



# Longitudinal Study of FUTURE STEM SCHOLARS

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## Summary

In this interactive workshop, we provide an overview of the *Longitudinal Study of Future STEM Scholars (LSFSS)*. We describe the study background, research questions and methods, key findings, and implications. Second, we share data about the postdoctoral scholars who have participated in our study. We describe their demographic characteristics, career trajectory indicators, and their teaching experiences and attitudes during their postdoc appointments. Finally, we review a tool that postdocs can use to self-assess their teaching proficiency, identify areas for improvement, and develop an action plan.

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Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.



## Study Overview

In the United States, improving undergraduate science, technology, engineering, and mathematics (STEM) education is a national priority. One strategy for improving STEM education at the college level is to better prepare future STEM scholars during their doctoral programs as effective undergraduate teachers.

Although data from the *Survey of Doctorate Recipients* suggest one of every three STEM Ph.D.'s will teach undergraduates within six years of completing their degree, graduate training tends to emphasize doctoral students' formation as researchers and scholars. As a result, STEM Ph.D.'s who enter faculty or instructional positions often receive insufficient pedagogical training, which can negatively affect undergraduate STEM learning. **Thus, preparing doctoral students who aspire to academic careers to be effective undergraduate educators has become a key strategy for advancing the national STEM agenda.**

To address this lack of information about doctoral teaching development programs, the *Longitudinal Study of Future STEM Scholars (LSFSS)* examines the preparation of future faculty for their pivotal role as teachers and mentors of undergraduates.

TABLE 1: PROJECT RESEARCH QUESTIONS

Primary Research Question	
How does participation in teaching development (TD) affect STEM doctoral students' teaching preparation, career pathways, and early-career performance?	
TD Program Description & Design	
1.	What are the variations of TD programs for STEM doctoral students?
2.	What elements should be considered in designing and evaluating TD programs?
TD Program Participation	
3.	Who participates in TD programs, and why?
TD Program Impacts	
4.	What influence does participation in TD programs have on the kinds of careers that STEM Ph.D.'s pursue and ultimately choose?
5.	What skills and knowledge do STEM doctoral students gain from TD programs that help prepare them for a diverse range of academic careers?
6.	What influence, if any, does participation in TD have on indicators of early-career performance (e.g., satisfaction, peer and student feedback, use of research-based instructional approaches) as academics?

## Sample and Data Collection

Since 2009, the LSFSS has followed a single panel of late-stage STEM doctoral students (initial  $N = 3,060$ ) from Arizona State University, the University of Washington-Seattle, and the University of Wisconsin-Madison. We selected these three research universities because they not only produce a large number of STEM Ph.D.'s, but they also have a large number of TD programs intended for doctoral students. Study participants included both doctoral students who participated in TD and those who never participated in TD. See Table 1 for the study's primary and secondary research questions and Table 2 for our data collection methods and timepoints.

**TABLE 2: SURVEY SUMMARY**

Year	Method	Sample Frame	Responses	Rate	Primary Focus
Year 1 (2009)	Survey	3,060	2,163	73%	TD participation and experiences
Years 2, 3 (2010-2011)	Interview	--	75	--	TD impact on teaching self-efficacy beliefs; current employment
Year 3 (2011)	Survey	2,146	1,445	67%	TD impact on teaching self-efficacy and behaviors as early-career professionals; career trajectories
Year 5 (2013)	Survey	2,146	1,414	66%	TD impact on teaching self-efficacy and behaviors as early-career professionals; career trajectories

## Key Study Findings

### Why do doctoral students participate in TD?

From our 2009 survey, we found that:

- Factors that most encourage TD participation are departmental requirements, the student's interest in teaching and learning, and his or her career goals.
- The factors that most discourage TD participation are lack of awareness of the programs, scheduling conflicts with TD events, and seeing TD participation as a lower priority.
- Women report engaging in TD programs at higher levels than men.

### What effects does TD have on doctoral students?

- TD programs positively affect participants' beliefs about their ability to teach undergraduates; moreover, TD has a greater influence on women's beliefs than on men's.
- Compared with non-participants, TD participation also positively influences certain teaching competencies, such as course design and assessment of student learning.
- Doctoral students who participate in TD programs learn high-impact instructional practices that they apply in their early careers.
- Through TD participation, some women develop an identity as teacher-scholars and make connections beyond their departments.
- Participating in TD programs and having actual teaching experience play equally important and complimentary roles in shaping early-career academics beliefs and skills.

### How does TD influence doctoral students' career trajectories?

- While proceeding through their doctoral programs, doctoral students often experience a mismatch among
  - (1) what they expected of graduate school,
  - (2) their actual training experiences, and
  - (3) their career interests and opportunities.

We found that some doctoral students use teaching development to realign this three-way mismatch.

- Teaching development activities help participants clarify their career interests and successfully compete for a wider variety of academic jobs.

## Implications

Through the LSFSS, we know that TD programs promote teaching self-confidence and competencies. TD programs also help doctoral students explore and align career goals to match the current academic job market, including the wide array of faculty positions available outside of research universities.

Because of their impact on the professional development of future STEM faculty, TD programs may play a key role in national efforts to improve undergraduate STEM education. Given the benefits of TD programs, university departments, colleges, and graduate schools should consider:

- Expanding their support of TD programs
- Encouraging STEM doctoral student participation
- Lowering barriers to doctoral student participation
- Coordinating TD program offerings on campus