

A Preliminary Survey on Graduate Training in Professional Skills

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Abstract

Ocean science graduate students, faculty, early-career employees, and employers were surveyed to learn which professional skills (from a list of eight) were thought to be most and least important for careers in academia and not in academia. The survey also asked which of those skills were taught in the graduate schools, and which of them were lacking from the perspective of the employees and employers. 342 responses from 64 organizations were tallied. The students and the faculty provided similar responses, and the early-career employees and the employers provide similar responses.

Regardless of career path, the results show:

- Agreement among all four target groups that “research”, “technical writing,” and “project management” are three of the four most important skills and that “non-technical writing” and “community outreach” are two of the four least important skills.
- “Proposal review” was less valued by the student/faculty groups but highly valued by the employee/employer groups.

For an academic career path, the results also show:

- “Teaching” was highly valued by the student/faculty groups but less valued by the employee/employer groups.
- “Non-technical oral communication” was less valued by the student/faculty groups but highly valued by the employee/employer groups.

For a non- academic career path, the results also show:

- Agreement among all four target groups that “non-technical oral communication” is one of the four most important skills and that “teaching” is one of the four least important skills.

In terms of skills taught (based on student/faculty responses) and skills lacking (employee/employer responses), more attention in graduate schools should be given to “project management” and “proposal review” skills, and more effective attention should be given to “technical writing” and “non-technical oral communication” skills.

Introduction

In early 2012, discussions among the organizers of the Ocean Science Educators’ Retreat and with the head of the MPOWIR program suggested the need for an understanding of which professional skills were being taught in our ocean science graduate schools, and which were perceived as needed in the view of employers and early-career employees (defined as employees in the first five years of their professional career). Did the students, the faculty, the employers, and the early-career employees agree on which skills were relevant, needed, and well-taught?

Although there are many meanings of “professional skills” and no clear granularity in how detailed such a list needs to be, as a preliminary survey we decided on the smallest number of topics that covered the spectrum for all kinds of training and all kinds of professions. An example listing is that of 49 skills in the AAAS Science Careers website at <http://myidp.sciencecareers.org>. We wanted, however, to keep the list shorter so people were more inclined to fill out the survey, and we wanted to not get “into the weeds” or into specific classes or scientific disciplines. We also had in mind how the analysis would be done, so an even number of “skills” was desirable and eight was the minimum number needed.

The following list of eight skills was selected, after some iterations and discussion. Seven of the eight skills are part of the AAAS MyIDP list of 49 (or paraphrase one or more of those skills), plus we added “community outreach” as something quite non-traditional but increasingly valued in the workplace. Those involved in preparing or vetting the list of eight were the co-authors, plus Jim Yoder (WHOI), Nancy Targett (U.Del), and Susan Lozier (Duke). Our final list was:

- Research
- Teaching
- Technical Writing
- Project Management
- Non-Technical Writing
- Non-Technical Oral Communications
- Community Outreach
- How to Review a Proposal

The idea was that the first three items would be “sure things” in research-oriented graduate schools, whereas the last five were mentioned in various settings as desirable training for many non-academic careers.

The survey (using Survey Monkey) was sent to all the members of the Consortium for Ocean Leadership, with requests to distribute to students, faculty, employers, and early-career employees. The survey was open for six weeks. We received 342 responses from 64 different organizations, with input from 143 graduate students, 121 graduate faculty, 73 employers (61 academics, 11 non-academic), and 64 early-career employees (37 of these were in academia). Thus, the results are skewed toward an academic view of training, needs, and relevance to one’s work.

The survey had two parts. In the first part, the questions were about perceptions of valued professional skills. In the second part, the survey sought information on whether those same skills were being taught, and was the training (if received) adequate for an employee/employer’s needs.

An example question in the first part of the survey was: “Choose the 4 most important and the 4 least important skills for you to have if you pursue a career in academia.” The same basic question was asked of each of the four target groups, and was asked about careers both in and outside of academia. Figure 1 shows the responses to this example question, as provided by the responding students.

