Amiable CONSULTING

AGeS^3-Annual Interim Evaluation Report
Spring 2024

Contents

Background

The AGeS^3 program, funded by the National Science Foundation (awards # 2218544, 2218547, and 2218504), promotes access to geochronology data and training by providing micro-grants and supporting new collaborative science. The AGeS^3-Grad program provides awards for graduate students to visit labs outside their own institutions to receive training and instrument access for geochronologic analyses that support their thesis/dissertation projects. The AGeS^3-DiG (Diversity in Geochronology) program provides awards to researchers and educators working with groups of undergraduates or secondary school students from minoritized backgrounds to conduct group research projects that involve geochronology.

This interim evaluation report summarizes:

- ★ Pre-program survey of AGeS^3-Grad 2023 and 2024 awardees
- ★ Listening sessions with AGeS^3-Grad 2023 awardees
- ★ Summary demographic data for AGeS^3-DiG 2023 participants
- ★ Pre-program survey of AGeS^3-DiG 2023 participants
- ★ Summary demographic and project data for all AGeS-Grad awardees (2015-2024)

AGeS3-Grad 2023 and 2024 Awardees

Data Collection and Analysis: Application and Pre-Program Survey

Demographics

Demographic data comprising gender identity, race/ethnicity, and degree sought were collected as part of the application for Grad awards. Project leadership categorized awardees' projects by method (high-temperature [HT], low-temperature [LT], or Quaternary [Q]) and general research area (climate, geomorphology, tectonics, etc.). These five aspects of awardee demographics are shown in Figure 1.

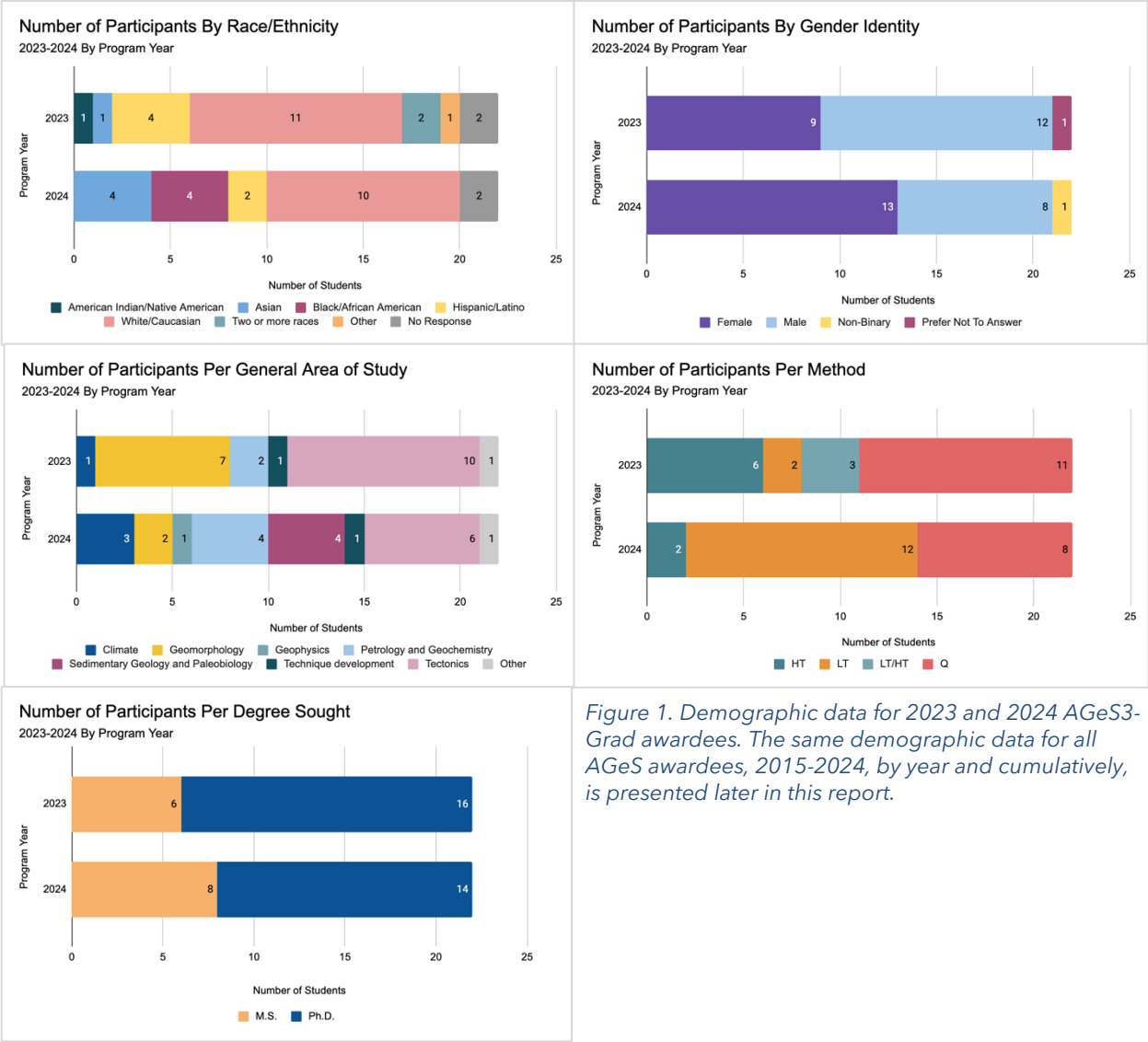

Figure 1. Demographic data for 2023 and 2024 AGeS3-Grad awardees. The same demographic data for all AGeS awardees, 2015-2024, by year and cumulatively, is presented later in this report.

Affective Doman Survey Questions

A pre-program survey was sent to all 2023 AGeS^3-Grad awardees in spring 2023 along with their award notification, and to 2024 AGeS^3-Grad awardees in May 2024 about a month after their award notifications. Nineteen students completed the survey in 2023 and 22 in 2024. The survey asked about awardees' geoscience identity, self-efficacy, and sense of belonging in the geosciences (Figures 2, 3, and 4). Collectively these are known as "affective domain" areas (Trujillo and Tanner, 2014), and are positively associated with persistence in STEM fields.

The post-program survey will be administered in May 2025 and will ask the same questions, to provide data on changes in these dimensions over that time. In order to connect individuals' pre- and post-program responses without identifying them, participants were

asked to provide a code (the first three letters of their mother's name and the last three digits of their phone number).

