

# Longitudinal Study of FUTURE STEM SCHOLARS

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## Key Points

In this brief, we report findings from our 2013 survey related to who in our sample participated in TD, when they participate across multiple career stages, and how much they participated. We discuss overall findings and then examine differences related to gender, race, current job title, and discipline. We conclude with implications and recommendations related to raising the awareness of TD programs, the importance of increasing TD engagement, and the need to further study the relationship between TD participation and career stage.

## LSFSS Study

*The Longitudinal Study of Future STEM Scholars* is exploring the short- and long-term impact of teaching-focused professional development on STEM doctoral students and early-career academics. Since 2009, the study has used repeated surveys and interviews to follow an initial cohort of 3,060 late-stage doctoral students.

## Participation in Teaching Development: Who, When, and How Much?

With increasing national pressure to improve undergraduate STEM education, teaching development (TD) opportunities for future faculty (i.e., doctoral students and postdoctoral scholars with academic career aspirations) have become more commonplace at research universities. Yet, research on TD for future faculty is scant, with most publications focused on teaching assistant training and small-scale program evaluations.<sup>1</sup> To assess not only the effectiveness of TD for future faculty but also whether TD is addressing larger undergraduate STEM reform goals, it is necessary to know who participates in TD, when they participate, and how much. Addressing these questions of participation is vital to expanding our understanding of doctoral students' and postdoctoral scholars' teaching development.

In this brief, we present findings from a *LSFSS* survey conducted in 2013 about (1) who in our sample participated in TD, (2) when they participated in TD across career stages, and (3) how much they participated. In the next two *LSFSS* research briefs, we will explore why doctoral students participated in TD and what influenced their participation.

<sup>1</sup> (1) Border, L. L. B. (Ed.) (2011). *Mapping the rage of graduate student professional development: Studies in graduate and professional student development*. Studies in Graduate & Professional Student Development (Vol. 14). Stillwater, OK: New Forums Press. (2) DeChenne, S. E., Lesseig, K., Anderson, S. M., Li, S.L., Staus, N.L., & Barthel, C. (2012). Toward a measure of professional development for graduate student teaching assistants. *The Journal of Effective Teaching*, 12(1), 4-19. (3) Marincovich, M., Prostko, J., & Stout, F. (Eds.) (1988). *The professional development of graduate teaching assistants*. Bolton, MA: Anker.

## Method

In 2013, we surveyed 2,146 early-career professionals who graduated from the three research universities in our original sample; 66% (n = 1,414) responded. Survey respondents described their TD participation during three periods in their career, as doctoral students, postdoctoral scholars, and early-career professionals.

We first performed descriptive analyses for all participants related to who participates, when they participate, and the extent of participation. We conducted the same analyses by gender, race, discipline, and job title. We then performed logistic regression analyses for all respondents and by gender, race, discipline, and job title.

## Who Participates in Teaching Development?

Our sample consisted of a roughly even split of men and women, a majority of White respondents, and a strong representative of life science and physical science disciplines. Most (87.8%) of our survey respondents indicated that they participated in at least some TD during their doctoral program, as a postdoc, or in their current job title. See **Table 1**.

With respect to gender, nearly an equal amount of men and women participated in TD as doctoral students, postdocs, or in their current position (86.8% and 89.5% respectively). Similarly, we found minimal overall differences between White, Asian-American, and underrepresented minority (URM) survey respondents (87.2%, 91.9%, and 88.5% respectively), although URM respondents reported high TD engagement

*We found that 84.6% of survey respondents participated in TD during their doctoral program, 28.5% as a postdoc, and 31.8% in their current position.*

levels (i.e., 55+ hours) more often than Asian-American and White respondents (31.6%, 19.8%, and 24.7% respectively).

Based on current type of employment (at the time of the survey), tenure track (TT) and non-tenure track (NTT) faculty reported higher TD involvement (96.0% and 95.9% respectively) than positions outside academia (81.9%), postdocs (88.1%), and other academic positions (85.4%). There were also differences between disciplines, where physical sciences (94.0%) and psychology (91.7%) reported higher percentages of participants than life sciences (86.5%), engineering (77.1%), and other disciplines (75.0%). Furthermore, a greater portion of engineering respondents did not participate in TD (37.7%) in comparison to those from life sciences (23.1%), psychology (14.2%), and physical sciences (13.5%).