	Most Important	Least Important
Research skills	95.0% (115)	5.0% (6)
Teaching skills	82.5% (99)	17.5% (21)
Technical writing skills (such as proposals and journal articles)	95.8% (114)	4.2% (5)
Project management skills (such as program development and program evaluation)	59.7% (71)	40.3% (48)
Non-technical writing skills (such as magazine articles and webstories)	1.7% (2)	98.3% (115)
Non-technical oral communication skills (public speaking, community outreach)	36.8% (43)	63.2% (74)
Community outreach	10.2% (12)	89.8% (106)
How to review a proposal	31.9% (37)	68.1% (79)

Figure 1: Student response to a question about training for careers in academia.

As expected, there was high concurrence that the first three skills were more important. The two least-important skills were given as “non-technical writing” and “community outreach.” Note that these are relative scores; ALL eight skills might have been thought to be valuable and worth spending time on, but the question forced there to be a top of the list and a bottom of the list.

Results, first part of the survey

The results like those in Figure 1 as provided by all four target groups were synthesized into one picture to provide a summary assessment of the perceived relative importance of selected professional skills for a career in academia. The vertical axis in Figure 2 is for the combined responses of the employers and early-career employees; the horizontal axis is for the combined response of the students and their faculty.



Figure 2: Summary Assessment of most and least-important skills for a career in academia.

Figure 2 shows agreement (green) among the four responding groups with respect to most important skills (upper right) and least-important skills (lower left). The red and yellow quadrants represent disagreement: (red) students and faculty think “non-technical oral communication” and “proposal review” are two of the four least important skills, but the employees/employers disagree; (yellow) students and faculty think “teaching” is one of the four most important skills, but the employees/employers disagree.

Figure 3 shows the same assessment for a career not in academia. It is identical to Figure 2, except that “teaching” has moved to the lower-left with all reporting groups agreeing that it is a less important skill, and “non-technical oral communication” has moved to the upper-right with all reporting groups agreeing that it is a more important skill. To summarize, for careers not in academia, all four reporting groups agree on the four most-important professional skills, and they agree on three of the least-important skills. Only “proposal review” is highly valued by employees/employers but low-valued by students and faculty.



Figure 3: Summary assessment of most and least-important skills for a career not in academia.

Results, second part of the survey

Figure 4 is an example response by students (faculty responses were similar) to a survey question about whether the eight professional skills were being taught in their graduate programs. The results are interesting, because the four most high-valued skills (see Figure 1) are not the four skills most taught. Project management stands out as one of the four most-important skills, but is taught in just 20% of the programs.

[It should be mentioned that “project management” has a variety of meanings, from the case of a single PI with a single grant proposal, all the way through to large engineering-oriented projects with many employees, funding by a contract, and multiple oversight and reporting requirements. This spectrum of meanings needs clarification in any future surveys. At the least, it ought to include a PI running a lab in academia with several grants from multiple agencies, and perhaps also include the kinds of modest project and program management more typical in industry or government laboratories, since that is where about two thirds of the graduates of the programs will end up employed. In this survey, we give program development and program evaluation as examples of “project management” in keeping with the broad nature of each of the eight selected skills.]

		Response Percent
Research skills		91.7%
Teaching skills		57.9%
Technical writing skills (such as proposals and journal articles)		78.5%
Project management skills (such as program development and program evaluation)		20.7%
Non-technical writing skills (such as magazine articles and webstories)		9.9%
Non-technical oral communication skills (public speaking, community outreach)		46.3%
Community outreach		38.8%
How to review a proposal		25.6%

Figure 4: Student response to a question about which skills are taught in their graduate programs.

The employee/employer questions in the second part of the survey were aimed at the perception of which skills were lacking in the early-career employees. That is, a skill that is lacking might have not even been taught in graduate school, or it might not have been taught sufficiently as to provide a needed skill base for the employee or the employer.

Figure 5 is the response by the employers to the survey question, "Which professional skills do you feel are most lacking in the oceanography and marine-related graduates that you hire?" A low score does not mean the skill is poor in the employees; it means the skill is not lacking. So an employee with excellent research skills would be graded low in Figure 5....the research skill is present, not lacking. The interpretation of Figure 5 has to be done on those skills that are most lacking, with the implication being that the skill was not taught, or was not taught well enough.

