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Why Professional Development Should Be Part of Graduate Education in Science, Technology, Engineering, and Math

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Graduate students on the job hunt are familiar with "nontraditional jobs" — a common euphemism for jobs outside of academia. This phrase implies that such jobs have been less commonly sought and held by graduates of advanced degree programs in science, technology, engineering, or math (the so-called STEM field). But in fact, the majority of such graduates today seek and find jobs outside of academia. In the 21st Century, "nontraditional jobs" are the norm for individuals holding graduate degrees in the STEM fields. Consequently, STEM graduates face a common issue: the narrowly-disciplined lab work required during their educational years can leave them without the broad skill sets that employers look for in job candidates. In consequence, STEM graduates often resolve to pursue tenure-track faculty posts instead of viable careers outside of academia. In this policy brief, I present findings about this issue from the 2017 Council of Graduate Schools report "Professional Development: Shaping Effective Programs for STEM Graduate Students."

What Employers Look For in STEM Graduates

The specific set of talents developed during a STEM PhD are invaluable and cannot be replaced by targeted professional development training. Above all else, employers seeking such candidates are looking for high-level research skills, technical knowhow, and field-specific training — the very skills honed by STEM PhD training. However, as the job market shifts and more graduates explore positions that require more than laboratory-related duties, post-graduate success and versatile employment opportunities increasingly require graduates to showcase a variety of skills and experiences.

Employers note that STEM-graduate candidates often have major deficiencies in communication and presentation skills, and note that many lack management skills and experiences in cross-disciplinary and cross-cultural collaborations. Employers also note deficiencies among STEM graduates in important "non-cognitive" traits and behaviors such as a "thirst" for learning and innovation, creativity, resiliency, risk tolerance, and an overall passion for the mission of an organization or project. Additional deficiencies that can worry employers include STEM-related skills such as proficiency in data science, entrepreneurship and technology commercialization, and understanding of issues in science policy, governmental compliance, and the management of risk. Graduates who are strong in these areas are more competitive and successful as new hires than their scientifically trained peers. Biotechnology has changed the face of research and, as a result, the modern researcher may need to be prepared to hold multiple roles within an organization. STEM PhD applicants or new hires who cannot step into a broad range roles may find themselves without jobs.

Model Professional Development Programs

In a survey of individuals from 226 U.S. and Canadian institutions, 62% stated that their institution offers professional development programs for graduate students in addition to the formal coursework required by degree-granting programs. Professional development programs in place at universities across the United States vary in size, resources, and offerings, but share certain features, according to survey respondents. Funding for professional development programs usually comes from the graduate school rather than from student fees, individual programs, or colleges. Most university programs also include program-sponsored training events. Purely centralized, university-based or specific program-based training programs are rare; and professional development efforts that combine university-wide elements with program-specific events reach far more students, including 100 or more doctoral students each year. In contrast, decentralized, program-based trainings reach five or fewer doctoral students each year.

What skills are featured? The most prevalent academic career skills offered by professional development programs are teaching, networking, and skills relating to job searches. General skills taught include communication, writing, mentoring, and (somewhat less frequently) leadership skills. Notably, the STEM-specific skills stressed in about half of professional development programs were usually limited to research ethics and research development. These are important skills for a STEM-graduate to possess, but the rarity of training in additional STEM-specific skills may be a source for the deficiencies many graduates exhibit, as discussed in the previous section.

Next Steps for Graduate Schools and Students

Students in STEM PhD programs need encouragement to take advantage of existing opportunities. Employers note that they value applicants who are self-motivated learners. Therefore, guiding students to proactive behavior and extracurricular training is the beginning of an effective approach toward helping them meet to meet needs of future employers. On-campus professional training events currently report low levels of student participation. Yet professional development programs cannot grow without strong student participation. And students themselves benefit from taking a directed, conscious approach to their own professional development during their graduate school years. Currently, not very many graduate schools, fewer than half surveyed, require students to devise individual professional development plans.

Faculty support for the pursuit of graduate professional development training is critical, but many students report resistance from faculty about the possible addition of professional development training to their academic plans. Whether imagined or not, students report that their advisors respond negatively to any pursuit of extracurricular training opportunities. Explicit faculty support would boost student participation in these vital training opportunities. Faculty members can play a major role in the post-graduate success of their students by helping them complete individual development plans and discussing those plans annually or more frequently with their advisees.

Graduate schools should understand the competitive advantage created by strong professional development programs. Schools that adopt formalized professional development programs are highly attractive to prospective graduate students with a keen sense of the competitive job markets they will soon enter. Any graduate school would be remiss to ignore that the modern workforce demands more collaboration, communication, and innovative problem solving than was true in the past. Graduate schools have a duty to prepare students to be competitive in an evolving workforce — and this means funding experiential training opportunities to supplement required degree coursework.

In sum, graduate schools offering degrees in science, technology, engineering, and math that fail to include professional development programs risk the loss of relevance, credibility, and enrollments. A progressive and proactive approach to enriching graduate education by incorporating professional development programming and experiential opportunities, can help any university program ensure continued student interest, tuition dollars, and real-world impact for years to come.