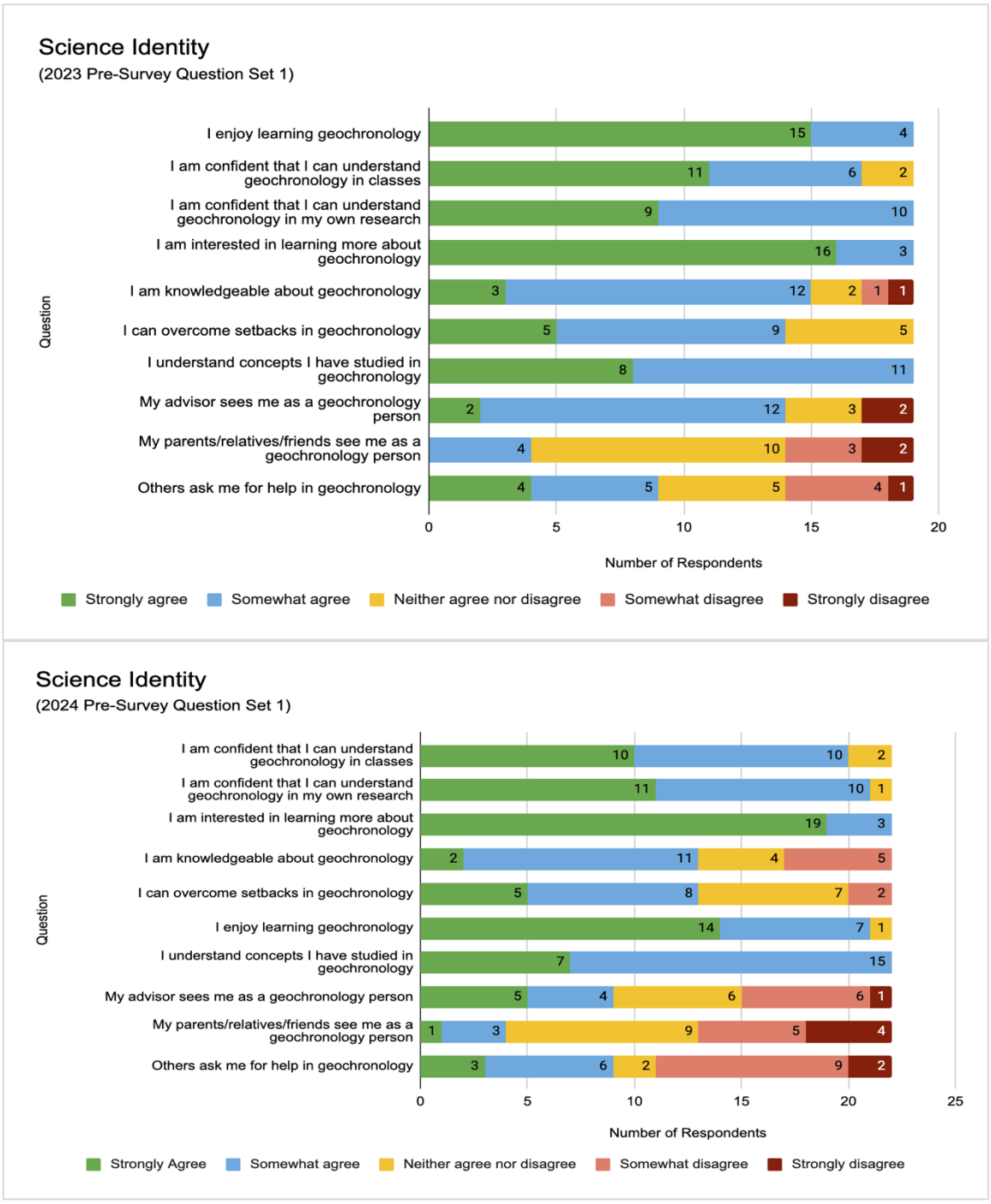

Figure 2. Questions aimed at understanding 2023 (top) and 2024 (bottom) AgeS3-Grad awardees' science identity with respect to geochronology.

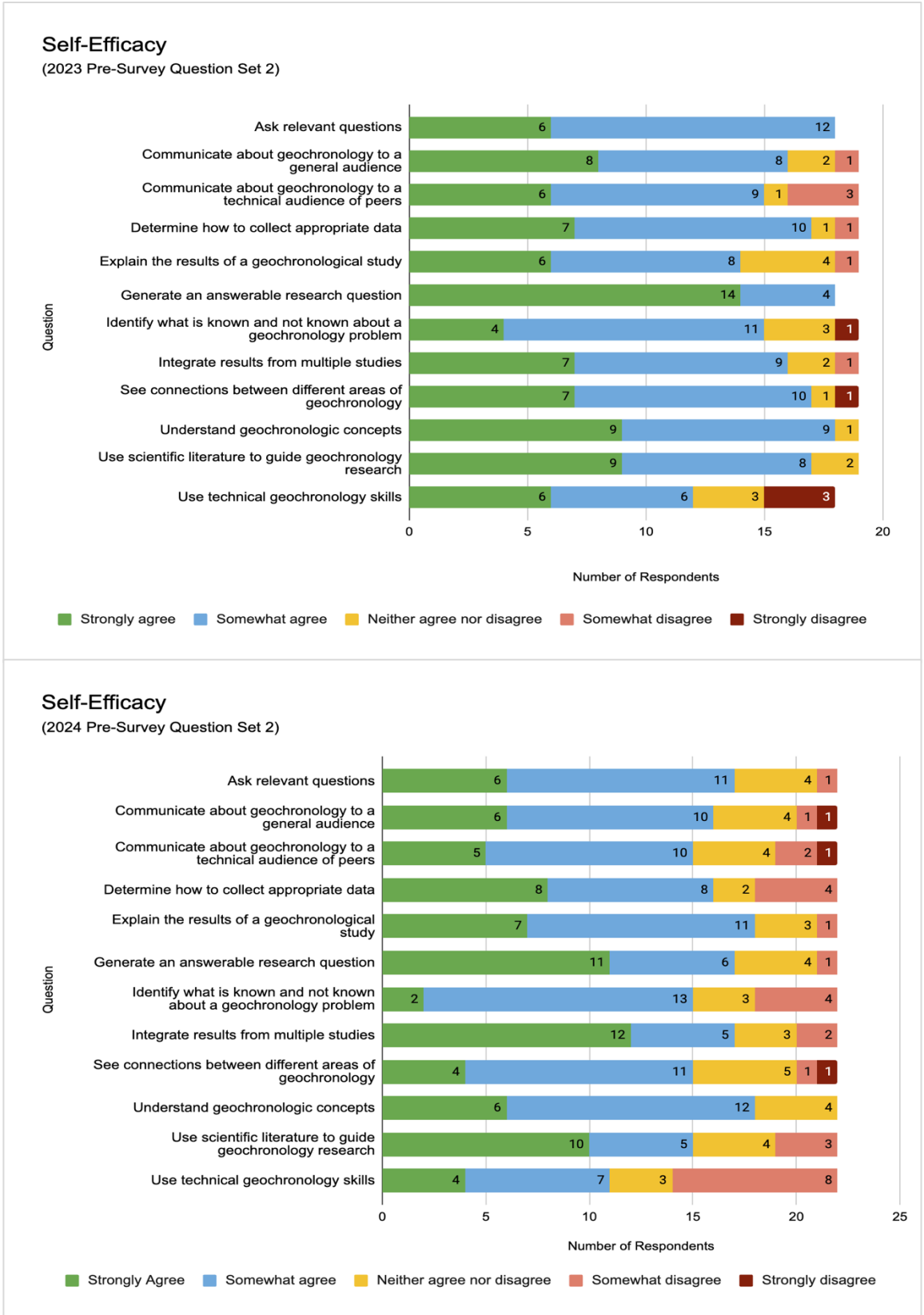

Figure 3. Questions aimed at understanding 2023 (top) and 2024 (bottom) AgeS3-Grad awardees' self-efficacy in geochronology.

