ED11B 0869

Opening access to results of the National Geoscience Faculty Survey

Anne E. Egger[1], Karen M. Viskupic[2], Ellen A. R. Iverson[3], Cathryn A. Manduca[3]

1 Geological Sciences and Science Education, Central Washington University, Ellensburg, WA 98926-7418, annegger@geology.cwu.edu,
2 Department of Geosciences, Boise State University, 3 Science Education Resource Center (SERC), Carleton College

AGU100 ADVANCING EARTH AND SPACE SCIENCE

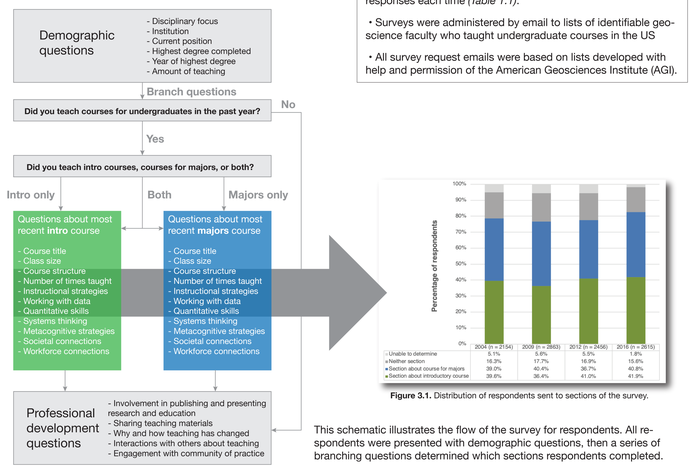
NAGT

NOTE: Figure and table numbers used in this poster are the same as those used in the final report to facilitate cross-referencing.

Survey design and administration

The National Geoscience Faculty Survey (NGFS) was designed to probe how faculty teach in undergraduate geoscience courses, learn about pedagogy and instructional content, and participate in the geoscience education and research communities.

Survey schematic



Reach and response rate

Table 1.1. Survey response rate

	2004	2009	2012	2016
Email requests	5700	5917	7784	9596
Total responses	2207	2874	2466	2615
Response rate	39%	49%	32%	27%

- The survey has been administered four times with over 2000 responses each time *(Table 1.1)*.
- Surveys were administered by email to lists of identifiable geoscience faculty who taught undergraduate courses in the US
- All survey request emails were based on lists developed with help and permission of the American Geosciences Institute (AGI).

Figure 3.1. Distribution of respondents sent to sections of the survey.

This schematic illustrates the flow of the survey for respondents. All respondents were presented with demographic questions, then a series of branching questions determined which sections respondents completed.

Demographics of survey respondents

Table 2.2. Distribution of survey respondents by institution type

Type of institution by highest degree granted	2004 (n = 2139)	2009 (n = 2826)	2012 (n = 2450)	2016 (n = 2462)
Associate's (AA/AS)	0.2%	2.0%	13.4%	12.8%
Baccalaureate (BA/BS)	8.1%	9.7%	10.7%	9.4%
Master's (MS)	19.4%	20.0%	20.6%	17.9%
Doctoral (PhD)	72.2%	67.7%	54.5%	59.5%
Special focus/other	0.1%	0.5%	0.8%	0.3%

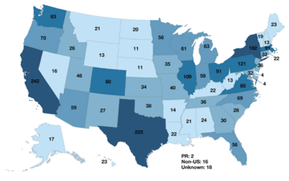


Figure 2.6. Distribution of 2016 responses by state (proportions are similar for all four survey administrations.

AGI maintains a database of geoscience departments in the United States, and we compare our demographic data with these published data* where possible.

