



Longitudinal Study of FUTURE STEM SCHOLARS

LSFSS Brief Series, No. 2
APRIL 2015

Key Points

Classifying teaching development (TD) programs is a complex process, especially given the diversity of programmatic content, delivery, and organizational cultures. To address this challenge, this research brief presents:

1. 12 core features of TD programs
2. Recommendations for their practical use

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 is using repeated surveys and interviews to follow an initial cohort of 3,060 late stage doctoral students.

The Anatomy of Teaching Development Programs: A Taxonomic Dissection

One purpose of the *Longitudinal Study of Future STEM Scholars (LSFSS)* is to measure the effect of teaching development (TD) programs on doctoral students' confidence and competencies in teaching, which are crucial for a successful faculty career. To determine impact of TD programs, it is necessary to understand their component parts and how they influence key TD outcomes.

However, after studying TD programs for doctoral students at three research universities, we found that classifying TD programs is challenging. TD programs vary with respect to presentation format, topic, participants' expected time commitment, and learning outcomes. Moreover, at many research universities, multiple institutional units, such as departments, colleges, centers for teaching and learning, and the graduate schools sponsor TD programs. As a result, TD opportunities for doctoral students can include modest departmental programs, multidisciplinary programs, and even multi-institutional initiatives.

Given the diversity of these programs, there has yet to be a defined and agreed upon taxonomy of TD programs for doctoral students in scholarly or practitioner-oriented literatures. The lack of a consistent classification scheme makes it difficult to define common critical elements of TD programs that contribute to doctoral students teaching development. In addition, without a common language to discuss the major components of TD programs, cross-program comparison becomes considerably problematic both within an institution and between colleges and universities. To address these concerns, this brief presents 12 important TD program features to advance the conversation of TD program classification, design, and assessment.

Core Features of TD Programs

In 2009, we identified and analyzed 77 TD programs at our three participating universities, which resulted in eight descriptive classification categories. Due to a lack of literature related to TD program typologies for doctoral students, we used the more developed literature on K-12 teacher development programsⁱ to revise our eight categories to include four new additions (see Table 1).

TABLE #1: CORE FEATURES OF TD PROGRAMS

	Core Features	Item Definition
Organizational Context		
1	<i>Scope</i>	<i>The organizational units and institutions involved in a program.</i>
2	<i>Funding</i>	<i>Sources of resources that establish or sustain the program.</i>
3	<i>Longevity</i>	<i>How the long the program has existed, whether it is currently active, and its historical background.</i>
4	Coherence	Extent to which a TD program fits with other TD initiatives/programs and doctoral training.
Program Features		
5	<i>Audience</i>	<i>Group(s) to whom the activity is targeted or intended and associated characteristics.</i>
6	<i>Selectivity</i>	<i>Extent to which participation is open or restricted.</i>
7	<i>Format</i>	<i>The way(s) programs are presented or delivered to participants.</i>
8	<i>Duration</i>	<i>The length of a program.</i>
9	Engagement	The number of hours a participant spends engaged in learning activities.
10	<i>Content focus</i>	<i>The professional skills, knowledge, or attitudes to be advanced by the program.</i>
Pedagogical Practices		
11	Active learning	Extent to which participants are actively engaged in their own learning.
12	Collective participation	Extent to which participants work together and produce collective products.

* Features in italics are the initial eight features proposed by the LSFSS in Connolly, Savoy, & Barger (2010).ⁱⁱ

ⁱ For example: Desimone, L. M. (2009). Improving impact studies of teachers' professional development: Toward better conceptualizations and measures. *Educational Researcher*, 38(3), 181-199. doi: 10.3102/0013189x08331140

ⁱⁱ Connolly, M. R., Savoy, J. N., & Barger, S. S. (2010, May). *Future-faculty professional development programs for doctoral students in science, technology, engineering, and mathematics: An exploratory classification scheme*. Paper presented at the annual meeting of the American Educational Research Association, Denver, CO.

The 12 core features are divided into three types: (1) **organizational context** (scope, funding, longevity, coherence), (2) **program features** (audience, selectivity, format, duration & engagement, content focus), and (3) **pedagogical practices** (active and cooperative learning).