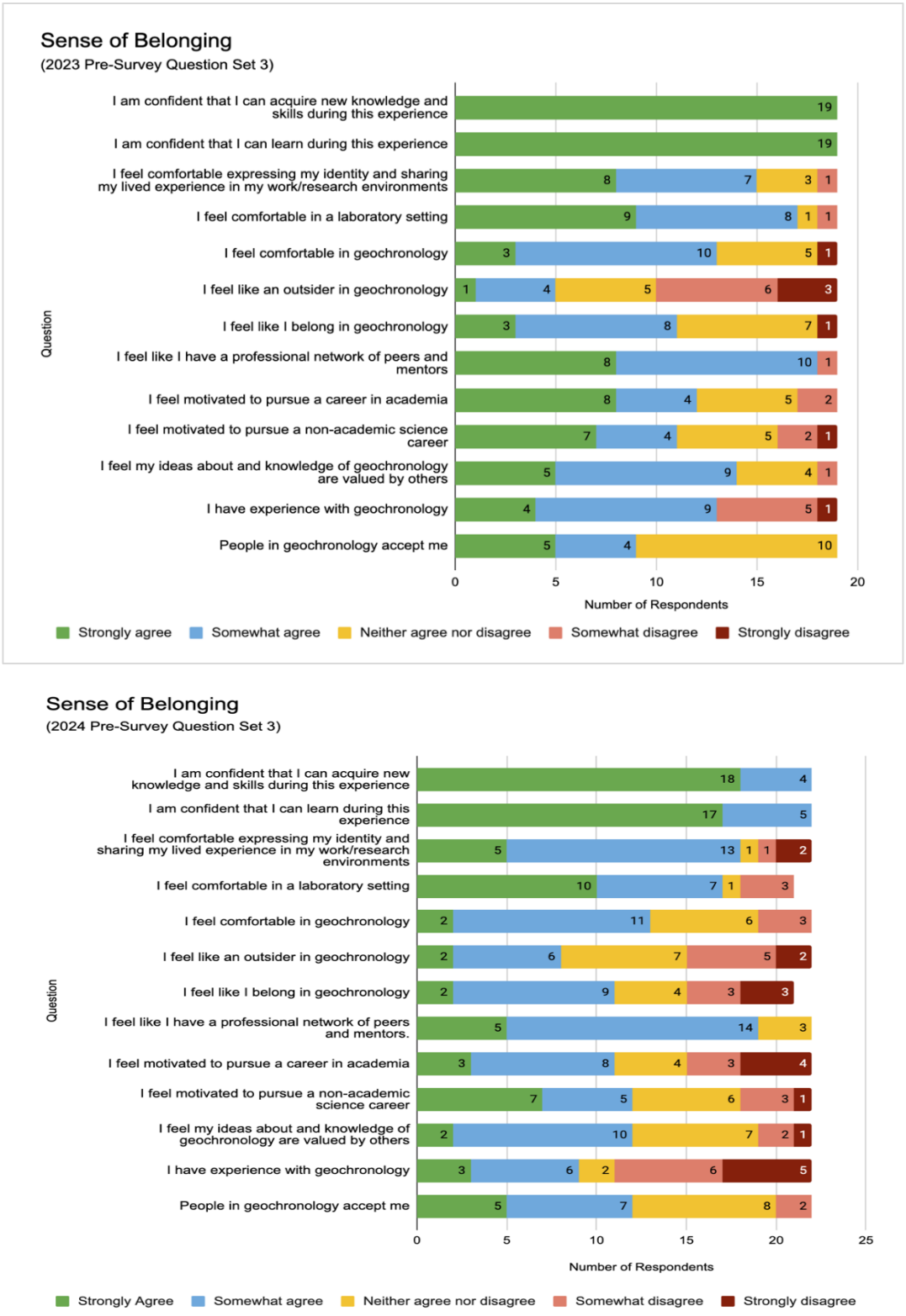

Figure 4. Questions aimed at understanding 2023 (top) and 2024 (bottom) AgeS3-Grad awardees' sense of belonging in geochronology.

Most students either "strongly agree" or "somewhat agree" with most factors in all three categories. In both cohorts there are substantial numbers of students who express lower agreement, including lower confidence in their understanding, knowledge, technical skills, and ability to communicate about geochronology to an audience of scientific peers. Students report the lowest agreement with statements about sense of belonging in geochronology: fewer than half "strongly" or "somewhat agree" that they "feel like I belong in geochronology" and that "people in geochronology accept me," and half indicated that they "feel like an outsider in geochronology." 2024 Grad awardees reported somewhat less agreement with statements about science identity, belonging, and self-efficacy (Figs 2-4) than the 2023 cohort, possibly related to the 2024 cohort's perceived lower level of experience than their 2023 counterparts ("I have experience with geochronology," Fig. 4). All 19 respondents in 2023 reported confidence that they could acquire new knowledge and skills, and learn, during their AGeS experience; in 2024, 4 out of 22 (knowledge and skills) and 5 out of 22 (learn) reported that they only "somewhat agree" with those statements (Fig 4).

Past AgeS students have often reported increases in areas of confidence and belonging as a result of their AGeS work, and we would expect to see improvements in these factors in the post-program survey if the 2023 and 2024 students have experiences as positive as previous students. It will be particularly interesting to see whether the outcomes for the 2023 and 2024 Grad awardees are different, since they had somewhat different starting points, as reflected in their survey responses.

Qualitative Data

The pre-program survey also included three open-ended questions:

- ★ What do you hope to get out of your participation in the program?
- ★ Are there any aspects of working with and visiting a new lab that concern you? If yes, please describe them briefly. (Consider financial, interpersonal, logistical, technical, intellectual, or any other concerns that have come up.)
- ★ What are some things that help you experience a sense of belonging? (Consider actions people can take, things people can say, the ways in which spaces are set up, resources that can be provided, and/or other things that support your sense of belonging. What do you need to help you thrive in this program?)

Responses to these questions were coded using a thematic analysis approach informed by grounded theory (Clarke & Braun, 2013; Charmaz, 2008) and using Nvivo qualitative analysis software. Similar themes emerged for responses from both 2023 and 2024 awardees, as described below. We suggest (as in 2023) that these responses be shared with personnel from host labs, advisors, and other project personnel to help them better understand the perspectives and needs of these early-career scientists.

2023 Awardees

Hopes for the Program

> "I hope to build lasting connections in geology and feel like I belong."

- Making connections in the geochronology field; learning from peers and experts
- Building a greater understanding of geochronology; gaining experience with geochronological methods and learning new techniques
- Improving research skills (asking research questions, data collection, analysis, interpretation)
- Gaining hands-on practical laboratory experience
- Preparing for future research and exploring future opportunities

Concerns about the Program

> "I worry that I don't understand [a topic] well enough and that this will be exposed in the lab, and I will be made to feel foolish or stupid."

- Lack of experience in certain methods; using new or unfamiliar methods
- Completing research successfully, conducting high-quality analysis
- Time constraints, e.g., having enough time to finish analysis and having enough time to prepare before visiting the host lab
- Being away from home, taking time away from a paid job, being away from family responsibilities
- Imposter syndrome, navigating a new space
- Logistics, such as coordinating with advisors and lab directors
- Accessing funds for lodging, flights, food, etc.
- Several respondents said they had no concerns.

Things that Contribute to Participants' Sense of Belonging

> "Open communication and an environment that promotes questions at any level of understanding–feeling like I can ask any questions regardless of how fundamental they may be."

- Guidance and mentorship, particularly when facing challenges or setbacks
- A space that encourages question-asking without judgment
- A welcoming environment, sense of humor, sharing a meal together, "getting to know people on a human level"
- Consistent communication and clear expectations
- Validation, "affirmations that I am a valued member of the geoscience community"
- Collaboration
- Encouragement
- Openness and understanding from others

2024 Awardees

Hopes for the Program

> "[I hope to] gain new skills and knowledge in the realm of geochronology so that I can continue utilizing these knowledge and skills in future projects."

Survey respondents shared a variety of things they hope to get out of their participation in the program, including forming a network, learning more about geochronology, and new skills and experiences.

- Many respondents shared that they hope to expand their networks by forming connections with peers, labs, mentors, and other professionals in the field. Some specifically highlighted mentorship as a hope.
- Many also hope to learn more about geochronology, how to conduct geochronology research, and how it can be incorporated into "current and future research." They hope to get "hands-on experience with geochronology analysis" and learn "geochronological techniques that are unfamiliar to me." Some noted specifically the ways in which they hope geochronology will strengthen their existing research.
- Some respondents shared more general hopes, including "new knowledge" and "experience." One shared that they hope this opportunity will lead to "the holy grail, a job with benefits."

Concerns about the Program

> "I also am not confident I am intellectually equipped for the rigor of problems I am setting out to answer."

While some respondents shared that they have no concerns about the program, some shared logistical and interpersonal concerns.

- Some respondents shared concerns about their budgets running out. A few simply said "financial [concerns]." In a similar vein, some shared concerns about "having enough time at the host lab" and having "enough time to complete all my necessary measurements." One expressed concern about leaving their home lab "for a long stretch of time." Other logistical concerns included project feasibility, sample quality, and sample quantity.
- Some respondents expressed concerns about working in a new, unfamiliar lab. This included "navigating a new location," "working with new equipment and techniques," and uncertainty about the safety of their host lab: "By stepping into a new lab I am putting my health and safety into the hands of scientists I have never met before and

that does scare me a bit." One shared that they are worried that they are not "orderly, careful, [and] clean enough to successfully do work in a clean lab."
- A few respondents shared feelings of imposter syndrome. Some of these concerns focused specifically on lack of geochronology experience while others were more general: "I'm worried that I'm not smart enough to be successful."
- A few respondents expressed concern about meeting and interacting with new people.

