



C I R T L

Center for the Integration of Research, Teaching, and Learning

**THE WISCONSIN LONGITUDINAL STUDY OF
DOCTORAL & POSTDOCTORAL TEACHING DEVELOPMENT
KEY FINDINGS**

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Executive Summary

Since 2005, *the Wisconsin Longitudinal Study of Doctoral and Postdoctoral Teaching Development* has followed 67 former doctoral students and postdoctoral researchers (“postdocs”) in science, technology, engineering, or math-related (STEM) fields who participated in various kinds of teaching development at the University of Wisconsin-Madison, including the Delta Program in Research, Teaching, and Learning.

The primary purpose of this final phase of the study (July 2010–August 2011) was to understand where study participants are in their careers, why they participated in teaching development at UW-Madison; what hindered or facilitated their participation; what they gained from teaching development activities; how they have applied what they learned from teaching development; and what effect teaching development has had on their career choices and trajectories.

1. Where are the study participants working now?

Degree completion.

- Of the 51 people who began the study as doctoral students, **43 (84%) had earned their doctorate**. Of the eight who had not finished, four reported that they were still enrolled at least part-time in coursework with the intention of finishing a doctorate at the University of Wisconsin-Madison.

Current employment.

- Of 67 findable study participants, **61 (91%) were employed full-time** when interviewed for this study in late 2010 and early 2011. Of the remaining 6, five were graduate students, and one was involuntarily unemployed.
- The most common positions held by study participants were **tenure-track faculty member (30%), academic researcher (22%), and postdoctoral trainee (19%)**.
- **Twelve (20%) of employed study participants were working outside higher education** in the business/government/non-profit sector.

Types of employing institutions.

- Forty-six respondents (75%) **were working for US postsecondary universities and colleges**, both public (32) or private (14).
- Three respondents, or 6% of those employed in postsecondary institutions, work in **international research universities**.
- Of the respondents working in US postsecondary institutions, **32 (70%) work in research universities, nine (20%) in master’s-level colleges and universities, two (4%) in baccalaureate institutions, two (4%) in two-year institutions, and one (2%) in a special focus institution**.
- The following table shows the Carnegie types of employing institutions and job types of all 49 respondents working in higher education—either in the US or abroad.

	Faculty (n = 26)				Researchers (n = 10)		Postdocs (n = 10)		Admin (n = 3)		Total (n = 49)	
	Tenure-Track (n = 20)		Non-Tenure-Track (n = 6)									
Carnegie Type	n	%	n	%	n	%	n	%	n	%	n	%
Associate's	0	0	2	100	0	0	0	0	0	0	2	4.5
Baccalaureate	2	100	0	0	0	0	0	0	0	0	2	4.5
Master's-Level	8	89	0	0	0	0	0	0	1	11	9	18
Research Universities	9	28	4	13	9	28	8	25	2	6	32	65
<i>Very High Research</i>	7	26	1	4	9	33	8	30	2	7	27	
<i>High Research</i>	0	0	3	100	0	0	0	0	0	0	3	
<i>Doctoral/Research</i>	2	100	0	0	0	0	0	0	0	0	2	
International	1	33	0	0	1	33	1	33	0	0	3	6
Special Focus	0	0	0	0	0	0	1	100	0	0	1	2
											49	100

Involvement in undergraduate education.

- Nearly half of all respondents (33; 49%) are **connected to undergraduate STEM education** in their current work—if not as full-time teachers, then through outreach, mentoring, or guest lecturing with undergraduates.

2. What encouraged and discouraged respondents' participation in teaching development?

Reasons for participating in teaching development activities.

- Most study participants were motivated by a desire to **enhance their teaching knowledge and skills** (62)¹ or by their general **enthusiasm for the practice of teaching** (46). While very few participants (9) were prompted to participate in teaching development because of a perceived connection with their graduate funding, many (57) thought teaching development programs and activities would **enhance their appeal as job applicants**.
- The desire for a teaching-focused community, while important, was not as important for participants as were other motivations. However, several (11) commented on the **value of learning in a community**.

Others' encouragement and discouragement.

- Overall, participants found **support for their interest in teaching development**. In describing what influenced their participation in teaching development, respondents reported more than twice as many facilitating factors (188 compared to 85 hindering factors).

¹ Totals are based on the number of participants who rated this motivation as a 3 or higher on a scale from 0 (not all at all important) to 5 (very important).

- Whether supportive or unsupportive, **advisors were by far the most significant influence** on whether participants pursued their interest in teaching.
- Supportive advisors tended to encourage participation in teaching development both explicitly by **advocating for participants' teaching development engagement** and implicitly through **their own involvement in these programs**. While some advisors who hindered or discouraged teaching development participation did so explicitly, many more did so tacitly by **challenging the value of teaching relative to research** for themselves or **complaining** about time spent on teaching. Although it was not communicated directly, participants sensed that advisors or other department members preferred and valued research over teaching.
- A **relative lack of teaching-related incentives** reinforced the superior status afforded to research, making it more difficult for participants to admit their interest in teaching. Similarly, participants asserted that **time and the need to balance academic and personal priorities** affected the extent to which they engaged in teaching development, regardless of the presence of other hindrances and supports.

3. In what kinds of teaching development at UW–Madison did respondents participate?

While the Delta Program was **the most common teaching development provider** to our study participants, many interviewees were involved in both Delta and non-Delta-sponsored teaching development opportunities. In fact, a majority of participants (57%) **had a mixed teaching development profile** that included activities offered through the Delta Program as well as through other teaching development program providers. The HHMI (Howard Hughes Medical Institute) Teaching Fellows Program was a common non-Delta teaching development experience.

Most interviewees (72%) had a high level of teaching development engagement, meaning that they reported more than 60 hours in such activities, typically in the form of several courses or internships, completion of the Delta Program certificate, or more than four semesters as a teaching assistant or lecturer. High engagement with Delta or non-Delta teaching development activities or programs was more common than high engagement with actual teaching experience.

4. How satisfied were respondents with their teaching development experiences?

A significant majority of respondents (88%) reported that their teaching development **met their expectations**, with 18% of these saying that teaching development **exceeded their expectations**. Many of the respondents in the latter category said they learned more than expected about teaching, either in theory or in practice. Those who said their expectations were met usually said their teaching development experience **helped them reach specific learning goals they had set beforehand**. Those who said teaching development did not meet their expectations critiqued the programs for **not offering enough actual classroom teaching experience**.

On a scale from 1 (“no help whatsoever”) to 5 (“extremely valuable”), respondents rated their teaching development satisfaction, on average, **4.28**. **Those with higher engagement levels generally rated their overall experience higher**. Respondents said that their teaching development programs were, in their words, “comprehensive”, “useful”, or had “utility” and had helped them prepare for classroom work, the professoriate, or academia in general. In many cases, satisfaction was tied **to direct applicability of the teaching development experience**, or whether or not they had been able to put their **learning into practice** professionally and with confidence.

6. What did respondents say they learned to do or perform as a result of their teaching development activities?

1. *Tools for Engaging Students.* The largest number of participants said they learned **methods for engaging students** in the STEM classroom, usually methods of promoting active learning. Many participants specifically mentioned lesson planning and syllabus design.
2. *Tools for Setting and Meeting Learning Objectives.* Respondents also reported that their teaching development activities gave them techniques and tools for thoughtfully **designing, organizing, and implementing important strategic objectives** in the classroom. Of numerous techniques and tools, mentioned most frequently were **formative and summative assessment**—important skills acquired from teaching development that were crucial to the **continual self-reflection** an instructor should employ throughout her or his courses.
3. *Tools for Articulating a Teaching Philosophy.* The final category of behavioral gains that respondents reported revolved around one tool in particular, a statement of **teaching philosophy**. Respondents said that they learned a great deal from activities that made them think about their personal **teaching objectives, philosophy, and goals** and, most important in relation to behavioral gains, **how to communicate** these objectives, philosophies, and goals to others.

7. What did respondents say they came to value or believe as a result of their teaching development?

Respondents who reported that teaching development activities changed their attitudes, values, and priorities as educators gave explanations that fit into three broad categories.

1. *Teaching Relationships.* Respondents reported that teaching development helped them understand that **teaching is not necessarily a one-way relationship** in which an expert delivers information to non-experts. They learned that their priority should be actively engaging students in the classroom. Important to this kind of affective change were the **concepts of student-centered learning and lesson design** upon which many teaching development programs at UW-Madison focus.
2. *Professionalism and Respect.* Effective teaching, these respondents reported, is much **more complex than it appears**. Teaching that is well done is just as systematic as any scientific research they carried out in the lab. Teaching development, in short, gave many respondents a different perspective on teaching: namely, that it is a **skillful activity that takes time, effort, and commitment and deserves greater respect**.
3. *Teaching and Research Convergence.* Along with a newfound respect for the skill and tenacity needed to be a successful teacher, respondents said that the **professional example set by faculty** involved in their teaching development changed their attitude regarding teaching. These mentors showed STEM doctoral and postdoctoral students that it was **possible to be both a successful researcher and a successful teacher**, roles that many previously had considered (or been trained to consider) mutually exclusive. The possibility, and importance, of integrating research specialization with skills in teaching helped many participants **come to a new understanding of STEM education**.

8. What ideas or concepts did respondents say they learned from teaching development?

Respondents' perceptions of cognitive learning gains (i.e., concepts, knowledge, information, and ideas) fit into four broad thematic categories.

1. *Diversity of Perspectives.* The most common cognitive gains reported by respondents were related to the concept of **diversity in the classroom**. They said that teaching development helped them learn

that students bring a variety of learning styles, backgrounds, and perspectives into the classroom, and that a good educator takes this diversity of perspectives and styles into account when teaching.

2. *Importance of Engaged Learning.* A smaller yet still noteworthy number of respondents said their teaching development programs taught them not only the importance of teaching and learning to the sciences but also the importance of **engaging students in active learning** in the classroom as a teacher.
3. *Connections Between Teaching and Scientific Research.* Another important conceptual gain from teaching development that respondents reported was the idea that **the teaching process could be connected to, and in fact enhanced by, the scientific methods** on which empirical inquiry is based. Some respondents spoke to the importance of **assessment** as an important teaching concept based in a research paradigm, in which continual evaluation of students and their perspective in the course can be used to improve teaching effectiveness and student learning. On a conceptual level, many respondents said they were quite surprised to find not only that there are indeed research-based **teaching and learning theories that could inform their practice** in the classroom, but also that these theories do not correspond with respondents' own experiences as students.
4. *Design, Organization, and Management.* Finally, a number of respondents said they learned principles of designing, organizing, and managing classes to meet specific learning goals that were important to their development as educators through teaching development programs at UW-Madison. Participants mentioned various learning materials and tools to clarify this conceptual point, pointing to "**backwards design**" of the syllabus, assessment, tests, activities, discussions, group work, learning aids and instructional materials, and even each class's time management decisions as different ways that teachers could design course features to meet specific learning goals.

9. How have participants applied what they learned from teaching development at UW-Madison?

A majority of study respondents (76%) had found ways to use the knowledge and skills they gained from teaching development. Specifically, delivering **instruction that increases student engagement** (e.g., through active learning techniques, inquiry-based learning, or the creation of learning communities within the classroom) was the most common kind of teaching development knowledge that participants applied. The second most common type of knowledge that study respondents applied was **course preparation and planning**, especially backward design, through which participants built courses by starting with learning goals. **Assessment** was the third most common way in which participants applied what they learned through teaching development.

Half of those who have not applied what they learned from teaching development programs had not done so because they had not yet held academic or other teaching positions. For others, time limitations were a significant hindrance. Still, among those who had not had the opportunity to apply their learning, there was some agreement about the types of teaching development knowledge and skills they would eventually apply—namely, course planning and preparation as well as approaches to content delivery.

10. How did teaching development at UW-Madison influence participants' career decisions?

While at UW-Madison, slightly more than half of participants experienced a **change in the type and setting of the work they wanted to do** after leaving the university. A large proportion of participants who changed their minds about the type of work (30) or the location of the work (14) they wanted to do after leaving UW-Madison **credited teaching development with a role in the change**. For the most part,

teaching development reinforced participants' extant interest in teaching-related careers and, thus, indirectly influenced their subsequent career decisions. Others shifted career priorities or expectations either during the job search or once they were in their first position after leaving the university. Several participants struggled to describe the relationship between these changes and their teaching development participation. For these participants, either the chronological order of the changes and other events in their lives was difficult to reconstruct or the career goals they brought to Madison had meshed with their goals as they were leaving the university.

Many participants reported feeling **anxious about the academic job market**. Approximately 25% of participants wanted additional preparation, particularly in administrative areas like management, budgeting, and maintaining a research program over time.

Still, most participants (41) **felt prepared to meet their career goals** upon leaving UW-Madison. In addition, 55 felt prepared for the responsibilities of the first job they secured after leaving the university. Teaching **development contributed to their sense of readiness** by offering relevant professional skills, knowledge and attitudes, especially self-confidence in their teaching ability. Teaching development also **affected participants' career search**, especially the variety of positions they applied for, their preparation for job interviews, and being able to offer what they felt was a stronger *curriculum vitae*.

11. What impact did teaching development have on participants' early career success?

Respondents reported that their participation in teaching development **contributed significantly to their early-career success**—namely, their job satisfaction, peer approbation, and membership in learning communities.

In response to interview questions that included a scale from 1 (“extremely dissatisfied”) to 5 (“extremely satisfied”), interview participants reported an **average job satisfaction rating of 4.0**. Comparisons show that respondents who participated in only Delta activities were more satisfied in their current jobs than those who participated in mixed teaching development or non-Delta teaching development programs, while those in **tenure-track positions rated their job satisfaction higher** than those in non-tenure track, postdoctoral, and research positions. Notably, those working in **government, non-profit and private sector positions rated their jobs higher** than those in universities.

When asked how they viewed their own effectiveness in their current job, nearly **90% of all respondents responded positively**. When asked what influenced their effectiveness, the largest proportion (23%) of these respondents linked their effectiveness most closely to how well they felt they were **balancing work and personal responsibilities**. Nearly as many of the respondents (21%) gauged their effectiveness by **how well they thought their students were performing in class**. When asked how they felt their colleagues, peers, students, or supervisors gauged their effectiveness, again, nearly 90% of all respondents responded positively. Respondents reported receiving this feedback through formal and informal processes.

Seventy-three percent of interview participants said that they currently felt like they were **a part of some sort of work-related learning community**; important features of these communities that encourage early-career success included **peer relationships, shared interest, networking, and collaborative opportunities**.

12. How has teaching development at UW-Madison influenced participants' career trajectory?

Although doctoral training traditionally emphasizes research and publication, most participants said they were **interested in careers that involved education and teaching**, especially as professors in a range

of higher education institutions. Almost 80% of those who wanted to work in a university environment also wanted a position in which **both teaching and research** played significant roles.

The most frequently cited influence on participants' career decisions and trajectory were related to **family concerns**, particularly the struggle to balance the career plans of a partner or spouse and the demands of parenting. Participants also reported that **professional success and job satisfaction** would likely influence their career trajectory. Earning tenure and having a productive line of research were particularly salient for those in academic positions.

When asked what they might have done differently as doctoral students or postdocs to better prepare themselves to pursue their careers goals, 22 study participants indicated that they would have sought **additional teaching development**. Other respondents would have **changed aspects of their academic or research experiences**, including choosing a different discipline or research group to work in.

13. What challenges did participants report?

As noted above, this inquiry revealed that participants reported very positive experiences with teaching development programs at UW-Madison. That said, some did communicate **challenges** they experienced in relation to their teaching development. For example, some participants were stymied by what they perceived as a **clash between focusing on teaching development and values held by their advisors or departments**. Other commented that the **limited teaching-related incentives** were outweighed by those that spurred a focus on research. Beyond this, another commented that experience with teaching development programs made it clear **how difficult teaching really is**, rendering teaching a less desirable career option. Finally, participants suggested that most of the teaching development programs they experienced **did not provide enough practical teaching experience**. One even reported feeling overwhelmed with theory and philosophy as she started her teaching career; she had learned about good strategies but was not sure how to authentically apply them once she entered the field.

14. Overview of How Teaching Development Affected Our Study Respondents

Looking across the various findings we are reporting, we seem to have collectively a significant amount of evidence to support claims related to the impact of the teaching development programs at UW-Madison in which our subjects participated. Among study participants who participated in teaching development activities at UW-Madison, *most* of them—

- sought out teaching development because they expected to become college teachers but felt very underprepared and needed to learn more;
- had their expectations for teaching development activities met and sometimes exceeded;
- sought, received, and eventually applied skills and knowledge related to effective undergraduate instruction (namely, engaging pedagogy, regular formative assessment, and “backward design”)
- perceived that participating in teaching development activities was not only informative and useful, but also helped them clarify, pursue, and successfully compete for the kind of jobs they most wanted;
- were generally feeling good about their effectiveness in their current position, and attributed some of their early-career success to what they learned from their UW-Madison teaching development and the confidence it gave them.
-

15. Implications for Teaching Development Providers

While these findings point to the significant and enduring positive effects of teaching development programs on those we interviewed, they also suggest that these programs still could take additional steps to better meet the professional development needs of future faculty. We believe there are two primary issues for doctoral students and postdocs that we want those who provide teaching development to consider and perhaps address.

First is **ensuring doctoral students and postdocs have easy access** to the variety of practical and conceptual activities they believe will be most useful to their formation as future academics. This means:

- Offering them teaching development experiences that include, or are explicitly linked to, practical teaching experience, *especially those in which they are the instructor of record*.
- Informing them regularly and repeatedly about the *availability, content, and expected outcomes* of teaching development activities, so that they might spend less of their valuable time trying to locate and integrate teaching development activities.

And, because we now better understand the influential role that faculty advisors play in doctoral students' and postdocs' participation in teaching development, the second consideration is **offering more assistance to doctoral students and postdocs in communicating with their advisor about their teaching development**. Supporting future faculty in this area can include both tools (e.g., role-playing workshops) and community (e.g., a support group). Similarly, teaching development providers might also consider providing tools and support to faculty who are advisors; several respondents explained that their advisors were not supportive simply because they did not have basic information or did not have the time to figure out what being more supportive could entail.

1. Introduction

1.1 Overview of Present Study

This longitudinal study, begun in 2005 under the direction of Dr. Susan Millar, tracks approximately 67 former doctoral students and postdoctoral researchers (“postdocs”) in science, technology, engineering, or math-related (STEM) fields, all of whom participated in various kinds of teaching development (teaching development) at the University of Wisconsin-Madison, including the Delta Program in Research, Teaching, and Learning. Earlier findings were reported by Bouwma-Gearhart, Barger, Millar, and Connolly (2007) and Barger, Bouwma-Gearhart, Connolly, and Millar (2007).

The primary purpose of this phase of the study, begun in July 2010 and finished in July 2011, was to understand the influence of teaching development programs on study participants’ conceptions of teaching and learning, transition into the job market, career trajectory, and sense of intellectual community. Another important purpose that follows from the longitudinal nature of the study was to contact as many ‘findable’ participants as possible five years after the study’s start and to see where they are now. This allows us to learn whether teaching development has any long-term effects as participants move from doctoral training into the job market.

Because graduate students trained at a relatively small number of research universities take faculty positions among the nation’s more than 4,500 higher education institutions, programs that help graduate students become more effective teachers could have far-reaching impact on undergraduate education in the United States. As such, the present study attempted to connect teaching development-related experiences to improvement in undergraduate STEM education through study participants’ *understanding, appreciation, and use* of reform pedagogies (Fairweather, 2008).

1.2 Overview of Report

The purpose of this document is to report the study’s findings to key leaders and stakeholders involved in teaching development for STEM trainees at the UW-Madison. Findings will help leaders and administrators reflect on teaching development programming as they move forward with project expansion. The findings from this study also will be of special interest to graduate students, faculty advisors, graduate-school administrators, heads of faculty development programs, and scholars interested in improving STEM education at the undergraduate and graduate levels.

The report is organized into 13 sections. After our overview, the first section details the study’s research design. The second section reports on respondents’ degree completion and post-training placement, while the third describes respondents’ teaching development experiences at the University of Wisconsin-Madison. Section 4 describes respondents’ motivations for and impediments to participating in teaching development, and 5 outlines respondents’ reported satisfaction with their teaching development programs and experiences. The sixth, seventh, eighth, and ninth sections detail, in order, respondents’ reported social, behavioral, affective, and cognitive gains from teaching development. Section 10 outlines respondents’ application of the knowledge and skills they gained in teaching development, 11 describes how respondents believed teaching development influenced their job searches and career-seeking, and 12 reports on respondents’ career satisfaction. The 13th section analyzes respondents’ self-reported career trajectories and future plans, while the 14th and final section wraps up with important highlights from the study and discussion moving forward.

1.3 Research team and funding

This research, which has been funded by the Center for the Integration of Research, Teaching, and Learning (CIRTL) since its inception, was conducted by two graduate-level project assistants, Ross Benbow and Derria Byrd, both doctoral candidates from UW-Madison's Department of Educational Policy Studies. The research was supervised by a member of CIRTL's Evaluation and Research Team, Dr. Mark Connolly. The research team worked under the auspices of the Wisconsin Center for Educational Research (WCER).

2. Research Design

This section describes the study's foundational research questions, as well as the methods through which the research team sought to answer these questions over a twelve-month period. Methods for building the sample, acquiring sources, and collecting and analyzing data are described.

2.1 Research Questions

This study specifically addressed the following sets of questions in order to gauge what participants gained from teaching development, particularly in terms of its effect on their career choices, trajectories and experiences:

1. Because our study participants began the study as trainees, how many have since completed their doctoral degree or postdoctoral training? At which institutions and in what positions have they found subsequent employment?
2. What motivated our study subjects to participate in teaching development? What supported or impeded their participation?
3. What, if anything, did study participants gain from their teaching development-related activities, with regards to:
 - a. knowledge and information (*cognitive*)
 - b. behaviors, skills, or practices (*behavioral*)
 - c. attitudes, values, or priorities (*affective*)
 - d. social networks, especially pertaining to intellectual community?
4. How, if at all, have study participants applied in their professional work what they claimed to have learned through their teaching development experience?
5. What factors or experiences most affected study participants' job search and career choice?
6. What effects on early-career experiences, if any, are attributable to teaching development participation, particularly with respect to
 - a. job satisfaction
 - b. use of research-informed teaching practices (i.e., not "straight" lecture)
 - c. peer approbation (i.e., pre-tenure review, feedback, departmental integration)
 - d. identification with one or more intellectual communities?

2.2 Methodology

Continuing the methodology used when the study began in 2005, the research team utilized qualitative methods, chiefly through semi-structured interviews of former teaching development participants at the UW-Madison. Qualitative methods, which help trained researchers more thoroughly probe individual respondents' experiences, perceptions, and interpretations, and which use direct quotations in analyzing and presenting data, helped the research team understand respondent attitudes in ways that we believed would better contribute to finding answers to the research questions above.

2.2.1 Sample

We worked with “findable” members of an initial sample of 83 people who participated as doctoral students and postdocs in the Delta program or some other form of teaching development at the University of Wisconsin-Madison. Of these 83, six participants could not be found, even after extensive internet searches, calls, and emails to the participants and past academic advisors. Ten participants were found through internet searches, but declined to participate. All told, after this detailed search, correspondence, and invitation process, 67 of the original 83 study participants participated in telephone interviews. It is these 67 respondents' answers to interview questions that make up the data collected and reported upon herein.

Of the 67 members of the sample who were interviewed, 38 participated in both Delta and other teaching development programs at UW-Madison, 23 engaged in teaching development at UW-Madison with no Delta experience, 5 participated only in Delta programming, and 1 participated in no teaching development whatsoever.

