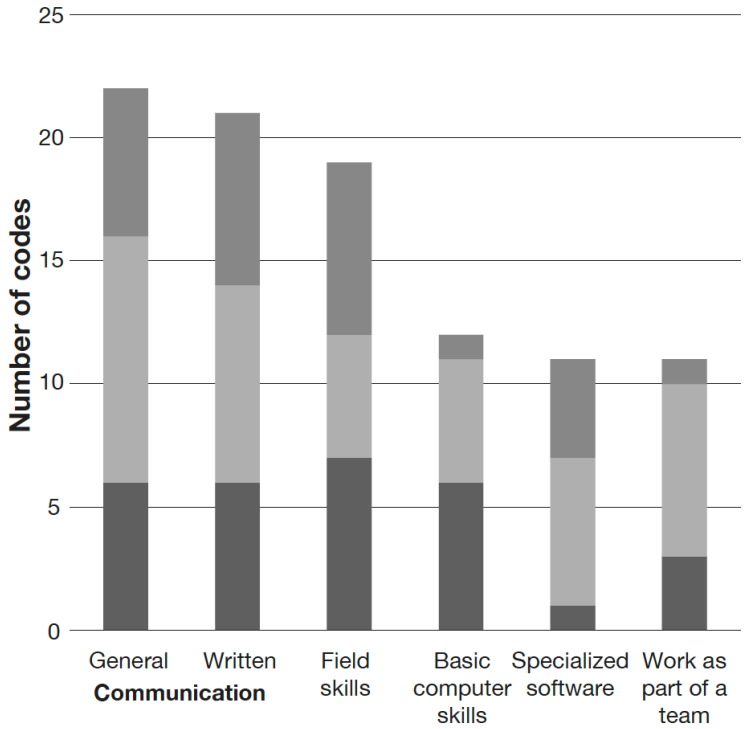
"A lot of the technical level stuff… can be taught, and it's just helpful if people have some background…"
P8 (government)

"In some respects we prefer [providing training]… We like to teach them our way of doing stuff."
P4 (government)

Viskupic, Egger, & Shafer (in review, JGE)

Employer Interviews: Skills





Viskupic, Egger, & Shafer (in review, JGE)

Employer Interviews: Skills

Skills:

Communication

Field Skills

Computer Skills (basic and GIS)

Teamwork

"Report writing is a valuable skillset and that's pretty much the bread and butter of what we do."
P7 (government)

"Being able to do field work and collecting data in the field is very important."
P4 (government)

"We do a lot of calculations using spreadsheets. You should be able to interpret and create graphs for different types of data visualizations."
P6 (scientific and technical services)

"That teamwork mentality has to be pretty strong. You have to be able to work with others."
P6 (scientific and technical services)

Viskupic, Egger, & Shafer (in review, JGE)

Employer Interviews: Dispositions

A bit of background: **What are dispositions?**

- Also referred to as soft skills, interpersonal skills, durable skills, transferrable skills, habits, etc.
- Internal attributes, attitudes, or values that stimulate action
- They are linked to and reliant upon knowledge and skills
- Dispositions can be learned

Viskupic, Egger, & Shafer (in review, JGE)

Dispositions relevant to the geoscience workforce

Disposition	Description
Desire to learn	
Attention to detail	
Professionalism	
Integrity	
Work ethic	
Initiative	
Positive attitude	
Organization	
Collaboration	
Flexibility	

Which **dispositions** do you think **your program** is helping students develop?

You can choose something from the list or say something else.

Lagerwall, Viskupic, & Egger (in review, JGE)

Employer Interviews: Dispositions

Dispositions:

Collaboration

Desire to learn

Flexibility

Initiative

"The more teamwork you're amenable to, the better the projects go. Everybody's just working toward the same end goal."
P6 (scientific and technical services)

