

Longitudinal Study of FUTURE STEM SCHOLARS

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Key Points

This research brief reports the findings from an interview study of 65 early-career academics about the factors that supported or constrained their participation in teaching development (TD) during their doctoral programs. Interviewees reported an overall devaluation of teaching in their departments and sought TD opportunities to fill gaps in their preparation for faculty careers. We offer three recommendations for improving TD support and participation.

LSFSS Study

The Longitudinal Study of Future STEM Scholars explored the short- and long-term impact of teaching-focused professional development on STEM doctoral students and early-career academics. The study used repeated surveys and interviews to follow an initial cohort of 3,060 late-stage doctoral students.

The Role of Teaching Development in Addressing a Three-Way Mismatch in Doctoral Education

In their landmark study of doctoral education, researchers Chris Golde and Tim Dore found a three-way mismatch between “the purpose of doctoral education, aspirations of the students, and the realities of their careers—within and outside academia.”¹ Almost 15 years later, the problem of misaligned expectations, experiences, and career opportunities persists in doctoral education.

For doctoral students who aspire to academic careers, this mismatch is especially dramatic. Scholars and policymakers have suggested that doctoral education does not adequately prepare students for the academic positions they want, the academic positions they get, and the full spectrum of faculty responsibilities, especially teaching.² As a result, doctorate recipients may leave graduate school confident in their ability to be researchers, but typically they are not prepared as college teachers.

The lack of purposeful teaching preparation persists despite the fact that many doctoral students express interest in college teaching and often go on to teach undergraduates at a wide variety of colleges and universities.³ In fact, one of every three science, technology,

¹ Golde, C. M., & Dore, T. M. (2001). *At cross purposes: What the experiences of today's doctoral students reveal about doctoral education* (p. 5). Philadelphia, PA: The Pew Charitable Trusts.

² See (a) Austin, A. E., & McDaniels, M. (2006). Preparing the professoriate of the future: Graduate student socialization for faculty roles. In J. C. Smart (Ed.), *Higher education: Handbook of theory and research* (Vol. 21, pp. 397–456). New York, NY: Springer; and (b) Leshner, A.I. (2015). Rethinking graduate education. *Science*, 349(6246), 349.

³ Golde & Dore, 2001; see also (a) Wulff, D. H., & Austin, A. E. (Eds.). (2004). *Paths to the professoriate: Strategies for enriching the preparation of future faculty*. San Francisco, CA: Jossey-Bass. (b) National Science Foundation (2014). Science and education indicators. Appendix Table 5-22.

engineering, and mathematics (STEM) Ph.D.'s is involved in some kind of college teaching within six years of completing their program.⁴ Yet, many STEM doctoral students face unsupportive faculty members, departments, and institutions that devalue doctoral students' need to deliberately prepare for faculty responsibilities beyond research,⁵ despite national efforts to improve undergraduate teaching in STEM disciplines.⁶ As a result, future STEM faculty experience a career preparation mismatch and are not prepared adequately for teaching roles.

To address doctoral students' unmet needs and preparation gaps, many research universities have developed professional development programs to better prepare students for a wide array of faculty careers and responsibilities. Teaching development (TD) is often a major component of these programs and consists of offerings of varying intensities and lengths (e.g., workshops, seminars, courses, and so forth). The primary purpose of TD programs for doctoral students is to help prepare future faculty to be effective teachers as they enter the academic workforce.

Although the number of TD programs is increasing nationwide, little is known about why STEM doctoral students participate in TD. To address this lack of information, we conducted a study to examine what motivates doctoral students to participate in TD programs and what factors support or constrain their participation. Our study was part of the larger *LSFSS*, which sought to investigate the impact of TD programs on STEM doctoral students as they progressed in their careers.

⁴ Connolly, M. R. (2012). *Postsecondary employment patterns of STEM doctorate recipients*. [Unpublished analysis of data from public version of Survey of Doctorate Recipients.]