Table 2.2.1: TFPD of Participants

TFPD Program Participation	<i>n</i>	%
Delta and other TFPD at UW-Madison	38	57
TFPD at UW-Madison with no Delta	23	34
Only Delta	5	8
No TFPD at UW-Madison	1	1
<i>Total</i>	67	100

In terms of broad fields of study, 33 of the respondents came from the biological sciences, 18 from physics, 11 from engineering, 4 from math, with one respondent studied both biology and engineering.

Table 2.2.2: Broad Field of Study of Participants

Participant Broad Field of Study	<i>n</i>	%
Biological Sciences	33	49
Physics	18	27
Engineering	11	17
Mathematics	4	6
Biology and Engineering	1	1
<i>Total</i>	67	100

Twenty-five respondents began the study late in their doctoral program, 16 in the middle of their doctoral program, 13 as early doctoral students, and 13 as postdoctoral students at the UW-Madison. Thirty-six members of the interview sample were females, while 31 were males.

Table 2.2.3: Point in Career in 2005 of Participants by Gender

Career State in 2005	Male	Female	<i>n</i>	%
Postdoc	8	5	13	19
Late Doctoral Student	12	13	25	37
Middle Doctoral Student	7	9	16	24
Early Doctoral Student	4	9	13	19
<i>Total</i>	31	36	67	100

2.2.2 Data sources and collection

The primary source of data in this study was one 90-120-minute interview of 67 study participants, the “findable” members of the sample who responded to our inquiries and eventually completed a telephone interview with our researchers. All interviews were audio-recorded and transcribed for data analysis.

Our research process necessarily began by organizing and cataloging the existing data on CIRTL and Delta participants, as well as the results of earlier reports from this longitudinal study (see, for example, Bouwma-Gearhart, Barger, Millar & Connolly, 2007). We then tracked former participants and updated a master database that included current biographical, career, and contact information for each participant. After reintroducing the study to the participants, researchers began the interview process in November 2010 and finished in March 2011 using a semi-structured interview protocol. The research team reviewed the study design and protocol as the first 15-20 interviews were gathered and analyzed. After 40 interviews had been conducted, the team applied thematic codes to the interview data and began a more thorough process of data analysis, which eventually was used to develop the findings reported here.

2.2.3 Data analysis

Data were analyzed inductively with the help of software called NVivo, one of the most commonly used tools for qualitative data analysis and coding. Based on the interview protocol, research questions, and early data collection, researchers developed a “coding tree” through which all interview data were categorized thematically and by different areas of analysis. After testing inter-rater reliability on 5 respondent interviews and scoring a 94%, Byrd and Benbow divided the remaining interviews and coded data to the final coding tree. The organized data were then used to write on specific issues and themes that came through the interview process and spoke most closely to the research questions.

How many doctoral student participants completed their degree?

What are study respondents doing now?

3. Findings

3.1 Participants’ Transition to Post-PhD Placements

In this section, we describe the respondents’ educational and career trajectories since participating in teaching development at the UW-

Madison, including whether respondents finished their doctoral degrees, how they transitioned to careers, and why they chose, and stayed in, the jobs they did. This information on the sample will help give background to research findings through the rest of the report and helps illuminate the career context in which our respondents find themselves five years after the beginning of this longitudinal study.

3.1.1 Degree and Training Completion

Of the 67 respondents who participated in a telephone interview and were able to confirm their current career placement, 59 (88%) had completed their doctoral degrees, while 8 (12%) had not (see Table 3.1). Of the 8 who had not finished, 4 reported that they were still enrolled at least part-time in coursework with the intention of finishing a doctorate at the University of Wisconsin-Madison. Sixteen respondents participated in teaching development at UW-Madison as postdoctoral students and had therefore already completed their doctoral studies.

Table 3.1.1: PhD Completion Status of Participants

Finished doctoral degree?	<i>n</i>
Yes, entered study as postdocs	16
Yes, received doctoral degree after 2005	43
No, have not received doctoral degree	8
<i>Total</i>	67

3.1.2 Transitions to Current Employment

For the majority of respondents who had completed their doctoral work by the time we interviewed them, career transitions took a variety of forms and pathways. Only 9 respondents (13%) reported that they had gone straight from their doctoral work at UW-Madison to their current position. The rest of respondents held one or more interim jobs before beginning their current positions, working as adjunct teachers or lecturers (13 respondents), in one or more postdoctoral positions (14), as researchers (18), or outside of academic and STEM completely (6). Eleven respondents reported staying on at UW-Madison in a variety of temporary positions after graduating, either working for their department or in other areas of administration. Nine former participants reported working multiple, simultaneous positions at some point during the transition to their current employment.

Respondents mentioned a number of factors that influenced the decision on which jobs to take and when. Seven respondents said that contacts they had made at UW-Madison influenced which interim jobs they took after leaving, 7 said their decisions to transition were based on family, partner, and childcare duties, and 5 specifically mentioned they took a position because they simply needed work. No other factors for taking one interim job over another proliferated. Respondents who spoke to the issue mentioned a number of other factors, including contract periods ending, “bad situations” (in the words of one respondent) with employers or work responsibilities, confusion over career goals and desires, as well as a feeling that certain forms of interim employment would better help them reach their desired career. As will be discussed below, in a number of cases postdoctoral work, which many thought would be temporary, went on much longer than expected.

3.1.3 Current Employment

Of the 67 members of our respondent pool, three current employment positions are most common: that of tenure-track faculty (20), researcher (15), and postdoctoral researcher or fellow (13). Other

respondents were found to be working as non-tenure track or adjunct faculty (6), postsecondary administrators (4), K-12 teachers (2), and in a non-profit agency (1), while 5 respondents were graduate students. While the number of respondents in tenure-track faculty positions varies predictably according to the point-in-career at which trainees were picked to participate in the study (with those who were early doctoral students populating these positions at a lower proportion than students who were middle and late doctoral students), respondents currently in research and postdoctoral positions steadily account for between a quarter and a third of all early, middle, and late doctoral as well as postdoctoral students. Notably, postdoctoral positions, traditionally considered temporary training stages between graduate training and faculty work, employ nearly one in five respondents.

Importantly, while 26 respondents are working now as faculty members teaching in STEM fields, a total of 33 respondents (49%) confirmed during their interviews that they are connected to undergraduate STEM education—if not as full-time teachers, then in a part-time or secondary capacity through outreach, mentoring, or guest lecturing with undergraduates, as part of their current work.

Table 3.1.2: Current Job Titles of Teaching Development Participants

Position	<i>n</i>	%
Tenure-track faculty	20	30
Researcher (not postdoc)	15	22
Postdoctoral researcher or fellow	13	19
Non-tenure-track faculty	6	9
Graduate student	5	7
Postsecondary administrator	4	7
K-12 teacher	2	3
Non-profit administrator	1	1
Unemployed	1	1
<i>Total</i>	67	100

Table 3.1.3: Job Titles by Point in Career at Time of Selection for Longitudinal Study

Current Position	Career Stage in 2005 (<i>n</i> = 67)							
	Postdoc (<i>n</i> = 13)		Late Doc (<i>n</i> = 25)		Mid Doc (<i>n</i> = 16)		Early Doc (<i>n</i> = 13)	
	<i>n</i>	% ²	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Tenure-track faculty (20)	6	30	9	45	3	15	2	10

² ‘%’ equals the percentage of respondents holding that position within the career stage category at which they began the study in 2005. For example, there are 20 respondents currently working as a tenure-track faculty members. As there are 6 respondents working in tenure-track positions who began the study as postdoctoral trainees, 30% of respondents working as tenure-track faculty began this study as postdocs.

Researcher (not postdoc) (15)	3	20	5	33	4	27	3	20
Postdoctoral researcher or fellow (13)	1	8	5	38	5	38	2	15
Non tenure-track faculty (6)	1	17	3	50	2	33	0	0
Graduate student (5)	0	0	0	0	1	20	4	80
Postsecondary administrator (4)	1	25	2	50	0	0	1	25
K-12 teacher (2)	0	0	0	0	1	50	1	50
Non-profit administrator (1)	1	100	0	0	0	0	0	0
Unemployed (1)	0	0	1	100	0	0	0	0
	14		25		16		13	

Of the 61 respondents who were working, 75% (46) of participants are employed in universities or colleges spread throughout the United States. An additional 3 respondents are working in international research universities. Public postsecondary institutions house almost half of employed respondents (30, or 49%), followed by private colleges and universities (14, 23%). Twenty percent of our study participants (12) work outside higher education (i.e., business or government/non-profit organizations).

Table 3.1.4: Current Employers of Teaching Development Participants

Employer	<i>n</i>	%
Public college or university	30	51
Private college or university	14	23
Community or technical college	2	3
International university	3	3
K-12 education system	2	3
Government or non-profit agency	4	7
Private industry or business	6	10
<i>Total</i>	61	100

Of those respondents working in postsecondary institutions as faculty, researchers, postdoctoral fellows, or postsecondary administrators, 32 work in Research Universities (27 of whom are in institutions Carnegie designates as Very High Research Institutions), 9 work in Master's-Level Colleges and Universities, 3 work in International institutions, 2 work in Baccalaureate institutions, with 2 in Associate's Level institutions.

Table 3.1.5: Carnegie Classification of Participants' Current Postsecondary Employers

	Tenure-Track Faculty (<i>n</i> = 20)	Non-Tenure-Track Faculty (<i>n</i> = 6)	Researchers (<i>n</i> = 10)	Postdocs (<i>n</i> = 10)	Admin (<i>n</i> = 3)	Total (<i>n</i> = 49)

Institutional Type	<i>n</i>	% ³	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Associate's	0	0	2	100	0	0	0	0	0	0	2	4
Baccalaureate	2	100	0	0	0	0	0	0	0	0	2	4
Master's-Level	8	89	0	0	0	0	0	0	1	11	9	18
Research Universities	9	28	4	13	9	28	8	25	2	6	32	65
<i>Very High Research</i>	7	26	1	4	9	33	8	30	2	7	27	
<i>High Research</i>	0	0	3	100	0	0	0	0	0	0	3	
<i>Doctoral/Research</i>	2	100	0	0	0	0	0	0	0	0	2	
International	1	33	0	0	1	33	1	33	0	0	3	6
Special Focus	0	0	0	0	0	0	1	100	0	0	1	2

3.1.4 Reasons for Current Employment

Although respondents' current positions and employers are easy to classify, respondents' expressed reasons for taking and staying in their current positions are complex and vary from individual to individual.

When asked why they chose and had stayed in their current position, 24 respondents mentioned that the institution offered their desired **balance of work responsibilities**, usually teaching and research. Respondents confirmed that, more than anything else, **they based their employment decisions on what they believed was the right balance between these activities and their lifestyle, interests, and capacities**. As one participant said of her reasons for taking her current job, "It was kinda the perfect job for me...It wasn't a major research institution, but they wanted to keep my research program alive...I could sort of go at my own rate, just do a little bit and then more of a focus on my teaching. And that's what I was looking for." Another respondent noted that he was drawn to his current position for its focus on research rather than teaching. "They were specifically looking for someone in my area of expertise," he said, "and they do have a very strong research group...I knew there would be good collaborators from the research front."

Of those respondents who expressed the teaching and research balance as a concern, 12 said that they chose their current employer because there was a stronger focus on teaching, while 5 said they chose their current position because they desired a stronger research focus. Seven respondents said that they found the balance at their institution satisfactory because it focused on both teaching and research equally.

Another significant concern for respondents when making their most recent employment decisions was **family life**. Nineteen respondents expressed reasons related specifically to their partner's career and employment opportunities (a handful even used the "dual-body problem" label to describe their circumstances), proximity of their employment location to family, and, in a few cases, how they thought their job would affect their family responsibilities. Again, finding an equilibrium between competing interests and priorities was a major component in many respondents' decisions. "The tipping point really was a balance between asking what truly were my scientific motivations," one respondent said. "What sort of lifestyle did I want to lead in terms of a home life and work balance?" He added, "and here I'm talking about hours of the day."

³ '%', equals the percentage of respondents holding that position within that institutional category. For example, one respondent working in an international university works as a tenure-track faculty member. As there are three total respondents working in international institutions, 33% of respondents working in international institutions work as tenure-track faculty.

Others, however, said that their **decisions were somewhat constrained by a work environment with fewer opportunities for employment and advancement than they had expected** as they finished their doctoral studies. Many found they could not be as selective in choosing their work as they had hoped. When asked why they chose their current employment, 12 respondents answered that they had chosen the job not because it was the best, but because it was the only serious opportunity available. “They chose me,” as one respondent noted wryly, “so I said ‘yes’.” While he said that he liked the mix of teaching and research at the institution, he said it was not necessarily by design that he had ended up there; it was because it was an offer. Others spoke in the same way of the influence of broader changes in academia on their career track and employment possibilities, including longer postdoctoral apprenticeships, dwindling tenure-track opportunities, and increased competition for employment in their fields of study.

Still, many respondents expressed a feeling of control over their choice and mode of employment, and were drawn to their institution by an array of considerations. Eight said made their employer was “a good fit” with environmental factors such as the location, local community, feelings of collegiality they got from the work environment, and the people they met during job interviews or tours of their prospective employer. Six respondents said they chose their current job because they felt a strong connection to the institution’s larger mission and goals, while 5 others came for opportunities to gain experience in a particular kind of research, 4 came because they already knew individuals at the institution or employer, 3 to work with a specific professor or mentor, and 4 to get away from Wisconsin. 2 of these, they said, needed to escape the cold.

3.1.5 Summary

Career transitions took a variety of forms and pathways. The overwhelming majority of respondents held one or more short-term jobs before beginning their current positions, working as adjunct teachers or lecturers, in one or more postdoctoral positions, as researchers, or outside of academia and STEM completely. Respondents mentioned a number of factors that influenced the decision on which jobs to take and when, including contacts they had made at UW-Madison, family, partner, and childcare duties, or because they simply needed work.

Nearly half of respondents confirmed during their interviews that they are connected to undergraduate STEM education in their current work—if not as full-time teachers, then in a part-time or secondary capacity through outreach, mentoring, or guest lecturing with undergraduates. Tenure-track faculty, researcher, and postdoctoral researcher or fellow positions are most common among respondents. 30% of respondents are tenure-track faculty, 22% are researchers, and nearly one in five are employed in postdoctoral and fellow positions. Of the respondents who were working, three of four are employed in universities or colleges spread throughout the United States. Public postsecondary institutions house almost half of employed respondents, followed by private colleges and universities. Twenty percent of study participants work outside higher education in business or government/non-profit organizations. Of those respondents working in postsecondary institutions as faculty, researchers, postdoctoral fellows, or postsecondary administrators, 32 work in Research Universities, 9 work in Master’s-Level Colleges and Universities, 3 work in International institutions, 2 work in Baccalaureate institutions, and 2 work in Associate’s Level institutions.

Respondents said that they had chosen to stay in their positions for a number of reasons, most importantly that the institution offered their desired balance of work responsibilities. Others mentioned that family life, colleagues and work environment, developing work experience, and their institution’s larger mission contributed to staying in employment positions. Though many felt their education and work experience made them competitive in the job market, respondents also expressed the feeling that the recent employment context in academia and throughout the larger economy has constrained career decisions.

Why did study subjects participate in teaching development?
What supported or impeded their participation?

3.2 Participants' Motivations, Supports and Hindrances

3.2.1 Section Overview

Interviewees were asked to rate, on a scale of 0 (“not at all important”) to 5 (“very important”), their motivations for participating in teaching development. They were asked to rate a set of motivations—desire to improve knowledge and skills in teaching, enthusiasm for teaching, to enhance funding prospects, to enhance job or career prospects, and to meet others with similar interests—and to offer other motivations not covered by this list. This section describes their responses.

3.2.2 Motivations for Participation

Interviewees were most motivated by a desire to improve their teaching-related *knowledge and skills* (see Table 3.2.1). Based on an average rating of 4.4, interviewees considered this to be between “important” and “very important.” Four interviewees, in particular, were motivated by a desire to be better teachers; yet, the desire to enhance their knowledge and skills was not limited to interviewees who sought academic and other teaching-focused careers outside the academy.

Study participants wanted to expand their knowledge about a range of teaching practices, including those focused on informal education—

A lot of my work was less maybe teaching but it was sort of informal teaching in forms of like teaching to maybe not formal students but to the public. Just kind of a desire to improve my ability to, you know, engage people with science and connect them into the science community. So that sort of relates to enthusiasm for teaching but sort of in a broader sense.

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It's more of learning what's out there. I mean I think that education is changing so fast and that at least in my department we don't move as- we move kind of more at a glacial speed. And so kind of learning what's on the cutting edge and through the education department.

This motivation was also spurred for some by the relative lack of opportunity to focus on their teaching and learning skill development. Four interviewees wanted to gain teaching experience, which was scarce in departments where TA positions were limited. Other interviewees (8) were concerned that there was no way other than teaching development to gain the teaching experience that would help them to be successful in academic positions that required both teaching and research. These interviewees repeatedly commented on this absence, which was also connected to their motivation to improve their career prospects—

I was aware of the fact that I didn't have a lot of training...I knew I was gonna be teaching but I hadn't had any teaching experiences...I hadn't actually run a classroom. I hadn't designed curricula, designed activities. I hadn't worked with students really in any really substantial way, substantive way. And I knew that that was gonna be a big part of my career!

• • •

I'm here because I wanna teach. And it was really frustrating not having an opportunity to explore that. I was really disappointed that nobody was teaching me how to teach. And so when I heard about the Delta Program, I was instantly interested because I wanted to teach, I needed the experience, and I knew that it wasn't just about the content. You hafta know how to teach. It's not

something that you just are born knowing how to do. As soon as I heard about it, I was interested because I wanted to be good teacher not just a teacher.

Teaching development experiences also played a significant role in helping interviewees to discover the areas in which more development might be useful. Not only did the programs help interviewees improve their skills but they also helped them to identify gaps that had been invisible—

I think the most important thing that I got [out of the Delta teaching portfolio class] was in the course of talking about what to put in there it kind of highlighted to me a lot of the things that I was missing in terms of teaching experience...There were definitely a number of different aspects of the teaching portfolio that came up and to some people it was, oh yeah sure that's a matter of fact sort of thing and they just wanted to know exactly how to include it in there. But for me it kind of really opened my eyes in terms of what I was lacking, that I didn't even have to put into a teaching portfolio.

Table 3.2.1: Summary of Motivations for Participation⁴

	0 Not at all important	1	2	3	4	5 Very important	<i>n</i>	Mean
Funding	22	11	11	9	0	0	60	1.0
Job/Career	5	4	6	18	15	18	66	3.3
Community	4	3	7	22	18	12	65	3.3
Enthusiasm⁵	1	3	5	7	23	16	55	3.7
Knowledge and skills	0	1	1	4	21	36	63	4.4

The average rating for *enthusiasm for teaching* was 3.7, suggesting that it was an important motivation for interviewees. In fact, some interviewees revealed that their pursuit of doctoral degrees was motivated by their focus on teaching—

I came to graduate school really not so much for the research. I mean that's what graduate school is, it's research. But I didn't come so much, "I want to research geology." It was, "I like geology and I want to teach it someday. And I don't want to teach it at the high school level."...What really lit my fire was teaching. To stand in front of a classroom and give the best lecture that I possibly could. To be in a lab and explain things with clarity. To see the light come on in a student's eye. Over the first five semesters I figured out about myself that teaching's my gig, and I want to learn more about it. So I looked to the Delta offerings.

Three interviewees wanted to be more involved with teaching development because they thought teaching was fun. Others were passionate about teaching and eager to get more involved.

This enthusiasm for teaching was motivated not only by interviewee's desire to have teaching as part of their careers but also from their own experiences as students—

[My focus on teaching came from] some of the professors I had as an undergraduate. They were

⁴ Participants occasionally offered fractional ratings (e.g. 3.5). In these cases, the rating was rounded up to the nearest whole number.

⁵ The "enthusiasm for teaching" motivation was added to the interview protocol after interviewing began so the *n* for this category is much lower than for the other motivations.

very enthusiastic and it seemed watching them it would be a great job. The opportunity to continually interact with students and to see that spark when they understand it and to be able to transfer what I've learned to a wide variety of students. So I think it was mostly the faculty that modeled that and so I was really enthusiastic and also just really wanting to continue to be part of university life after I graduated.

Unlike skills and enthusiasm, *funding* concerns played almost no role in interviewees' decision to get involved with teaching development programming. On average, participants rated a concern for funding a 1.0. Six interviewees commented that they "didn't really think about it at all," meaning they did not connect teaching development to the funding that supported their work at UW-Madison or that would support their research in the future.

While funding was not a significant motivation for many interviewees, one who rated this motivation as "very important" had been very concerned about—

Frankly speaking my initial motivations for getting into teaching were purely funding. Zoology, the particular program that I was in did not have funding to...have a research assistant position. So I took up teaching.

Similarly, concerns about wanting to secure research funding in the future motivated another interviewee to enhance her understanding of teaching and learning—

NSF has their broader impacts, and at least being able to understand what that means—well they have it for now, that may be shifting—If [you] don't even know the vocabulary to use, or possibilities to explore, again you're pretty one dimensional.

Interviewees were equally motivated by an interest in their *job/career prospects* and a desire to meet peers with whom they had *common interests*. The average rating for these motivations was approximately 3.3, a rating that reveals their moderate importance. Some interviewees described their career-influenced interests in teaching development in terms of competition. The scarcity of jobs required, these interviewees (3) believed, applicants to do whatever they could to make themselves more attractive to potential employers—

You see the writing on the wall. There's 300 applicants for one job. You've gotta figure out how to get yourself competitive...My motivations were very mechanical. I needed to get better at teaching so I could get a job...It was more of a very practical exercise.

• • •

Well you just have to open up the *Chronicle of Higher Ed*, or back pages of *Science*, everybody wants somebody who can do everything, and walk and talk and chew gum at the same time. You can't afford to be a one-trick pony right now and expect to get a job.

Despite this functional motivation, most were not concerned with competition. There, instead, was an impetus for interviewees to leverage their teaching development experiences to reveal the depth of their experience and commitment. The Delta Program was a clear way for them to communicate this commitment and their "well-roundedness" as applicants—

Entering the Delta Program was an attempt to really fill out my *curriculum vita*, to make sure that my job application was regarded as someone who was not only good at teaching but had knowledge of the inner workings of teaching and learning and had more experience than the typical graduate student would have...it was definitely in the back of my mind that this would look fantastic to a future employer.

Nevertheless, job potential was not on all interviewees' minds—

It never was for getting a job. I enjoy teaching, I think that was most of the motivation...I'm applying now for faculty positions, and there will be a teaching appointment, and I think that if you've had these experiences, yeah it will help you. But I don't think that was ever my intent.

Similarly, another interviewee commented that while he was not motivated by his career aspirations when he sought out teaching development programs, “In retrospect I’m pretty glad I did it because it is a lot easier to get a job.” Interestingly, one interviewee commented that concerns about her career were “like the opposite of a motivation...a reason not to do it” because a focus on teaching seemed to be in conflict with success as a researcher.

From a *common interests* perspective, five interviewees suggested that they were drawn by the opportunity to work with professors and other mentors as a way to get to know experts who were concerned about teaching. Peers who were already involved in teaching development activities were a motivating factor for four interviewees. For others, learning within a group context was appealing, especially compared to the limited social opportunities the lab offered. One interviewee echoed the Delta Program’s Learning Community pillar when describing the value she found in the social aspects of her teaching development experiences—

Being in a lab can be fairly isolating, especially if you want to go beyond a particular technique, or the technical. You can't learn to teach in a box. And I don't pretend to think that I know everything that is that I should know, in terms of connecting with students, especially connecting with students who have a background different from my own. So I need help. And I think these programs are one way of at least putting the potential questions on the table. And it's a way to commiserate, kind of have somebody—or several somebodies—who are at similar or one step beyond where I'm at...There is a social component to it in terms of meeting like-minded folks, but there is also the professional component of meeting people who have skills that I might wish to borrow at some point.