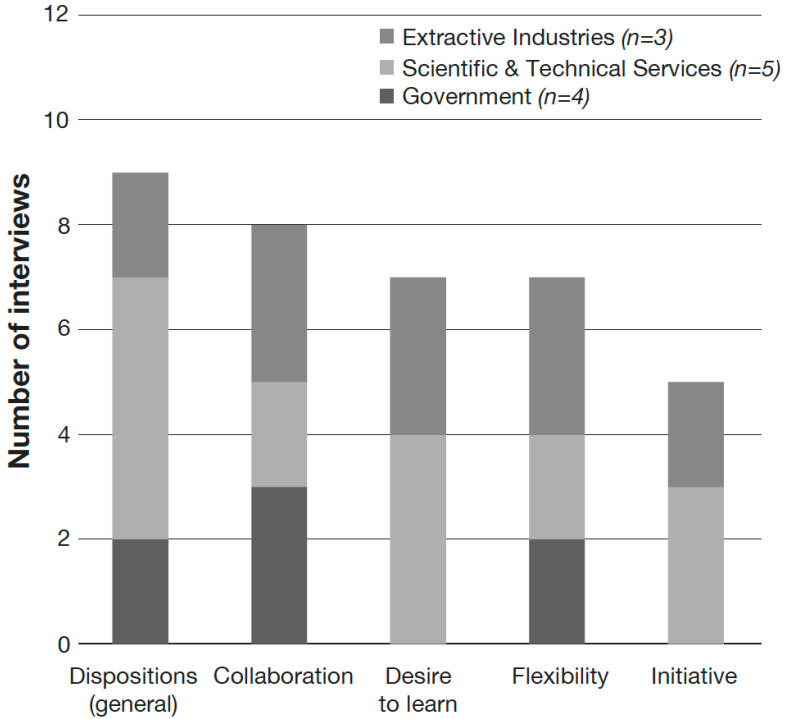
"More than anything, what I value and what I expect is that somebody has the capacity to continue to learn."
P1 (extractive industries)

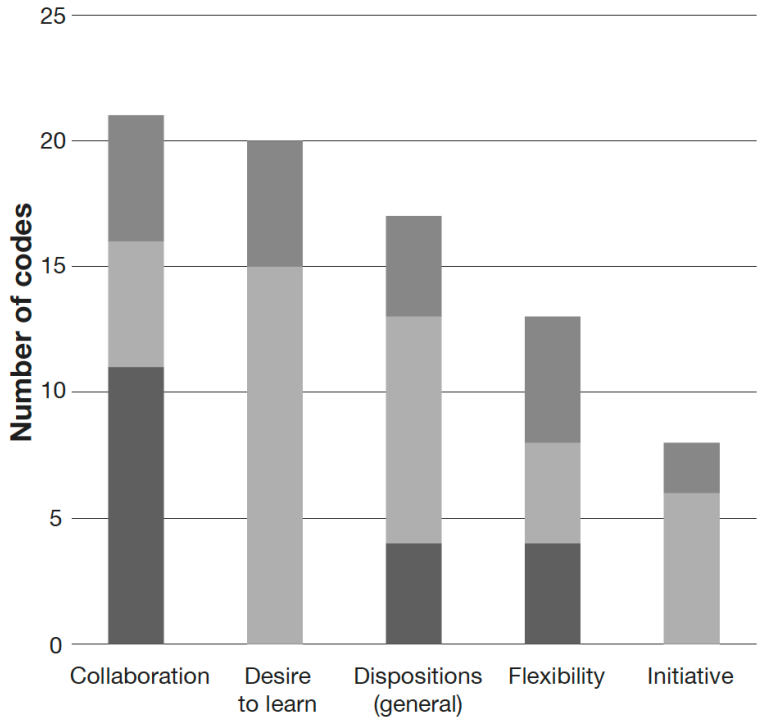
"There are days when the job changes a lot and being able to… move when maybe the target moves…[is] very valuable and powerful."
P15 (extractive industries)

"[I'm looking for] that drive and that ownership and that willingness to take on new things and finish it."
P12 (scientific and technical services)

Viskupic, Egger, & Shafer (in review, JGE)

Employer Interviews: Dispositions





Viskupic, Egger, & Shafer (in review, JGE)

Summary so far…

- There are a variety of jobs for bachelor-level geoscientists in many different types of industries
- We have an idea of what skills and dispositions students will need to enter those jobs

But what do students know?

How can we do a better job making workforce skills and opportunities visible to students?

What can you do in your courses and programs?

New Collection of Resources in Teach the Earth (TTE)

Browse Key Resources

- Teaching Materials
- Workshops
- Intro Geo
- Career Development
- Diversity
- K12
- Two-Year Colleges
- Departments

Search Multiple Earth Education Websites

About

Teach the Earth is a portal to thousands of resources from dozens of Earth Education websites.