The most lacking skills according to employers are "technical writing" and "project management." The latter is no surprise, for Figure 4 shows the topic is not really taught in the graduate schools, according to the students and the faculty. The former, however, is a surprise, for Figure 4 shows it is taught in 78% of the cases, but evidently it is not taught well enough to satisfy the needs of the employers.

		Response Percent
Research skills		8.6%
Teaching skills		18.6%
Technical writing skills (such as proposals and journal articles)		58.6%
Project management skills (such as program development and program evaluation)		65.7%
Non-technical writing skills (such as magazine articles and webstories)		32.9%
Non-technical oral communication skills (public speaking, community outreach)		41.4%
Community outreach		35.7%
How to review a proposal		22.9%

Figure 5: Employer response as to which skills are lacking in their new employees.

In Figure 6, the results of the two parts of the survey are combined, using the response of the early-career employees and the employers. (Note that most of the employers are in academia, and half the employees are in academia, so this is an academic-weighted result.) On the horizontal axis, the most/least important skills are displayed; on the vertical axis, the skills taught (Fig. 4) and taught effectively (i.e. not lacking, see Fig. 5) are in the top half of the picture, while those skills not taught (Fig. 4) or not taught effectively (i.e. lacking, see Fig. 5) are in the bottom half.

To summarize Figure 6:

- (green quadrant) Only “research” is perceived as important, taught, and taught effectively.
- (yellow) “Teaching” (to the early-career employees and their employers) is perceived as one of the four least important skills, but is taught, and is not lacking in the graduates.
- (blue) Three skills are perceived as least important, and are not taught much in the graduate schools.
- (red) Three skills are deemed to be most important, but are not taught (“project management”) or are lacking in the graduates (“technical writing” and “non-technical oral communication”).

Skills Taught, and Taught Effectively*

	<ul style="list-style-type: none"> • Teaching 	<ul style="list-style-type: none"> • Research 	
Least Important Skills	<ul style="list-style-type: none"> • Non-Technical Writing • Community Outreach • Proposal Review 	<ul style="list-style-type: none"> • *Technical Writing • Project Management • *Non-Technical Oral Communication 	Most Important Skills
	Skills Not Taught, or Not Taught Effectively*		

Figure 6: Combined assessment of most/least important skills and what is taught or not taught effectively in graduate school, for careers not in academia.

Conclusions

Even though this was a preliminary survey, it provided some clear results with significant implications. It highlights the perception of valued and lacking skills in today's professional arena and where those perceptions vary among four different groups – students, faculty, employers and early-career employees. In a recent article published in *Science*, Austin and Alberts (2012) argue that current academic training is not taking into account all the needs of its students, even those going into academia. Additionally, Rosenberg (2012) suggests that “there is a huge disconnect between how we currently train scientists and the actual employment opportunities available to them.” He was specifically speaking of the biomedical field, but the statement can be extended to other fields.

From our survey, we can say that more attention in graduate programs should be given to project management skills (again – a very broad topic for the sake of this survey) and proposal review skills. Both of these skills were ranked as important by employees in the first five years of their professional career and by the employers that hire and oversee them, yet they were ranked by students and faculty as not taught. Additionally, more effective attention in the graduate schools could be given to technical

writing skills and non-technical communication skills, as these were labeled as relatively important, but were not taught being taught effectively.

Community outreach is not addressed clearly in this preliminary survey, although it is much discussed in various academic and federal-agency forums. It was perhaps too convolved with “non-technical communications” (both oral and written) in the survey, so provided unclear or indistinct implications. At face value, it was rated as less important and less taught and less needed (by employees/employers) so fell off the bottom of the survey. It is also possible that there is an inherent time lag between the survey “snapshot” of what is happening right now, and the on-going discussions that are more about what should be happening in the future. In the end, the training going on now must prepare people for the future, so today’s sense of needs may be lagging an appropriate sense of what is needed in the future.

These results presented here are dependent on the population surveyed (academic-heavy here) and the skills chosen to be surveyed. Following OSER 2012 in September a small working group was put together to improve the survey for future efforts; the follow-on survey ought to enhance the former and fine-tune the latter.

References:

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