Similar to what one interviewee shared (noted above) about what he learned about the positive effect teaching development had on his career prospects, others (2) commented that shared interests were not a motivation to become involved with teaching development but it became an important element of their experience—

[Community] wasn't particularly a motivation. It wasn't a detractor. It wasn't something I thought about too much I would say. But, you know, in hindsight, that's definitely one of the big things I've gotten out of the program...You're asking why I did it. And I guess I'd give it a 3. But, you know, if I were to take a Delta class again, and I'm planning on it, that'd be a 5 for the future.

Overall, the set of motivations we offered captured most interviewees’ range of motivations for participating in teaching development. They added very few additions under the “Other” category. That said, several (3) offered that “not being completely fulfilled by the research side of things” inspired them to get more involved in teaching and learning. Research also motivated three other interviewees who were drawn to the Delta Program’s “Teaching-As-Research” pillar as a way to meld their interests and to continue to contribute to their fields—

There had not been much ed sciences or formal research on the topics that I study and I felt that as a field of study, a field of research that the world needed, studying the how you teach, what to teach and how to teach in climate, air pollution and policy...was something that was really important...a large part of my participation in Delta was to you know have a framework for conducting that research and getting started on it as a graduate student.

Other interviewees were drawn by teaching development itself. Six commented that the opportunities were interesting and they were curious about what the programs had to offer. In some cases, participation was its own reward; five interviewees commented that they were eager to engage in additional teaching development after participating in the programs and having fun, which inspired to them participate more. Exploration inspired four interviewees who wanted to engage new ideas from education theory (2) or to investigate career options that might be available to them (2)—

I think each experience I had in the program was valuable so I saw something with each

course...that I completed. So I knew that the next experience would be just as valuable too. Ultimately I knew that having the [Delta] certificate would be another really good thing to put on my resume to make me that much more of a desirable candidate for position.

While many interviewees were required to attend training for their roles as teaching assistants, only one reported participating in teaching development because it was required.

3.2.3 Influences on Participation

Interviewees were asked to identify any people, circumstances, or contexts that facilitated or hindered their ability and desire to participate in teaching development programming. Overall, there were significantly more elements that enabled interviewees' participation. There were 188 mentions among the top facilitating factors and only 85 mentions among the top hindering factors. **Topping both lists were advisors**, who appeared to encourage more than discourage interviewees' desire to enhance their knowledge of teaching and learning. In each case, a small number of interviewees asserted that nothing either facilitated (5) or hindered (9) their teaching development participation.

3.2.3.1 Facilitated Participation

Advisors were the most significant factor that supported interviewees' participation in teaching development activities. (See Table 3.2.2.) There were 65 mentions of the various ways in which advisors played this supportive role—by modeling a value for teaching by participating in the Delta Program or other CIRTl activities (9), encouraging interviewees' pursuit of teaching development (53), and, in rare instances, by being indifferent to the way interviewees' spent their time (2) or eventually developing a positive attitude toward teaching development (1). Of these, advisors' support or encouragement was the most often mentioned facilitating factor—

It always helped when my advisors were supportive of [teaching development]...[Some] advisors looked at it as one more thing that you're putting on your plate, and you're wasting time you should be in the lab doing research. But, when I had an advisor that was supportive of this extra work because they recognized it would help my research ultimately, then, it made participation easier—when they viewed it as a worthwhile experience.

One interviewee reported that “as long as I was getting my research done, [my advisor] didn't care what else I was doing.” Other advisors framed teaching as a way to better learn the research material. An interviewee shared that his advisor “mandated for everybody in his group to TA for two years, ‘I don't care if you have money or not.’ Because he thought [we would] learn the chemistry better if we are forced to teach it more.”

Table 3.2.2: Factors that Facilitated Participation

Factor	n	
1. Advisor	65	
-supportive, encouraging	53	
-connected to Delta/CIRTl	9	
-indifferent (little supervision)	2	
-changed his/her mind about teaching	1	
2. Teaching Development Features	42	
-marketing	12	
-staff/instructors (people and attributes)	9	

<i>-infrastructure (flexible, stipend, affiliations)</i>	6	
<i>-required</i>	4	
<i>-teaching development learning environment & community</i>	4	
<i>-enjoyed previous teaching development exposure</i>	3	
<i>-counted toward degree</i>	2	
3. Other Encouragement		29
<i>-mentors' support of and commitment to teaching</i>	18	
<i>-from peers</i>	11	
4. Department Attention to Teaching Development		18
<i>-lab, program, department encouraged teaching development</i>	17	
<i>-indifferent (little supervision)</i>	1	
5. Personal Incentives		15
<i>-personal motivation</i>	11	
<i>-incentives: support, recognition, experience</i>	3	
6. Career Context		10
<i>-teaching development complemented or relevant to research</i>	5	
<i>-teaching connected to job concerns/goals</i>	3	
<i>-change from lab</i>	1	
7. Time		9
<i>-timely/fit schedule</i>	3	
<i>-flexible offerings</i>	3	
<i>-short time commitment</i>	3	

Features of the teaching development activities themselves made it easier for interviewees to participate. Marketing (12) was the most frequently mentioned—presentations in their departments, emails and other program announcements helped to ensure that interviewees knew there were teaching development offerings available. This information rarely came from sources not affiliated with the programs themselves—

One of the [Delta] directors...is now the chair of the department so it definitely makes a difference to have an advocate for a program within your own department because every year he advertises it to the incoming grad students, he really urges the other grad students who have participated to tell the new ones about it, he promotes the program within the department.

The staff and instructors (9) who implemented teaching development programs were significant as well. Interviewees listed staff's personal attributes (e.g. encouraging, skillful, amazing) and specific names, noting that the encouragement of individuals who interviewees respected helped to ensure that they would pursue teaching development opportunities themselves—

Certainly the instructor for the [Delta] course was really easy to interact with...She made an environment where it felt fine to go ahead and voice your opinions, and talk about things. So that because you were in a classroom with a bunch of people that were basically strangers. So it's hard to get discussion going, but she was good at greasing the wheels.

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[My department chair] and I got along really, really well...he wasn't on my committee. He wasn't my advisor. But I kind of continued through my time at University of Wisconsin to consult with

him very frequently and ask his advice. So the fact that he was teaching it was really valuable to me. It was important for me taking that [teaching development] class.

One interviewee described the teaching development programs as “addictive” because the staff and classes helped to keep him coming back. Interviewees also noted that some of the design features of teaching development programs (9), including their flexibility, the occasional access to stipends and grant funding, and the programs’ affiliations, made participation more possible—

It was nice, regarding the internship, because they allowed me to use my chemical education research project as part of my internship. If they didn't allow me to do that I wouldn't have found the time to do an additional internship with my program.

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What honestly made the difference was that several of the programs came with small [or occasionally] a sizable stipend. And frankly money beats out anybody's preconceived notions of what you should be doing. But basically, [you can say], “Somebody values this, even if you don't.”

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[Teaching development] involved professors at the university...already standing tenured professors were teaching the courses, were organizing the internships...[and] maybe all the staff at Delta also worked as researchers at the University, or professors, or worked in labs at the university. So they already had an internal connection.

Mentors who communicated a value for teaching (18) and other graduate students who participated in teaching development programs (11) also were influential for interviewees’ teaching development engagement—

There was a core of people [in my department] who were really serious and excited about teaching like I was. And we interacted with each other informally and kind of formed our own little click. There definitely were other people who weren't really serious about teaching at all.

One interviewee noted that her principal investigator’s love of teaching led him to encourage her participation. In some cases (17), departments encouraged interviewees to participate in teaching development because it was something that that community valued. As one interviewee shared—

The emphasis on effective teaching and creating positive teaching environments for students at all levels has been a very noticeable growing focus of the department. And so that environment certainly inspires most of the people who come through here...There are some people who come in who may not think they can do it, or they think of science more in a pure, more a traditional sense, where there's a big separation between the research and teaching. And I think some of those people are converted, so to speak, by the time they leave here.

There were also more personal factors that facilitated interviewees’ participation in teaching development activities. The most significant of which was participants’ personal motivation to enhance their understanding of and skills in teaching and learning (11)—

[Beyond what was required,] I mostly made the decision to go to [teaching development] on my own. They sounded like things that would be useful to me, and so I went. I can say for certain that my advisor never told me to do any of that sort of stuff. That was all self-initiated.

In addition, a few (3) interviewees mentioned the incentives that accompanied teaching development participation, including access to support and experience among fellow participants as well as the recognition that good teaching occasionally garnered. Interviewees also found that teaching development opportunities could complement their research (5) and was relevant to their career goals (3). In this way, investment in teaching development was also an investment in other priorities interviewees were already focused on. One interviewee’s teaching helped motivate her research because the two were so intertwined.

For another, classroom experiments to improve teaching and learning became a compelling research interest that has carried on long since UW-Madison.

Finally, time (9) was also a facilitating factor because of the timeliness with which interviewees learned about teaching development opportunities (3) and programs’ flexibility, which helped ensure that teaching development would fit into participants’ schedules (3)—

It was really helpful that it was in the evening, because I felt that it was something that I could do on my own time that wasn’t taking away from my work in the lab. So that was very important...If it was during the day, I would have felt that I needed to kind of get formal approval from [my advisor]...By doing it in the evening it was basically on my time...and I could do it without fear of repercussion.

In addition, interviewees’ participation was supported by the “low burden to entry” that resulted from the relatively low time commitment the programs required. Five other interviewees noted that nothing in particular had facilitated their teaching development participation.

3.2.3.2 Hindered Participation

As with the factors that facilitated interviewees’ teaching development participation, advisors (25) were the most-cited factor in hindering interviewees’ teaching development engagement. (See Table 3.2.3.) In most of these circumstances (23), advisors’ reluctance, discouragement, or dismissal of teaching development prevented interviewees from pursuing teaching development opportunities—

[My advisor] was not supportive of that [the Delta certificate], because it was too time consuming. And she was concerned that it would take away too much time from my research. So I managed to do a few little things here and there, but I was unable to take the time to do like a full teaching certificate, or a Delta internship, or something like that.

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[My advisor] complained about teaching, so I knew she didn’t really like teaching herself. And she’s always talking about getting results so that we can publish papers. She made it very clear that getting results to get papers is what you need to do to be successful in grad school. She pretty much like said that and it was definitely understood by us all.

In a smaller number of cases (2), interviewees’ concern that their advisors *might* not approve of their teaching development involvement prevented interviewees from pursuing these opportunities. One such interviewee reported that he adopted an avoidance strategy because he was “concerned about how [my advisor] would feel about me spending time not devoted to my research. Perhaps that was justified, or perhaps not. But it was easiest just to not deal with it.”

Table 3.2.3: Factors that Hindered Participation

Factor	n	
1. Advisor		25
-against, discouraged, reluctant	23	
-worried about his/her response	2	
2. Lack of incentive		19
-was not encouraged	10	
-not valued in his/her community	5	
-no incentive (rewards, funding)	3	
-already had teaching experience	1	

3. Time		18
-high course requirements	4	
-longer time to graduation	2	
4. Competing Priorities		10
-research as main priority	9	
-tension between research and teaching	1	
5. Lack of Attention to Teaching Development in Department		8
-not discussed or valued	6	
-limited TA opportunities	2	
6. Poor Fit		3
-s/he did not fit with teaching development environment	2	
-teaching development did not fit career goals	1	

The lack of incentive to focus on teaching or teaching development (19) was the second most important factor that kept interviewees from these learning opportunities—

There is no incentive for a purely research-driven mentor and laboratory to invest a graduate student's time in this teaching business. You can figure that out once you're an assistant professor somewhere.

• • •

Balancing research and teaching, teaching's usually gonna come out on the short end of that stick just because of the emphasis that's placed on the tenure process and on advancements and raises or whatever on research and not as much on teaching.

Ten interviewees reported that they were not compelled to pursue teaching development because it was not encouraged around them. Beyond not being encouraged, others (5) received messages that teaching was not valued or worth the investment of resources. A small group of interviewees (3) discussed that all of the incentives that they were being trained to value (e.g. funding, recognition) actually helped to discourage a focus on anything but research.

Time (18) was the third most-cited factor—there just was not enough time to pursue all that participants were interested in. Those who specified further reported that teaching development courses required a significant time commitment (4) or that focusing on teaching development would extend their time to graduation—

At times the Delta requirements seemed difficult...if I didn't hear about Delta early in my graduate career and I was trying to complete all of the different requirements maybe the last couple years of the program, it would have made it really difficult to try and squeeze in all the course requirements and all the internship requirements, it just seemed like there were a lot of little check boxes that we had to check to get through. And on top of our graduate research it was a lot of work unless it was spaced out properly.

Other factors that discouraged interviewees' involvement in teaching development included competing priorities (10) that kept them focused on research or torn between research and teaching, the lack of attention to teaching development and teaching in interviewees' department (8), and a mismatch between the teaching development experience and interviewees' personality or career goals (3)—

[Teaching development] activities are not necessarily valued that much. And I do think it would be nice in terms of structural change in the university to get some more value for that...Not that I think a lot of the students are doing it because of recognition. But I think it helps the community

realize there's value in what these people are doing and there's a reason for this, the university supports this.

. . .

It was never explicitly stated, but I certainly felt like folks in my department who do "bench science" were watching me. Teaching programs were seen as bastions of escape for people with absolutely no bench skill whatsoever, and if I were wasting my time it must be because I can't pipette worth a damn...It was implied at least that I was letting down most of grad committee and my grad advisor by having any interest in doing anything other than producing data.

Finally, nine interviewees commented that nothing had prevented them from taking advantage of teaching development experiences to the extent that they would have liked.

3.2.4 Summary

Most study participants were motivated to engage in teaching development (teaching development) by a desire to enhance their skills in teaching and learning or by their general enthusiasm for the practice of teaching. Few were concerned with teaching development's connection to their funding prospects but many saw the programs and activities as ways to enhance their appeal as job applicants. That said, many found that their original motivations did not fully encompass what they ultimately gained from the programs. For example, few considered the importance of the community they would encounter in the teaching development programs but many commented on the value that learning from and with others who also valued teaching held for them.

Overall, participants found support for their desire to participate in teaching development. They reported more than twice the number of facilitating factors (188 compared to 85 hindering factors). Advisors were by far the most significant factor—as either supports or hindrances—that influenced the extent to which participants felt comfortable and able to pursue their interest in teaching. While advisors' support for teaching development was often explicit—via modeling through their own involvement or suggesting and advocating for students' participation—their role as impediments to teaching development participation also involved tacit challenges to the value of teaching relative to research. In addition to advisors' complaints about having to spend their own time on teaching, participants *sensed* that advisors or other department members preferred and valued research over teaching. The paucity of teaching-related incentives reinforced this belief. Finally, time and the need to balance priorities affected the extent to which participants engaged in teaching development, regardless of the presence of other hindrances and supports.

In what kinds of teaching development activities did study subjects participate? Which were most popular?

3.3 Participation in Programs and Activities

3.3.1 Section Overview

This section encapsulates the context of participants' engagement with teaching development. In addition to participants' depth of engagement—as measured by the number of hours spent on various teaching development activities—this section includes the type of teaching development activities and providers participants experienced.

3.3.2 Teaching Development Program Providers

Nearly 70% of interviewees were involved in the Delta Program, including some who experienced both Delta and non-Delta teaching development. Experiences with other teaching development organizations and opportunities—both at UW-Madison and beyond—accounted for the 21 mentions of other teaching-related training discussed by interviewees.

3.3.2.1 At UW-Madison

Beyond Delta, interviewees participated in several other UW-Madison teaching development programs, including the Wisconsin Program for Scientific Teaching (3), KTI (K-Thru-Infinity) (2), MRSEC (Materials Research Science and Engineering Center) (2), CBE (Center for Biology Education) (2), the Teaching and Learning Symposium (2), and the Letters and Science Teaching Fellowship (2). Working through KTI, one interviewee was able to link what she was learning at the university with teachers' needs in the community—

I was also involved with the KTI programs... [through which] I worked with a local school district. So I worked with the Madison school district with the sixth grade classroom, with the two different teachers in the sixth grade classrooms. So the goal of the program was to combine the university knowledge with teaching in the local public schools. And so through that program I had weekly seminars with other fellows who would give talks about teaching and teaching complex science content to elementary and high school students as well.

Interviewees were also involved in other teaching and learning collaborations like the Teaching Improvement Project, SCALE (System-Wide Change for all Learners and Educators), and The Writing Center.

3.3.2.1 Beyond UW-Madison

Eight interviewees discussed their teaching development experiences with several professional organizations—including American Astronomical Society, American Society for Microbiology, National Association of Biology Teachers, National Science Teachers Association, Institute of Transportation Engineers—that either focused on teaching development or included teaching and learning elements in their annual conferences and other gatherings. Seven interviewees participated in the HHMI (Howard Hughes Medical Institute) Teaching Fellows Program, a yearlong learning opportunity in which participants learn about scientific teaching and develop, deliver, assess, and disseminate a biology course. After arriving at UW-Madison, one interviewee continued to participate in a University of California professional development workshop on inquiry-based learning.

3.3.3 Levels of Engagement

Based primarily on data from a previous stage of this study and supplemented with interview data from the current phase, interviewees were grouped into levels of teaching development engagement. The dosage levels reported below reflected an **updated** understanding of the amount of teaching development in which participants engaged during their time at UW-Madison. The levels were scaled into high, medium, and low categories based on the amount of time interviewees invested in teaching and in Delta and non-Delta teaching development programs (see Table 3.3.1 below).

Table 3.3.1: Definitions of Teaching Development Dosage Levels

<i>Level of Engagement</i>	Teaching Development Investment
<i>Low</i>	1 to 8 hours, typically several short activities (e.g. brown bag discussions, round table dinners, conference sessions, limited mentorship) or 1 semester as a teaching assistant or lecturer
<i>Medium</i>	Up to 60 hours, typically an internship, a mix of shorter activities and a longer activity (e.g. seminar, course, or ongoing mentorship), or 2 to 3 semesters as a teaching assistant or lecturer
<i>High</i>	More than 60 hours, typically several courses or internships, completion of the Delta Program certificate, or more than 4 semesters as a teaching assistant or lecturer

Among the 67 interviewees, 9% had “low” engagement, 19% “medium,” and 72% had “high” teaching development engagement across the three types of teaching development activities—Delta, non-Delta, and teaching experience. (See Table 3.3.2.) Considering each type of activity separately, equal proportions of participants (34 or 51%) had high engagement with Delta or non-Delta teaching development activities while 24% (16) had high engagement with teaching experience.

Table 3.3.2: Dosage Levels Among Study Participants

	<i>n</i>	%
<i>Low Engagement</i>	6	9
<i>Medium Engagement</i>	13	19
<i>High Engagement</i>	48	72

3.3.4 *Types of Teaching Development Activities and Programs*

Interviewees participated in a broad array of teaching development activities that were provided by a range of organizations internal and external to the University of Wisconsin-Madison. Most participants (38 of 67) had a “mixed” teaching development profile, meaning that they participated in UW-Madison’s Delta Program as well as in activities offered by other departments or organizations. Two interviewees exemplified how participants with mixed teaching development experiences drew on a range of activities to explore teaching and learning—

My first teaching fellowship that I got was actually the Howard Hughes teaching fellowship...that was a one-year fellowship intensive program where we took I think two or four courses...it was a two-semester deal. And then in the second semester...it was this whole long preparation for teaching an honors level first year freshman course...that was the dominant one. But I also periodically participated in programs supported by the Delta Program. I didn't do the certificate they have, or had at the time. But I did take- I think I audited a couple classes, and definitely attended different programs that they had and workshops...[Also] I was a TA [Teaching Assistant]. That was actually before I did my Howard Hughes fellowship. I TAed for [a zoology course]. I think it was the second semester of a two-semester course.

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The largest and most cohesive part of that [my teaching development experiences at UW-Madison] was the Delta Program, Delta certificate program. The formal courses that I took as part of that certificate program including the diversity in the college classroom, teaching in the college classroom...So yeah three courses, an extensive internship, and I attended a few of the roundtables and brown bags, single digits in terms of both...I did extensive guest lecturing, across the university in Atmospheric Science, Environmental Studies, Biology, Zoology, and Chemistry. And I was also asked to teach on [a topic] through the engineering new TA orientation...At Madison I also mentored undergrad- undergraduate research scholars, undergraduate hourly research assistants, and grad students. I think the total was about ten, probably five grad students five undergrad.

Approximately one-third, or 21 interviewees, received their teaching development through non-Delta experiences. Only 7 interviewees participated exclusively in Delta Program offerings and only 1 had

no teaching development experience.⁶ The following section outlines the types of teaching development activities interviewees discussed as well as the programs, departments, and organizations that offered these professional development opportunities.

3.3.5 *Most Frequent Teaching Development Experiences*

The most common type of teaching development in which interviewees engaged was Delta's non-course offerings. There were 63 mentions⁷ of these Delta experiences, which included brown bags, round table dinners, internships, and other program-sponsored events. After this, interviewees were most involved in activities that provided formal teaching experience (55 mentions) like holding teaching assistantships, acting as a course instructor or guest lecturer, or playing a leadership role in the training of other teaching associates or teaching development-enthusiasts. Courses were the third most common type of teaching development interviewees experienced with 46 mentions. Beyond this, interviewees were exposed to other course offerings through academic departments across campus. The narrative below elaborates on the types of offerings described above.

3.3.5.1 *Delta's Non-Course Offerings*

Interviewees most frequently discussed the Delta Program's non-course offerings when reviewing their teaching development experiences. The Delta Program offered interviewees professional development opportunities in several different forms. Sixteen interviewees participated in Delta brown bag series or panels, during which experts shared their knowledge of and/or experience with instructional materials and their development. One interviewee detailed the range of content he or she encountered through these experiences—

I went to a few brown bags...the person from Michigan State she came...and talked about teaching large lectures and using clickers and other things. And I've been to a couple of like instructional technology brown bags...[and] I've been to a couple meetings [about] learning about different technology and...a talk or two about teaching and diversity and other things.

These were followed closely in frequency by roundtable dinners and workshops, which were attended by 14 and 11 interviewees, respectively. These offered interviewees more general discussion connected to elements of teaching and learning and that linked to issues and topics of interest beyond the classroom. For example, interviewees participated in workshops that helped them develop tools and products that would be useful during their job searches like teaching statements (3), teaching portfolios (2), and a *curriculum vitae* (1). Some interviewees (10) participated in Delta internships that offered more sustained engagement with subject matter through a sponsored project with a faculty or staff member and often offered connections to the community—

Actually through Delta I went to...maybe an open house that they had at [a nearby college] about doing Delta internships there. And so I met a [science] teacher here at [a nearby college]. And I kind of expressed a future interest in doing an internship with him. And so I ended up doing it in the spring. And we developed a short course. So it was a one-credit course delivered over three full days...it was eight hours a day for three days.

In some cases (2), the flexibility of these learning opportunities enabled interviewees to integrate their research, teaching and learning interests.

⁶ This lone interviewee did attend a Delta Brown Bag, but based on unusual circumstances of his participation, we deemed this one-hour of participation akin to no teaching development experience.

⁷ Because our respondents usually referred to more than one program in their interview, it makes more sense to report the number of times they mentioned a particular type of phenomenon rather than simply report the number of respondents who mentioned it.

Five interviewees pursued and subsequently received a Delta Program certificate. Other types of Delta professional development beyond courses included attending Delta events or participating in more administrative activities, including the Delta Program diversity committee.

3.3.5.2 Teaching Experiences and Training

Formal teaching experience was the second most common type of teaching development in which interviewees engaged. Teaching assistantships (TAs) offered the most prevalent avenue through which interviewees engaged in formal teaching experiences. Specifically, more than 55% of interviewees held TAs during their graduate or post-doctoral work. In addition, thirty-eight of the 55 mentions regarding formal classroom teaching (almost 70%) related to these semester-long experiences. In some cases (11), interviewees who were TAs did not lead courses themselves but instead assisted a professor by leading discussion sections and/or labs and by grading. A nearly equal number (12) were responsible for course delivery in addition to administrative tasks like grading and working one-on-one with students. The amount of TAing interviewees did ranged from one semester to more than 6 semesters.