Workforce skills | Go

Search "workforce skills" in the TTE portal

https://serc.carleton.edu/NAGTWorkshops/workforceskills/index.html

New Collection of Resources in Teach the Earth (TTE)

Building Geoscience Workforce Skills

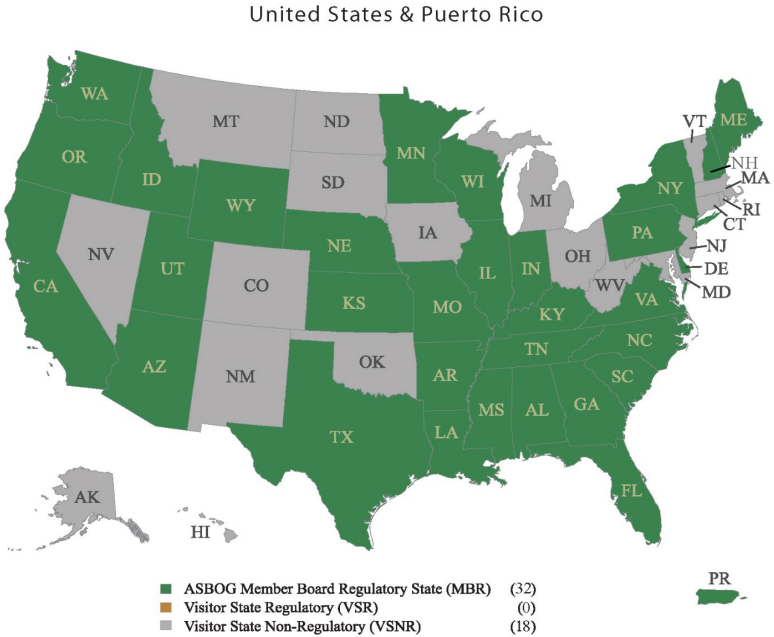
Course and Program Resources

1. **Getting Started:** background knowledge about workforce skills and opportunities
2. **Strategies**: strategies for helping student build workforce skills and awareness
3. **Activities**: a work in progress where community members can share learning activities, assignments, courses, etc.
4. **Get More Help**: workshops and webinars

https://serc.carleton.edu/NAGTWorkshops/workforceskills/index.html

Getting Started: Get to know…

- The geoscience workforce
- Professional licensure
- Federal agency requirements
- Your alumni
- Department of labor resources



https://asbog.org/state_boards.html

https://www.onetonline.org/

Strategies for building geoscience workforce skills and awareness

Initial Publication Date: May 14, 2024

The following pages describe specific strategies you can implement in your courses and programs to help build your students' knowledge about the geoscience workforce and the skills that will help them be successful in the workforce and their careers.

Build students' awareness of geoscience jobs and careers

- ❑ Start early
- ❑ Share career profiles
- ❑ Ask everyone to talk about their career path
- ❑ Help students build their network

Connect to workforce skills in your courses, research experiences …

- ❑ Incorporate skills and dispositions into your learning outcomes
- ❑ Focus on specific skills that are most desired
- ❑ Simulate the workplace
- ❑ Address skills and dispositions across the degree program

Help students reflect on, prepare for, and communicate their workforce readiness

- ❑ Use reflection prompts
- ❑ Use planning templates or individual development plans (IDP)
- ❑ Incorporate resume and interview preparation
- ❑ Offer a career planning course or workshop series

https://serc.carleton.edu/NAGTWorkshops/workforceskills/strategies.html

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Build students' aware
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Connect to workforce

Help students reflect
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ommunicate their
orkforce readiness

Each strategy includes:

- An overview and brief example(s)
- Reasons why you might use the strategy
- Tips for success
- Links to resources for more information