Things that Contribute to Participants' Sense of Belonging

> "In this field where I have no experience, the thing that increases my sense of belonging is interacting with people who understand I am very uncertain due to my lack of knowledge, and are willing to patiently guide me so that I'm not overwhelmed by all the new knowledge I'm learning."

Respondents highlighted a variety of program elements that will support their senses of belonging:

- Many respondents shared the importance of feeling welcomed and included, with some specifically mentioning diversity and the importance of the program being "welcoming to people of all backgrounds." Some also specifically expressed appreciation for inclusion of participants without prior geochronology experience, noting that it will be helpful to receive "background knowledge," guidance, and patience as they learn about geochronology.

- Some shared that they hope to experience a strong sense of community within the program, which would include frequent check-ins, "meeting in person at least once," and ongoing "communication through the provided Slack channel."

- Some respondents highlighted the importance of receiving support and resources throughout the process of learning about geochronology and completing their lab work. This ranged from "helping me make a plan before I delve into a big lab project" to "a good working environment." One appreciated "distributing funds before an expense rather than compensating for costs afterward. It helps to relieve financial stress and allows me to focus on the science."

Data Collection and Analysis: Listening Sessions

This summary includes qualitative data from two listening sessions with AGeS^3-Grad awardees. Evaluators conducted listening sessions using a semi-structured protocol including questions about participants' experiences in the program, the impact the program has had on them, and their suggestions for improvement.

As above, researchers used a thematic analysis approach informed by grounded theory to analyze the qualitative data (Clarke & Braun, 2013; Charmaz, 2008). After transcribing the listening sessions, researchers analyzed the data using Nvivo qualitative analysis software.

Program Impact

> "I've developed my ability to handle data. After you get your data back you have this huge sheet full of numbers, and now you have to do something with it. You have to create meaningful figures with them. You have to make interpretations from that big sheet of numbers. Now, it's not as intimidating."

Focus group participants described the following ways in which the program has impacted them thus far:

- Program participants gained a better understanding of the logistics behind running a lab and completing successful experiments, particularly relating to planning project timelines.
- Participants built research and geochronology skills including zircon separation, new softwares, and data analysis methods.
- Participants gained a deeper understanding of geochronology, its importance, and the ways in which they can incorporate it into future work.

> "I think it's really gained my knowledge of the true importance of getting accurate ages and the uses of geochronology."

- Participants learned about grant funding and built proposal-writing skills.
- AGeS-Grad students developed networking skills and feel part of a larger community of geochronologists.
- Participants developed a greater sense of confidence in themselves; one participant explained, "I achieved something that I didn't think was possible."
- Program participants were able to complete work that would not have otherwise been possible without the AGeS microgrants.

> "Something that has stuck with me is the idea of prioritizing networking with people in person through the lab visits. I started my PhD in the pandemic and it's been a weird couple of years of meeting people, but not really meeting people. The people at my lab facility were approachable. They helped me frame up future interactions. I know now I can email somebody about something relating to my research, but also go see them, get to know them, and meet up at a conference, or go to their lab facility and that strengthens [my network] a lot more."
>
> "I think, overall, it's kind of opened my eyes to the process of applying for funding. It's not fun to get rejected from grants, but it's really, really awesome when all the hard work that you put in is recognized."

Program Experiences that Led to Impact

When asked which program experiences supported these impacts the most, participants shared that supportive hands-on experience in the lab and helpful mentors were at the top of the list. They also appreciated timely and clear communication from AGeS leaders, opportunities to write proposals, and, for some, being placed in the same host lab with a fellow AGeS award recipient enhanced their overall experience in the program.

Hands-on Lab Experience

Graduate students shared that seeing how lab work is done "step-by-step," in a collaborative environment was critical to their experience. One participant shared that being at the lab in person was much more helpful to their growth as a scientist compared to "watching a video or reading an academic paper" and noted, "Now that I have done it, this is never going away. I spent late evenings in the lab repeating procedures." They appreciated having dedicated time to process data and felt the in-person experience was "learning-oriented" and allowed them to have ownership of their data.

> "It was kind of an in-depth, detailed orientation into the world of geochron, the specific technique that I was using that I wouldn't have gotten otherwise with another grant or just in my PhD in general."
>
> "I enjoyed being given the run of the lab for a short time and really feeling like I was in charge of what was happening with my own data."

Supportive Mentors and Program Leaders

Grad students shared that they felt supported by program leaders and mentors in their host labs. They felt that their lab mentors cared about their future careers, were responsive to their questions, and were willing to put in extra time so that students felt successful in the lab. One

participant noted, "It was nice to have someone there to put out fires I started or any figurative fires [laughs]."

> "I've met one of the PIs of the program who is really enthusiastic about catching up, asking about my progress, and talking to me about my projects… what they have done to put together this big set of collaborative labs is a tremendous effort and that's awesome."
>
> "The experience with the host lab was incredible. I had really good rapport with the lab manager and with the host who runs the lab."
>
> "We had to come to seminars and then we had follow-up dinner events. [My mentor] talked to me about career planning, talked about the project, and about the geochronology community. Because it's a full day, multi-week visit, that was very much all the time."

Science Self-Concept

> "I feel like AGeS made me a lot more independent, and can claim more authority in the scientist title. Maybe not necessarily in my specific field yet, but at least in other contexts, because being the PI on this type of grant, the funding is going directly to me. It's not going to my advisor, my institution. It's mine to work with and to coordinate with. Just having more autonomy I feel like has validated my claim of the label of scientist."

When asked about the extent to which they consider themselves to be scientists, participants shared that they generally have greater confidence in claiming that title and that having the opportunity to work independently helped them embrace the concept of being a scientist. However, some said that although they would confidently describe themselves as scientists to those in other fields or with their family and friends, they felt less assured to do so in their own field.

> "If I am in a group of mixed companies, say, of more humanities folks and scientists to identify with the natural science world, I'd call myself a scientist, but if I'm amongst other graduate students or faculty, other people in my field, I believe I refer to myself less as a scientist because there's certain hierarchy rankings that I don't know if I'm allowed to claim that title, I guess."

Several participants shared that receiving the AGeS grant helped them feel more confident in their identity as scientists. One explained, "I think maybe I graduated from one grade to the next within the continuum of being a scientist-in-training." Another described their experience working on their project to be "what real scientists do," which made them feel like "I'm also now a real scientist."

> "It helps combat the imposter syndrome a little bit where you're like, 'Oh, wow. People see my research as fundable.' It makes you feel like you're doing something right. Yes, I think it all helps in the feeling that I can be a scientist and that I am a scientist."

Future Career Aspirations

> "I think before AGeS, I was working in very abstract space and was reminded of why I got into science and what got me hooked, and that's working with kinetic materials and actually looking at stuff, and so I think AGeS is going to push me to continue to develop more field and lab work experiences for myself that I probably wouldn't have if I didn't do this."

AGeS students shared how the program has influenced their future career aspirations including some deciding to pursue a Ph.D., having a clearer focus of the kinds of research they want to conduct in the future, and realizing through this experience that they want to incorporate more hands-on lab work into their research. Some who had previously not done geochronology work identified new ways to use geochronology in future projects.

Some also noted that receiving the AGeS grant will support their resumes and "academic profile" while applying for academic programs, funding, and internships in the future.

> "I interviewed a lot better. I applied for an internship, and to be able to say, 'I just got $10,000 in funding.' I think that is an example of success."

Cultivating a Sense of Belonging

> "I remember the review that came back from my proposal and I appreciated that they used gentle language in giving me feedback. The proposal reviews are fair with useful feedback from geochronology experts, so I thought that was good."

Participants shared program elements that support their sense of belonging, which included:

- Receiving kind and supportive feedback on proposals;
- Supportive leaders and mentors;
- Feeling part of a welcoming, warm community; and
- The inclusion of students with and without geochronology experience.

Several students also noted that they felt a strong sense of belonging at their host labs thanks to the ways in which host lab personnel supported their work and helped them get settled in a new environment.

> "[My lab manager] was really awesome. We got together, we chatted in downtime, and she was very helpful. She gave me a tour around the building and stuff, told me about places to go eat, coffee shops and all that, a place I could do some work if I needed to."