Our data suggest that:

- The large increase in respondents from two-year colleges (Associate's institutions) from 2009 to 2012 brought institutional representation more in line with the full population *(Table 2.2)*
- The 2016 survey respondents
  - Represent about 25% of the population of college-level geoscience instructors in the US
  - Represent similar proportions of disciplinary focus as AGI has compiled from department data *(Table 2.1)*
  - Match the geographic distribution of geoscience departments *(Figure 2.6)*
  - Slightly overrepresent more senior faculty (professors and associate professors) *(Figures 2.2 and 2.3)*

Table 2.1. Respondents' disciplinary focus

Disciplinary focus	2004 (n = 2094)	2009 (n = 2785)	2012 (n = 2348)	2016 (n = 2600)	2017 AGI data
Geology or geophysics	64.5%	62.8%	65.5%	58.1%	55.4%
Oceanography or marine sciences	12.6%	11.3%	8.6%	9.3%	8.5%
Atmospheric science or meteorology	5.6%	6.5%	9.1%	9.5%	7.6%
Other	17.3%	19.4%	16.7%	23.2%*	28.5%

* Includes 7.1% who selected Geoscience Education/Science Education as their discipline.

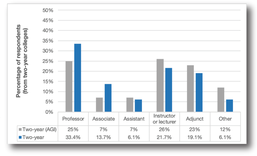


Figure 2.2. Comparison between current position of 2016 respondents from two-year colleges and AGI faculty rank data.

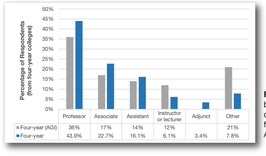


Figure 2.3. Comparison between current position of 2016 respondents from four-year colleges with AGI faculty rank data.

** Wilson, C., 2018, Status of the Geoscience Workforce 2018: American Geosciences Institute.*

This work was supported by the National Science Foundation (NSF) Division of Undergraduate Education under grants for On the Cutting Edge, with additional support and funding provided by the InTeGrate project and SAGE 2YC. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the NSF.

Differences between introductory and majors courses

Class size

- Courses for majors are more likely to be small than introductory courses *(Figure 3.2)*.
- In **introductory courses**, the proportion of small classes increased from 2009 to 2012 and 2016 and the proportion of large classes decreased *(Figure 3.2A)*—explained by the increase in the number of respondents from Associate's institutions.
- In **courses for majors**, the proportion of small classes decreased from 2004 to 2016; the proportion of medium classes increased, and the proportion of large classes remained very low (< 2.5%) *(Figure 3.2B)*.

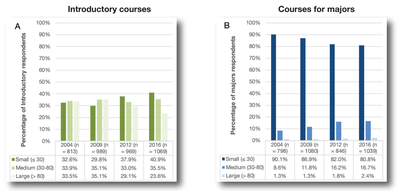


Figure 3.2. Class sizes reported by respondents for introductory courses (A) and courses for majors (B).

Involvement of others in teaching

Others are more commonly involved in teaching introductory courses than courses for majors *(Figures 3.3 and 3.4)*. The nature of the involvement differs by institution type, with Baccalaureate institutions looking most different from other institution types.

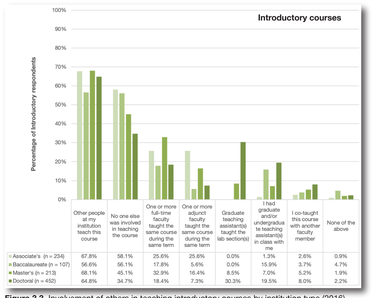


Figure 3.3. Involvement of others in teaching introductory courses by institution type (2016).

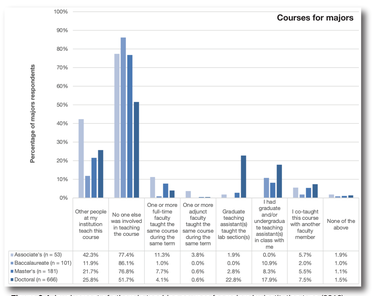


Figure 3.4. Involvement of others in teaching courses for majors by institution type (2016).

Class time spent in active learning

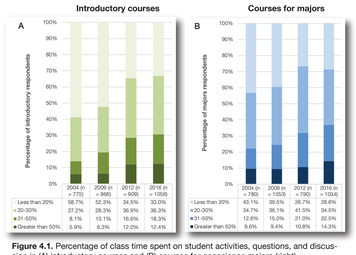


Figure 4.1. Percentage of class time spent on student activities, questions, and discussion in (A) introductory courses and (B) courses for geoscience majors (right).