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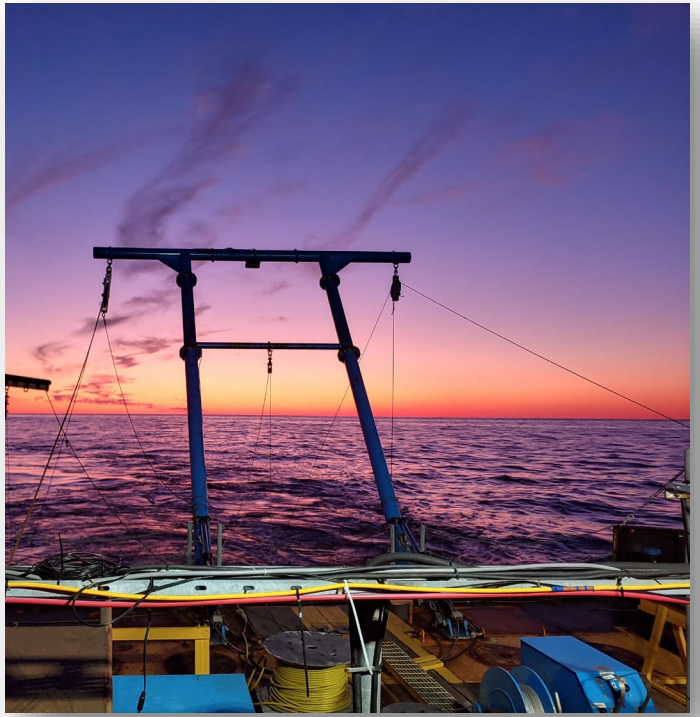
https://serc.carleton.edu/NAGTWorkshops/workforceskills/strategies.html

What can you do as a department/program head?

- Point your faculty to this resource: There are lots of things on the website for individual courses, any instructor can decide to implement them
- Lead the effort in your department to consider building workforce skills and awareness across the whole program
- Think about both curricular and co-curricular activities



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Strategy: Address skills and dispositions across the degree program

Not all skills and dispositions need to be practiced in every class or experience

Help your faculty coordinate which skills are developed in which classes

Use a matrix to design how students build their skills and dispositions throughout the program

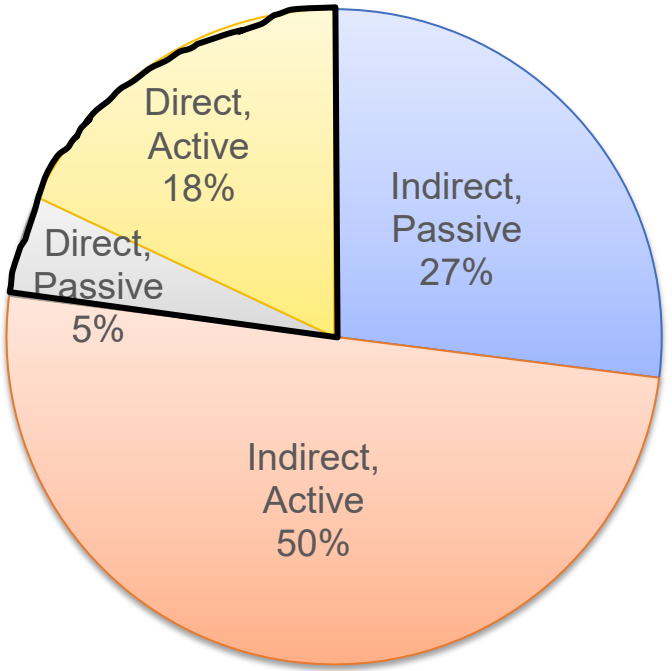
Required Courses	Written Report	Oral Presentation	Poster Presentation	Creating Graphics
GEO 201	X			
GEO 202		X		X
GEO 320	X			X
GEO 370			X	X
GEO 386		X		

Strategy: Incorporate skills and dispositions into your learning outcomes

Explicitly name the skills students are developing and the value of the skills beyond the course or program

- Faculty report using many strategies to help students develop dispositions, but students are unlikely to recognize the value
- Help your faculty shift from indirect to direct statements in their learning outcomes

Self-reported strategies used to develop students' dispositions



Lagerwall, Viskupic, & Egger (in review, JGE)

Strategies for helping students reflect, plan, communicate:
Offer a career planning course or workshop series

GEOS 301 Career Exploration and Planning

Spring 2024

Meets Thursdays, 3:00 - 4:15 in ERB-2100
Instructor: Karen Viskupic, PhD

Geosciences Learning Hub Hours: Tuesdays, 1:30 - 2:00 and Thursdays, 1:30 - 3:00; GLH information and staffing calendar available on the Geosciences Learning Hub website
Office location: ERB-3153; karenviskupic@boisestate.edu

Welcome

Welcome to GEOS 301 Career Planning in the Geosciences. I am excited to be teaching this course, and to help you explore career options and make plans for achieving your career goals!

Course goal and description

This course will help you plan and prepare for the life you want after college, something it makes sense to do now so that you can maximize the investment you're making in your education. This course will help you define your career goals and develop a plan for achieving them. You will learn about yourself and about career options in the geosciences, and think about career paths that balance your interests, abilities, and work values with opportunities in the current job market. You will leave the course with a career preparation plan to guide the remainder of your time at Boise State, setting you on a path to achieve your career goals.