Opportunities for Program Improvement

> "I think I would communicate with potential host labs about bandwidth and capacity. My particular host lab ended up having four AGeS students in the same cohort, which was a lot. [laughs] They managed it as best they could, but even outside of AGeS they're totally backed up. I'm glad they did get to host all of us, but for their own sanity and maybe for the sanity and timeline of other students in the future, understanding if the lab even has space to process these samples in a timely manner. "

Participants had positive experiences in the AGeS-Grad program overall, but shared several opportunities for the program to grow and improve. These ideas included working with labs to determine bandwidth for supporting students and having more opportunities for students to network and connect with each other in person and virtually about their projects. One participant also suggested that it would be helpful to get "more students aware of the AGeS grant earlier on."

> "It would be ideal to have an in-person gathering at some lab. I know Arizona has a big geochronology lab space and a little poster session or whatever gathering event in-person, plus a lab tour. That'd be super cool. Or if there's a summer school in geochronology, I would attend, to broaden my knowledge about all different types of geochronology tools."

Advice for Future AGeS Participants

Some participants shared advice for future AGeS applicants and grantees. They shared the following tips:

- "Prepare your grant very, very early," which allows you to share it with trusted mentors who can provide feedback.
- Be flexible and adaptable, even if your project does not go according to plan: "Data is data and you can answer questions with data, whether or not it's the outcome you wanted."

- Avoid trying to "overprepare" before getting to your lab, as "it's okay to wait until you're at the place where the experts are and let them guide you through the process."
- Communicate with your lab ahead of time about scheduling and expectations. A pre-meeting with your advisor and your contact person at your host lab is helpful. One participant specifically advised discussing sample strategy with the host lab prior to collecting samples.
- Before getting to the host lab, make a list of anything you might need during your visit so you are well-prepared.
- "Time management is key."

Looking Ahead

> "I think AGeS can be a really good model for other programs to develop these sort of micro grants that are such a good amount. In my graduate career, trying to find my own money, I often find that grants are either too small or way too big. AGeS is like a perfect sweet spot if you're just trying to wrap something up on a project or do something on the side that is interesting to you."

AGeS-Grad students enjoyed their time in the program and experienced positive and supportive host labs that led them to develop their research skills, build a wider community, and see themselves as scientists. As one participant shared, "I wanted to attend this focus group to share how awesome the AGeS has been for me." They are excited to see the program continue to support new students with new research ideas and hope that this program can serve as a model for others that want to help students grow their skills and thrive as geochronology scientists.

AGeS^3-DiG 2023 Awardees

Data Collection and Analysis: Pre-Program Survey

Demographics

A pre-program survey was sent to DiG project leaders, who sent the survey to participants in their respective projects. 21 students completed the survey. The survey requested demographic data using individual self-describe boxes for race/ethnicity, gender identity, sexual identity, and disability status, phrased as, e.g., "How do you describe your gender identity?" This approach allows respondents to provide more nuance than pre-defined boxes, and race/ethnicity and gender responses can be binned into the broader categories used in other AGeS^3 data collection. Collecting data on sexual identity and disability status is

new for AGeS, to our knowledge. Full responses to these questions and counts for each are provided in Table 1. Binned data are shown in Figure 5.

Following these demographic questions, the survey asked, "Are there any other aspects of your identity that you think are important for us to know? For example, are you a first-generation college student (first in your family to attend college), a student from a lower-income background, a student with family care duties, a student from a rural background, a student who is older than most other college students, or another identity you would like to share?" Responses to this question were as follows:

- ★ Adult Learner, student veteran
- ★ rural background, lower-income
- ★ Roman Catholic
- ★ First generation college student/Veteran
- ★ I live in Juarez and I cross the border every morning to go to classes, living near my school will be a dream come true!
- ★ I am a first generation student and my parents immigrated here with not money. We are a little more stable now but we don't have a high income. I also had to take care of my siblings growing and as my parents were both constantly working.
- ★ Older than most college students
- ★ First Gen American (parents are immigrants)
- ★ chronically ill
- ★ I am a first-generation college student. I am older than my fellow students, I am 29 years old. I come from a middle-class family.

Gender Identity	Count	Sexual Identity	Count	Race/Ethnicity	Count	Disability Status	Count
Female; she/her; woman	10	Lesbian; I love women	2	White; Caucasian	14	No disability; none; healthy; etc.	17
Male; he/him	10	Straight; heterosexual; hetero	13	Hispanic Latino; Hispanic/Latino	2	Disabled veteran	1
Agender; non-binary	1	Pansexual	1	Hispanic	2	I have a disability	1
		Bisexual	2	Asian	1	Asperger's syndrome/high functioning autism	1
		Queer	1	Korean	1	Mentally disabled	1
		Male	2	White, Latina	1		
Did not answer	1	Did not answer	1	Did not answer	1	Did not answer	1

Table 1. Full range of responses to self-describe free-text demographic/identity questions for DiG 2023 participants. Semicolons separate provided responses, and commas are original to the responses. Note also the additional dimensions of identity (bulleted list above) that participants provided.

Collecting data on additional dimensions of student identity provides new information about the diversity of students the AGeS3 program is serving, such as veteran status, disability, and first-generation college student status. Using self-describe boxes avoids either an exhaustive list of options for each identity category, or a short list and a self-describe or "other" box. This method is recommended when there is capacity in the project to code the qualitative data (Gofman et al 2021), as was done here, with binning.

Figure 5. Demographics of AGeS^3-DiG participants. Self-describe free text responses, shown in Table 1, were binned into larger categories to the extent possible.

Affective Domain Survey Questions

The survey also asked about participants' geoscience identity and self-efficacy (Figure 6), sense of belonging in the geosciences (Figure 7), and social capital (Figure 8; Trujillo and Tanner 2014; Saw 2020). The post-program survey will be administered in May 2025 and will ask the same questions, to reflect changes in these dimensions over that time. Participants were asked to provide a code (the first three letters of their mother's name and the last three of their phone number) in order to connect individuals' pre- and post-program responses without identifying them.