## When and How Much?

We found that 84.6% of survey respondents participated in TD during their doctoral program, 28.5% as a postdoc, and 31.8% in their current position. Among those who engaged in TD as doctoral students, 75.5% participated in at least one brief workshop. On average, they reported an average of 2.3 brief workshops or conference, 67.8% in at least one brief talk or presentation, 52.8% in at least one in-depth workshop or conference, and 38.8% in a formal course. On average, respondents participated more than once in each type of

**Table 1:** Sample characteristics and TD participation

	%	n	TD Participation %	
			Yes	No
All Participants	-	1414	87.8	12.2
<b>Gender</b>				
Men	52.3	726	86.8	13.2
Women	47.7	664	89.5	10.5
<b>Race</b>				
White	75.3	1034	87.2	12.8
Asian-American	17.2	235	91.9	8.1
Underrepresented Racial Minority	7.6	104	88.5	11.5
<b>Current Job Title</b>				
Unemployed	6.5	91	87.9	12.1
Postdoc	28.3	395	88.1	11.9
Tenure Track Faculty	18.1	252	96.0	4.0
Non-Tenure Track Faculty	7.0	97	95.9	4.1
Others in Academia	8.8	123	85.4	14.6
Others Outside Academia	31.3	437	81.9	18.1
<b>Discipline</b>				
Life Sciences	36.6	511	86.5	13.5
Physical Sciences	30.0	418	94.0	6.0
Psychology and Social Sciences	17.2	240	91.7	8.3
Engineering	12.2	170	77.1	22.9
Other	4.0	56	75.0	25.0

TD activity. They reported an average of 2.3 brief workshops or conferences, 3.5 talks or presentations, 1.7 in-depth workshops or conferences, and 1.8 formal courses.

Of those who engaged in TD as postdocs, 51.9% were involved in a brief workshop or conference, 57.5% in a brief talk or presentation, 28.3% in an in-depth workshop or conference, and 17.6% in a formal course.

On average, they reported an average of 2.3 brief workshops or conferences, 3.1 brief talks or presentations, 1.7 in-depth workshops or conferences, and 1.5 formal courses.

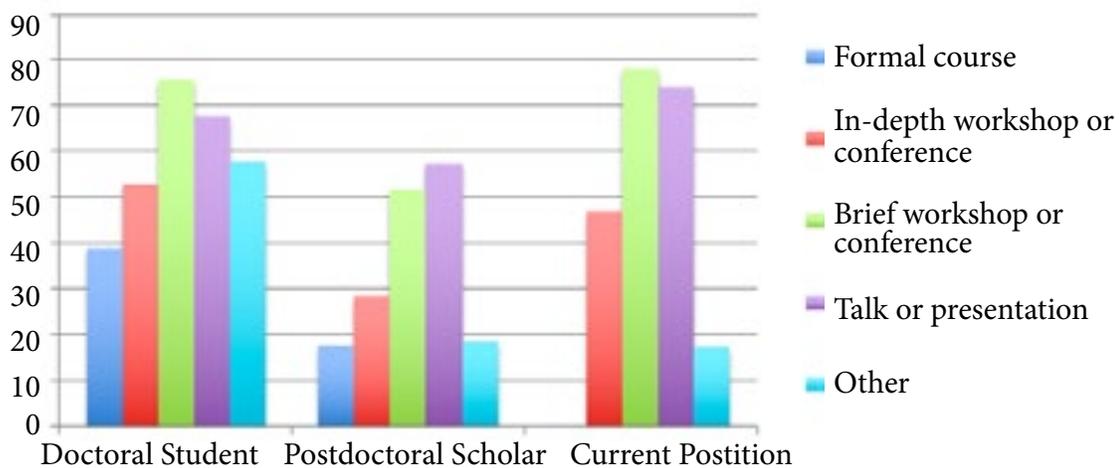
For those who engaged in TD in their current position, 78.2% reported brief workshops or conferences, 74.2% in talks or presentations, and 46.9% in in-depth workshops or conferences. On average, they reported an average of 3.5 brief

workshops or conferences, 4.4 brief talks or presentations, and 2.2 in-depth workshops or conferences. See **Figure 1**.

