

SPOTLIGHT

Improving Retention of Underrepresented Groups in the Geosciences Through an Intensive First-Year Experience at the University of South Carolina

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INTRODUCTION AND PROGRAM DESCRIPTION

There have been many efforts to broaden participation and diversity in the geosciences with varying degrees of success. The goal of the National Science Foundation-funded GeoScholar Program in the School of the Earth, Ocean & Environment (SEOE) at the University of South Carolina was to increase geoscience exposure and the number of geoscience undergraduate majors (environmental, geological, and marine sciences) from low-income, historically excluded, and first-generation college backgrounds.

The GeoScholar Program ran from 2015 to 2022 and included an intentional multiyear effort that consisted of financial support along with increased access to introductory geoscience courses, mentoring, and community building through a shared living space, the Green Quad. GeoScholars were provided annual scholarships of \$5,000 to serve as a recruitment tool and to reduce students' need to work while taking courses. In the first year, cohort building was accomplished by having all of the GeoScholars reside in the living and learning Green Quad (GQ) community. The GQ is geared toward students interested in sustainability and is strongly marketed to those with interests in environmentally related careers, though other majors are also commonly in residence (e.g., business, engineering, and art). Housing activities included on-site tutoring, faculty and staff advisors, and targeted internship opportunities. Geoscholars also enrolled in a GQ/Geosciences University 101 course with other non-GeoScholar students in order to foster a sense of belonging, promote engagement, and provide support in navigating university systems.

As part of the GeoScholar program, a new environmental 101 (ENVR 101) course, Introduction to the Environment, covering all aspects of the geosciences, was developed and specifically geared to first-generation, historically excluded, and low-income college students enrolled in university-wide Gamecock Guarantee and Opportunity Scholars programs (GG/OSP). This course was limited in enrollment to a maximum of 20 students; taught by a Black faculty member, it was the first and is the only current science course offered by these programs. Administrative support included the Principal Investigator, the Undergraduate Director of the SEOE, the Faculty Principal and staff of the GQ, and the Director and staff of the university's TRIO (GG/OSP) Programs. While there were many positive, long-lasting outcomes of the GeoScholar program, we focus specifically on the impacts of housing, long-term and engaged one-on-one mentoring, and changes in attitudes in the GG/OSP students who completed ENVR 101.

RESULTS

Four cohorts (years) of GeoScholars (N = 19), first-year geoscience students who completed a required core course, Marine Science (MSCI) 101 (The Ocean Environment with lab) (N = 320, GeoScholar removed), and GG/OSP students who completed ENVR 101 (N = 76),

were surveyed at the beginning and end of the semester-long courses. GeoScholars participated in focus groups and were surveyed throughout their time at the University of South Carolina. Surveys contained targeted questions regarding (1) housing; (2) sense of belonging; (3) attitudes, self-efficacy, and career interests; and (4) support and barriers. A non-parametric Wilcoxon-ranked significance test was used to test significance at the 0.05 level. Of the respondents who lived on campus, only the GeoScholars and ~31% of MSCI 101 students lived in GQ, while the GG/OSP and remaining MSCI 101 respondents were housed in other dorms across campus.

Perceptions of housing across all three groups were neutral to positive on a 1–5 scale (>3.0), with those living in the GQ (GeoScholars and MSCI 101) being significantly more positive than non-GQ residents ($p < 0.05$). There were no differences among the GeoScholars, GG/OSP, or MSCI 101 groups regarding their sense of belonging to the geosciences nor did this change with time (3.2–3.4). Geoscholars' self-efficacy, attitudes, and geoscience career interests, which started out quite high (>4), only increased throughout their first year and beyond ($p < 0.05$). While MSCI 101 students were similarly high, their self-efficacy remained relatively constant. In contrast, GG/OSP students began the semester as relatively ambivalent, but their self-efficacy increased by almost a full point by the end of the course ($p < 0.05$). All three groups were neutral to negative (average 2.2–2.5) regarding perceived barriers in pursuing geoscience careers, and their perceptions did not change with time.