Course learning outcomes

After successful completion of this course, you will be able to:

1. Analyze your interests, values, and abilities as they relate to potential careers
2. Describe geoscience career options that match your interests, values, and abilities
3. Evaluate the skills and experiences needed to pursue careers of interest
4. Tailor your job/internship applications so that they are competitive
5. Write a career development plan

Boise State University example:

- 1-credit elective course (required as of Fall 2025), graded
- Meets once per week for full semester
- Intended for sophomore or early junior geoscience majors

From Viskupic et al. (2022)

Student quotes from the end of a geoscience career planning course

"When I entered the geoscience program my knowledge of careers within the field was limited… **I have come to realize there are hundreds of fields of study within Earth science.**"

Students don't know what careers are available to them with a geoscience degree

Understanding the possibilities increases motivation and confidence

"I'm beginning to realize that a geoscience degree can be utilized for more than geoscience, as long as you can **show you know how to solve problems and communicate**. I feel like **you can apply a geoscience degree to a lot** of technical career paths."

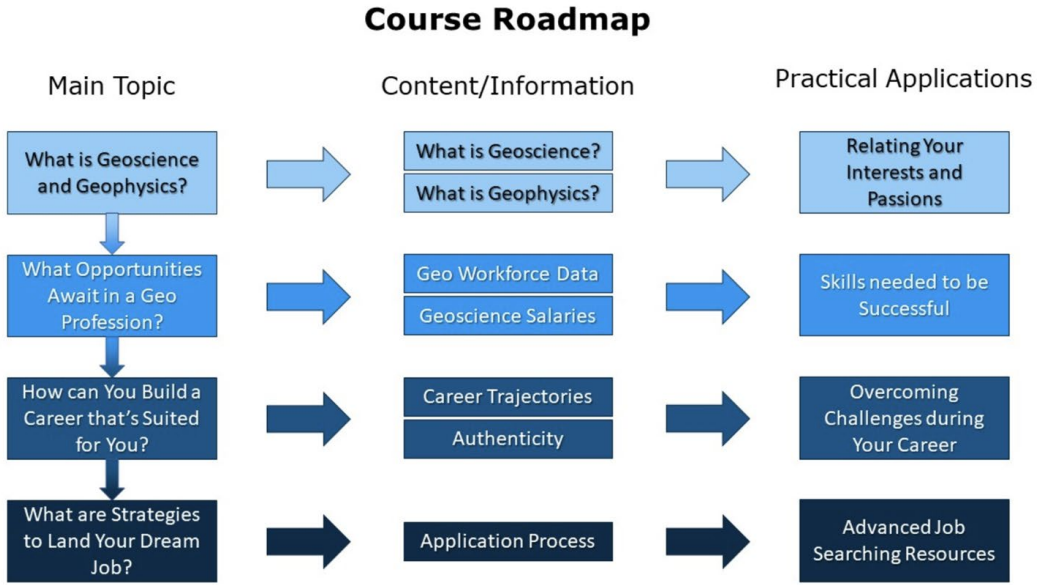
"I have gone from feeling unfocused and a little lost to having a reasonable plan of action. **I didn't even know if I had made the right choice of major, and I was afraid that there was only one path** that geosciences could take me on… These fears have been assuaged now."

Viskupic, K., Wenner, J.A., Harrigan, C.O., Shafer, G. (2022) A mixed methods study of the challenges for geoscience majors in identifying potential careers and the benefits of a career awareness and planning course, *Journal of Geoscience Education*, DOI: 10.1080/10899995.2022.2147383

Strategies for helping students reflect, plan, communicate:

Offer a career planning course or workshop series

EarthScope Consortium



Asynchronous short course.