Overall, participants spent an average of 40.3 hours in TD programs, with an average of 32.9 hours as doctoral students, 7.0 hours as postdocs, and 10.6 hours in their current position. We divided TD engagement during each of these career stages into five levels, which included no participation (0 hours), low (1-10 hours), low-moderate (11-25 hours), high-moderate

(26-55 hours), and high engagement (over 55 hours). The highest TD engagement reported was during doctoral programs, when nearly 43% of participants indicated that they spent 26 hours or more in TD activities (high-moderate or high engagement). TD engagement at these higher levels was notably less common during postdoctoral appointments and current job titles (8.7% and 12.6%, respectively). See **Table 2**.

**Figure 1:** Percentage of TD activity type across career stages



**Table 2:** Percentage of TD engagement across career stages.

	Doctoral Student (n = 1222)	Postdoctoral Scholar (n = 794)	Current Position (n = 860)	Overall (n = 1361)
Non-participant	17.8	73.6	68.6	20.7
Low engagement (1-10 hours)	18.1	10.5	8.1	14.9
Moderate engagement (11-25 hours)	21.4	7.3	10.7	18.9
Moderate engagement (26-55 hours)	24.1	5.29	7.3	21.5
High engagement (>55 hours)	18.6	3.4	5.2	24.1

<sup>2</sup> TD hours were estimated from the frequency of engagement in different types of TD activities (Formal course = 30 hours, in-depth workshop or conference = 12 hours, brief workshop or conference = 6 hours, talk or presentation = 1 hour, other = 1 hour)

## Gender and Race

We found statistically significant differences for women at each career stage with women consistently outpacing men (Doctoral Student, 82.9% vs. 87.1%; Postdoctoral Scholar, 24.5% vs. 33.2%; and Current Position, 26.6% vs. 38.5%). See **Figure 2**.

However, men and women engaged in specific TD activities equally. A few exceptions include women being more likely to engage in in-depth workshops or conferences as doctoral students, and to participate in more talks or presentations both as doctoral students and in their current position. We also found that men were statistically more likely to be non-participants across each career stage. Lastly, women were more likely to participate in high engagement TD activities (55+ hours) than men both during doctoral programs (15.1% vs. 22.8%) and in their current positions (3.2% vs. 7.8%).

In terms of race, we found few differences within each career stage. Exceptions include Asian-American doctoral students engaging in more formal courses than White and URM students (49.4%, 44.3%, and 46.1% respectively) and White respondents engaging in more talks

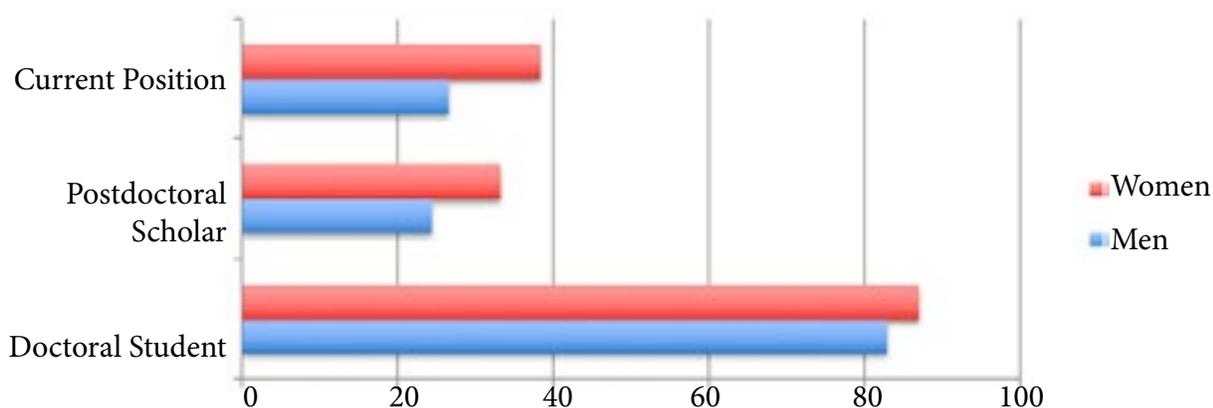
and presentations than Asian-American and URM participants in their current positions (79.4%, 63.6%, and 64.3% respectively).