⁵ Anderson, W. A., et al. (2011). Changing the culture of science education at research universities. *Science*, 331(6014), 152-153. doi:10.1126/science.1198280

⁶ For example, see: (a) [Coalition for Reform of Undergraduate STEM Education](#). (2014). *Achieving systemic change: A sourcebook for advancing and funding undergraduate STEM education*. Washington, D.C.: Association of American Colleges and Universities. (b) Wieman, C. E. (2014). Large-scale comparison of science teaching methods sends clear message. *Proceedings of the National Academy of Sciences*, 111(23), 8319-8320. doi:10.1073/pnas.1407304111. (c) Bradforth, S. E., et al. (2015). Improve undergraduate science education. *Nature*, 523(7560), 282-284. doi:10.1038/523282a

⁷ For a detailed description of the research methodology, see: Benbow, R.J., & Connolly, M.R. (2014, April). *Why take the risk? Exploring the role that teaching development plays in STEM doctoral education*. Paper presented at the annual meeting of the American Educational Research Association, Philadelphia, PA.

Interview participants believed that TD programs provided the flexibility to pursue interests that had motivated them to enter graduate school, expand their professional networks related to teaching, and develop important teaching competencies that would aid them in faculty careers.

The Study

Between March 2010 and October 2011, we interviewed 65 early-career academics who (1) had participated in ten or more hours of TD programs as doctoral students, (2) had completed their Ph.D., and (3) were employed by a postsecondary institution at the time of the interview. In their interviews, we asked, among other things, what motivated them to participate in TD and what factors encouraged or discouraged their participation.⁷ Below, we summarize several major findings.

Findings

Devaluing Teaching

Most interview participants started graduate school with hopes becoming a professor who would engage in both research and teaching activities. Upon entering graduate school, however, interviewees felt a disconnection between their expectations of faculty work and what they observed in their academic departments. This discrepancy was particularly

noticeable with regard to the perceived importance of teaching; some graduate students expected that they would develop the knowledge and skills to become effective STEM teachers but instead faced departmental cultures that devalued teaching, as the following quote illustrates.

They didn't say it directly, but it was sort of an attitude that [teaching] was less worthy or less, I don't know, less important than research and didn't really require any preparation.

(Multi-racial female, Earth, Atmospheric, and Ocean Sciences postdoctoral researcher).

Interviewees said they were discouraged from participating in TD because it meant spending less time in the lab or field, thereby reducing their research productivity. While this was not the case for every interview participant, instances of faculty members supporting TD were less common. In addition, some interviewees observed that faculty members' attitudes for doctoral TD broke along generational lines; younger faculty members often supported TD, whereas the department's "old guard" held onto an apprenticeship model of doctoral training that prioritized research, as evidenced by the following quote.

I unfortunately think that a lot [of faculty], especially the older people in academia, think that people who are interested in teaching aren't serious... scientists...and [are] only interested in teaching because they can't cut the research. I definitely think it had an impact on [my] relationship [with my advisor].

(White female, Biology postdoctoral researcher)

Interviewees also pointed out that they were trained narrowly for faculty positions at research-intensive universities (i.e., to become like their advisors) and found themselves unprepared for the multiple career paths where teaching plays a significant if not

primary role. The following quote demonstrates both the narrow focus of future faculty preparation and the desire to seek out additional training experiences to prepare for teaching careers.

It's sort of like you were given the message, you know, like you are here to find a tenure track position at a Research I university. But a vast majority of us didn't get those positions. So because I knew that I wanted to teach, I was able to sort of seek out those experiences and get the help that I needed.

(White female, Psychology assistant professor)

Lastly, many participants mentioned that even though they had teaching responsibilities as teaching assistants (TAs), they were not given sufficient training or support for that role. Instead, they were encouraged to do only the bare minimum so teaching would not affect their work in the lab. As the following quote shows, participants were left to learn by observation and lacked formal preparation in key aspects of college teaching.