So much information!

https://learning.americangeosciences.org/courses/course-v1:IRIS+IRIS001+2022/about

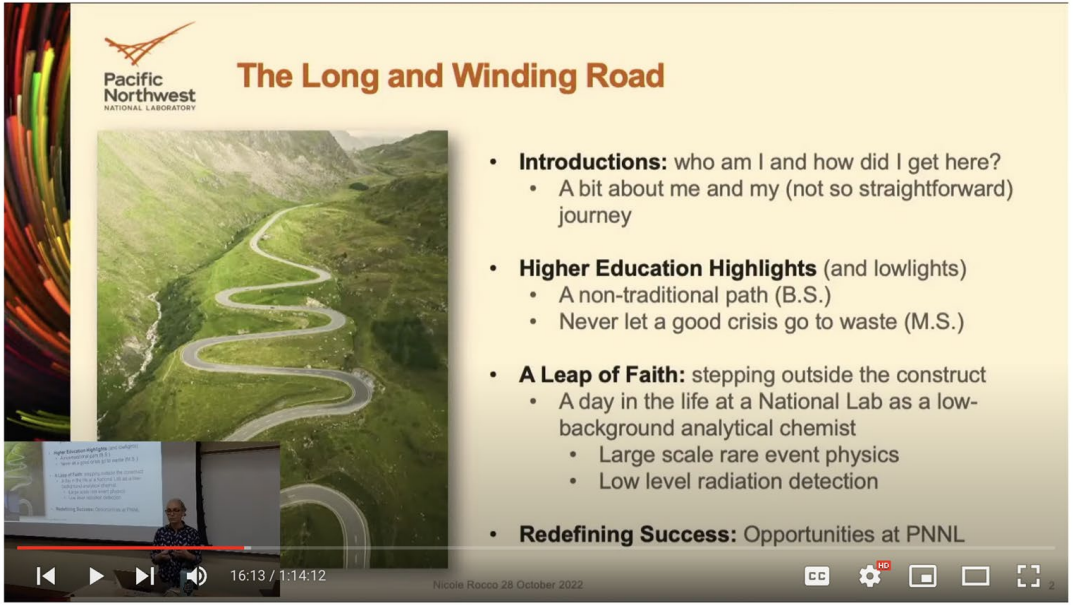
Strategies for building awareness: Ask everyone to talk about their career path

Do you have a seminar? Guest speakers in a class?

Ask visitors to prepare a brief description of their job and career path

OR

Be the person who asks, “Can you tell us more about how you got to where you are?”



Activities

Initial Publication Date: May 14, 2024 | Revision: September 30, 2025 (see revision history: 2 events)

The activities on this page demonstrate ways that you can incorporate geoscience workforce skills into your courses. They have been submitted to Teach the Earth by community members.

Do you have an activity to share? Please contribute your activity.

Learning from geoscience professionals

Career reflection: Outside of class, students watch a 10–15 minute recorded interview with a recent alumnus who discusses their job, pathway to it, and any recommendations they have for current students. Students then write a brief reflection that they submit prior to class. A follow-up discussion allows students to share their reflections and make additional connections between the course and careers.

Career portfolio: This activity is an opportunity for students to document their interaction with environmental professionals with whom they interact during and after their environmental field course. Each career portfolio entry includes details about the environmental professional's career path and job characteristics.

Reflecting on careers

Assessing your Interests, Values, and Abilities to Guide Career Exploration: Not all of our interests, abilities, and values need to be part of our career, but some of them should be. This assignment will help students identify, reflect on, and prioritize characteristics of potential careers that are important to them.

Preparing for the application and interview process

Cover Letter Writing Project: Cover letters are an important part of a job application. This activity helps students learn about and draft a cover letter for a job or internship. The focus is on Earth Science students and jobs, and is integrated into a field course. The full activity includes journaling and self-reflection, peer reviews, giving and receiving feedback, group discussions, and writing.

Behavioral Interview Questions: Behavioral interview questions (such as, "What would you do in this situation?") are often used to assess applicants' skills and dispositions such as collaboration, problem solving, initiative, and flexibility. In this activity, students practice answering behavioral interview questions using the STAR (situation, task, action, results) method.

Simulating the workplace

When should we move the marina? In this assignment students use real world data to solve an applied problem in geomorphology. They use ArcGIS and time sequential aerial photography to determine when a marina on Lake Mead must be moved to avoid problems of sedimentation related to a major drawdown of the lake. Students must estimate the rate of delta progradation and come up with a timeframe for when the marina will become unusable. It is set up as a realistic consulting project, based on a project completed by the author.

Activities

Contribute to the collection!

We are working to grow our collection of activities and courses that support the development of workforce skills.

We would love to highlight what you are already doing.

Strategy: Bring in help!

NAGT
Earth education for all

NAGT's Traveling Workshop Program offers a single-session virtual workshop on connecting courses and curricula to geoscience workforce skills—tailored to your department/program.

The session can also be incorporated into an in-person workshop.

Learn more about the TWP and request a workshop

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