Preparation for these TA experiences also varied greatly. While 16 interviewees discussed training, two mentioned that they were not trained before beginning their TA. In addition, even among those who received training, the preparation was not consistent. Most of the training mentioned lasted for one-half to one full day. Only two interviewees who discussed training experienced weeklong orientations.

Beyond TAing, ten interviewees had teaching experiences in which they were responsible for delivering course content. Half of these were through guest lecture opportunities but three interviewees held lecturer positions in which they delivered full courses either during the semester or over the summer.

Finally, seven interviewees had leadership roles in which they helped develop and implement trainings for others who sought teaching development. Most of these (5) were involved in TA training either as a coordinator or a presenter, which (in some cases) led to other moments of leadership recognition—

I helped coordinate TA training in [a UW-Madison science] department...I was awarded...the College of Letters and Science teaching fellow. In which I had to give workshops. I think I gave more workshops than I took. Now that I think about it...I also helped with [another UW-Madison department's] TA workshops. And gave one of those.

Other instruction experiences included leading Delta Program trainings and working with K-12 teachers.

3.3.5.3 Course Offerings

Courses were the third most common type of teaching development interviewees experienced. Most of these courses (35) were offered through the Delta Program. The most popular Delta courses were *The College Classroom* (10), *Effective Teaching with Technology* (8), and *Instructional Material Development* (8). Twelve of these courses were associated with Delta programming that offered weekly engagement with special topics related to teaching and learning. These affiliated courses included *Research Mentor Training* (4), the Internship Program prerequisite course (4), *Expeditions in Learning* (3), and *Creating a Collaborative Learning Environment* (1). One interviewee described her experiences with Delta course—

The courses...there's a lot but...one that really stands out was the one that we took while we were doing the internship where we all met and talked about our projects and...that was helpful because at that time that I took that course, I was still in the beginning stages of developing my project, so having other people's opinions on how to develop it was really helpful...then there was the college classroom course, I loved that one.

Departments and other academic units offered the other teaching development courses interviewees mentioned. These included the College of Letters and Science, Educational Policy Studies, Zoology, Plant Pathology, Psychology, and Chemistry.

3.3.5.4 Learning about Teaching Beyond the Classroom

Just as teaching involves more than formal classroom experiences, so, too, did interviewees' teaching development experiences include more than professional development related to the classroom. There were 25 mentions of mentoring and educational outreach opportunities in which interviewees engaged. Some interviewees took courses related to mentoring and internships, both of which are informal teaching experiences.

In addition, interviewees experienced teaching development related to these informal experiences that was itself informal. Fourteen interviewees mentored undergraduate or graduate students during their graduate or post-doctoral work at UW-Madison. One interviewee related that he discovered that mentoring is not only a form of teaching but that it also plays an important role in knowledge construction—

I definitely saw those [mentoring] experiences as teaching-related experiences also. And those were very important for me to realize that these kinds of interactions are the way knowledge is produced. And that knowledge can't just be made sitting in isolation. And that these kind of face to face interactions these interactions where even though there's a teaching mentor mentee relationship here it's more complicated than that. And that the so-called mentee is not acting as a file but co-constructing this knowledge that we're making. And that's extremely crucial to the survival of not only research careers but departments, programs, and the actual institution.

Beyond mentoring students who worked in the lab with them or tutoring other students on campus, some interviewees mentored community members through structured programs like the Wisconsin Youth Apprenticeship Program in Biotechnology (administered by the Wisconsin Department of Workforce Development) that engages high school juniors and seniors in a specialized curriculum and in a lab- or industry-based apprenticeship. While describing the Youth Apprenticeship program, one interviewee captured the long-term impact that the program had on her and on the student she mentored—

[Through this program, high school students] can get an experience in science and decide whether or not that's something that they wanted to participate in when they go on for college...I had a high school student who worked for me for two and a half years through that program. And it was a really great experience again for me, as basically a mentorship program, where she came in with me, and she had no experience, she was a high school student, and got to learn all the different techniques that we were using...And she worked for me for quite a long time, and basically toward the end she pretty much knew almost all the techniques that I knew how to do. I still keep in touch with her, she went to school [outside Wisconsin], and I believe the last time I talked to her she was looking at going to graduate school for [a specialty in life science].

Eleven interviewees also participated in teaching development focused on informal science education or educational outreach that helped participants communicate their research to a range of audiences, including the general public. Two interviewees created their own teaching development opportunities by starting an outreach-focused organization or by volunteering in the community. One interviewee captured the value of these informal educational opportunities—

A lot of the training I got was informal in the sense that I started a group [for biology outreach]. That's still ongoing on campus. So basically I worked with people at Biotech, which is an educational outreach group at the biotechnology center. And I got a lot of training from the head of that. And so I learned how to kind of communicate with the public about science topics. And then we set up hands-on activities around the state. So that was something that was sort of

informal. But I feel like I received a lot of training from that.

Four other interviewees were connected to formal science outreach organizations including the Bio-Trek Science Outreach Program (1) and Biocore (3)—both through UW-Madison.

3.3.6 Additional Teaching Development Exposure

In addition to the more formal or explicitly teaching-focused programs and organizations outlined above, interviewees also engaged in other forms of teaching development. Several took advantage of formal opportunities to design teaching-related learning opportunities for themselves: three minored in education, two secured teaching-focused post-doctoral fellowships, and one participated in a one-off program in which participants explored teaching for inclusivity. Others were able to gain teaching development through experiences that were not formally intended as such. For example, five discussed the role of peer mentorship in their teaching development experiences. One interviewee described one such experience that resulted in the creation of a tool that was shared throughout her department—

It wasn't exactly training but the grad students within [my science] department we all, it was after that first course on effective teaching strategies or whatever it's called. A few of us took it together and afterwards we decided we really don't need to all reinvent the wheel. When we TA for that intro course and we end up teaching 6 sections a week, so it's a lot of work. And until then we all created our own [course] plan... We decided to create a website... where we put all our lesson plans... [and] materials so [others] could just go to the website and think of whatever topic they wanted to do and then see if something already existed for it.

Also, while it may not have been an explicit part of any program in which they participated, these interviewees discussed the importance of the modeling peers offered and the value of being able to discuss teaching with others who were similarly invested. Other interviewees (3) found that their project assistantships or research assistantships also offered opportunities to build teaching-related skills even though this was not the focus of these arrangements.

3.3.7 Summary

While the Delta Program was the most common teaching development program provider that participants experienced, many interviewees were involved in both Delta and non-Delta-sponsored teaching development opportunities. In fact, most participants (57%) had a mixed teaching development profile that included activities offered through the Delta Program as well as through other teaching development program providers. Other teaching development experiences included those offered by UW-Madison programs other than Delta as well as those accessed through professional organizations, associations, and/or conferences. The HHMI (Howard Hughes Medical Institute) Teaching Fellows Program was a common external teaching development experience.

Based on the amount of time interviewees invested in their teaching development experiences, most (72%) had a “high” level of engagement, meaning that they invested more than 60 hours—typically in the form of several courses or internships, completion of the Delta Program certificate, or more than four semesters as a Teaching Assistant or lecturer. High engagement with Delta or non-Delta teaching development activities or programs was more common than high engagement with practical teaching experience.

The most common type of teaching development in which interviewees engaged was Delta’s non-course offerings, which includes brown bags, round table dinners, internships, and other program-sponsored events. This was followed in frequency by formal teaching experience (e.g. Teaching assistantships, acting as a course instructor or guest lecturer, or leading teaching-related trainings) and participation in teaching development courses, most of which were offered through the Delta Program.

Did teaching development meet respondents' expectations?

How would respondents rate their teaching development experiences?

What programs were most significant?

3.4 Expectations, Satisfaction, and Significance

Though our research questions did not specifically address respondent satisfaction with their teaching development experiences, we thought this a good point at which to take a barometer of whether or not respondents' expectations for teaching development were met, which program experiences they thought most significant, and, ultimately, how satisfied they were with their overall teaching development experiences. Though it had been several years since most of the respondents we interviewed had been involved in teaching development at UW-Madison, the majority still were able to speak specifically to what teaching development activities or experiences had been most beneficial to them and why. In this section, we explore respondents' answers to these questions.

3.4.1 Expectations Met

We asked our respondents about their expectations for teaching development. After asking what their expectations were for becoming involved in teaching development, we next asked respondents whether or not their experiences had met those expectations. Of the 56 who directly answered the question, 10 respondents (18%) said that their teaching development experiences had *exceeded* their expectations, 39 (70%) said their experience had met their expectations, and 4 respondents (7%) said their programs did not meet their expectations.

Those who said teaching development exceeded their expectations said they were not anticipating learning as much as they did about teaching, either conceptually or behaviorally. "I had never heard of a teaching portfolio, or having a teaching statement," one respondent answered. "I didn't know that we were going to be able to lecture and have it videotaped...I found that to be really valuable...it exceeded expectations, and it really kind of put it more into a framework of what you can learn for teaching, and how that can benefit you." For many, what had been a quick decision to participate in teaching development had had a much more significant influence than they could have expected at the time. As one respondent noted, "I certainly never thought, what was it, seven years on I'd be talking about my program and still using really the tools from it."

Former students who said the program met their expectations went into teaching development with a certain set of goals and, usually, met those goals. "I went in wanting to gain a better understanding of how to teach to a diverse general audience, and I think I definitely learned that and more," one respondent said. Touching on a point others mentioned, this respondent spoke of the sometimes vague motivations and expectations that he said guided his participation and, later, colored his view of the benefits of that participation. "You know, going into it, you never really know if there's going to be any real major things that you learn that you just didn't even think about...but I think there definitely were some things that weren't on my radar that I learned about and realized how useful they would be."

The respondents who said teaching development did not meet their expectations said that there was not enough actual classroom teaching practice or that their expectations were simply too high going into teaching development. Some of those who equivocated on the question said they had "very limited" or "no" expectations going into teaching development, and therefore could not confidently speak to whether or not their expectations were met.

3.4.2 Satisfaction with Teaching Development

To gauge each interviewee’s satisfaction with their overall teaching development experience, we asked respondents to rate their teaching development satisfaction on a scale from 1 to 5, 1 being “no help whatsoever” and 5 being “extremely valuable”. **The average rating for the 64 respondents who answered the question was 4.28 out of 5.** Though variable sample sizes for teaching development dosage, involvement, discipline, and point in career categories do not allow for anything approximating statistically significant findings, we have broken down these satisfaction ratings nonetheless for the curious.

Table 3.4.1: Satisfaction Average by Overall Teaching Development Dosage

Teaching Development Dosage	<i>n</i>	Average Rating
Low	4	3.80
Medium	10	4.05
High	50	4.37

Table 3.4.2: Satisfaction Average by Type of Teaching Development Involvement

Teaching Development Involvement	<i>n</i>	Average Rating
Delta Only	5	3.20
Mixed – Delta and other teaching development	39	4.05
No Delta – Other teaching development only	20	4.28

Table 3.4.3: Satisfaction Average by Discipline

Discipline	<i>n</i>	Average Rating
Biological Sciences	32	3.96
Engineering	11	4.09
Mathematics	4	4.38
Physics	17	4.47

Table 3.4.4: Satisfaction Average by Point-in-Career Starting Study

Point in Career	<i>n</i>	Average Rating
Early Doctoral	13	4.29
Mid Doctoral	14	4.29
Late Doctoral	25	4.46
Postdoctoral	12	3.88

Respondents’ explanations for their satisfaction rating varied considerably. Ten respondents said that their teaching development programs were, in their words, “comprehensive”, “useful”, or had “utility” that had helped them prepare for and know what you expect in classroom work, the professoriate, or academia in general. **In many cases, this kind of satisfaction was tied to whether or not**

they had been able to put their learning into practice professionally and with confidence. “Everything I’ve done,” one respondent who is currently a tenure-track faculty member remarked, “has allowed me to get over those initial learning curves that typical assistant professors need to get over. And so when I compare myself to my younger colleagues, you know, I’m way more comfortable than they are.” Another respondent, who is mentoring STEM undergraduates in her laboratory, said she learned “how it works” through her experiences in teaching development – and wanted to teach anyway. “Everything was at the very least a good experience,” she said. “To understand what the reality of teaching is, what the reality of students these days are...the mentorship in particular helped me. It’s a useful skill. If you can’t mentor – if you can’t mentor people in your laboratory you’re not ever gonna get anything done.”

Linked to the idea of teaching development’s perceived utility to participants was their satisfaction with the actual strategies, skills, techniques, and behaviors they were taught that they could put into practice to be better educators. Thirteen respondents mentioned this as an explanation for their satisfaction with teaching development at UW-Madison. “It really got me thinking...you know, if you’re going to lecture, like what is the purpose of the lecture?” one respondent asked. “How do you design a lecture that’s gonna be really effective at getting across what you wanna get across?” One respondent, who is currently teaching, signed up for teaching development because she wanted to improve her skills in the classroom. “The fact that the students are scoring me highly on these evaluations makes me think it paid off,” she said. “I don’t think I’d be getting the same types of scores if I hadn’t done the Delta class.” Along with behaviors, 11 **respondents said they were satisfied with their experiences because of the theoretical and philosophical gains they made through teaching development**, including learning the importance of having instructional goals and objectives, the diversity of backgrounds and learning styles in classrooms, and of having a teaching philosophy.

Eleven respondents also linked their satisfaction with UW-Madison’s teaching development programs to “pride” – pride in community, place, and the opportunities the university had to offer STEM trainees in education. “I think Madison is at the forefront of education in helping graduate students transition from like undergrads to actually becoming professors,” one respondent said. “And part of that is actually learning how to teach, and the fact that UW put importance on that...I’m pretty proud of having graduated from a university that has been at the forefront of this.” The teaching development emphasis on education, these participants said, was an important factor in their wanting to learn more about the practice, and to possibly carry their knowledge on to other universities and colleges. These reasons, coupled with career opportunities that were opened up by skill enhancement, networking, and collaboration with other students or faculty, generally increased satisfaction with teaching development.

Still, even some respondents who scored their teaching development experiences well mentioned drawbacks. Nine respondents said that they were not as satisfied with their teaching development experience because they did not consider it useful, either because they were not able to actually teach in a classroom or because their teaching development activities did not expose them to new information. Furthermore, 5 respondents said they were not as satisfied with their teaching development experience because they currently are not teaching, while 2 respondents said that teaching development at UW-Madison seemed to aim their programming towards “disciples”, or those who had already bought into the underlying philosophy, especially concerning “teaching as research”. Two other students said that they would have liked more support after their programming was finished to help them transition into a career, while a few others said that the programs were not extremely helpful in small doses.

3.4.3 Significant Teaching Development Programs

To further gauge what teaching development activities respondents felt most met their needs, we asked interviewees which, in particular, were most significant to them and why. Eight teaching

development activities came up multiple times. Eight respondents said that their TAing experiences were the most significant for them, with 8 respondents saying that a specific course, Delta's "College Classroom," was most significant. Eight respondents said that their experience with the Howard Hughes Medical Institute (HHMI) fellowship was most significant. Four respondents said independent mentoring experiences they had during their doctoral studies were most significant and 2 respondents each mentioned "Teaching Biology" and K-Through-Infinity (KTI).

The programs that were considered most significant by respondents were those that allowed for actual, "independent" teaching practice in the classroom. Eighteen respondents mentioned this as a reason why they considered one program more significant than another. "The actual teaching experience was the most significant, the most rewarding," one respondent said. "It was the thing that, more than anything else, gives you the ability to see if the techniques you want to use are viable, if you have a good way to evaluate if you're effective, knowing that the things that you're trying are effective. That was most rewarding for me." It was actually being in charge, many said, that most influenced their development as educators and their own skills in teaching. "I was actually in front of students and sort of held accountable by them," another mentioned. "So I had to actually come up with things for them...it was practicing doing those things, or practicing being engaged with students." Many compared the experience, as fruitful as it was, to baptism by fire. "Everything else added a lot of value," one participant said, "but nothing compared to the TA experience when it came to exposure to students...sort of thrown in the fire."

Once again, perceived **usefulness was a reason many interviewees rated programs as significant.** Eight respondents, speaking to this point, listed programs as "most significant" because they believed the programs had had a direct impact on their teaching through the methods they learned, a greater self-confidence in educational situations, and through the ability to find resources that could improve their teaching in the future. Six participants called programs "most significant" because of a specific mentor's involvement, while 4 respondents each spoke to transformative cognitive changes as well as collaborative and work opportunities offered that made certain programs stand out.

3.4.4 Summary

An overwhelming majority of respondents (88%) reported that their teaching development met their expectations, with 18% of those believing that teaching development *exceeded* their expectations for the programs when they signed up. Many of the respondents in the latter category said they were not anticipating learning as much as they did about teaching, either conceptually or behaviorally. Those who said their expectations were met usually referenced specific learning goals they had set before taking part in teaching development that were met as a result of participation. Those who said teaching development did not meet their expectations critiqued the programs for not offering enough actual classroom teaching experience.

Respondents who rated their teaching development satisfaction on a scale from 1 to 5, with 1 being "no help whatsoever" and 5 being "extremely valuable", gave their teaching development experiences an average of 4.28 out of 5, and those with higher dosage levels generally rated their overall experience higher. Respondents said that their teaching development programs were, in their words, "comprehensive", "useful", or had "utility" that had helped them prepare for and know what you expect in classroom work, the professoriate, or academia in general. In many cases, this kind of satisfaction was tied to whether or not they had been able to put their learning into practice professionally and with confidence.

Linked to the idea of teaching development's perceived utility to participants was their satisfaction with the actual strategies, skills, techniques, and behaviors they were taught that they could put into practice to be better educators. Along with behaviors, respondents said they were satisfied with their experiences because of the theoretical and philosophical gains they made through teaching development

as well as the sense of “community”, “solidarity”, and “pride” in teaching that came from involvement in the STEM-focused teaching development community. Specific programs that were considered most significant by respondents were those that allowed for actual, independent teaching practice in the classroom. Again, utility was key to significance and, ultimately, satisfaction.

Did respondents gain from involvement in social networks and intellectual community?

3.5 Social Gains

Respondents were asked a series of questions during telephone interviews designed to link their teaching development activities at the University of Wisconsin-Madison to perceived gains in terms of social networks and membership in an intellectual community or communities (social gains), practices or behaviors (behavioral gains), skills, attitudes, values, and priorities (affective gains), and in knowledge and information (cognitive gains). Their responses tell us a great deal not only about which learning concepts, skills, or behaviors rose above others, but what program facets participants still consider valuable years after their programs have ended.

To get at respondents’ perception of the social gains they received from their involvement in teaching development at UW-Madison, including gains attributed to social networks, intellectual communities, and collaborative associations with other educators, we asked each respondent the following question: “Did you benefit from any kind of a shared learning environment among your fellow participants, the program staff, or other professional contacts that were involved in teaching development activities and, if so, what would you say you gained?”

All but 6 respondents answered that they had indeed benefited from the social environment fostered by teaching development participants and staff, and for a variety of reasons. Most of their answers fit into three broad categories of responses: “Different Disciplines, Shared Passion”, the theme discussed by a majority of respondents, as well as “Networks and Collaboration” and “Mutual Support”.

3.5.1 Different Disciplines, Shared Passion

By far the largest group of respondents attributed social gains from teaching development to exposure to students and faculty with different backgrounds, experiences, and perspectives. These relationships, respondents noted, granted them access to perspectives to which they would not have come into contact under the normal, discipline-specific circumstances of graduate school. Thirty-three respondents, more than half of those who answered the question, mentioned this attribute of teaching development specifically when speaking to social gains.

Indeed, many felt the benefits of this kind of exposure were extraordinary. “I thought it was great that the program I was in people were from all different departments across the entire university,” one respondent noted. “I mean, usually you’re cooped up with people of your own kind...when do you really go get to meet somebody who’s in a completely different – like doing history or geography?” He went on, “And this gave me a chance to see that, you know what, the same problems I have with teaching they also have with teaching...you can learn from other fields, and they can learn from you as well.” Respondents said they had much to learn from students and faculty from different departments, and that the “common thread” of teaching helped them bridge disciplinary divides. “Everyone has such different backgrounds and can bring different pieces of knowledge,” a former participant said. “We all may need to read something and each person has a different perspective on it. So I think it was a really important factor in having a community.”

One respondent said this social contact, across campus, was an important part of the teaching development learning experience – even if it might have been distressing at times. “I got to meet people on campus that – from different departments – I never would have crossed their path otherwise,” she said. “From that I was exposed to ideas that I felt uncomfortable with and I wouldn’t have sought out on my own. And you know, at the time it can be kind of bitter medicine, but it’s definitely good medicine.” Another said **the inter-disciplinary makeup of the community forced one to take a wider view**. “You could see the common themes that need to be taught with any course, and so then you’re able to think,” she said, “in not so much of a silo effect.” Whether it was in sharing stories, anecdotes, or different approaches to teaching across different fields and sets of experiences, in venting to one another about common mishaps in classrooms across campus, or in gaining access to students and faculty with a wider breadth of teaching-related knowledge and experience, respondents recognized this exposure to a diverse community of educators as an important gain from their teaching development activities.

The “common thread” of teaching development that connected disparate disciplines and academic units from across the UW-Madison campus necessarily brought people together who shared one common interest above all: a strong enthusiasm for the practice of teaching. 15 respondents mentioned this shared enthusiasm as an inspiration to their continued development as educators. “I think that’s one of the biggest things that’s helped, you know, developing in that work, is people who are interested...that’s a key component,” one former participant confided. “Just having a chance to meet people who are interested in these types of topics...you don’t really have a chance, at least, I didn’t discuss them in the research lab. So it’s nice to have people you can talk to about these things.” Another respondent said it showed her that her individual priorities, thought they were different from her colleagues in the lab, were not necessarily unfounded. “Finding a group of like-minded people that valued teaching and talking about teaching reinforced that, and I hate to say it,” she said, “it’s okay to like teaching. I mean, that’s fine, you know? You don’t have to be the next big research start to make a contribution to science to have, you know, a successful career.”

According to respondents, **the shared bond of learning between researchers, students, and educators was made stronger still** because all recognized that, despite the importance of teaching to an institution of higher education, **theirs was an interest that was not shared in many quarters of the university. For many STEM doctoral and postdoctoral students, teaching development represented a unique opportunity to escape, albeit briefly, the “silo” of the research laboratory** where, in many cases, interest in teaching was nonexistent. “In my lab,” one respondent said, “nobody was really interested in teaching. Most people sort of aspired to a job where they...hafta teach as little as possible. So I felt it was very valuable to actually meet other people who are excited about teaching and then, you know, just discussing ideas about teaching and hearing about their experiences.”

Another respondent agreed. “Being in a lab can be fairly isolating, especially if you want to go beyond a particular technique, or the technical,” he said. “These programs are at least one way of putting the potential questions on the table...a way to commiserate, kind of have somebody, or several somebodies, who are at a similar or one step beyond where I’m at. And they can help me think about what my next step should be.” It was an important point. “You can’t learn to teach in a box,” he said. As another former participant, seemingly agreeing with the point, said, “I think most of my growth as a teacher and mentor has come from that shared learning experience.”

3.5.2 Networks and Collaboration

When asked what social gains they might have made, 18 respondents answered by referring to **specific social networks that they had developed through their teaching development experiences**. Whether these contacts led to simple collaborative opportunities on campus, chances to get a behind-the-scenes look at the faculty life, ways to bounce ideas off another person or persons, conference presentation

or associational membership, employment leads, or actual job offers, **many of these respondents saw networking as the main social gain that came from their teaching development.** 8 respondents said they still maintained contact with students or faculty from their teaching development experiences, while 6 respondents said their contacts from teaching development had helped them in their job search.