Respondents were asked to estimate the proportion of "lecture" class time spent on student activities, questions, and discussion—all generally considered active learning strategies. They could enter a number between 0 and 100 and we binned responses into four categories *(Figure 4.1)*.

- **Overall, the amount of class time spent on student activities, questions, and discussion in both introductory and majors courses has increased.**
- The largest decrease occurred in the percentage of respondents reporting less than 20% of class time in these activities, particularly in introductory courses.

Working with data

Overall, there are big differences between the reported use of data skills in introductory and majors courses, with 5-25% higher "yes" responses from instructors in courses for majors *(Table 5.1, Figure 5.1)*.

Table 5.1. Ways in which students worked with data in introductory and majors courses (2016)

Did your students.... *(yes responses)*	Introductory (n = 1032)	Majors (n = 1024)
Describe quantitative evidence in support of an argument	60.4%	76.4%
Access and integrate information from different sources	62.4%	72.8%
Address uncertainty, non-uniqueness, and ambiguity when interpreting data	52.2%	72.5%
Evaluate important assumptions in estimation, modeling, or data analysis	41.8%	65.2%
Recognize distinctions among data sources (e.g. direct, indirect, and proxy)	40.7%	45.4%

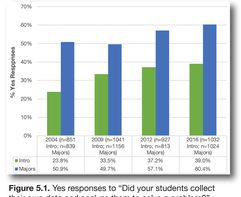


Figure 5.1. Yes responses to "Did your students collect their own data and analyze them to solve a problem?"

Societal connections

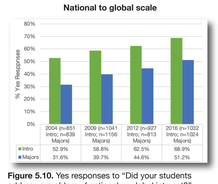


Figure 5.10. Yes responses to "Did your students address a problem of national or global interest?"

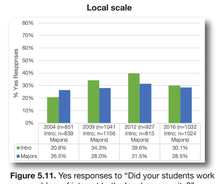


Figure 5.11. Yes responses to "Did your students work on a problem of interest to the local community?"

- Overall, a much higher percentage of students in both introductory and majors courses are reported to address global and national problems than work on a problem of interest to the local community.
- The percentage of respondents indicating that their students addressed a problem of national or global interest increased over time for both introductory and majors courses, with positive responses more common in introductory courses *(Figure 5.10)*.
- Working on a local scale is less commonly reported, and has changed more in introductory courses than in majors courses *(Figure 5.11)*.

Differences in research activity between respondents at 2-year and 4-year institutions

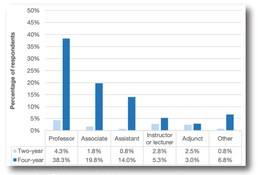


Figure 2.1. Distribution of 2016 respondents by current position and institution type.

Two-year college respondents make up 12.8% of the total respondents *(Table 2.2)*, but they make up nearly half of the adjunct respondents and about a third of the instructor/lecturer respondents *(Figure 2.1)*.

Research presentations *(Figure 2.7)*

- The large majority of respondents presented their research at a minimum of one meeting in the previous two years.
- The proportions of respondents who presented their research at meetings one or more times did not change over time.
- The greatest proportion of respondents report presenting twice.
- The percentage of respondents who had not presented their research at any meetings in the previous two years was higher in 2012 and 2016 compared to 2004 and 2009, and reflects the increase in respondents from Associate's institutions (who accounted for about half of those who indicated they had presented their research zero times in the previous two years while representing only about 13% of the respondent population *(Table 2.2)*.

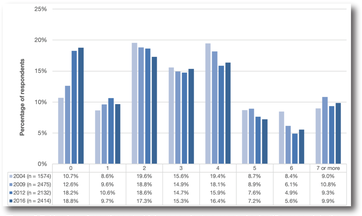


Figure 2.7. Number of meetings at which respondents presented scientific research in the previous two years.