DISCUSSION

Numerous studies have highlighted the importance of cohort building and creating an overall supportive environment for underrepresented minorities as well as low-income and first-generation college students (e.g., NSTC, 2021). This is especially true in geosciences. Campus housing provides a mechanism for students to obtain better access to campus resources, increase their social networks, and become integral parts of campus, especially in the first year when retention is the lowest. At the same time, housing may expose differences in culture that are particularly acute in first-generation, historically excluded, and low-income students (Armstrong and Hamilton, 2013). Indeed, if these cultural differences are not addressed, students from low-income families often benefit less than their peers (Schudde, 2016). Here, surveys across all three groups regarding their perceptions of housing relative to their geoscience attitudes clearly showed the positive impact of the GQ living and learning community across all geoscience majors during the students' first year. Focus groups with GeoScholars further highlighted the GQ experience as critical to their success in the geosciences, as housing activities included on-site tutoring, advisement, and focused GeoScholar activities, in addition to larger-scale cohort building across geoscience majors.

GeoScholars' self-efficacy, attitudes, and geoscience career interests, which started out quite high and were similar to the MSCI 101 cohort, only increased throughout their first years and beyond. Similarly, self-efficacy significantly increased for ENVR 101 students, reaching levels similar to the geoscience majors in MSCI 101. While no GG/OSP students switched majors to the geosciences after taking ENVR 101, the substantial increase in self-efficacy highlights the importance of exposure in increasing overall positive perceptions of the geosciences.

Perhaps not surprising is that all three groups were similar and relatively neutral regarding their sense of belonging and perceived barriers in pursuing geoscience careers, suggesting that this ambivalence was widely shared across communities. This did not change despite participating in GQ activities and taking courses and attending seminars that explicitly discussed career paths and opportunities. What is intriguing is that neither the GeoScholars nor the GG/OSP students perceived themselves differently from the MSCI 101 group, nor did their perceptions decline overtime. These results diverge from other work showing increasing alienation and frustration by students in the field (Means and Pyne, 2017), suggesting that the intense mentoring, cohort building, and support offered by the program was successful in offsetting potential poor experiences.

LESSONS LEARNED

Historically excluded, low-income, and first-generation college students face complex and varied challenges to entering and succeeding in college. Rather than piecemeal efforts, mitigation approaches must therefore also be complex and require intentional and simultaneous strategies that build support mechanisms throughout a student's university experience. While it is difficult to decouple the compounding impact of the multitude of barriers students may face, our results show that embedding low-income, historically excluded, and first-generation college students in living and learning communities that directly support geoscience majors in their first year strongly supports long-term success in the field. Direct financial support was further critical because it enabled GeoScholars to live in the GQ and have the time to participate in GQ activities. It reduced financially related cultural differences between groups. Importantly, while GeoScholars were adamant that the GQ made a difference in their attitudes, perceptions, and belonging, their responses indicated it may not be needed beyond their first year. Rather, they stressed the continued strong 1:1 mentorship by GeoScholar advisors and mentors as a guiding force in their success.

Facilitating opportunities for low-income, first-generation, and historically excluded college students to enroll in geoscience-related courses results in greater positive perceptions of the geosciences but not necessarily in more students pursuing geoscience degrees. To truly increase diversity, efforts must be comprehensive, intentional, and long term. We recommend that increasing diversity in the geosciences must move beyond the classroom and limited research experiences, and focus on shared living spaces that facilitate cohort building in the first critical year and continued mentorship and cohort support throughout the collegiate career. Removal of financial barriers that prevents students from taking advantage of opportunities is essential. Future work should concentrate on finding new ways to reduce negative student associations with pursuing geoscience careers and to increase students' sense of belonging, especially in highlighting earning potential and providing more examples of non-academic career paths.

REFERENCES

- Armstrong, E.A., and L.T. Hamilton. 2013. *Paying for the Party: How College Maintains Inequality*. Harvard University Press, Cambridge, MA, 344 pp.
- Means, D.R., and K.B. Pyne. 2017. Finding my way: Perceptions of institutional support and belonging in low-income, first-generation, first-year college students. *Journal of College Student Development* 58(6):907–924, <https://doi.org/10.1353/csd.2017.0071>.
- NSTC (National Science and Technology Council). 2021. *Best Practices for Diversity and Inclusion in STEM Education and Research: A Guide by and for Federal Agencies*. Prepared by the Interagency Working Group on Inclusion in STEM, Federal Coordination in STEM Education Subcommittee, Committee on STEM Education of the National Science and Technology Council, 57 pp.
- Schudde, L. 2016. The interplay of family income, campus residency, and student retention (what practitioners should know about cultural mismatch). *The Journal of College and University Student Housing* 43(1):1–27.

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