

# Looking back: What do geoscience graduates value most from their academic experience?

**Carl E. Renshaw**, Dept. Earth Sciences, Dartmouth College, Hanover, New Hampshire 03755, USA, [carl.e.renshaw@dartmouth.edu](mailto:carl.e.renshaw@dartmouth.edu)

Rising tuition and the advent of online learning alternatives are compelling geoscience departments to define and quantify the value of their degrees (Arum and Roksa, 2011). Because the value of a college education is multidimensional, no single metric can capture it in its entirety. For example, course evaluations have long served as the primary means of assessment in higher education. But course evaluation data provide limited, and sometimes contradictory, insight into the overall value of an academic degree, particularly because most evaluations focused more on teaching rather than learning (Benton and Cashin, 2012; Denson et al., 2010; Renshaw, 2014).

A more direct approach to measuring a key dimension of the value of a college degree is to ask graduates what aspects of their academic experience they found most useful in developing the skills and abilities they use in their careers. Such studies are uncommon, so results from even a relatively small sample provide a rare lens on the value of a college geoscience degree.

With this goal in mind, in 2014 the Department of Earth Sciences at Dartmouth College surveyed all of its alumni (undergraduate and graduate) for whom we had up-to-date contact information ( $n = 817$ ). In addition to the usual questions on post-Dartmouth education and careers, we asked alumni to reflect back on their academic experience. We asked both general and detailed questions on what aspects of their training were most helpful in supporting their careers.

For alumni who graduated after 1995, the survey presented each respondent with an individualized list of earth-science courses they had taken at Dartmouth and asked them to assess the effectiveness of each course in developing the skills and abilities they use on the job.

For all courses offered in the fall of 2009 or later, we were able to compare alumni retrospective assessments of course effectiveness with end-of-course evaluations. Nearly half of the alumni completed the survey ( $n = 369$ ). About one-third of our alumni were pursuing careers outside of the geosciences. Among those in geoscience careers, the distribution of employment sectors was broadly similar to national averages (Gonzales and Keane, 2010). Additional details on the survey design, implementation, and results are given in the GSA Supplemental Data Repository<sup>1</sup>.

Conventional wisdom often posits that students only appreciate the long-term value of a course after they graduate and join the working world. However, repeated studies have shown that end-of-course student ratings are strongly correlated with retrospective ratings of the same course provided years later by the same students (e.g., Overall and Marsh, 1980). Only rarely do a course's ratings improve with time.

Our survey adds another dimension to our understanding of how alumni value different courses. We found that regardless of course content, end-of-course ratings of overall course quality, teaching effectiveness, and amount learned were all significantly ( $p < 0.001$ ) correlated with alumni ratings of how effective those courses were for their career.

To further explore why alumni valued some courses more than others, we took advantage of a unique aspect of our end-of-course evaluations; we asked students to rate the emphasis each course placed on different skills and concepts. The data reveal that alumni were more likely to value courses that focused on general skills, such as communication and the process of science. In contrast, we found no significant correlation between courses that focused on data collection and analysis, quantitative analysis, or use of scientific literature and alumni ratings of how useful these courses were in their careers. The perceived value of courses focused on these more specific skills likely depends on the particulars of an individual's career. Not all careers, for example, require extensive use of the scientific literature.

A college education is more than just courses. When asked which academic experiences, not just courses, were most effective in developing the skills they use in their careers, the vast majority of alumni indicated that faculty mentorship (87%), the classroom experience (94%), independent research (79%), field-based learning (85%), and peer learning (79%) were all very or extremely valuable to their careers. But a finer parsing of these data (i.e., differentiating ratings of "very" versus "extremely" valuable) reveals interesting trends. For example, alumni were more likely to rate field-based training (69%), faculty mentorship (63%), and independent research (59%) as "extremely valuable" than they were to similarly rate the classroom experience (51%) or peer learning (40%). And the perceived value of field-based training and independent research has increased over time; recent graduates (classes of 1996 or later) placed greater value on these experiences than did earlier generations. In contrast, the perceived

GSA Today, v. 26, no. 6, doi: 10.1130/GSATG253GW.1.