Research publications *(Figure 2.8)*

- A large majority published at least one research article in the previous two years.
- The proportions of respondents who published one or more research articles did not change substantially over time.
- The percentage of respondents who had not published any research articles in the previous two years was higher in 2012 and 2016 compared to 2004 and 2009. As with presentations, respondents from Associate's institutions accounted for about 40% of "none" responses in those years, while representing about 13% of the respondent population *(Table 2.2)*.

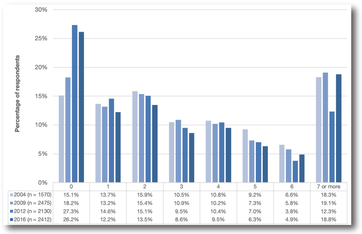


Figure 2.8. Number of articles respondents published about scientific research in the previous two years.

But wait—there's more!
Read about the history of the survey and **download the full report**:
https://serc.carleton.edu/NAGTWorkshops/CE_geo_survey/index.html
You can also follow the project on **ResearchGate**: National Geoscience Faculty Survey

Bibliography of papers based on survey results

Macdonald, R. H., Manduca, C. A., Mogk, D. W., & Tewksbury, B. J. (2005). Teaching Methods in Undergraduate Geoscience Courses: Results of the 2004 On the Cutting Edge Survey of U.S. Faculty. *Journal of Geoscience Education*, 53(3), 237-252.

Manduca, C. A., Iverson, E. R., Luxenberg, M., Macdonald, R. H., McConnell, D. A., Mogk, D. W., & Tewksbury, B. J. (2017). Improving undergraduate STEM education: The efficacy of discipline-based professional development. *Science Advances*, 3(2). doi:10.1126/sciadv.1600193

Lally, D., Forbes, C. T., McNeal, K. S., & Soltis, N. A. (2019). National Geoscience Faculty Survey 2016: Prevalence of systems thinking and scientific modeling learning opportunities. *Journal of Geoscience Education*, 67(2), 174-191. doi:10.1080/10899995.2019.1565286

Egger, A. E. (2019). The Role of Introductory Geoscience Courses in Preparing Teachers—And All Students—For the Future: Are We Making the Grade? *GSA Today*, 29. doi:https://doi.org/10.1130/GSATG393A.1

Beane, R., McNeal, K. S., & Macdonald, R. H. (2019). Probing the National Geoscience Faculty Survey for reported use of practices that support inclusive learning environments in undergraduate courses. *Journal of Geoscience Education*, 1-19. doi:10.1080/10899995.2019.1621714

Riihimaki, C. A., & Viskupic, K. (2019). Motivators and inhibitors to change: Why and how geoscience faculty modify their course content and teaching methods. *Journal of Geoscience Education*, 1-18. doi:10.1080/10899995.2019.1628590

Soltis, N. A., McNeal, K. S., Forbes, C. T., & Lally, D. (2019). The relationship between active learning, course innovation, and teaching Earth systems thinking: A structural equation modeling approach. *Geosphere*, 15(5), 1703-1721. doi:10.1130/ges02071.1

McFadden, R. R., Viskupic, K., Egger, A. E. (in press). Use of data analysis and quantitative skills in undergraduate geoscience courses. *Journal of Geoscience Education*

Beane, R., Altermatt, E.R., Iverson, E.R., & Macdonald, R.H. (in review). Design and impact of the National Workshop for Early Career Geoscience Faculty. *Journal of Geoscience Education*

Viskupic, K., Egger, A. E., McFadden, R. R., Schmitz, M. D. (in review). Comparing desired workforce skills and reported teaching practices to model students' experiences in undergraduate geoscience programs. *Journal of Geoscience Education*

Gamage, K., McFadden, R. R., Macdonald, R. H. (in review). Development of Students' Skills in Introductory Geoscience Courses: A Comparison of Self-reported Teaching Practices at Two-Year and Four-Year Institutions. *Journal of Geoscience Education*