Organizational Context

The first four features in the TD framework relate to organizational context. **Scope** describes the institutional units that organize or sponsor a TD program (e.g., departments, graduate schools, centers for teaching and learning). The second feature is **funding** (both the amount and funding source), which is significant for program sustainability, direction, and functioning. The third is **longevity**, which describes the current state of the program (active or not active), how long it has been or was active, and its historical background. Lastly, **coherence** relates to how the program fits with learning experiences in other TD offerings as well as disciplinary training in doctoral programs.

Program Features

The next cluster of core features deals with programmatic features. **Audience** defines a program's participants (e. g., demographics, discipline), which shapes a program's content and format. Because programs range from massive online open courses (MOOCs) to advanced learning experiences restricted to a handful of students, **selectivity** describes the degree of access that prospective participants have to a particular program. Another feature, **format**, refers to the various ways that programs can be delivered (e.g., short presentations, semester-long courses, in person, online). **Duration** includes the length of a program (e.g., 1 day, 2 weeks, 1 semester), and **engagement** is how many

hours participants invest. **Content focus** relates to the topic of the program and the professional skills, knowledge, and attitudes that participants are expected to acquire.

Pedagogical Practices

The last two categories highlight two pedagogical practices essential to effective TD programs. **Active learning** is the degree to which participants are able to engage in their own learning rather than being passive recipients. **Collective participation** captures the extent to which programs require collaborative learning experiences.

The 12 core features are a promising way to describe the essential components of doctoral TD programs. In the next section, we suggest practical applications of the 12 core features in program design and evaluation.

Putting the Twelve Core Features to Work

Through the LSFSS, we found that TD programs are extremely diverse within and between institutions, which makes it harder to coordinate TD programs as well as to evaluate their impact. The 12 core features of TD programs may help address both challenges. TD practitioners can adapt the 12 core features to potentially improve TD program coordination and to guide the evaluation of TD programs. Below, we argue that the 12 core features can be used as a holistic reflective tool in four ways:

1. Mapping current programs along the 12 core dimensions,
2. Identifying programmatic strengths and weaknesses,
3. Comparing programs within and across the institution to locate gaps or redundancies, and
4. Identifying areas of strategic investment.

Programmatic Mapping

First, TD designers and evaluators can use the 12 core features as a descriptive lens to map a specific program. This process does not compare the program against an ideal TD program; Instead, it is meant to serve as a neutral analysis of a program's current state. We provide guiding questions that can be used to guide the process and create a useful overview of a program (see Table 2), but we encourage that TD practitioners add to or modify the proposed questions for their specific context.

Strengths and Weaknesses

Once a clear map of a program is defined, TD practitioners could use the map to size up the strengths and weaknesses associated with design decisions based on audience, format, content focus, duration, engagement, and active learning strategies. For instance, the mapping process may reveal that a program attempts to focus on more content than is feasible for the current program duration or that the program has not articulated clearly how active learning strategies are used.

The map can also examine organizational factors such as scope, funding, longevity, and coherence to determine what is helping the program succeed and what factors may limit its impact. For example, a program that attempts to reach a wide range of STEM doctoral students but that has been historically affiliated with only one STEM department may not accomplish its intended reach across campus.

Cross-Institutional Program Comparison

The 12 core features can also be used to map and assess multiple programs across a college or university. Campus leaders would complete the programmatic mapping questions for each program, discuss the strengths and weaknesses for each

program, and then compare the programs of interest to locate areas of concentration, redundancies, or significant gaps that are missing from the current programmatic “mix” on their campus.

For instance, an intra-institutional comparison may reveal noticeable gaps in particular content areas such as course design and learning assessment. Or an analysis may show that most programs are offered for the same duration, require the same level of student engagement, and fail to reflect doctoral students' busy schedules. It may also identify key organizational factors related to scope, funding, longevity, and coherence that support or dampen teaching development efforts on campus.

Strategic Investment

Lastly, the 12 core features can help identify areas of strategic investment, especially across the breadth of campus TD offerings. Campus leaders can use the results of the programmatic mapping exercise and their review of program strengths and weaknesses to target areas that require the most attention or that could have a sizeable impact. This process could provide campus stakeholders with the evidence to warrant/justify investing time, energy, and resources into teaching development.