<sup>1</sup> GSA Supplemental Data Item 2016061, survey design, implementation, and results, is online at [www.geosociety.org/pubs/ft2016.htm](http://www.geosociety.org/pubs/ft2016.htm). You can also request a copy from GSA Today, P.O. Box 9140, Boulder, CO 80301-9140, USA; [gsatoday@geosociety.org](mailto:gsatoday@geosociety.org).

value of classroom instruction has decreased more than any other academic experience and was the lowest rated academic experience by recent graduates. Only 37% of recent graduates reported that classroom instruction was extremely valuable, compared to >70% identifying independent research and field-based training as extremely valuable to their careers. Standardized course evaluation data are only available back to 2009, so it is unknown if the decreasing value of classroom instruction reflects a decrease in course quality. It's more likely that the commoditization of the classroom experience reflects the growing importance of non-classroom experiences in a college education.

The same conclusions are evident even when asked about value in different ways. When we asked alumni which skills and abilities they wish had had more emphasis in their training, writing and independent research topped the list for recent graduates, with writing having the greatest increase in perceived need compared to its importance to earlier generations. Even in the era of 140-character tweets, writing skills remain vital to career success.

Although the value of developing skills and abilities to be used in careers is only one measure of the benefit of a college education, it is an undeniably important one. With respect to optimizing the perceived value of a traditional college academic experience in developing these skills and abilities, our results have both good news and bad news for geoscience departments. The good news is that the components of a college education that alumni most value (independent research, field training, and writing) are often already strengths in many geoscience departments and are challenging to provide in online learning environments. The bad news is that these aspects are the most resource-intensive to provide. Maintaining, or even increasing, emphasis on these experiences will require greater efficiency in providing other aspects of a college experience perceived as providing less value.

The decreasing perceived value of the classroom experience, particularly at the introductory level, which was consistently rated as being of lowest value of any academic experience, presents opportunities for enhancing efficiency with little risk of lowering value. This is not to suggest that introductory courses are unimportant. Indeed, introductory geoscience courses serve not only as important gateways to higher-level concepts and ideas but also as critical recruiting tools. But if we seek to maximize the value of a college experience by placing greater emphasis on resource-intensive activities such as independent research, field training, and writing, we must find ways to deliver other critical aspects of their training more efficiently.

One example of such efficiency is the hybrid approach to introductory courses, where high-quality online lectures and learning exercises are supplemented with in-person discussion sections, laboratory exercises, group problem solving, and formative and summative assessments. This approach is entirely consistent with the goals of "flipped classrooms" and "active learning," which critically require enhancing the quality of out-of-classroom learning. By reducing the demand to provide live lectures, such an approach frees up resources required to provide more emphasis on high-value activities, even in large enrollment classes. At the extreme end of this spectrum are experiments such as Arizona State University's Global Freshman Academy. Although touted as a means to expand access to higher education, it can also be viewed as a way to focus resources where value is greatest.

It is naïve to believe that higher education will be exempt from the technology-driven enhancement in productivity seen in virtually all other industries. The idea that hybrid approaches to course delivery offer enormous potential for providing greater learning opportunities while reducing resource costs is not novel, and many informal and formal experiments of this type are ongoing. What is new here is putting these experiments within a broader strategic design that is not based on altruism, branding, or outreach to potential donors, but instead on a strategic plan rooted in an understanding of the perceived value of different college academic experiences. Ultimately, what the alumni are telling us is that we should let college faculty do what they do best, which generally is not lecturing in large enrollment classes, but rather providing more individualized learning experiences.

## REFERENCES CITED

- Arum, R., and Roksa, J., 2011, *Academically Adrift: Limited Learning on College Campuses*: Chicago, University of Chicago Press, 272 p.
- Benton, S.L., and Cashin, W.E., 2012, Student ratings of teaching: A summary of research and literature: The IDEA Center, IDEA Paper no. 50: <http://ideaedu.org/research-and-papers/idea-papers/idea-paper-no-50/> (last accessed 25 Jan. 2016).
- Denson, N., Loveday, T., and Dalton, H., 2010, Student evaluation of courses: What predicts satisfaction?: *Higher Education Research & Development*, v. 29, no. 4, p. 339–356, doi: 10.1080/07294360903394466.
- Gonzales, L.M., and Keane, C.M., 2010, Who will fill the geoscience workforce supply gap?: *Environmental Science & Technology*, v. 44, no. 2, p. 550–555, doi: 10.1021/es902234g.
- Overall, J.U., and Marsh, H. W., 1980, Students' evaluations of instruction—A longitudinal-study of their stability: *Journal of Educational Psychology*, v. 72, no. 3, p. 321–325.
- Renshaw, C.E., 2014, Design and assessment of a skills-based geoscience curriculum: *Journal of Geoscience Education*, v. 62, no. 4, p. 668–678, doi: 10.5408/13-100.1.

*Manuscript received 1 June 2015; accepted 21 Dec. 2015.* 