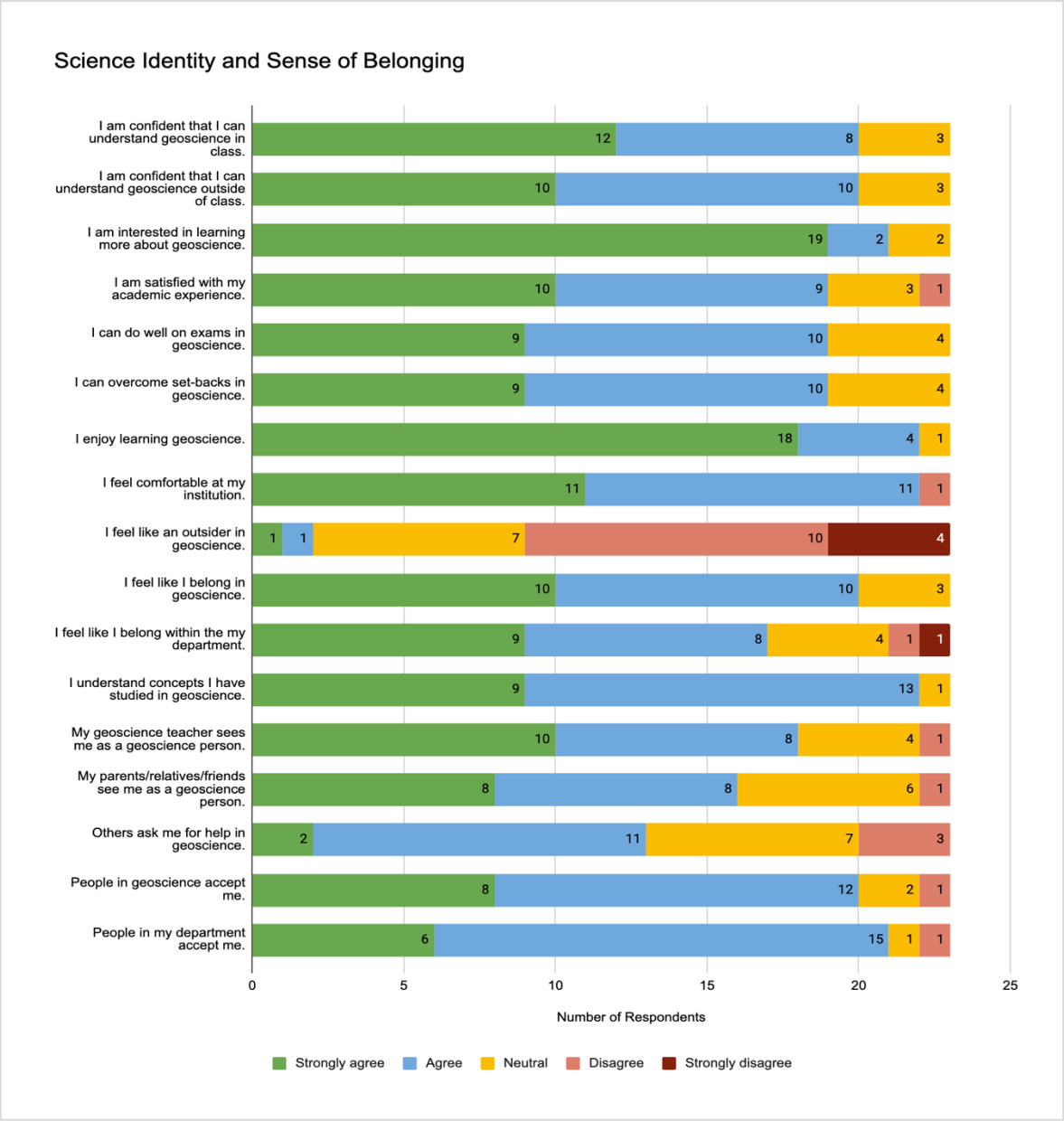

Figure 6. Questions aimed at understanding respondents' science identity with respect to, and sense of belonging in, geoscience.

Most students either "strongly agree" or "somewhat agree" with statements, or are "absolutely" or "very" confident with respect to most factors in all three categories. Although these responses overall appear more positive than those of the Grad awardees who were asked similar questions, note that the questions in the DiG survey asked about geoscience, while the Grad survey asked about geochronology; other questions also differed somewhat because of the differences in education and experience level between the two groups. Fewer than half of DiG participants reported that they did not feel like they belonged, or felt like outsiders, in geoscience, but this is still a substantial number. Although DiG students have not to our knowledge been surveyed in the past, as noted above past AGeS^3-Grad students have often reported increases in areas of confidence and belonging as a result of their AGeS work, and we would hope to see improvements in these factors among DiG students in the post-program survey.

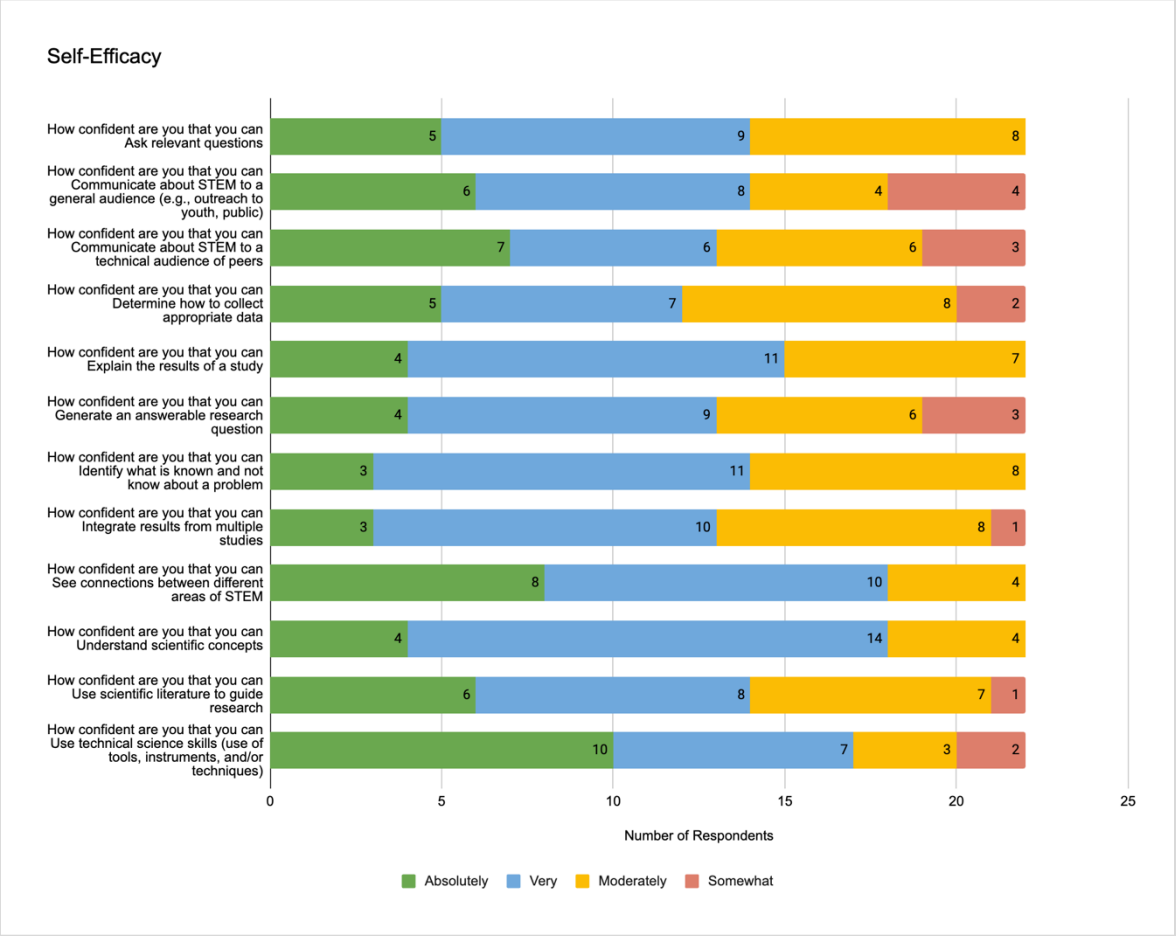

Figure 7, Questions aimed at understanding respondents' self-efficacy in STEM.

Results on students' social capital - the support they receive from their networks, and from whom they receive it - show some interesting features (Figure 8). While university faculty and other personnel provide a large portion of the support for students' needs in their geoscience careers (blue and maroon bars), students also report that they get this support from their peers as well (light green bars). Of particular interest is the report of low support in the areas of people "who [introduce] you to people in their professional network" and "who [take] you to their place of geoscience work." DiG project leaders should consider addressing these needs for their students, or at least discussing with them that lack and how they might fill it.