Consider the following fictional story. Kim, an associate dean of the graduate school, leads the professional development of graduate students on her campus. She knows that some doctoral students see improving their teaching abilities as a way to increase/expand their academic employment options. The graduate school has several TD programs, but Kim knows of others run by the center for teaching and learning and the engineering college. Because Kim is aware of numerous limitations, challenges, and gaps with the graduate school's programs, one of her goals this year is to figure out what is being offered on campus and how various programs might fit together to provide graduate students with more options that are better integrated.

TABLE #2: PROGRAMMATIC MAPPING QUESTIONS

	Core Features	Key Questions
1	<i>Scope</i>	<ul style="list-style-type: none"> • What campus units or external organizations/institutions are involved in the program? • How are they involved?
2	<i>Funding</i>	<ul style="list-style-type: none"> • How is the program funded? • Are funding and resources sufficient?
3	<i>Longevity</i>	<ul style="list-style-type: none"> • How long has the program been active? • How has the program changed over time?
4	Coherence	<ul style="list-style-type: none"> • How does the program relate to other teaching development opportunities? • How does the program relate to other doctoral training in general?
5	<i>Audience</i>	<ul style="list-style-type: none"> • Who is the target audience? • What are characteristics of the target audience?
6	<i>Selectivity</i>	<ul style="list-style-type: none"> • How open or restricted is the program to potential participants?
7	<i>Format</i>	<ul style="list-style-type: none"> • How is the program presented or delivered to participants?
8	<i>Duration</i>	<ul style="list-style-type: none"> • How long does the program last? • Are there other ways to offer this program that require less time?
9	Engagement	<ul style="list-style-type: none"> • How many hours are participants expected to devote to the program? • What will they be expected to do during the program and outside of the program?
10	<i>Content focus</i>	<ul style="list-style-type: none"> • What is the topic of the program? • What are the program's intended learning outcomes?
11	Active learning	<ul style="list-style-type: none"> • How, if at all, are active learning strategies used in the program?
12	Collective participation	<ul style="list-style-type: none"> • How, if at all, are collective or collaborative learning strategies used in the program?

Kim and her staff start by identifying teaching development programs on campus by reaching out to program leaders across academic and administrative units and inviting them to participate in a TD program committee. The TD program committee then maps individual teaching development programs using questions like the ones we have provided. The committee meets regularly to discuss the strengths and weaknesses of each program along the 12 dimensions. The committee then compares all of the TD programs across campus and identifies areas of concentration, redundancies, and gaps. For example, the committee finds that no program currently helps doctoral students learn how to assess student learning. In addition, they find that there are no programs offered over the lunch hour and very few programs are offered past 5pm when a higher proportion of doctoral students are out of their labs. Moreover, the committee discovers that the college of engineering and the center for teaching and learning are offering nearly identical versions of a class on teaching effectively with technology. After much discussion, the committee develops several recommendations to improve TD for doctoral students on campus.

Kim presents the committee's findings and recommendations to the graduate dean and other

TD programs are unexpectedly diverse within and between institutions, which not only complicates coordination among programs but also makes it harder to evaluate TD program activities and outcomes. The 12 core features of TD programs may help address both challenges.

key administrators, suggesting how collaboration and coordination among TD program leaders could lead to more effective use of scarce campus resources, while at the same time, better meeting doctoral students' TD needs.

We argue that the 12 core features of TD programs offered in this brief could be useful to campus leaders such as Kim. They provide a much-needed lens for discerning key aspects of TD programs. The descriptive power of the 12 core features can prompt programmatic review and reflection at both the program level and the institutional level. The 12 core features are not meant to be prescriptive but rather a tool to aid campus leaders in framing their TD programs and identifying ways to refine and improve them.



This project is funded by the National Science Foundation (Award no. 0817537).

The Longitudinal Study of Future STEM Faculty is housed within the Wisconsin Center for Education Research in the School of Education at the University of Wisconsin–Madison

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.

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RECOMMENDED CITATION

Hill, L., Connolly, M.R., Savoy, J.N., & Associates (2015). The anatomy of teaching development programs: A taxonomic dissection. *LSFSS Brief Series, No.2*, Madison, WI: Wisconsin Center for Education Research, University of Wisconsin-Madison.

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