While a handful of respondents had stories featuring teaching development contacts leading them directly to job opportunities, a larger number spoke of **implicit benefits that came from their access to the teaching development community at UW-Madison.** One respondent, for example, said that networking at various teaching development events played an influential role in his decision to pursue a faculty career. **“The networking opportunities were off the charts,”** this participant said of his teaching development programs. “It was priceless to see faculty members interacting with each other behind closed doors...it was also a huge shot in the arm in terms of me feeling like this was a job trajectory I could do, where the people who would be, frankly, on the search committees thought I could do it.” Others talked about the confidence that came with sharing work, ideas, and solutions to problems with fellow teaching development participants and faculty. “People were using a lot of my ideas” from small discussion groups, one respondent noted, “so that made me very confident in terms of like, okay, I’m on the right track here.”

As these quotes make clear, **networking also inherently led to opportunities to collaborate.** Thirteen respondents specifically mentioned research or other collaborative work opportunities that had arisen from contacts they made through learning communities attached to various teaching development experiences. These opportunities encompassed everything from informally helping other students with their resumes and teaching statements, to working with a team of fellow TAs on learning material development, to co-publishing research papers with STEM faculty members. **Throughout, the feedback and sounding board provided by fellow community members, many of these respondents said, was invaluable.**

3.5.3 Mutual Support

Tying closely to the issue of collaboration, shared values and experiences, and the common bond of teaching between teaching development participants and mentors was the idea that **learning communities also offered doctoral and postdoctoral students a strong, and necessary, support network.** This support network gave them more strength and confidence, some said, than they might have otherwise had.

Fifteen respondents mentioned this community of support in various ways. “That’s one of the things about working in a group: it gives you a better idea of what other people are going through too,” one respondent said. “That always gives you more confidence when you realize that other people have the same issues that you do.” One respondent talked about a group of fellow students with whom she was involved in teaching development. They later took on a massive, and high pressure, project together. “As a group,” she said, “we really sort of helped each other along through that class and learned from each other, because we were all sort of presented with the same issue of, you know, we’re graduate students and we’re trying to prepare two week’s worth of materials...but you know, our challenges were the same, you know?” Like several other respondents, she believed that meeting challenges brought people closer together. As one former participant said, “I think there’s always something to be gained in solidarity...knowing that I was not the only person who was interested in strengthening my teaching.” Feedback from interested peers, he added, only strengthened this bond. “I think that that...was very valuable to get that kind of feedback from people who were open to sharing it and also interested like you were, so, you know...you had that sort of sense of solidarity and that sense that you weren’t alone.”

Still, for others, the benefits that came from the teaching development community or communities that they had become a part of during their doctoral or postdoctoral training were more difficult to pin down, as were the influences of these gains on their current mindset. One respondent, in describing what

she thought she had gained from her experiences, seemingly summer up this feeling. “I think a lot of it wasn’t necessarily so much like practical things where I can point to one specific thing I did and say, ‘Oh that helps me now in this one specific way,’” she said. “I think it’s not so much like that as it is more – more intangible things...just sort of the culture maybe of being around these people that were interested in teaching and doing these activities.” She added, “I’m sure like the way I think is kind of affected by that and still affects how I teach today, but it’s not necessarily something I can point to as much as it’s just from being around people.”

3.5.4 Summary

All but a handful of respondents answered that they had benefited from the social environment fostered by teaching development participants and staff, and for a variety of reasons. Most of their answers fit into three broad categories of responses.

The most common responses attributed social gains from teaching development to exposure to students and faculty with different backgrounds, experiences, and perspectives. These relationships, respondents noted, granted them access to perspectives to which they would not have come into contact under the normal, discipline-specific circumstances of graduate school. A second, slightly-less common responses referred to specific social networks that they had developed through their teaching development experiences. Many of these respondents saw networking as the main social gain that came from their teaching development. A third theme of responses centered on the idea that learning communities offered doctoral and postdoctoral students a strong, and necessary, support network. This support network gave them more strength and confidence, some said, than they might have otherwise had. Shared challenges, feedback, and collaborative learning brought members of the community closer together and helped stoke an interest and excitement for teaching.

What skills, practices, and behaviors did participants gain?

3.6. Behavioral Gains

Another important aspect of learning researchers hoped to elicit from respondent interviews were their perceptions of the behavioral knowledge they gained from their involvement in teaching development at UW-Madison, including which skills and practices they thought were most important to their development as educators. In response to the question, “What, if anything, did you learn to do or create as a result of your participation in teaching development programs?” all but 4 respondents answered in the affirmative that they had gained important skills, practices, and behaviors from their teaching development experiences. Their answers fit into three categories of tools: “Tools for Engaging Students”, “Tools for Meeting Objectives”, and “Tools for Communicating a Teaching Philosophy”. As we’ll see, a number of these skills and behaviors linked directly to cognitive gains respondents thought were most useful.

3.6.1 Tools for Engaging Students

Twenty-six participants responded to the question of what, if any, important behavioral skills they took from their teaching development by referring to **specific techniques, tools, and methods they learned to engage students in the STEM classroom**. This was the most popular category of responses to our behavioral question, and though it tracks closely to the *conceptual* gains respondents reported in regarding the importance of engaging students in the classroom, participants pointed to *specific behaviors* in answer to this question that helped them actually apply *broader concepts*.

For example, one student mentioned repetition as a tool for helping students engage, and learn, important concepts in the classroom. “Another thing I learned...that I use every day is reiteration. So putting out a concept once, if it’s something that’s really key or important, you probably want to have a summary repeated again and again,” she said. “These little details of things maybe I’d never thought about before, it really made me sit down and think about I’m presenting my information. And that I found to be extremely valuable.” One participant talked of other important techniques he took from his teaching development activities. “I learned about think-pair-share, jigsaw activities... [and a] micro-teaching thing evolved into a weekly activity that I do in one of my classes now” he said. Another said that she picked up tools that helped her develop appropriate discussion questions. “You know, like how to write a question that can be engaging in a big group...that you have to discuss with your neighbor a little bit. Or, you know, an open-ended question to give at the end of the lecture to start with on the following day.” One respondent said that he remembered a number of little “tricks” from his teaching development. “A lot of times if I’m doing a lecture I’ll stop in the middle and do some little question exercise,” he said. “I don’t do constant lecturing.” Another said that one of his teaching development courses “had a short feature on one to five minute exercises and activities that can be used in the classroom.” It was very helpful, he said. “I think in terms of the direct practical technique that was one of the- the things that stuck with me the most.”

Of the participants who responded in this way, 20 individuals pointed specifically to **lesson plan and syllabus design techniques they had learned that would engage their students and foster a more dynamic learning environment in their classroom**. “We had projects,” one respondent remembered, “where you had to basically create a lesson plan for a day and then ultimately...give a lecture.” The exercise was significant, he said, as it showed him, through practice, what he would need to do to be an effective teacher. “There was sort of a process that we went through, you know, almost a template.” Respondents mentioned a number of specific techniques, including learning material development (8 respondents), pair and group work design (7), question planning methods (5), the use of “clickers” in large classes (3), methods to tailor their teaching to a diversity of learning styles (3), various communication skills and techniques that could be used in a classroom context (3), as well as tools for creating an effective “learning community” (2), all practices which respondents also connected to broader concepts in engagement and active learning.

3.6.2 Tools for Meeting Objectives

Another category of frequently mentioned behavioral gains, “Tools for Meeting Objectives,” also connected closely to a key conceptual theme described earlier: “Design, Organization, and Management”. In the view of many respondents, this was a key concept that showed the importance of linking classroom design, organization, and management to specific learning goals. In what could be seen as a direct behavioral facet of this conceptual theme, 18 respondents reported that their teaching development activities gave them *techniques* and *tools* for thoughtfully designing, organizing, implementing, and concluding such a strategic vision in the classroom. As distinct from a strictly conceptual understanding of the importance of such tools to student learning, these respondents reported that their teaching development programs actually gave them the skills necessary to carry out such a plan.

A number of respondents believed this to be the biggest strength of their teaching development experiences at UW-Madison. “Having an objective, you know, and being able to clearly execute, and, you know, teach the students your objectives,” one respondent said, reflecting this point. “Then, you know, having a sort of conclusion, and making sure your objectives are met.” Another participant, who took part in outreach activities as a doctoral student, agreed. “I got a lot of practical experience there both designing activities, implementing them, and eventually teaching others to implement them,” she said. “I think that has helped my teaching ability quite a bit.”

In many cases, these practical skills, in turn, reinforced the more philosophical and conceptual knowledge participants were getting through teaching development. “It is making a syllabus that is more than just ‘Here are the topics in each day,’” said one participant who is currently a tenure-track faculty member. “It is also thinking about the course objective and learning goals,” she said, and developing an *actual, real* plan from those goals and objectives. One respondent, who had already taught a number of semesters before taking a teaching development course, said that the course actually helped her learn why she was using the techniques she was using, and how to refine them for continued use. “I was doing it, but I didn’t know why I was doing it,” she said. “I became more consciously competent...these courses helped me know what I was doing and why those things were important and how they helped the students improve their learning.”

Respondents mentioned a number of specific techniques and tools they learned in teaching development that they believed better helped them meet strategic learning objectives. 15 participants said **formal and summative assessment, through mini-quizzes, evaluations, and other tools, was an important skill they had picked up in teaching development, and crucial to the process of continual self-reflection an instructor should employ through her or his courses.** 11 respondents mentioned techniques for developing grading rubrics, while 8 talked to the formal process for building daily lesson plans and activities. 5 participants answered that the ability to find and incorporate scholarly literature on teaching and learning into their teaching was an important tool they had gotten from teaching development, while 5 mentioned specific leadership, management, and organizational techniques which could help them meet specific instructional goals.

3.6.3 Tools for Communicating a Teaching Philosophy

The third and final category of behavioral gains that respondents reported revolved around **one tool in particular, a “teaching statement” or “teaching philosophy”**, which several teaching development programs at UW-Madison make an essential part of their curriculum for training future faculty. 17 respondents said that they **learned a great deal from activities that made them think about their personal teaching objectives, philosophy, and goals and, most importantly in relation to behavioral gains, communicate these objectives, philosophies, and goals to others.** While the majority of respondents reported written teaching statements, portfolios, scrapbooks, and artifacts, a few mentioned that their teaching development experiences helped them communicate ideas verbally as well. Again, respondents reported this behavioral gain separately, in many cases, from the *conceptual* gain many mentioned they attributed to their teaching development experience regarding the importance of thinking through their teaching goals and objectives. As one respondent put it, the skill itself was important to the concept. “In a sense it put down my teaching goals in writing,” he said. “And whenever you put it down in writing it usually kinda helps organize your thoughts.” Another communicated much the same thoughts. “One of the workshops was creating a teaching statement,” he said, “and that was useful because it actually helps you...sort of organizing your thoughts on how you want to teach.” Communicating the results of this conceptual process, another said, was crucial to his practice as a teacher. “I improved my ability,” he said, “to both reflect on my own practice and...incorporate that into my own practice.”

While learning to formulate and communicate what might have at first been vague, imprecise notions of what was most important to them as educators, respondents also were able to develop a tool that would help them in their job search. A few respondents mentioned that the formulation and communication abilities they learned in teaching development were useful as they gave job talks and presentation on their own research, while 5 respondents mentioned the development of “teaching portfolios” as important skills they learned from their teaching development. “A teaching portfolio was something I had never heard of before I had taken that class,” one participant said. “Different examples of...how you are as a teacher...basically the different experiences that you have...almost like a scrapbook, rather than just having a resume.” He added, “That was pretty informative.”

3.6.4 Summary

Respondents reported gaining important skills, practices, and behaviors from their teaching development experiences that fit into three categories of tools: “Tools for Engaging Students”, “Tools for Meeting Objectives”, and “Tools for Communicating a Teaching Philosophy”.

The largest number of participants referred to specific techniques, tools, and methods they learned to engage students in the STEM classroom, usually *specific behaviors* that helped them actually apply *broader concepts*. Of the participants who responded in this way, a high percentage pointed specifically to lesson plan and syllabus design techniques they had learned that would engage their students and foster a more dynamic learning environment in their classroom.

Respondents also reported that their teaching development activities gave them *techniques* and *tools* for thoughtfully designing, organizing, implementing, and concluding important strategic objectives in the classroom. Respondents mentioned a number of specific techniques and tools, though formal and summative assessment was mentioned most frequently not only as an important skill they had picked up in teaching development, but as one that was crucial to the process of continual self-reflection an instructor should employ through her or his courses.

The third and final category of behavioral gains that respondents reported revolved around one tool in particular, a “teaching statement” or “teaching philosophy”. Respondents said that they learned a great deal from activities that made them think about their personal teaching objectives, philosophy, and goals and, most importantly in relation to behavioral gains, how to communicate these objectives, philosophies, and goals to others.

Did teaching development affect participants' attitudes, values, and priorities?

3.7. Affective Gains

Changed attitudes, values, and priorities connected to respondents' prospective roles as educators were another category of gains our research believed would speak well to how students could benefit from teaching development. The researchers therefore asked the following question of interview participants: “Did your teaching development program experiences change how you think about teaching and, if so, how?”

Of the 65 respondents who answered the question, 52 (80%) said that teaching development had changed the way they thought about teaching, while 13 said it had not changed the way they thought about teaching. Of those who answered that teaching development did not alter the way they thought about teaching, 5 respondents said their experiences “enriched” their work in important ways by offering explanations for concepts, techniques, and methods they were already utilizing in the classroom.

For those who answered in the affirmative, responses for how teaching development changed the way they thought and, more importantly, *felt* about and *valued* teaching fit into three broad categories, some of which overlap with one another as well as with reported conceptual gains, which are termed here “The Teaching Relationship”, “Preparation, Professionalism, Conceptual Complexity, and Respect”, and “The Possibility of Convergence”.

3.7.1 The Teaching Relationship

When respondents were asked about the affective gains that they believed resulted from their teaching development experiences, many responded said that they learned at a conceptual level, first, that there was teaching and learning theory that could inform their practice in the classroom and, second, that

this theory supported practices that did not necessarily subscribe to the version of education they had experienced in their schooling.

In affective terms, 27 respondents reported, this concept changed the way they valued teaching. As many of these participants said, teaching development opened their eyes to the fact that teaching is not necessarily a “one way” relationship which features an expert or teacher expounding for a group of non-experts or students. **Teaching can and, according to educational experts, many times *should*, be different than the kind they received as students, even though they had been “successful” students.** “It was very significant,” one participant said. “It completely changed my outlook on teaching, and I guess more importantly on how students learn. Because previously I had thought of teaching as me standing in front of a classroom and imparting my great wisdom on students.”

Others described the revelation in different terms. “I don’t consider myself a very dynamic public speaker, so I sort of thought of teaching as that,” one respondent answered. “You know, keeping students awake while you’re teaching them about glycolysis,” she said. “But after the program I sort of stepped back and I thought, well, it’s been shown that that’s not the best way to impart information or concepts, so I think I can do somethings too. I mean, I think I can make myself a good teacher.” As another respondent noted, “it showed me that there were ways to teach that were more consistent...with the way I approach the world than the ways of teaching that had modeled to me.”

Important to these kinds of affective changes were the concepts of active engagement, student-centered learning, and activity and lesson design upon which many teaching development programs at UW-Madison focus. Central to these lessons, respondents believed, was the importance of the mode, manner, design, and means through which teachers imparted important information to students. Every facet of a course was important. **The focal point of the teaching and learning relationship, which many respondents before had believed was necessarily on classroom instructors, should actually be on students.** It was a different perspective, but one that made sense to many who had been exploring the profession. As one participant noted, this idea “just changed the focus altogether. Like from the focus being on me to the focus being on the students...so many things branched off of that...that was really what made me re-think how I think about teaching people from their perspective instead of mine.”

Even as he pointed to its centrality to his change in feeling, one student joked about the traditional view of the teacher, and how it informed his teaching and learning-related values. “I really, truly had this vision of, you know, of this – of the term professor, right? It’s someone who professes. That to me is a profound word that says that I’m talking about something deeply meaningful to me, right?” He continued. “So I had images of people waxing poetic on topics that they thought had ultimate significance, like DNA,” he laughed. “Instead, what I learned is that while that may or may not have its place, the business of teaching is very different.”

3.7.2 Preparation, Professionalism, Conceptual Complexity, and Respect

Just as respondents noted the impact that student-centered teaching and learning theories had on the way they valued teaching practice, 26 different individuals pointed to concepts regarding teaching methodology, organization, design, and overall strategy as the impetus for affective gains through teaching development. Teaching, these respondents reported, was not as “simple” as it seemed. There were many “behind the scene” details, including hours of preparation, self-reflection, attention to scholarly research, and the execution of finely-tuned skills, that went into a successfully taught class. **Teaching that was well-done, respondents intimated, was just as systematic as any scientific research they carried out in the lab. Teaching development, in short, gave many respondents a different perspective on teaching: namely that it a professional activity that takes time, effort, and commitment and deserves respect.**

“What I learned,” one respondent said, “is that the people that are really good at [teaching] put a lot of time and effort into it.” Another student said she was surprised by how intricate teaching could be conceptually. Teaching development, she said, was her only chance to learn about the craft. “There’s an actual pedagogy to it. I know that seems strange, but from a lab rat like a science angle, where we’re not taking any education courses but we’re expected to go teach in the college classroom, [teaching development] is our only opportunity basically to take a class that has anything to do with teaching.” Another respondent underlined the idea. “It’s a hell of a lot tougher than it looks, to do it right,” he said. “I think it’s very easy to be ineffective, it takes a lot of work to be mediocre, but if you want to be good, excellent, outstanding, it’s a – I’m trying to think of a non-colorful phrase – it’s a calling. It’s a quest...being a truly outstanding educator is no BS, and it’s a full time and a half time job.”

The intricacies of the teaching process were only highlighted by the number of new concepts and techniques participants said they were exposed to in teaching development. **New ideas, concepts, and philosophies on teaching and learning served to change the way that they felt about the profession.** Nine respondents said learning about the diversity of learning styles students bring to the classroom changed the way they saw teaching, and a handful of respondents said the same regarding what they learned of the importance of creativity, self reflection and mid-course adaptation, learning objectives, assessment, and backwards design. Not only did exposure to these frameworks lead to a change in perception regarding teaching, but in many cases, respondent said, **it led to a richer and more nuanced understanding of teaching and learning - values that many were later able to utilize as educators.** “Teaching-related training programs,” one respondent said, “added more complex layers” to her teaching. “They enriched the learning experience.”

3.7.3 The Possibility of Convergence

Along with a newfound respect for the skill and tenacity needed to be a successful teacher, 10 respondents said that **the model set by faculty advisors involved in their teaching development experiences changed their attitude regarding teaching.** As many said, these mentors showed STEM doctoral and postdoctoral students that it was possible to both be a successful researcher and a successful teacher, positions which many in the past had considered (or been trained to consider) mutually exclusive.

As one respondent said, “If you cared about teaching when I was working on my graduate degree, that wasn’t something that you could talk about at all. That was something that had to be swept under the carpet...as far as I was concerned, at a major research institution, those people [who did both research and teaching] just didn’t exist.” Her arrival in Madison, and participation in the Delta program, however, changed her mind. “Then I got more involved in the Delta program and I learned about all these other professors on campus...that felt that their informal education and science outreach was equally as important as the ground-breaking research they were doing in their laboratories. That was a really important experience for me.”

Indeed, the possibility, and importance, of the nexus between research specialization and skills in teaching that many faculty members involved in the UW-Madison teaching development community personified **helped many participants come to a new understanding of STEM education.** Though teaching had been devalued in the sciences, one respondent noted, there was still time for the field to improve itself. “Everyone is learning and everybody is getting better,” she said, and this was important to acknowledge. It was also important to acknowledge, she added, that things would need to continue changing if future students were expected to carry the torch. “If you walk in [to a classroom] thinking you’re God’s gift to microbiology, and that your words are golden and that you don’t need to change,” she said, “you’re screwing yourself and you’re screwing the students.”

3.7.4 Summary

Respondents who reported teaching development had led to changed attitudes, values, and priorities connected to their roles as educators gave explanations that fit into three broad categories, termed here “Teaching Relationships”, “Preparation, Professionalism, Conceptual Complexity, and Respect”, and “The Possibility of Convergence”.

Participating in teaching development opened their eyes to the fact that teaching is not necessarily a “one way” relationship which features an expert or teacher expounding for a group of non-experts or students. They learned that their priority should be actively engaging students in the classroom. Important to this kind of affective change were the concepts of student-centered learning and activity and lesson design upon which many teaching development programs at UW-Madison focus.

Just as respondents noted the impact that student-centered teaching and learning theories had on the way they valued teaching practice, many also pointed to concepts regarding teaching methodology, organization, design, and overall strategy as the impetus for affective gains through teaching development. Teaching, these respondents reported, was not as “simple” as it seemed. There were many “behind the scene” details that went into a successfully taught class. Teaching that was well-done was just as systematic as any scientific research they carried out in the lab. Teaching development, in short, gave many respondents a different perspective on teaching: namely that it a professional activity that takes time, effort, and commitment and deserves respect.

Along with a newfound respect for the skill and tenacity needed to be a successful teacher, respondents said that the model set by faculty advisors involved in their teaching development experiences changed their attitude regarding teaching. These mentors showed STEM doctoral and postdoctoral students that it was possible to both be a successful researcher and a successful teacher, positions that many had considered (or had been trained to consider) to be mutually exclusive. Indeed, the possibility, and importance, of the nexus between research specialization and skills in teaching that many faculty members involved in the UW-Madison teaching development community personified helped many participants realize come to a new understanding of STEM education.

What knowledge and information did participants learn about?

3.8. Cognitive Gains

This section highlights one of the most significant areas of learning gains: those entailing concepts, knowledge, information, and ideas. All but 3 respondents answered in the affirmative that they perceived important cognitive gains from participating in teaching development at the UW-Madison. Their answers fit into four broad thematic categories, termed “Diversity of Perspectives”, “Importance of Engaged Learning”, “Connections Between Teaching and Research”, and “Design, Organization, and Management”. These concepts, as we will see, were important to behavioral and affective gains as well.

3.8.1 Diversity of Perspectives

The most common answer to the question of important cognitive gains centered on what respondents said was the concept of diversity in the classroom. In all, 23 respondents said that teaching development helped them learn that students bring a variety of learning styles, backgrounds, and perspectives into the classroom, and that a good educator takes this diversity of perspectives and styles into account when they teach.

Participants formulated this concept in different ways. “I think all of [my teaching development programs] touched on kind of diversity issues, which again was something I was vaguely aware of, but

hadn't really put a lot of thought into," one respondent said. "It was nice to really dig into the meaning of diversity, and different ways you might need to think about methods for teaching different students of different backgrounds, and then how different people interpret things differently." As another former participant explained in relation to diversity issues he was exposed to in teaching development, these concepts could have a transformative influence on how one viewed teaching. "You really need to think about when you're trying to prepare a lecture or prepare a course, to try and be as inclusive as possible. I think that was a big thing that came out of [my teaching development] experiences," she said. "I didn't think about the different learning styles before, and the fact that people that end up being teachers usually are people that are good at school...that doesn't necessarily translate to the majority of the students in the classroom." Another respondent added, "I think one of the biggest things was looking at your audience in its full diversity and understanding how best to help everyone learn. You need to take different strategies...in your way of teaching in order to address a diverse audience...I think that was one of the most important things [I learned]."