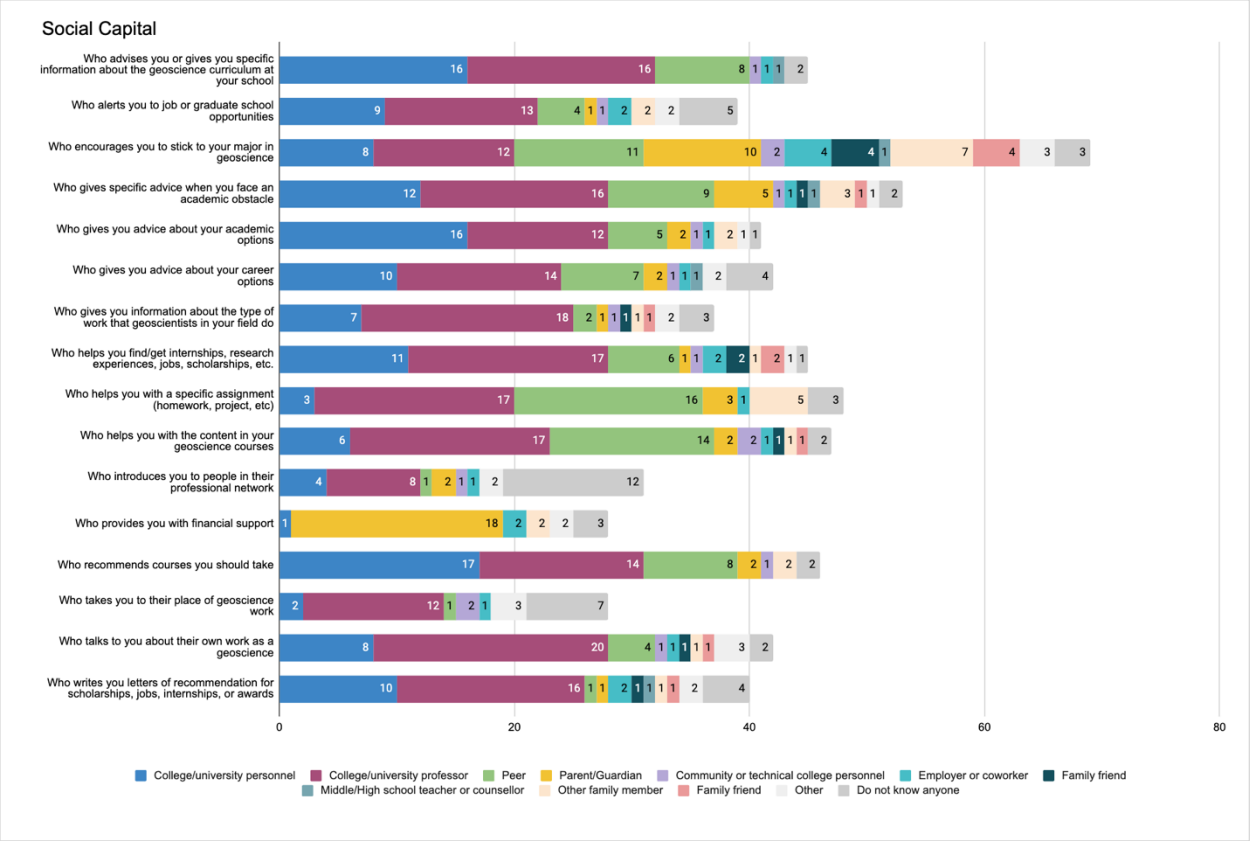

Figure 8. Questions aimed at understanding students' social capital.

Qualitative Data

Similar open-ended questions were used in the DiG pre-program survey as in the Grad pre-program surveys ("What do you hope to get out of your participation in the program?" and "What are some things that help you experience a sense of belonging?"), and text was coded in the same way. Themes that emerged were as follows:

Hopes for the Program

> "[I hope to gain a] better understanding of how to conduct research, compile the data, and be able to present it in a way that makes it understandable."

- Participants hope to learn about the research and field work processes, gaining experience in both. Many specifically hope to gain "hands-on geochronology experience" and have opportunities to apply their knowledge. Some also hope to learn technical skills and advanced tools for geochronology.
- Participants hope that the DiG program will support their future education and career goals, including helping them gain skills "that I can transfer on into other field and research projects," make decisions about their future career paths (e.g., research-based or industry-based), and "further pursue my passion of the geosciences."
- Some participants hope to learn about new or different topics within geoscience.
- A few participants hope to make contributions to the geochronology field: "[I hope to] make meaningful contributions to scientific understanding."
- Some would like to expand their network and build new connections.
- Some would like to improve their ability to communicate scientific data.
- One participant hopes the program will help them overcome imposter syndrome and another hopes the program will help "prove that I can handle the work I would love to do."

Things that Contribute to Participants' Sense of Belonging

> "Having willingness to teach and listen to the questions the students have is the best way to make a student feel accepted and understood."

- Many participants named positive relationships as a key part of environments where they can experience a sense of belonging. They hope to experience an "open and safe space where we as a team can grow and learn together," opportunities to strengthen "peer-to-peer bonds," and kindness among other program participants. One described this as, "When people say 'Hi' as we pass in the halls." Some also described this environment as "inclusion."
- Many also emphasized the importance of feeling like they can ask questions without judgment or "scrutiny." One said they appreciate "knowing that my professors' doors are open if I have any questions or concerns."
- Being taken seriously and feeling appreciated are other factors that contribute to some participants' sense of belonging. This includes being "considered for opportunities," "feeling acknowledged," "knowing my efforts are appreciated," "positive affirmations from my professors or superiors," and even having been encouraged to apply for the DiG program.
- Some participants shared that collaboration helps them feel a sense of belonging: "Collecting and interpreting data with my fellow peers and professors in this program will support my sense of belonging."

- A few participants said that clear communication and directions help them experience belonging.
- Other things that support participants' sense of belonging included "a fluid work environment," "support," and "open and safe spaces" to learn.

AGeS Demographics Over the History of the Program

Figures 9-13 show selected demographic categories of AGeS-Grad awardees over the entire history of the program, both by year and cumulatively. AGeS has supported mainly White students (55), but also at least 32 non-White students. AGeS has supported about equal numbers of male- and female-identifying students. Tectonics is the most common area of study for Grad awardees' projects; topics have diversified over time, with more "soft-rock" projects (climate, geomorphology) in more recent years. Quaternary methods are most common, but are subequal with low-temperature methods and about 30% more common than strictly high-temperature studies. AGeS has supported about twice as many Ph.D. students as Master's degree students.

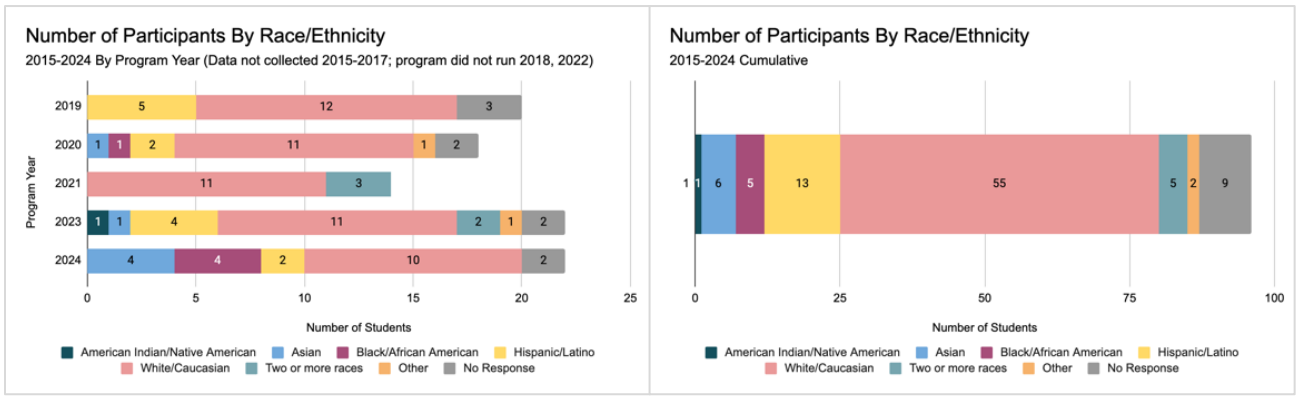

Figure 9. Race and ethnicity of AGeS awardees: by year (left) and cumulative for all award cycles.

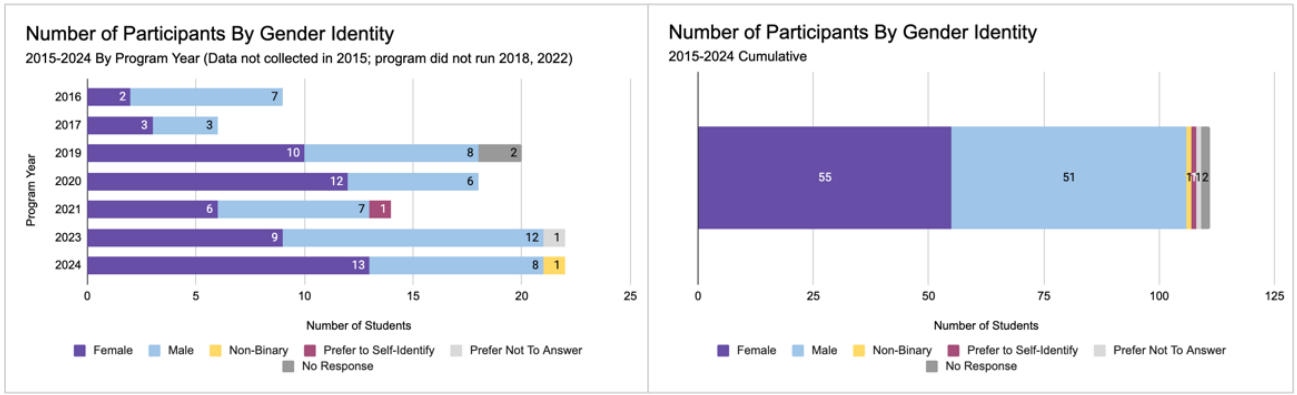

Figure 10. Gender of AGeS awardees: by year (left) and cumulative for all award cycles. Note that available responses changed over time: AGeS1 used M or F; 2019, Male or Female; 2020, Man or Woman plus Prefer to Self Describe and Prefer not to Answer. "Nonbinary" was added as a response option in 2023.