You can [be a] TA, but that's all sort of—. You just watch how someone else teaches, and you go along with what they do, but it never taught you how to build a syllabus or how to manage a classroom, or how to develop a series of lectures or develop tests that actually accurately measure student performance.

(White female, Clinical Psychology postdoctoral researcher)

Overall, most participants felt that their doctoral programs and TA responsibilities did not sufficiently prepare them to teach undergraduates. Many interviewees who were concerned about this gap sought out TD opportunities that would help meet their career goals. This was especially important to interviewees who were anxious about their academic

job searches, both in navigating the requirements of various institutional types and in finding some degree of work-life balance. Thus, TD programming became an important way for interviewees to address perceived gaps in their preparation for a faculty career.

Filling the Gap

We found that interviewees reported four reasons for participating in TD activities. First, for those who were TAs, TD was often part of a mandatory TA orientation, although interviewees said such training was typically minimal and more procedural than pedagogical. Second, they believed TD programming would expose them to skills not provided by their doctoral programs, such as designing a syllabus, engaging students, assessing student learning, and managing a classroom. Third, interviewees expected to connect with and learn from peers and faculty from many disciplines who were also interested in teaching and learning. Finally, they thought TD would better prepare them for various careers that require teaching skills, as evidenced by the following quote.

The experiences I had and the training I had in grad school were incomplete. I knew I wasn't doing the things the instructional faculty had to do. I realized that there were deficiencies in my training that I felt I needed more experience to address.

(White male, Biochemistry postdoctoral researcher)

Despite the growing number of TD programs nationwide, little is known about what motivates doctoral students to participate in TD and what contextual factors within their doctoral programs promote or constrain participation.

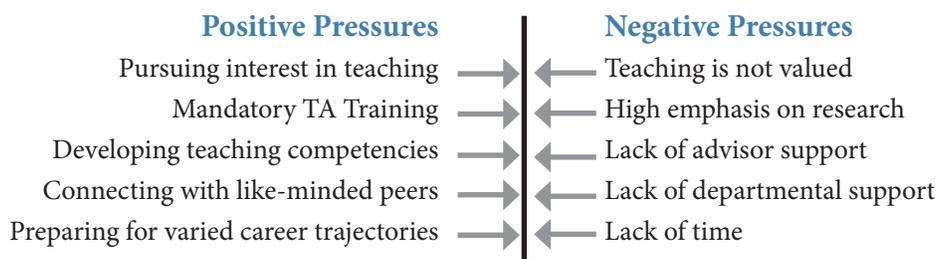
In short, participants believed that TD programs helped them do two important things: (1) develop important teaching competencies that would not only aid them in academic careers but also align with their initial reasons for entering graduate school; and (2) expand their professional network to include people who also take teaching and learning seriously.

Barriers to Participation

Some interviewees had negative interactions with advisors, faculty members, peers, and others who discouraged any professional development that did not focus on research and publishing. However, strong support for TD from faculty members, department chairs, and other influential personnel helped counteract negative messages.

We found, among our interview participants, advisors' attitudes toward TD participation fell into one of three stances: they openly supported TD activities despite resistance from larger departmental dynamics; remained neutral and uninvolved; or expressed their implicit or explicit discouragement for TD involvement. Interviewees said interacting

FIGURE 1: FACTORS AFFECTING TD PARTICIPATION



with the third type of advisor could be tense and stressful. Some respondents, as evidenced in the following quote, believed that such interactions led their advisor to invest less time in them because they did not “take science seriously.”

My advisor was very non-confrontational, so it was easy to do your own thing. But basically what would only change would be his opinion of you. Like his opinion of me as a student. And he definitely invested less in me as a student than he invested in some other students.

(White female, Biology postdoctoral researcher)

Lastly, interviewees said although adding TD to their substantial doctoral program responsibilities often increased their stress and workload, the benefits of TD participation far outweighed potential negatives because TD was (1) crucial to their career development and (2) allowed them to improve job applications by showcasing additional teaching experience.