## Current Job Title

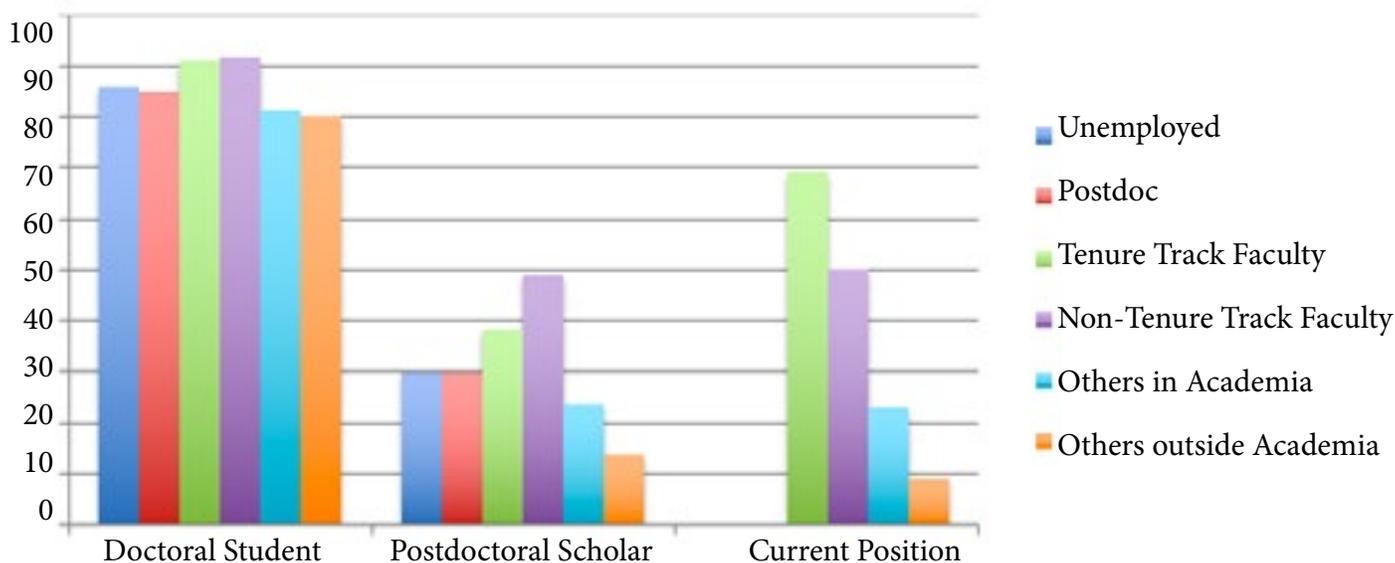
Based on current job title, there were significant differences in TD participation across all career stages. Regardless of career stage, TT and NTT faculty participated at the highest rates. There were practically no differences between TT and NTT faculty as doctoral students, but there were differences when they were postdocs (38.2% vs. 48.9%) and in their current positions (69.4% vs. 50.0%). See **Figure 3**.

In terms of TD activity types, we found few statistically significant differences. For instance, current TT faculty reported the highest participation in formal courses as doctoral students (54.0%), followed by NTT (48.2%), others in academia (44.8%), and those outside of academia (41.5%). We also found differences in the average overall amount of TD participation (measure in hours) for TT faculty (65.5 hours), NTT faculty (57.6 hours), postdocs (32.7 hours), and others in and out of academia (both 27.4 hours). However, there were no statistically significant differences in TD engagement levels.

**Figure 2:** Percentage of TD participation between men and women across career stages.



**Figure 3:** Percentage of TD participation and current job title across career stages.



### *Discipline*

During respondents' doctoral programs, TD participation by physical scientists (92.6%) outpaced respondents from psychology (89.6%), life sciences (82.2%), engineering (71.8%), and other disciplines (69.6%).

However, during postdoctoral appointments, life sciences reported the highest level of TD involvement (35.5%) followed by psychology (33.3%), other disciplines (31.0%), physical science (20.1%), and engineering (18.3%). In current positions, psychology was the highest (42.5%) followed by other disciplines (37.8%), physical science (33.8%), life science (29.7%), and engineering (16.3%).

In terms of the type of TD activity, we did not find significant differences between disciplines during doctoral studies, postdoctoral appointments, or current job title. We also did not find significant differences with respect to the number of TD activities engaged in during doctoral, postdoctoral, and current career stages.

Lastly, while not statistically significant, we found that engineering respondents had the highest rates of non-participation in TD across doctoral (35.6%), postdoctoral (85.3%), and current job title (83.7%) as compared to participants in other disciplines.