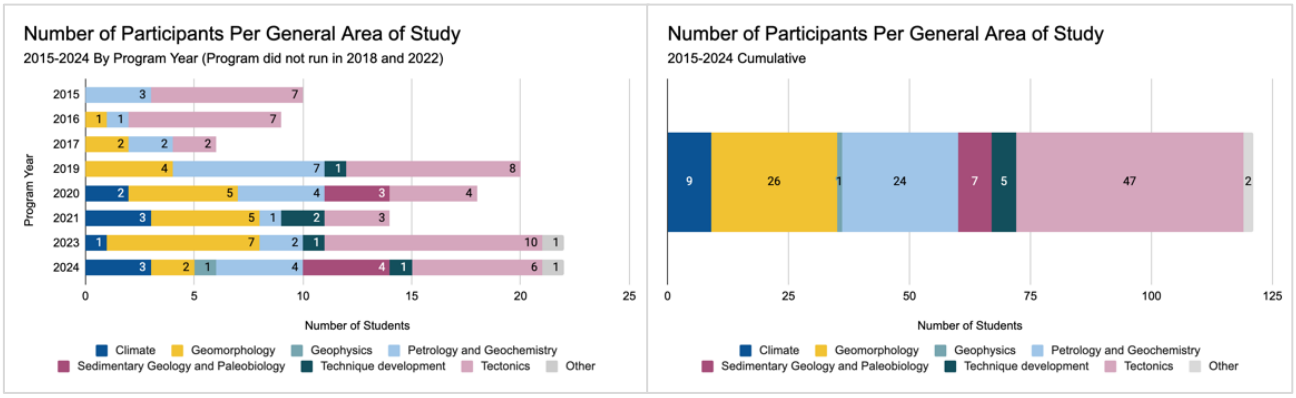

Figure 11. General area of study for projects of AGeS awardees: by year (left) and cumulative for all award cycles.

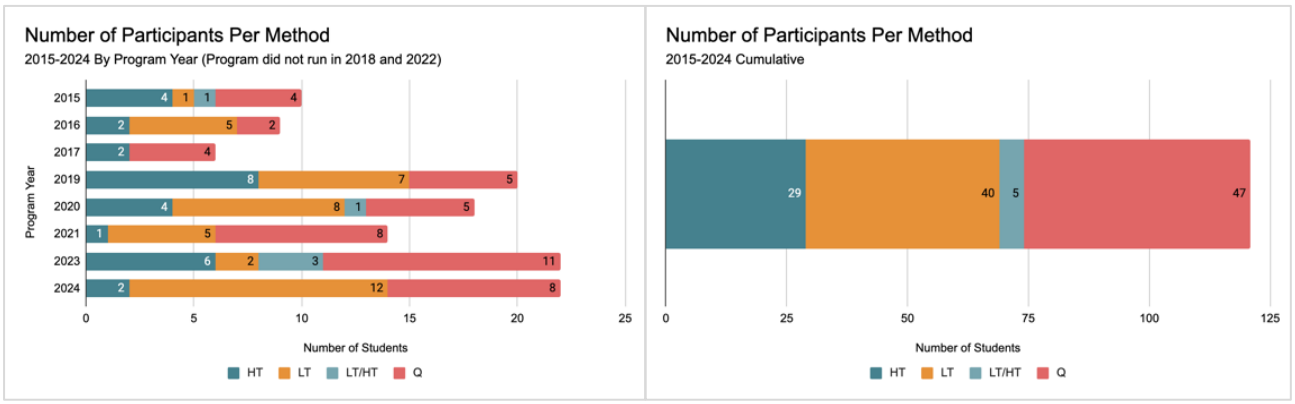

Figure 12. Geochronologic method used in projects of AGeS awardees: by year (left) and cumulative for all award cycles. HT=high temperature; LT=low temperature; LT/HT=a combination of both; Q=Quaternary.

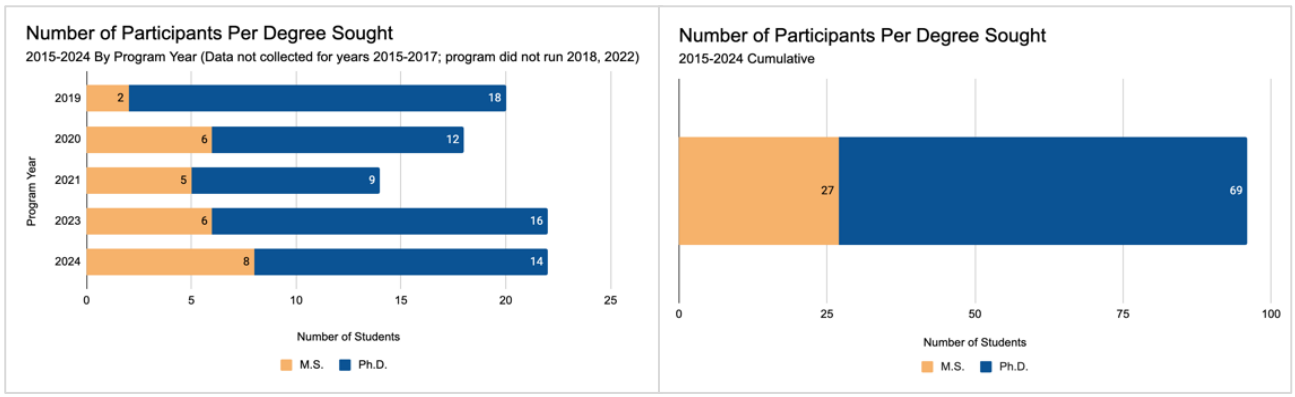

Figure 13. Graduate degree sought by AGeS awardees at the time of their awards: by year (left) and cumulative for all award cycles.

Conclusion

The impacts of the AGeS^3 program are built on the strong foundations of the first two rounds of AGeS funding and development. The program has continuously diversified in both scientific disciplines and awardee demographics over its history, and has provided crucial financial and/or experiential support to well over 100 graduate and undergraduate students. Based on reporting from AGeS2, and interviews of several AGeS3 2023 awardees, students' feedback on their experiences and descriptions of resulting growth are overwhelmingly positive. These results suggest that this relatively modest financial investment per student, along with the strong and supportive network of AGeS labs, reviewers, and leadership, contributes to large improvements in student outcomes.

The diversity of AGeS^3-Grad and -DiG students is high relative to the geosciences overall. When provided open-text boxes to describe their own identities, participants provided nuanced responses that are not possible using more traditional demographic checkboxes. Collecting additional data on student demographics may help project leadership better understand the experiences and identities of AGeS students and how the program can better support them.

Some Grad awardees who are just beginning their AGeS programs report that they lack confidence that they will be able to do what is required of them, that they are smart/careful/skilled enough, or that they will look foolish in the host lab because they don't know something. Students identified a variety of program components that contributed to their sense of belonging and confidence. These include patient lab mentors and welcoming communities; the program's culture of including students without geochronology experience (not only those with prior exposure); and being encouraged to apply for DiG or awarded an AGeS3 micro-grant itself. Post-program surveys of 2023 and 2024 Grad awardees and 2023 DiG participants, and interviews of 2024 Grad awardees, will help illuminate additional areas of growth among these students.

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