In tandem with this wider concept, many of these respondents said, was the idea that students had a variety of ethnic, philosophical, social, and historical "cultures" that influenced how they interacted with the teacher, subject matter, and how best they would learn in the classroom. Several of these respondents referred specifically to different dimensions of learning, including visual, auditory, and tactile, while others believed the conceptual importance of understanding different domestic and international cultural mannerisms and styles were most important. "Working with people that come from different cultures," one respondent noted, "and how the things that you say could be construed differently depending on the type of culture that the person is coming from...I never thought about that." A handful of participants also pointed out that diversity is a major asset in the learning environment that can be utilized to improve classroom learning and research.

3.8.2 The Importance of Engaged Learning

A slightly smaller but still significant number of respondents, 20 in all, said their teaching development programs taught them not only the importance of teaching and learning in the practice of science, but the importance of engaging students in active learning in the classroom as a teacher.

On a conceptual level, many respondents characterized this as a revelation that there was indeed teaching and learning theory that could inform their practice in the classroom, and that this theory supported practices that did not necessarily subscribe to the version of education participants had experienced in their schooling. As one respondent put it, "Active learning, you know? All my classes were lecture-based, so I had never experienced active learning as a student, and then sort of...reading about the research that says how active learning can be effective...that definitely was a new concept for me." One former participant, who believed that "active learning" had become an often-used but frequently misunderstood slogan for ascendant theories in teaching and learning, nevertheless noted its importance to his experience. "I hate to say," he said in answer to the question, but "just kind of like the catchphrase of 'active learning'...I have a better understanding of what that means and how to involve the students in classes instead of just lecturing them." In the words of several respondents, the idea that a teacher in STEM could be anything but the "sage on the stage" was new to them and an important influence on their thinking since their teaching development involvement. It was not simply the formal curriculum in workshops, courses, or training sessions that underlined this concept. Several respondents noted that the environment surrounding their teaching development at UW-Madison, with noted research professors and STEM faculty involved in and motivated by teaching and learning and a broader community of educators committed to undergraduate teaching, underlined this point.

To this broader notion, a number of respondents added that their teaching development brought to their attention scholarly research in education, particularly teaching and learning, that

they only vaguely knew existed before their experience. Respondents believed that their exposure to this theory reiterated the importance of the teaching process, the professionalism of the vocation, and the importance of knowledge and experience to an educator hoping to get through to his or her students. Concepts regarding describing complicated scientific or technical subjects to lay people, working with and building relationships with students to facilitate learning, and becoming familiar with theories and discourses surrounding education and education research all came up multiple times in interviews.

3.8.3 Connections between Teaching and Research

Another important conceptual gain respondents reported from their teaching development experiences was the idea that **the teaching process could be connected to, in fact enhanced by, the scientific method** and processes that scholars usually associate more closely with research than with classroom work. “I think the most valuable cognitive idea,” one of these participants said, “would be sort of thinking of the teaching process in terms of the scientific method...like kind of looking at it as a process of, you know, steps in which you identify what the problem is, and you try to come up with...an experiment or a strategy to be able to deal with whatever those challenges are, and then evaluate whether the strategy that you used was effective or not.”

Respondents characterized this connection and its component parts in a number of different ways. While only 7 respondents specifically mentioned “Teaching as Research” (TAR), a learning pillar associated with the Delta program at UW-Madison, when speaking to these ideas, a number of others mentioned **ideas and concepts closely associated with the TAR model**. 16 respondents, for example, spoke to the importance of targeted assessment as an important teaching concept, in which continual evaluation of students and their perspective in the course can be used to improve teaching effectiveness and student learning. “It sounds so sensible,” a participant noted, “but it was a revelation to me. I was like, ‘Wow, how have I not heard of this before’...the concept of evaluating students – student learning, and evaluating your teaching.” Especially important, respondents said, was the concept of continual self-reflection in improving the teaching and learning process. Other respondents spoke to the importance of formative assessment to evaluate diversity and learning styles in the classroom as a concept that they took from teaching development, as well as the importance of creativity in the classroom which, in the mind of several respondents, seemed to adhere to the idea that teaching and learning was in many ways an “experiment” that demanded innovation and openness to different frames of reference. “Implicit in that,” one respondent said in reference to TAR, “I would say, is to be open to new ideas. Not to be stuck in your ways...you know, thinking of teaching as research I would say means to inquire. You know, how can I do this better? Am I teaching the best that I can? How am I falling short? It’s an approach to teaching with inquiry and passion.”

3.8.4 Design, Organization, and Management

Finally, added to concepts of diversity, the importance of student engagement, and closely linked to the concept of teaching as research, 11 different respondents spoke to the efficacy of **designing, organizing, and managing classes to meet specific learning goals as an idea that was important to their development as educators through teaching development programs at UW-Madison**. Participants mentioned a number of learning materials and tools to clarify this conceptual point, pointing to **“backwards design” of the syllabus, assessment, tests, activities, discussions, group work, learning aids and instructional materials, and even each class’s time management decisions** as different ways that teachers could mold each course into a vehicle fashioned to meet specific learning goals.

Teaching philosophies, or statements of an individual’s conceptual aims in teaching, were an important tool conceptually for a number of respondents, as they helped clarify the idea that good teaching is pointed, contemplative, and deliberate. “The concept that stayed with me the most,” one respondent said, “was the idea of developing a teaching philosophy in terms of, you know, what would be

the methodology of teaching, how would you gauge that it worked, and so on...it hadn't occurred to me that that sort of planning would typically go into teaching." As another participant noted, "the idea that it would be a good idea to have something written down, and a concept of what you think is important in your teaching, was not something I had really considered." For many respondents, the importance of the concept of a teaching philosophy was tied directly to the importance of the actual skills and techniques to communicate such a philosophy.

3.8.5 Summary

Respondent perceptions of learning gains entailing concepts, knowledge, information, and ideas fit into four broad thematic categories, termed "Diversity of Perspectives", "Importance of Engaged Learning", "Connections Between Teaching and Research", and "Design, Organization, and Management".

The most common answer to the question of important cognitive gains centered on what respondents said was the concept of diversity in the classroom. Respondents believed that teaching development helped them learn that students bring a variety of learning styles, backgrounds, and perspectives into the classroom, and that a good educator takes this diversity of perspectives and styles into account when they teach.

A slightly smaller but still significant number of respondents said their teaching development programs taught them not only the importance of teaching and learning in the practice of science, but the importance of engaging students in active learning in the classroom as a teacher. On a conceptual level, many respondents characterized this as a revelation that there was indeed teaching and learning theory that could inform their practice in the classroom, and that this theory supported practices that did not necessarily subscribe to the version of education participants had experienced in their schooling.

Another important conceptual gain respondents reported from their teaching development experiences was the idea that **the teaching process could be connected to, in fact enhanced by, the scientific method** and processes that scholars usually associate more closely with research than with classroom work. Some respondents spoke to the importance of targeted assessment as an important teaching concept, in which continual evaluation of students and their perspective in the course can be used to improve teaching effectiveness and student learning. Others spoke to the importance of formative assessment to evaluate student diversity and learning styles.

Added to these concepts, a number of respondents also spoke about the efficacy of **designing, organizing, and managing classes to meet specific learning goals as an idea that was important to their development as educators through teaching development programs at UW-Madison**. Participants mentioned a number of learning materials and tools to clarify this conceptual point, pointing to "**backwards design**" of the syllabus, **assessment, tests, activities, discussions, group work, learning aids and instructional materials, and even each class's time management decisions** as different ways that teachers could mold each course into a vehicle fashioned to meet specific learning goals.

How have study participants since applied what they learned from their teaching development experiences?

3.9 Participants' Application of Knowledge and Skills

3.9.1 Section Overview

While not all interviewees were in academic or traditional teaching roles, a majority (51) had found ways to continue to utilize the knowledge and skills they gained from teaching development (teaching development) while at UW-

Madison. **In fact, when asked if they have had the opportunity to apply what they learned through their teaching development engagement, more than 76% of interviewees reported that they had.** Ten others commented that they have not had the opportunity to apply what they learned through their teaching development experiences.

Half of those who have not applied what they learned from teaching development programs (10) reported not doing so either because they were not teaching or were not in academic positions. Only one person was unable to do so because of the specific course being taught. Nevertheless, among those who had not had the opportunity to apply their learning, there was agreement about the areas in which they would apply their teaching development knowledge and skills: 1) planning and preparation and 2) content delivery.

3.9.2 Application of Teaching Development

Focusing on student engagement was the way in which most interviewees (30) have applied their teaching development knowledge and skills. (See Table 3.9.1.) Within this group, seven spoke specifically about active learning techniques that position students as agents in the learning process. In addition, three discussed their application of inquiry-based learning techniques through which students' own curiosity and engagement with the material helps determine the unfolding of the curriculum—

I definitely have incorporated what I have learned [through teaching development] about inquiry-based learning and active learning in the classroom. I've been able to use some of those when I'm a guest lecturer and also in my mentoring of undergraduates in the lab. Instead of just telling the students what I want them to do that day, [I facilitate] independent research projects where they really have to think about what they want to do and why they want to do it, making it more inquiry-based for them as well in the classroom.

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I just keep trying to incorporate more active things. [For example,] there was this one chemistry concept that students have always struggled with in my class...I was like how can I turn this into like some just little activity that will make them see it instead of just writing on the board?...I made these signs that students wear around their neck. One of 'em is the acid, and the other one is the base. And then they flip over, and they become the conjugate base and the conjugate acid respectively. And they way they do that is I blow up a balloon, and I take a marker, and I label it with H plus to be a hydrogen ion. And they pass it back and forth. And as they pass it back and forth, they flip their signs over...It takes all of like a minute to do...and they get it now. I've used it for three semesters, and their homework and exam scores for those particular questions have improved dramatically...And I'm like really? That's all it took? But it works because they remember the balloon. That was definitely something we talked a lot about in the [Delta] college classroom [course] that even like simple things can help.

Also, emphasizing the role of community in the learning process, three interviewees reported valuing collaboration with colleagues to develop content that would keep students engaged throughout their courses.

Table 3.9.1: Application of Skills and Knowledge

Type of Application	<i>n</i>	
1. Focus on student engagement	30	
-active learning	7	
-inquiry-based learning	3	
-collaboration with colleagues	3	

2. Planning/preparation		28
-curriculum development and selection	13	
-goal-setting/backward design	7	
-use of teaching development materials	6	
-review of educational theory	4	
3. Emphasis on assessment		19
-designing tests and exams	11	
-evaluation rubrics	3	
-pre- and post-course surveys	2	
-grading	2	
-focus on “continuous improvement”	2	
4. Methods for content delivery		17
-employ discussion/peer learning	9	
-less lecture	3	
-flexibility	2	
5. Approaches to teaching		13
-collect information from students	6	
-reflective practice	4	
-account for varied learning styles	3	

Interviewees also reported drawing on their teaching development experiences during the planning and preparation processes for the teaching responsibilities (28). For most (13), this planning was evident in the way they selected and/or designed curriculum materials for their courses or training sessions. Goal setting was also prevalent. Seven interviewees shared that they started their planning process with course goals, and some (2) worked backward from there to design the flow of their courses—

I actually did the backwards design thing of here's what I want the students to learn and actually I have a broad view of what I want them to learn in the syllabus itself too, and I've organized the class by [these]...I did the backwards design thing based on information I gathered from colleagues, I figured out what people thought was important to learn...decided how I was going to go about achieving that and then selecting the instruction materials to fit. And then I have a learning objective for each lecture...[and] I make sure that each test question is related to those learning objectives, [which] are meant to be a study guide for them.

Several (6) were able to draw directly on materials they experienced or developed during their teaching development at UW-Madison to support the development of courses they have taught since. Four interviewees reported being more inclined to review educational theory materials to support their course development—

The major part that I took back from the program was educational theory. It exposed me to a lot of different theories in education that I wouldn't have been exposed to outside of Delta...So, really it opened my eyes to the whole field of educational research. And not just within chemistry. And I know I...would not have done that on my own time because it was Delta, it was more of a formal program, and it...forced me, but in a good way.

Assessment (19) was the third most popular context in which interviewees applied what they learned through teaching development programming. Most of these interviewees (11) drew on their teaching

development experiences when designing tests and exams. Interviewees also leveraged their teaching development knowledge or skills when designing evaluation rubrics (3) or grading student work (2). Others emphasized their collection of student information through pre- and post-surveys (2) and their focus on continuous improvement (2)—

During the course I assess how students are doing both directly, in terms of how well I think they're doing, and then also their attitudes indirectly as well, about how well they think things are going. And then after the course I look at it scientifically and say, I think they really did well on the first two goals, and they probably agree with that as well. The third goal, for example, that didn't go as well, so do I need to change that goal? Do I need to change how I'm trying to get that across? [This] defined my approach, and what I definitely do in my teaching.

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One specific thing was I did a brief survey at the start of class...[I] asked students why they were in the class; why they were interested in material science...what they thought material science did and what their career plans were afterwards. I repeated the same evaluation at the end of the semester and that was interesting to me because a lot of the students coming into the course had no real idea of what material scientists did and they had a much better idea at the end. When I got my evaluations back, the chair of our department had seen those questions I asked the students and was very happy...because no one in the department had done that before...that's something that I got directly from Delta, is doing evaluations and surveys with students.

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One of the things that was really exciting for me was the teaching-feedback loop, one of the approaches for doing that was called "just-in-time teaching"...every single lecture has a pre-lecture quiz associated with it and some have post-lecture follow up questions too. I get a lot of information about what the students are struggling with or not, and also as a consequence I know what they are going to struggle with from previous iterations too, I incorporate what I learn from that into future iterations of the class.

Beyond methods for student engagement, many interviewees (17) applied their teaching development skills and knowledge when delivering course content. For most (9), this involved the use of peer learning (e.g. through paired and grouped discussion and work) and discussion—

I try to think of ways to create learning communities within [the large] group so they could still have a discussion-like atmosphere...So there were like mini lectures and we had some projects such as debating...So they had group learning experiences. So the whole theme was group learning as a way to engage students in a discussion-like atmosphere, creating learning communities within a larger class.

In addition, interviewees reported consciously spending less time on lecturing (3) and being prepared to respond to surprises that emerged during their courses (2)—

We try to run these courses not so much in the traditional way that they've always had math courses. But we try to make it so that they can kinda gain more ownership of the material and become more interested in it. So in pretty much all of the other math classes, you just lecture. But in these elementary ed classes, we try to tone down the lecturing quite a bit. And we try to get them to sort of do more discovery and kind of learn how to make their own guesses and conjectures and learn- get them to start checking themselves.

Finally, their teaching development experiences also informed the way many interviewees (13) approached the practice of teaching. For most (6), this involved drawing on feedback and background information from students about expectations and understanding regardless of whether interviewees were engaged in informal classroom teaching or more informal mentoring situations. This also involved reflecting on their practice (4) and supporting students' positive classroom experiences by accounting for the different ways in which students learn (3)—

[Through teaching development] I improved my ability to both reflect on my own practice and to look at whatever other people were doing and reflect on the literature and incorporate that into my own practice.

. . .

I've been able to take [the teaching development] techniques that I've been taught in that class by trying to both have a written protocol that's extremely detailed that anyone from the company can follow for standard practice. And then [I] have the visual parts of it, so that anyone can reference it and be able to see it in a flow chart type idea. So even though it's not teaching per se, I have to first get approval from this group to do it, so when I get the approval I can do it. But then I have to show... a very detailed protocol someone that's more of a written learner can learn. And then also have the visual part of it as well, so anyone can reference it quickly and be able to say, okay, this is what we're going to do.

. . .

Somehow [in class] I have to explain things completely different than they way I understand them...and the same with mentoring...So going back to that point is really difficult. And I think some of the [teaching development] classes helped. You become more sensitive to that idea...But to try to take something that I love and understand and explain it to someone that really is having a hard time. And if the first way doesn't work, then try a different way. And if that doesn't work, then try a different way. And keep doing it until you find the right way.

This reflection helped two interviewees discover that their teaching development experiences encouraged them to develop “higher standards” for themselves regarding their teaching efforts and practices.

3.9.3 *Hindrances to Application*

While only 10 interviews reported not being able to apply what they learned through teaching development, fifteen shared factors that may have prevented them from applying their teaching development as much as they would have liked or at all. For most (10), **time—or “the tyranny of the clock”—was the biggest factor that inhibited teaching development application.** In addition, the context of their teaching (i.e. having a large teaching load, trying to get the basics down, or teaching from a set curriculum) inhibited others' (3) application—

The first semester you're teaching a class, it's about surviving the class and hopefully bringing along a few students with you. The very first semester you teach, you just wanna be the awesomest teacher ever, and all your students totally get it and everything. That's not how it works. And so then you're like well next semester I'm gonna do all these activities. And then you do two...And because there's just not time to like make up all new stuff. And so every semester you just try and like incrementally put in a few more things that you think might help. So really it's just a factor of time.

Beyond this, one interviewee argued that being new in the department limited flexibility. Others also (2) reported that institutional/departmental culture or student capacity affected their ability to apply their teaching development knowledge.

Five interviewees were not in teaching roles, meaning that they felt they had no venue in which to apply their teaching development experiences. Two interviewees who were not teaching voiced concerns about where teaching might fit into their academic lifestyle because research inevitably suffers when teaching is given the priority—

At some point I decided that I was not balancing teaching and research very well. And my research was really suffering. And I needed to do research for a while. So I really haven't touched teaching and outreach for the past two or three years. And I'm okay with that right now. Maybe at some point I'll go back, but at this point I feel like the culture of astronomy would reward me more if I

was doing good research right now rather than good education and outreach...I just feel like it makes more sense right now to devote myself to research...that's the main thing that's limiting me.

One interviewee also referenced the “publish or perish” pressure on pre-tenure professors, which deters them from focusing more in improving their teaching practice.

In rare revelations of negative experiences, some interviewees related challenging experiences of applying teaching development. One interviewee lamented the “bad habits” he learned from his teaching development experiences. In particular, he was concerned that the Delta Program’s Teaching-as-Research (TAR) philosophy was not good preparation for good scholarly research—

I actually picked up—as far as research skills—a lot of bad habits from Madison...I know that the [teaching development] programs at Madison were mainly to introduce people to these ideas and not train them as researchers but the manner that they went about introducing the teaching [as] research model in Delta [required that I] overcome a lot of that when I learned really how to do research...When you're actually doing research...[you're] really trying to make up protocols that will fly in a grant or in a paper or perusing the research literature for a specific theoretical framework and stuff like that. [But in Delta], they were just saying think of something about your own teaching that you're interested in and read a little bit about it and make a change and look at a gain...So I had to slap myself around when I really started exploring studies in chemistry education and slapping my head every time I thought of something that took me back to that TAR model.

In another circumstance, an interviewee found that her wealth of theory about teaching and learning presented a challenge for her in her initial teaching tasks, although this was short-lived—

When I first started teaching I got overwhelmed because I actually knew too much about teaching but hadn't taught enough. So I remember sort of freaking out knowing that lecturing was not necessarily the best way to get students to learn but I knew all these strategies. But I didn't really know when to apply them or which ones work with my personality. But I got over it.

3.9.4 Potential Application

Most interviewees (12) who discussed how they would apply what they learned through teaching development focused on how they would approach planning and preparation for their courses. Echoing what those who had applied teaching development reported, these interviewees foreshadowed course objectives and backward design (4), selecting and developing curriculum materials (2), and drawing on others in the community who could support their efforts. In addition, several interviewees (3) referred to the need to become an “expert” in their content area before or as they put their courses together—

My process would be to first make an objective of what I wanted the students to learn by the end of the semester and then creating an outline and syllabus, how to get them there for the semester...Then determine how I was gonna evaluate them and provide feedback. After I've outlined the whole syllabus I will look at it and find where there are content areas that I thought I needed more work on and learn more about that. And then also look at what I thought were gonna be challenging topics. And then use the teaching or research teaching community, either online or at my current university, to see if other people have addressed these concepts and if there were better methods out there to teach different concepts.

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Less lecture. I would like to be able to do more small-group activities, more kind of give them a problem they solve in a small group and then we come back and we all talk about it, have more discussion more helping them kind of build the ideas that I'm presenting, figure out how things work as opposed to me just telling them how things work.

Would-be applicants also mentioned that they would apply their teaching development takeaways to course delivery (9), including using student background information (2), staying one step ahead of the class (2), and employing interactive and small-group approaches to engage students (3).

3.9.5 Summary

Regardless of whether participants were in academic or other teaching roles, a majority had found ways to continue to utilize the knowledge and skills they gained from teaching development. In fact, 76% of interviewees reported that they had had the opportunity to apply what they had learned. Specifically, a focus on student engagement (e.g. through active learning techniques, inquiry-based learning, or the creation of learning communities within the classroom) was the most common way in which participants applied their teaching development knowledge. Preparation and planning was also important in application, especially background design through which participants built courses by starting with learning and/or course goals. This connects to assessment, which was the third most common way in which participants applied what they learned through teaching development.

Half of those who have not applied what they learned from teaching development programs had not done so because they had not held academic or other teaching positions. For others, time limitations were a significant hindrance. Still, among those who had not had the opportunity to apply their learning, there was some agreement about the areas in which they would apply their teaching development knowledge and skills, particularly through planning and preparation or approaches content delivery.

What factors or experiences most affected study participants' job search and career choices?

3.10 Relevance of Teaching Development to Participants' Career Decisions

3.10.1 Section Overview

Interviewees were asked about the role that teaching development had in changes they may have experienced in the kind of work they wanted to do long-term or in the setting for that work. In addition, they were also asked specifically if their teaching development experiences affected their knowledge and skills, confidence, job search and/or preparation for their post-UW-

Madison employment.

On the whole, interviewees were positive about the groundwork that had been laid for their transition into professional lives after graduate school or after post-doctoral training. Forty-one interviewees (61%) left UW-Madison believing they possessed the knowledge and skills they would need in their professional lives. Similarly, nearly 80% (53) of the interviewees felt prepared for the demands of their first professional role after UW-Madison. **However, despite this preparation, less than half of the interviewees (33) reported feeling confident about their preparation as they entered the job market.**⁸

3.10.2 Teaching Development and Changes of Mind

Of the 53 participants who responded to this question, a majority (57%) indicated that they had not experienced a change in the kind of work they wanted to do and almost a third (32%) experienced such change. (See Table 3.10.1.) **For some interviewees (30), teaching development played a role in this change, influencing their increased interest in teaching while they were at UW-Madison. Among**

⁸ The tables in this section reference different sample sizes. The n for each response is based on the number of interviewees who provided a clear answer to the question. Some meshed their answers regarding their career preparation and transitions, making it more difficult to parse out answers to individual questions. As a result, the ns fluctuate across tables and, in some cases, are much smaller than the full sample size.

other benefits, these experiences⁹ confirmed or solidified interviewees' interest in teaching-related careers (23), helped them learn that they enjoyed teaching and were good at it (20), and exposed them to career options they had not considered (12)—

I think it [teaching development] confirmed in me that I did want to pursue teaching in my career, and that I was good at it. So I think that really helped. And I don't know what I would have done otherwise if I didn't have those experiences as a graduate student. I think it would have taken me a lot longer to discover that I do really enjoy teaching and I want it to be a major part of my career.

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Initially in grad school I of course wanted to teach at one of the best schools and [teaching development] made me think, schools where you're not necessarily getting like the cream of the crop students that that's still alright. As long as I'm teaching and I'm with colleagues who like teaching. That's one thing about these teaching programs that made me realize...that I want to be around other people who want to teach. That was definitely something I hadn't really thought would be that important, but I think it is.

⁹ Factors other than teaching development also influenced changes in the kind of work interviewees' wanted to do after leaving UW-Madison. These included being naturally drawn to academia (3) and/or discovering how much they enjoyed and could be successful in research (4). Some (2) also cited personal reasons—the desire for a balanced life (1), having limited job choices (1)—for shifts in their career goals.