## Implications and Recommendations

### *TD Participation is More Common than You Think*

The vast majority of our sample—87.8%—participated in TD, with 42.7% completing 26 or more hours as doctoral students. Despite the research-centric cultures at the three large research universities included in our study, respondents were still quite active in pursuing TD as doctoral students, regardless of where they ended up in their current position. Key campus stakeholders such as faculty members, department chairs, and graduate deans should take notice that graduate students are participating in and want TD programs.

While our study is not representative of every doctoral granting institution, we hope that it increases awareness of the need to (1) continue to support TD programs and (2) expand and improve TD experiences.

### *We Need to Increase TD Engagement*

Even though the majority of respondents participated in TD at some point, there is evidence to suggest that there is room for improvement. In previous *LSFSS* analyses<sup>3</sup>, we found that participants needed to engage in a moderate amount of TD, especially in a formal course or intensive activity, to receive the benefits of TD participation. We also found that as participation increased, their confidence in their ability to use effective teaching practices also increased. Overall, across all three career stages, 54.5% of participants failed to engage above at high-moderate or high levels. Even during the doctoral stage, 57.3% of participants failed to surpass a low-moderate amount of TD engagement. See **Table 2**. Thus, while it is encouraging that TD participation is occurring, campus leaders should find ways to encourage graduate students to engage in more TD to reap the full benefit.

The lack of moderate to high levels of TD engagement is even more pronounced during the postdoctoral and current position career stages where 84.1% of those that completed a postdoc and 76.7% of those in their current position completed less than 11 hours of TD. See **Table 2**.

Specific to postdocs, this is particularly problematic when we consider that 67% of those that did a postdoc in our sample had undergraduate and or graduate teaching

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responsibilities.<sup>4</sup> Our study suggests that TD participation is more concentrated during doctoral programs and that more work needs to be done to distribute TD participation across career stages. We encourage campus leaders to (1) assess the extent and quality of campus TD opportunities for doctoral students, postdocs, and current faculty; (2) design TD specifically for postdoctoral scholars that builds upon prior TD participation, provides help with their current teaching responsibilities, and that prepares them with the essential teaching skills for future academic careers; and (3) evaluate factors that promote or deter TD participation across all three career stages at their institution.

Lastly, our study also revealed gendered differences in TD participation. For each career stage, women participated in TD more often than men, suggesting that men may perceive TD to be less important relative to their other academic obligations. While our data supports the presence of a gender gap, we are unable to draw definitive conclusions as to why. We recommend that campus stakeholders, TD professionals, and researchers further investigate gendered aspects of STEM doctoral education so as to identify actions that will continue to encourage the participation of women while at the same time increase male engagement in TD.

<sup>3</sup> Connolly, M. R., Lee, Y.-G., Hill, L., & Associates (2015). *STEM college teaching: Building confidence through teaching development. LSFSS Brief Series, No. 3*, Madison, WI: Wisconsin Center for Education Research, University of Wisconsin-Madison.

<sup>4</sup> Connolly, M. R., Savoy, J. N., Lee, Y.-G., & Hill, L. B. (2016). *Building a better future STEM faculty: How doctoral teaching programs can improve undergraduate education*. Madison, WI: Wisconsin Center for Education Research, University of Wisconsin-Madison.

## *Create Continuity in TD Participation Across Career Stages*

Lastly, our findings suggest that the relationship between career stage and TD participation needs further exploration, especially with respect to how career expectations influence TD participation. For instance, we found that more NTT faculty engaged in TD in their current position than TT faculty (69% vs. 50%), but during doctoral programs, participation was nearly identical (91% vs. 92%) and during postdoctoral appointments TT faculty did more (38% vs. 49%). Was it that both NTT and TT faculty in our sample desired faculty positions as doctoral students and altered their perceptions as postdocs? Did TT faculty already feel that they engaged in enough TD as doctoral students and postdocs to not warrant additional training in their current position?

Were NTT faculty “catching up” from their reduced participation as postdocs or were their current work demands influencing their current TD participation? Our study is unable

to answer these questions. We recommend that future studies examine how career aspirations, career realities, and TD are related so more targeted TD reform strategies can be identified and applied to improve TD participation across career stages.

## Conclusion

In this research brief, we explored survey results that revealed who in our sample participated in TD, when they participated across multiple career stages, and the extent of their participation. We found that most respondents participated in TD but more work needs to be done to (1) expand awareness and support of TD programs, (2) increase engagement levels, and (3) create greater continuity in TD participation across career stages. Future studies should target gendered patterns of TD participation and further explore how TD participation evolves across career stages.



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