In summary, the subjects we interviewed participated in TD programs to expand their professional networks, gain crucial pedagogical skills, and better prepare for future faculty careers, despite various individual and departmental challenges.

Recommendations for Advancing Teaching Development

In this section, we offer three suggestions for increasing TD program support and participation.

Use TD to Realign the Three-Way Mismatch

Over a decade ago, Golde and Dore argued that there was a mismatch between doctoral student goals, the training received in programs, and career realities. Several participants in our study reported a similar mismatch with respect to college teaching. They entered doctoral programs expecting to develop teaching proficiency, but instead faced programs

and departments that devalued teaching and did not prepare them for the academic jobs they wanted. Their doctoral training indeed prepared them as researchers, but often it did not provide sufficient opportunities to develop other skills and abilities that are vital to the success and satisfaction of early-career academics.

We found that participants used TD to gain teaching knowledge and skills, which helped realign the teaching three-way mismatch between their goals, experiences, and career realities. Participating in TD also expanded access to potential academic jobs, which is especially important at a time when the academic labor market is soft.

Given the role that interviewees said TD played in addressing the three-way teaching mismatch, key campus stakeholders might consider whether doctoral students experience a similar mismatch at their institutions. Specifically, they might pay closer attention to four things: (1) doctoral students’ interest in teaching, (2) how easily students can access TD opportunities, (3) how much doctoral students are exposed to alternative academic careers, and (4) which doctorate recipients take STEM college teaching jobs. If students report that their interests, experiences, and career opportunities are misaligned, then campus leaders could use existing TD offerings or develop new programs to help realign any mismatches.

Recognize How Faculty Members Influence Doctoral Students’ Participation in TD

We found that faculty member support is a central factor in hindering or promoting TD participation. Yet, faculty reward structures often prioritize research over teaching. Such an imbalance incentivizes faculty members to take teaching less seriously, which is then conveyed explicitly and implicitly to their doctoral students. Some universities are revisiting their tenure and promotion criteria to increase the value of teaching activities. Such a change may have unexpected benefits for doctoral students’ TD participation to improve tenure and promotion

criteria across the United States. Unless research universities reconsider the importance of teaching in their tenure policies, the devaluation of teaching will continue to be a major stressor and delimiting factor for doctoral students' desire to engage in TD.

Lower the Time Costs of Participation

Since teaching development experiences are not usually arranged in a structured curriculum, interviewees often had to work hard to cobble together TD activities that would meet their various needs. The time it takes to find TD activities, let alone the time to participate, is a major cost for doctoral students, who are already incredibly busy. To address this, doctoral programs could incorporate TD into their existing training experiences to create synergies between research, teaching, and other faculty roles. Integrating TD into the doctoral curricula could better prepare future faculty for the wide array of academic responsibilities found at different types of institutions.

Moreover, academic departments could work with existing TD programs to offer programs that reflect disciplinary perspectives on teaching and learning. Regardless of how doctoral students receive TD

programming, the goal is to make it much easier for doctoral students to participate. Three ways to lower barriers include: (1) clearly advertising TD opportunities and associated benefits, (2) providing multiple pathways to TD participation, and (3) integrating TD activities with other doctoral education experiences.

Conclusion

Some doctoral students enter graduate programs expecting to learn how to teach, yet they sometimes encounter departments and faculty members who do not believe that developing teaching skills and knowledge are necessary for future academic careers. TD can be an effective way to realign this teaching mismatch, but it requires that students, faculty members, and other key campus stakeholders better understand what graduate students want, the experiences they receive in their doctoral programs, and the requirements of varied academic career trajectories. TD is not intended to conflict with or replace other important aspects of traditional doctoral education, especially research. Instead, TD can work in tandem with other aspects of career preparation to produce well-rounded Ph.D.'s who have the skills they need to succeed in academic careers.



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