Table 3.10.1: Changes of Mind Related to Career Goals during Time at UW-Madison

Changed mind about KIND of work (n = 53)			Changed mind about SETTING of work (n = 37)		
	#	%		#	%
Yes	17	32%	Yes	16	43%
No	30	57%	No	18	49%
Wavered/ Unclear	6	11%	Maybe	3	8%
Teaching Development played a role in thoughts about KIND of work (n = 40)			Teaching Development played a role in thoughts about SETTING for work (n = 22)		
	#	%		#	%
Yes	30 ¹⁰	57%	Yes	14 ¹¹	39%
No	9	23%	No	8	36%
Not sure	1	3%			
How teaching development played that role			How teaching development played that role		
		#			#
Confirmed/solidified career goals		23	Exposure to the job of teaching		4
Discovered interest in, enjoyment of, skill at teaching		20	-seemed appealing		1
Exposed to new career possibilities		12	-seemed unappealing		3
-types of institutions		7	Confirmed value for teaching		3
-types of positions		2	Gained teaching experience		3
-balancing teaching and research		2	Exposure to different institutions		3
Enhanced comfort or confidence		8			
Wanted to do more teaching		6			

Teaching development also helped some interviewees decide that they did not want to combine teaching and research in their work because they discovered it was impossible to balance the demands of each (4), were deterred by the poor pay academics receive (1), or were unsure of the value of teaching (1). One reported that his research took him way from teaching because he found it to be so fulfilling—

I changed my mind in grad school. If you'd ask me in 1994 when I started my PhD what my dream job was I would've said, "Dude, back in California, Chico State or Western Washington." It'd be all about geography, right? I'm like I gotta get back out West where there's mountains and mostly

¹⁰ Includes interviewees who may have said that they did not change their minds about the kind of work they wanted to do and that teaching development helped confirm or solidify the plans they already had.

¹¹ Includes interviewees who said that they did not change their minds about the setting of the work they wanted to do and that teaching development helped confirm or solidify the plans they already had.

teaching and research...But I really just fell in love with my research. And decided I didn't want to go that [other] direction.

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So I would say what I learned from this whole experience is that I didn't wanna be a professor. That everyone I know is really stressed out by trying to be a really good teacher and be a really good researcher. And in some ways, you never feel like you're doing either one well. So I don't think I want that combination...I'd rather focus more on one just 'cause I don't wanna feel like such a divided person. So at this point, I'm sort of agnostic about whether or not it goes more in the teaching direction or more in the research direction...Either one of those sounds good to me.

Others, who reported not changing their minds about the kind of work they wanted to do, commented that such a change would not have been possible because they had decided early on that they were committed to teaching (8)—

I've always been interested in teaching, because I think that's likely how you'll have a large impact. Very few researchers' work gets read by more than a handful of people, and you're more likely to have a larger impact if you're interacting with students.

Some interviewees (6) had difficulty discussing any changes in their aspirations because it was difficult to remember the order of the shifts in their preferences or if they had really changed over time or because these preferences had changed several times during their UW-Madison experience—

In terms of career aspirations I go back and forth a lot in terms of what I want. What I would be most happy doing...since the start of undergrad I've gone back and forth a lot on this. Sometimes I think I would just love to...be in an astronomy research institute...And there's instead wanting to be more a mix of institutions where I do my research, I also mentor students, I also get the opportunity to teach, then there's some days when I think I just really want to be at a pure teaching institution and I'd like to do smaller research projects with undergrads but not have to be under the pressure of writing articles, a lot of articles every year. And then there's the aspect that I really enjoy places like the [major planetarium] and pure outreach. And then there's the aspect of I took some courses in grad school for [a health profession], and maybe if this career route doesn't work out for me I'd really like to be a [health professional].

Some interviewees (37) also discussed changes in the setting in which they hoped to work. Of these, eighteen did not experience such a change but some (16) did. For example, nine interviewees reported moving away from an interest in professorship at a research I institution while four shifted their interest to research I institutions, three to liberal arts colleges and two to industry¹²—

Originally in graduate school, I thought I was going to head into biotech industry. And when that was not available when we made our move [outside the United States], I stayed at the university and got to train more students one on one in the lab and found that I really enjoyed that.

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When I started graduate school, I was thinking that I might enjoy being at a smaller teaching college or a research university...But the longer I was at Madison, I definitely recognized that I wanted to be at a big research university. I enjoyed the teaching part, but that I also enjoyed the research part. And I wanna have a place where I could do both things.

Fourteen interviewees reported that teaching development played a role in changing their perspective on the setting in which they wanted to work, including through providing exposure to what teaching actually requires (4) as well as actual teaching experience (3), by confirming the value interviewees placed on teaching (3), or by introducing them to postsecondary institutions beyond the research university (3)—

Being able to expose myself again [through teaching development] to successful people who took teaching seriously was enabling. It opened your eyes to serious academicians who also did teaching. Not to professors that had to keep the lights on by showin' up for a course. ...that helped me respect my own calling to want to teach a little bit and that I did not ultimately pursue...Those experiences allowed me to consider it and reject it thoughtfully, rather than having missed the boat entirely.

. . .

I thought about teaching, but I definitely think these [teaching development] programs helped me realize it's something I really, really like and that it got me definitely thinking more about like liberal arts colleges and also community college. Like I don't think I'd even thought about a career at a community college. But after going to these programs and thinking I really want a job that focuses on teaching. That got me thinking a community college job would not be so bad actually.

One interviewee reported that this exposure to other types of teaching and institutions was a “huge” part of what the Delta Program did for her.

Other interviewees experienced a shift after completing UW-Madison—for example, during the job search process (4) or during their subsequent work experiences (2)—

When I interviewed, I said I don't know if I'd want to come here, because there are no opportunities for teaching, because I really like that sort of thing. And they told me about the internship program that I got to participate in, and they really told me no, there's a lot of opportunities within the company that you don't really get to see. And so, like I said, I had taken the job, and I'm really surprised even now...there are a lot of opportunities for teaching...So I'm still getting those opportunities, it's just not in a way I'd ever thought I would get before.

. . .

[I applied] to a couple of chem ed positions with the intent of also having some laboratory research going on as well...[but it] was really an afterthought...[And then I got] to [an East Coast state] and realized that it wasn't Wisconsin, it was sort of like a happy little ideal between a liberal arts college in which the departments aren't that big...as well as having attributes of a- of a research one institution and the fact that I would have graduate students who could help me do this research and I can think beyond what I was thinking about doing at a liberal arts college. And so this became the best of both worlds.

. . .

I had thought that I would gravitate towards a smaller university... a small department where I could really have smaller classes and get to know the students better and know the faculty better but I ended up at a very large department [during] interviewing I realized that this was a much better fit for me than some of the smaller schools.

Among those who did not experience a change in the desired setting for their long-term work, some interviewees (8) reported personal factors, including family (3) or other individual preferences (3)—

Not really. I think I'm pretty much just doin' what I thought I would be doing. I pretty much just ended up right where I thought I would be. And I'm pretty happy with it. And all the things I got to do in Madison helped me get there but didn't change my mind. I think I always kinda wanted to be at a smaller-type school, and have close interactions with students, and do a little bit of research but not be a serious researcher, and get to do upper level courses. And that's what I'm doin'.

Another four interviewees were still deciding about the appropriate setting for their career goals. Like this interviewee, they are open to a range of opportunities: “I don't know if I want to be at an entirely teaching institution...I mean I really like research and I like science a lot. I'm open to any range of university jobs. And if that doesn't work industry's fine too.”

3.10.3 Teaching Development & Career Preparation

For the most part, interviewees felt prepared for the work they wanted to do after leaving UW-Madison in terms of the knowledge and skills they possessed, their confidence in their abilities, and their preparation for the responsibilities of their first job after UW. In addition, many indicated that their teaching development experiences influenced this preparation in a variety of ways, including through the role it played in their job search process, considerations, opportunities or success.

3.10.3.1 Knowledge and Skills

As they completed their work at UW-Madison, forty-one interviewees (72%) believed that they had acquired the knowledge and skills they would require to be successful in their chosen fields. (See Table 3.10.2.) As one interviewee reported, there were surprises, adjustments, and moments of transition in his first position but he nevertheless was “definitely confident, and I knew I was ready.” Three were uncertain about their preparation but realized that they must have had the necessary skills and knowledge because they were offered jobs based on their training—

When I sent out applications this round, I felt like I did not have enough teaching experience. I was feeling like I was short. But apparently, that wasn't the case (laughs). So that was kind of a surprise to me, that what I had done, the teaching experiences that I have are apparently sufficient.

Table 3.10.2: Career-Relevant Knowledge and Skills Upon Leaving UW-Madison

Possessed needed knowledge and skills (n=57)		
	<i>n</i>	%
<i>Yes</i>	41	72%
<i>No</i>	12	21%
<i>Not sure</i>	4	7%
Teaching development played a role in this preparation (n=39)		
	<i>n</i>	%
<i>Yes</i>	35	90%
<i>No</i>	4	10%
How teaching development played that role		
	<i>n</i>	
Increased comfort and confidence	14	
Emphasis on reflection	12	
Gained relevant skills	9	
Preparation for job search	8	
Exposure to teaching and learning community	4	
Essential skills that were missing		
	<i>n</i>	
Teaching experience	11	
Administrative skills	6	
Research experience	4	

Still, some interviewees (17) yearned for more skills as they left UW. In particular, interviewees wished that they had had more teaching (11) or research (4) experience and/or exposure to the attitudes and administrative skills that almost all positions require (6)—

I also knew what my weak points were...By virtue of doing a PhD, you get project management skills, but really you're never formally trained in that. Then you go out in the world and you find out how important that is.

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I get the feeling that they [interviewers] are looking for an outstanding researcher who can bring money to their institution with small projects that can be done by undergrads. So that would require great grant writing skills and a solid publication record and a project for undergrads and maybe a little more teaching experience. At that point I had never actually run a course or dealt with all the realities that come with- lecturing as a TA is just different than actually lecturing a running a course.

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Faculty members hafta deal with disappointment. They hafta deal with rejection all the time. You don't deal with that too much as a graduate student. Maybe you just wanna learn on the job. But those are skills that I didn't learn at Madison that I've had to learn here...[Also] coming into academia, the thing that you don't learn how to do is all the citizenship-type stuff, all the committees, and all the extra work that you hafta do because as a graduate student...you don't have these other commitments.

One interviewee commented that there are professional skills that one does not develop as a graduate student—"managerial skills, budgeting. How do you manage a million dollars? How do you that out and do research?"—and that may even be invisible until you are expected to have those skills "out in the world."

Some interviewees sought additional training even after they were offered positions because they did not feel strong enough in particular skill areas—

I got here I gave my interview I got the job and I was like, "Oh my God, they're crazy." And so part of the idea of- of delaying the start date was that I could go back for a year in my post doc and really home in on the things I thought I was weak at...I decided that I would go back and spend my last year focusing on that area of research. And getting comfortable with not only doing it myself but advising graduate students in doing that...I went back for a year, and formed my own ad-hoc chem ed group with the blessing of my post doc advisor. He threw some money at me and we did some fun things. I got to run a little group before I had to do it you know basically professionally. And the people here at [this state] thought this was completely hysterical because two faculty members was like, "We're not gonna offer you the job unless we're confident that you can do it and so you're just insane."

In another case, an interviewee, who felt over-prepared in terms of her teaching experience as she entered the job market, declined a job offer because she wanted to gain more research experience before becoming a faculty member.

Similarly, among those who felt prepared upon leaving UW-Madison, four commented that in hindsight they actually had not been prepared for what the professional world demanded—

At the time, I felt pretty strongly that [the job I was offered] was what I wanted and this was a good opportunity for me to go after it. It wasn't necessarily a decision point. I felt like I had already made the decision that it's something that I wanted and that was an opportunity to go after that. Okay? Now at the time, like I did feel like I'm competent to do this. In retrospect, I think maybe I wasn't. I think it was probably a year or two too soon.

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I thought I [was], I was wrong but I thought I [was]. And even after I went through [a teaching residency], I was like okay, well I pretty much knew all of that, I got a better understanding of a couple things by doing the training that they gave me. But really, until I was in that classroom my first year, and I was like oh my god, what the hell did I get myself into?

Thirty-five interviewees reported that teaching development helped them develop the skills and knowledge they needed to be successful in the professional roles they sought. Teaching development supported interviewees' growth in a number of ways, including through increasing their comfort and confidence with their teaching ability (14), emphasizing the reflection that facilitates ongoing improvement (12), and offering access to relevant professional skills (9)—

I feel like I had the start. I felt if I hadn't had the experiences from Delta or from the educational program, I would not have been as confident, and in fact I don't know if I would have taken the leap because I would have doubted my abilities...[Delta] certainly gave me the skills that I needed to start out, to get my foot in the door, and to set things up, and to realize its not as bad as I was fearing.

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I became more consciously competent. I [had been] doing things but I didn't know why I was doing them or how they were helping and these [teaching development] courses made me know what I was doing and why those things were important and how they helped the students improve their learning...It's nice [through the Delta Program] to have that validation of, yes, you're actually getting it or, no, you're not. Sometimes it's very easy to read about education theory but not actually understand it. And not be able to put it into practice. But be able to have it "graded" and be able to discuss about it. You can really understand, okay, yeah, I do understand it, and I do have the skills now to move forward. Or, you know, I really don't understand and I need to spend a little more time thinking about this. So I think that doing it in the classroom is good.

One interviewee revealed that while she had most of the knowledge and skills she needed, it was also valuable to feel prepared to develop what she need. As she noted, "I had the tools I needed to be more prepared."

Looking beyond the classroom, teaching development also helped prepare interviewees for the job market (6) and exposed them to a larger teaching and learning community (4)—

Probably every interview I had the fact that I had taken those [teaching development] classes came up in a positive way. They all recognized that even though, for example, it may be a national laboratory where I ultimately took the job, their intent was not for me to be teaching people to do things. But the communication skills, which certainly the classes fostered or helped with, are things that all organizations value. It's something I can point and say that I consider communication an important thing. It was definitely good in that respect.

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In the job interview it gave me some confidence to talk about teaching at a different level. I was much more familiar with some of the jargon that people would use when they were talking about teaching...Also when I interview[ed] for the job I had to give a lecture. I had to teach a class, an actual class. And like he just gave me the topic...I remember being pretty stressed out, because I couldn't think of ways to make it very active learning because of the topic. So then when I gave my research talk I made sure to incorporate an active learning thing in my research talk just to show that I didn't have to lecture at the board...It turned out ...that I was the only person who used the board to draw pictures. Everyone else gave a PowerPoint teaching lecture.

3.10.3.2 Confidence

Twenty-nine interviewees felt confident about their career preparation as they left UW-Madison. (See Table 3.10.3.) The range of experiences interviewees had as graduate students or post-docs provided a useful toolkit with which they would handle the challenges they faced—

I developed [through my PhD] the ability to always keep learning, and to not be intimidated by what appears to be the impossible, or unachievable. That I did it before, I can do it again, it may not be pretty, and the path may be twisted and full of a lot of potholes, but I can get there. And that's what I think a PhD is worth, a kick in the tookus to let you know that you can solve a problem, and if that problem is technical, if that problem is a particular learning challenge, if that problem is folks who cannot seem to read instructions to authors and learn to format, all of those problems can be addressed. You've got the skill set, you've got the knowledge, just go forward and do it.

One interviewee worried that he may have spent too much time on teaching, which would not ultimately advance his goal of earning tenure—"I thought, I really care about teaching [but] I spend too much time on that. And I need to get grants and papers. First thing they tell you at a place like this... [is]: You can't teach your way to tenure." Nevertheless, this was a rare response.

A number of interviewees (12) reported that they would have been more confident if they were more comfortable with their skills (6),¹³ if they knew more about teaching and/or research (4), or if they had had more teaching practice (2). One interviewee shared that he was "disheartened" about his teaching experience as he left UW-Madison because he was aware that he was far behind other applicants. Another attributed her apprehension to the "uneasiness" that one typically feels when starting something new.

Table 3.10.3: Confidence about Career Preparation

Confident about career preparation (n=34)		
	<i>n</i>	%
<i>Yes</i>	29	87%
<i>No</i>	5	13%
Teaching development played a role in this confidence (n=34)		
	<i>n</i>	%
<i>Yes</i>	29	87%
<i>No</i>	5	13%
How teaching development played that role		
	<i>n</i>	
Teaching experience	9	
Emphasis on improvement	5	
Preparation for interviewing	5	
Familiarity with teaching tools/products	4	
Interviewees needed more...		
	<i>n</i>	
Comfort ¹⁴	6	
Knowledge	4	
Practice	2	

¹³ Two interviewees mentioned suffering from an "imposter syndrome" because of which they were never fully able to accept their preparation despite the training and accomplishments they had experienced.

¹⁴ Refers to comfort with teaching and/or research.

Almost 30 interviewees suggested that their teaching development experiences buoyed their confidence about their preparation for their careers. Several (9) attributed this to the teaching experience they garnered through teaching development—

Because sometimes the more you know, the more you realize how far behind you are. So in that sense, [teaching development] made me realize that I do have to work on [teaching] more. So...it's a positive effect, but it's not really in the direction you expect it to be.

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I gained confidence with all of the experiences in the [teaching development] program. I was gaining more and more confidence of my abilities as a teacher but also as an education researcher. And I gained more confidence in my knowledge and my background that I would be able to apply it in the field. And I could see where I could step easily into an academic position, well not easily, but step into an academic position. It's not as daunting anymore now that I have that experience. Where as, before, it would have been terrifying.

In addition, teaching development helped interviewees become familiar with useful teaching tools and products (4) and attitudes and practices that supported continuous improvement (5). Such faith in his own ability to improve helped one interviewee to continue to teach even after a difficult start—“after the initial disaster I didn't just stop teaching forever.” teaching development also helped participants to be more confident during the job search process (5), especially during interviews—

I think it makes a better package, so I feel more comfortable and confident in applying to places, being able to mention that I've had these experience, that I've been innovative and that it was effective. But whether it really makes a difference in your ability to make it on to a short list, I don't have that confidence yet. At least the place that I was applying to.

• • •

Definitely my teaching experiences made me feel more confident. I could say that I've taught. I knew that I could teach. I knew that I could talk with people. I knew I could talk about teaching with people. And so it helped in interviews. It helped me when I got here. I knew what I was doing and how to prepare.

One interviewee shared that she would have been more confidence if she had had more experience with the Delta Program, “I feel like I should be more well-versed. I wish I could have done more with the Delta Program, because I think that really would have helped me be even more confident in my abilities, and feel better about just stepping in to a teaching position.”

3.10.3.3 Impact on Job Search

Thirty-five interviewees were confident that teaching development influenced aspects of their post-UW-Madison job search. (See Table 3.10.4.) For most interviewees (32), this influence was felt during the job search process itself—through greater preparation for the interview experience (10) (e.g. the ability to articulate their teaching values), broader choices for application submission (8), and presentation of a more compelling *curriculum vitae* that communicated a commitment to teaching (4)—

[Delta] had a really great program for getting a teaching portfolio made and getting ready to apply for positions. So I took advantage of those classes, and without that I wouldn't have known how to start or how to even shape a teaching narrative, for example. That certainly gave me the tools that I needed to be able to apply, and to actually present myself as a qualified and good candidate.

• • •

Being able to put on my resume all the things I did as a grad student that's teaching related has definitely helped. I have an offer now for a faculty position and one of the things they said in my

phone interview was, "It's really clear from your CV that as a grad student, you knew you wanted to teach."

The validation of interviewees' teaching values and goals (17) was a second way in which teaching development influenced interviewees' job search. As a result, they were more likely to prioritize these values and communicate their commitment to teaching during the job search process—

I was very intense on making sure that I had a post-doctoral fellowship and was in a program and had an advisor that was supportive of my teaching efforts. That was definitely a number one priority. 'Cause usually I think if I hadn't had that [teaching development] experience I would be more reluctant to communicate my desire to be involved in teaching since that was not really looked upon very favorably. But since I felt like I had enough experience and that I felt like I didn't want to be with someone who was not supportive. So it was better to be upfront about what I wanted.

• • •

I had very little teaching experience, but I had a. So that I think definitely helped me get interviews and my current job.

Despite not having a wealth of hands-on teaching experience, one interviewee felt that his "clearly articulated approach and philosophy toward teaching" was an asset during his job search. He was sure that this was part of why he was invited for interviews and offered the position he ultimately accepted. Teaching development also influenced interviewees' career trajectories (10), primarily because it exposed them to broader range of career options (7)—

When you're in academics, there is a real strong push for you to stay in academics. And there is definitely a feeling like you should go on to run a research lab and do teaching on the side. And I think the experiences that I had as a graduate student, with Delta and some of the other programs, made me realize that it doesn't have to be that way. You can do teaching as a primary career, and research on the side, it can be the other way around. So I think that was the main message that helped me in figuring out what career path I was going to take.

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I wouldn't have bothered to send out the teaching position applications if I hadn't gone through all of the Delta stuff. Or maybe I would have, but they would have been laughable, as it was they were not bad, but of course I didn't have the experience.

Table 3.10.4: Impact of Teaching Development on Job Search

Teaching development influenced job search (n=58)		
	<i>n</i>	%
<i>Yes</i>	35	60%
<i>No</i>	22	38%
<i>Not sure</i>	1	2%
How teaching development influenced job search		
		<i>n</i>
Informed job search process		32
<i>-improved interviewing experience/preparation</i>		10
<i>-application choices</i>		8
<i>-more compelling curriculum vitae</i>		4
<i>-ability to communicate teaching values</i>		4
<i>-ultimate position selection</i>		4
Validated teaching values and goals		17
<i>-solidified teaching as part of career goal</i>		8
<i>-clarified teaching values and preferences</i>		6
<i>-confirmed on the right track</i>		3
Affected career trajectory		10
<i>-improved awareness of career options</i>		7
<i>-influenced long-term goals</i>		3

Some of those who reported that teaching development did not affect the choices they made during their job search felt this was so because they had limited choices as they left UW-Madison (4) or because they were not ready to pursue teaching positions (7)—primarily because their focus on research required that teaching and teaching development play a small or nonexistent role as they entered the job market—

I'm in a somewhat specific field. And the job choices were limited if I wanted to have some sort of balance between research and teaching. Because my area of research is somewhat focused, [teaching development] didn't steer in any way because I needed to go wherever there were openings of that nature.

3.10.3.4 Preparation for current role

As detailed in Table 3.10.5, fifty-five interviewees (89%) felt prepared for the responsibilities of their first job after leaving UW-Madison—

I absolutely felt prepared in terms of the teaching having lectured before. I was prepared for that. And my first semester here I had a course release, and I was new so no one really knew who I was. I wasn't really on any committees or anything like that. I had a lot of time, much more time than I did as a graduate student to work on research. So in terms of workload, I found it to be less as a professor than as a graduate student.

I felt very prepared. I had been waiting for this opportunity. So I felt very prepared. There's always things that come up that you feel like you could have been more prepared for, but... there's a continual feedback in terms of the reflection that happens even while you're teaching. That process

is reflecting back on what did and didn't work. And what from what I learned previously could I apply to make this better?

Table 3.10.5: Preparation for First Job after UW-Madison

Felt prepared for job responsibilities (n=62)		
	<i>n</i>	%
<i>Yes</i>	55	89%
<i>No</i>	2	3%
<i>Somewhat</i>	5	8%
Teaching development influenced this preparation (44)		
	<i>n</i>	%
<i>Yes</i>	32	76%
<i>No</i>	12	24%
How teaching development influenced preparation		
		<i>n</i>
Acquired teaching-related skills and knowledge		30
-teaching experience		20
-familiarized with teaching tools		5
-developed comfort and/or confidence with teaching		5
Gained important skills beyond teaching		8
-general management skills		5
-non-technical skills		3

In fact, two interviewees described feeling over-prepared for their first position—

I was a little over-prepared, and that freaked me out. I felt I knew too much about teaching without enough teaching under my belt. But that's sort of a delightful problem to have...When I got the job I thought, "I've no idea what I'm gonna do next with research." That's one of the reasons I probably didn't even want a research one position because I didn't really understand how to create my own research project.

More interviewees felt only “somewhat” prepared (5) than felt unprepared (2) for the demands of their first job after graduate study or post-doctoral training at UW-Madison—

I blame my own research group for [not] having everything that I needed. Here I literally sat down and I was like, "I don't even know what I need."...And I love them to death but mentoring and advising my graduate students has probably been the biggest challenge because I was just there and so I'm more along the lines of taking advice than giving it and so that's been an interesting transition. But...I've been figuring out what this relationship is and entails. And I'm learning that it isn't necessarily what I thought it was at the very beginning...So everything else other than teaching those programs at Madison probably didn't do much but you know we can knock teaching off the chart. That's a good start.

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I got a lot of help on ways to be creative and ways to be a better teacher but there was just some stuff when I actually started my teaching that I just felt was basic in terms of being up in front of a

class, basic class management dealing with student things that weren't covered because they were basic. A lot of the [teaching development] courses or Delta programs focused on how to be a more effective teacher and I just needed to figure out how to get up and do this every day and be in front of a class and that was more basic [and] wasn't there.

Two interviewees reported that preparation aside they were still challenged in their first position and five reported being nervous despite feeling prepared—

I was definitely very scared. I think its natural to be a little bit nervous and terrified and scared. I've always been wondering, do I have what it takes, can I really handle it. But, as I started the job, and I went through, my first month and my second month, I realized that I do have what it takes and it's actually really enjoyable. You swallow that nervousness and you just go and do your best, and I'm glad that I had the tools that I did to be able to succeed.

Nevertheless, several interviewees (9) expressed a belief that—prepared or not—they could learn on-the-job and ultimately be successful.

Thirty-seven participants related that their teaching development experiences were an important part of their preparation as they transitioned into their first professional role after UW-Madison. Teaching development helped interviewees acquire teaching-related knowledge and skills (30) and other important skills beyond teaching (8)—

Because I've talked to people about these [teaching-related] things before, I was better able to deal with those things when I had to deal with students in those situations. So that was another gain. [teaching development] gave me confidence because it's not the first time I'd ever heard of having to deal with a student who is not doing so well in your course and comes and asks for some special treatment but [also] has a good reason for needing that.

• • •

[Teaching development programs] affected the preparation in that they helped me organize my thoughts better. I think the teaching programs really gave me a different way to think about things...In general, they helped me think about what I was doing and manage my time a little bit wiser. Those sorts of general skill sets have played over in my preparation for my current position.

Teaching experience was the most often mentioned (20) of the teaching-related elements that were important to interviewees—

[Through teaching development at Madison] I was able to seek out new and different teaching opportunities, and I got to learn a little bit about teaching and learning, that I got to make things like syllabi and all of that and even down to teaching that final course that I did the summer before I left was fantastic. So that definitely helped.

• • •

I was basically a super TA. They called me a lab instructor. There was a professor doing the lectures, and I developed and taught the lab. So the only really kind of new thing was I had to develop all my own labs, and that was a little rough at first just 'cause of the pace. But in general I wasn't intimidated by the job.

[Teaching development] helped the mentoring. A lot of people would always say, "I like coming to you for things because you're much more patient."—in fact, patience was not one of my virtues to begin with. I learned that—"And you actually take the time to explain things in a way I can understand." And that would be due to all the teaching experiences I had at UW.

Some interviewees (5) also valued the general management, communication and presentation skills they gained through their teaching development experiences.

3.10.4 Summary

Just over half of participants experienced a change in the kind of work they wanted to do after leaving UW-Madison or in the setting in which they wanted to work. Approximately half of participants in each category credit teaching development with a role in the change. For the most part, teaching development helped reinforce participants' extant interest in teaching-related careers and, thus, indirectly influenced their subsequent career decisions. Others found themselves shifting priorities or expectations during the job search process or once they were in their first post-Madison positions. Several participants struggled to discuss these changes because the sequential timing of changes was difficult to remember or because what they wanted before coming to UW-Madison has since meshed with what they wanted or sought out as they were leaving.

Most participants felt prepared for their careers as they left UW-Madison. (Teaching development supported this preparation for some by offering access to relevant professional skills, including comfort and confidence in their teaching ability.) Despite this preparation, many participants reported not feeling confident as they entered the job market and approximately 25% yearned for additional preparation, particularly in administrative areas like management, budgeting, and maintaining a research program over time. Compared to those who felt prepared for their desired career, an even larger proportion felt primed for their first professional position. In addition, teaching development affected a large proportion of participants' post-Madison career search, especially through greater preparation for the interview experience, broader choices for application submission, and presentation of a more compelling *curriculum vitae*.

How has teaching development influenced participants' early career experiences?

3.11. Career Satisfaction, Effectiveness, and Peer Approbation

One specific research question that interested our team from the onset of the latest phase of the longitudinal study was how respondents believed their teaching development involvement had affected early-career experiences, specifically with respect to job satisfaction, the use of research-informed and student-centered teaching practices, peer approbation, and their involvement in one or more learning communities.

With each passing year, more members of the research sample obtain career positions. Since the latest phase commenced three to four years after many of the study participants had finished their training at UW-Madison, it was possible to gather more data on how, exactly, participants believe teaching development programs are influencing their job transitions and employment situations. To gather appropriate data, researchers asked respondents questions about job satisfaction, then whether teaching development at UW-Madison had prepared them for their current responsibilities, how effective they viewed themselves in their current positions and how effective they believed they were viewed by others, and, finally, whether or not they currently were involved in "learning communities".

3.11.1 Job Satisfaction

Former job participants were asked to rate their satisfaction in their current job on a scale from 1 to 5, with 1 being "extremely dissatisfied", and 5 being "extremely satisfied". Responses by 65 interview participants elicited an average job satisfaction rating of **4.03** out of 5. Though variable sample sizes for teaching development involvement, position type, and employer categories do not allow for anything approximating statistically significant findings, we have broken down these satisfaction ratings nonetheless for the curious.

Table 3.11.1: Job Satisfaction Average by Type of teaching development Involvement

Teaching Development Involvement	<i>n</i>	Average Rating
Delta-Only (5)	5	4.4
Mixed – Delta and other teaching development (39)	39	3.96
No Delta – Other teaching development only (20)	20	4.06

Table 3.11.2: Job Satisfaction for Most Prevalent Positions

Position	Current/Recent Job Satisfaction	
	<i>n</i>	Average (out of 5)
Tenure-track faculty	20	4.25
Non tenure-track faculty	5	3.6
Postdoctoral researcher or fellow	13	3.7
Researcher (not postdoc)	13	3.9

Table 3.11.3: Job Satisfaction by Employer Type

Employer	Current/Recent Job Satisfaction	
	<i>n</i>	Average (out of 5)
Public college or university	27	3.29
Private college or university	15	3.86
Government or non-profit agency	3	4.0
Private industry or business	4	4.5

3.11.2 Preparation for Current Responsibilities

When asked whether their teaching development at UW-Madison had prepared them for work responsibilities, **77% of respondents answered in the affirmative, saying that their experiences had helped them feel better prepared for their current job.** In many cases, preparation contributed to feelings of stronger job effectiveness not only on the part of respondents, but on how respondents considered their peers and supervisors viewed their effectiveness and, ultimately, how satisfied they were with their current work.

Respondents attributed this preparation to actual, hands-on “teaching experience” they gained through their teaching development that had influenced their current teaching. “I feel like because I’ve talked to people about these things before, I was sorta better able to deal with those things when I had to deal with them,” said one respondent, referring to her teaching development experiences in relation to her current work as a teacher. “It kinda gave me confidence because it’s not like, you know- it wasn’t like the first time I’d ever heard of, oh, you might hafta deal with a student who...is not doing so well in your course and comes and asks for maybe like some special treatment.”

Teaching development experiences also helped participants feel prepared for other kinds of educational responsibilities in their work, as well. One current researcher spoke to the benefits. “The fact that I work with undergraduates in the lab, I think that the teaching experiences that I have really influence my abilities to, you know, have students in the lab and to train them and be mentors to them,” he said. “Because it really did shape how I viewed mentoring and being an instructor in the lab for undergraduates.” Another respondent agreed. “I think it helped the mentoring. A lot of people would always say, ‘I like coming to you for things because you’re much more patient.’ In fact, patience was not one of my virtues to begin with. I learned that [in teaching development].” One respondent, who was not working as an educator, said his teaching development still helped him feel better prepared for his current responsibilities. “They helped me think about what I was doing and- and sort of manage my time a little bit wiser,” another respondent answered. “And so those sorts of general skill sets have played over in my preparation for my current position.” Whether it was practice, experience, an approach, or an “awareness” that they could apply in their current position, these respondents felt more confidence from their training.

Respondents who answered that teaching development had not prepared them for their work responsibilities gave four reasons, the most prominent of which was that they did not teach in their current line of work, and therefore the skills that they gained in teaching development were not applicable. 5 respondents said that they did not consider their teaching development actual “teaching experience”, believing that it was too theoretical to be practical to their work as educators. 3 respondents said they had already learned what they needed to know for their current job *before* they started teaching development, while 2 respondents said that while their teaching development experiences were helpful in some regard, they had not adequately prepared them for the myriad non-teaching responsibilities they would take on as faculty members, including service and committee duties on campus and student advising. As with those who believed teaching development had helped them prepare, these participants put a premium on applicability and utility when it came to comparing their gains against their preparation.

3.11.3 Individual and Peer Attitudes on Effectiveness

When respondents were asked how they viewed their own effectiveness in their current jobs, the results were overwhelmingly positive. Of 60 respondents who answered the question, **43 responded that they viewed their own effectiveness in generally positive terms** (they said they were doing “pretty well,” in the words of many, but there was always room for improvement). 10 respondents responded to the question in extremely positive terms, saying they thought they were “very effective” in their current positions. 7 respondents, or just about 12% of those who responded to the question, said they needed to do more to be effective.

When respondents were asked why they thought they were effective or not as effective, **the largest proportion replied that they tied their effectiveness most closely to how well they believed they were balancing the many responsibilities that needed to managed and balanced in their positions and, just as importantly, at home.** For new faculty members, these responsibilities included some combination of research, teaching, publishing, grant writing, service on campus, home life, children, as well as a partner’s career choices and opportunities. One respondent put it well when he said, “there’s just never enough time in the day.” He continued. “So every year...I’m thinking about my activity report that I’m gonna have to write next month. You know I always look back and I’m like, ‘Damn. I should have gotten more done. There’s so much to do’...but at the same time I look at the list of things that I’ve done in the last year and I’m kind of shocked, like, ‘Wow, when did I sleep?’” Another respondent spoke to his duties as a mentor and researcher. “It’s still trying to find that balance between mentoring and research and, you know, keeping the whole program moving forward.” While some respondents said teaching development had helped learn to carry out some responsibilities that they now depended on at work, there were few mentions of teaching development’s influence on this early-career balancing act.

Nearly as many of the respondents gauged their effectiveness, as well, by how well they thought their students were doing in class. “The way that I measure my effectiveness,” one respondent said, “is, you know, when I think about a student, can I predict that they will be successful in their next chemistry class...I'm looking for did they- did they come away with an understanding of these concepts that's going to help them?” Another spoke to his new faculty position and the courses he was teaching. “I don't feel like I'm in a rut 'cause I haven't been here long enough to get ruddy...I have really wanted this semester to do better at keeping up with my work...you know be able to be- really get the students to do more themselves,” he confided. “To help them to really learn themselves rather than having me just be a information delivery...some real solid improvement that I could do that would- that would you know small change that would make a huge difference in the class.” He laughed. “So I think call me next year and see how it goes.” **Other respondents, in turn, said they looked at their own effectiveness in terms of simply staying above water or needing to publish more (4). Some looked at their effectiveness as it compared directly to peers in similar positions (3), while others said that the research and tenure process moved too slowly at times and that they wished they had accomplished more in their early careers (3).**

After respondents described how they viewed their own effectiveness, they were asked not only how they felt their colleagues, peers, students, or supervisors gauged their effectiveness, but through what means they were able to get this feedback. Again, the responses were overwhelmingly positive. Of the 58 who directly answered the question, **42 respondents reported that they had received generally positive feedback, 8 respondents said they had received very positive feedback, and 8 said it was either too early or there was no way to know what others thought of their effectiveness.**

Respondents reported receiving this feedback through formal and informal processes. 22 participants reported that their institution or department had a formal student evaluation process at the end of each term, while 21 respondents said that they had formal processes whereby they had a regular review by peers or supervisors. 15 respondents said there was no formal process for receiving feedback at their place of employment. 6 of these participants said they actively sought informal feedback from students, peers, or supervisors so they judge their performance, while others said they were able to solicit feedback at conferences and from fellow members of professional associations.

3.11.4 Learning Communities

Peer approbation was important, of course, when it came to whether or not respondents felt they were a part of learning communities in their current jobs. “Learning communities,” which we defined as communities brought people together for shared learning, meaningful connections, discovery, and the generation of knowledge, were an important concept and attitudinal gain many respondents reported from their teaching development experiences, as well as a central pillar in Delta at the UW-Madison. But did participants now feel like they were a part of one or more learning communities?

Of 60 who answered the question put to them by researchers, 44 respondents (73%) said that they felt like they were a part of learning communities in their current job, while 16 (27%) said they felt as if they were not. For many participants who felt a part of such a community, the **peer relationships, shared interest, networking, and collaborative opportunities that they allowed were an important factor in supporting their early-career experiences.**

“Learning communities”, in participants’ minds, took many shapes and forms. On being asked about her association with any learning communities, one new faculty member immediately described a small, informal group of which he had recently become a member. “We call [it] the Assistant Professors Club,” he said. “It's the four young members of the faculty going to lunch...trying to figure out what the hell we're going to do when this is our department, as well as you know the sort of- you know to hand advice off to each other about how we're finding out how we're getting through this so that's been amazing.”

Others described communities closer to those that they had experienced as trainees at UW-Madison through their involvement with teaching development. “[I am] definitely part of a learning community,” a new faculty member said. “Through this teaching portion, I’ve been able to meet some people who have really continued to affect my professional development in teaching. And so in meeting those people I that there’s a learning community there.” One assistant professor described his small, liberal arts institution. “[My college] is small enough that, and I would say...the faculty is a fairly close-knit group, and we do formally and informally talk about our jobs, and teaching especially, and how we should change things, that sort of thing,” he said. “So I guess -- and this sounds weird to say -- but the campus really is a community in that sense.” Another former teaching development participant spoke of the unique learning communities on her campus that offered support for science educators interested in improving their teaching. “We have our own monthly...conversations in science teaching or education...sort of a monthly brown bag where people present their research or whatever they want to talk about,” she said. “There’s definitely a community of people...when I got here they had just hired two or three new science education faculty, so, you know, you definitely know them ‘cause you’re all on the tenure promotion process at the same time. And some of them- or at least one of them I’m starting to collaborate with.”

“Learning communities” were not limited simply to academia. One participant, who worked in private industry, said the “learning community” concept was important to her company. “They encourage us to...set personal development goals,” she said. “And so one of those that they encourage us to do is to find what we call a coach, or several coaches within the company...across all the different groups are a lot of people that either have the same degree level that I do, or just are very innovative thinkers that are part of that group. And so some of them are my coaches.” She continued. “So I think I am part of a learning community, it’s just a different one than maybe I thought that I would be, I guess, if I would still be at the university.”

Participants also mentioned membership in disciplinary associations that allowed special peer and networking contact as well as educational collaboration that enriched their current positions. “Internationally and nationally,” one respondent answered, “I feel like I’m a part of that...I just went to the American Society of Cell Biology meeting, and I also oftentimes go to the Society of Developmental Biology meeting.”

Regardless, **learning communities provided respondents with a sense of belonging, shared experience, and opportunity with peers and fellow educators that in many cases enhanced their satisfaction in their new careers.** The feelings that a handful of respondents expressed regarding isolation in their new careers, as they worked tirelessly to juggle what seemed like an endless number of demands, in many cases strikingly diverged from those who had succeeded in connecting to a wider circle of like-minded peers. Indeed, for many of the latter, the decision to become involved in a larger learning community was as deliberate as it was beneficial. “I feel like I’m part of the community of these people that only care about discovering new things and explaining the natural world, and that’s all that matters,” one respondent, a faculty member said. When asked if that wider community was important to him in his work, he answered, quickly and emphatically, that it was. “At its best it’s- it’s- it’s people who are passionate about what they do and love talking about it and want to talk to you about your work and you talk to them about their work...I love that part of it. And I like being around that. And that is part of the reason I want to stay in academia.”

3.11.5 Summary

Respondents reported that teaching development contributed to job satisfaction, preparation for career responsibilities, peer approbation, and current respondent membership in learning communities in significant ways.

On a scale from 1 to 5, with 1 being “extremely dissatisfied”, and 5 being “extremely satisfied”, responses by interview participants elicited an average job satisfaction rating of 4.03 out of 5. Rough comparisons show that respondents who only participated in Delta were more satisfied in their current jobs than those who participated in mixed teaching development or non-Delta teaching development programs, while those in tenure-track positions rated their job satisfaction higher than those in non-tenure track, postdoctoral, and research positions. Notably, comparisons also show that those working in government, non-profit and private sector positions rated their jobs higher than those in universities.

When asked whether their teaching development at UW-Madison had prepared them for work responsibilities, more than three in four of respondents answered in the affirmative, saying that their experiences had helped them feel better prepared for their current job. In many cases, preparation contributed to feelings of stronger job effectiveness not only on the part of respondents, but on how respondents considered their peers and supervisors viewed their effectiveness and, ultimately, how satisfied they were with their current work.

When respondents were asked how they viewed their own effectiveness in their current jobs, the results were overwhelmingly positive, with nearly 90% of respondents responding in positive terms. When respondents were asked why they thought they were effective or not as effective, the largest proportion replied that they tied their effectiveness most closely to how well they believed they were balancing the many responsibilities that needed to be managed and balanced in their positions and, just as importantly, at home. Nearly as many of the respondents gauged their effectiveness by how well they thought their students were doing in class. When asked how they felt their colleagues, peers, students, or supervisors gauged their effectiveness, again, nearly 90% of respondents responded in positive terms. Respondents reported receiving this feedback through formal and informal processes.

Peer approbation was important when it came to whether or not respondents felt they were a part of learning communities in their current jobs. Seventy-three percent said that they currently felt like they were a part of learning community. For many participants who felt a part of such a community, the peer relationships, shared interest, networking, and collaborative opportunities that membership allowed were an important factor in supporting their early-career experiences. Whether they were formal or informal, institutional or extra-institutional, disciplinary or interdisciplinary, learning communities provided respondents with a sense of belonging, shared experience, and opportunity with peers and fellow educators that in many cases enhanced their satisfaction in their new careers.

3.12 Participants’ Career Trajectories

3.12.1 Section Overview

Participants were asked to reflect on the evolution of their careers. In doing so, participants discussed both what they thought was next in their professional lives as well as the experiences or factors that would most affect their future career decisions. Interviews ended with a summary question in which interviewees related what, if anything, they would have done differently to prepare themselves for their eventual professional roles. differently along the way.

What lies ahead in the careers of study participants?

What factors or experiences will most affect their trajectories?

3.12.2 Participants’ Anticipated Career Trajectories

When asked about their future career trajectory, most interviewees (42) reported plans to have ongoing careers in education and teaching—most within higher education. A few were interested in research positions within the public or private sector (6), and nine were still undecided or flexible about where their careers might go—

I might move from the non-profit [where I work] into something more industry related if I can. I do hope that in the long run I'm not in [a] research lab...So that's making the transition from academia to kind of blend between academia and industry and my non-profit to something more industry related, like really in the drug discovery research. And then go with that for a bit. But I still always am kind of keeping my open for kind of a smaller school teaching role. Depending what the industry company is, how time consuming and how much I like it, I could be always be open to going into a switch like that as well. Because I do enjoy teaching. And depending what the course content is, I think that all of the experience that I've been getting so far would still benefit that, as far as the science goes, the science that I've been involved in.

Nearly 60% of interviewees (38) hoped to (continue working) in a university environment. Of this group, most (29) were interested in opportunities that combined the ability to both teach and to conduct research—

My current plan is I'm looking for a tenure-track assistant professorship at a liberal arts school. But they range in terms of teaching involvement. It ranges from 100% teaching to about 50/50...The ideal program would be a school, a liberal arts school, that has a fairly strong existing research program tailored towards undergraduates [and] that has the kind of facilities that I need to be able to do my research.

Smaller numbers were interested in teaching-only positions (6) or in eventually working in higher education administration (3). One interviewee, for example, was drawn to community colleges because of the student profile—

In five years I think I will look for a real job again. And I would love that real job to be at the community college level or at a small liberal arts kind of place...Where it's small classes and it's real students who are regular people ...[who are] taking this class because they need to get a better job, because they need to support themselves and their families.

Several interviewees (23) discussed the types of higher education institutions in which they would like to work. Most of this group (13) was focused on research universities¹⁵—

I am looking for a combination research and teaching position that allows me to do a little of both...I'm probably looking for not a research one university, but something that's either below that or there is more emphasis on teaching but also the opportunity to do research.

In addition, seven planned to work in another type of university environment, which was identified either by its focus (e.g. Teaching) or another relevant attribute like size. While many interviewees reported that teaching development programs helped them understand that they might be better suited for a professorship at a liberal arts college, only three specifically mentioned an intention to work in this type of institution.

3.12.3 Influential Factors for Career Trajectories

Interviewees were asked to consider the factors or experiences that would influence their career decisions and trajectory. (See Table 3.12.1.) The most cited factor was familial concerns. Sixty percent of interviewees discussed the role that a spouse/significant other's career (16), wanting to have or already having children (13), or other family considerations (e.g. wanting to live/work close to other family members or wanting to start a family some day) would play in their future career decisions. As one

¹⁵ Only two participants specifically mentioned not wanting to work in a research one environment.

interviewee related, decisions were no longer made singly—“My career plans now that I'm married also involve my wife's career plans. I want to have a family; I don't want to work like a beast forever.” In addition, considering others’ needs and opportunities also influenced how much could be devoted to one’s professional life—

I'm getting of the age where if I want to have kids I'd better do it soon. So I think that that's going to be something that changes my time management. I think I've only recently got enough balance in my life where I don't feel like I'm working all the time.

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I have the “two body problem.” My husband's also in academia, so...we're hoping that I can finish my post-doc when he finished his PhD and then ideally land academic jobs somewhere close to each other. His teaching credentials are stronger than mine, and he would really like to teach. So I'm hoping that I can be marketable enough in any sort of like teaching or research setting to try to get a job wherever he gets a job. That's kind of why I'm trying to be really open minded I guess...I guess in our dreams we'd be at some small state school together.

Combining the reports of those who thought elements of their professional life would be influential, most interviewees (81%) believed that their professional experiences, satisfaction, and success would influence their career trajectory. For example, 17 interviewees discussed the importance of valuable professional experiences (e.g. the professional training (9) or opportunities to teach or mentor (8)) to their preparation for job expectations and responsibilities—

Definitely my experiences in the classroom and mentoring undergraduates in the lab [have affected my career] and then my experiences with the Program for Scientific Teaching. Those are probably the two primary things that have influenced my decision to stay in academics and to work with undergraduates in the classroom and then also work with undergraduates in the lab.

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I think the kind of mentor that I choose for the next stage of my career—my post-doc mentor—is probably going to have a pretty big impact, I'm hoping to pick a good one! So I would really like to find somebody who can push me, but can also give me some insight into what it takes to be a successful research scientist [and] help me figure out if that's really something that I want to do.

Table 3.12.1: What's Next—Influential Factors and Experiences

	# of interviewees	Percent
Familial concerns	40	60%
-spouse/significant other's career	16	
-having/wanting to have children	13	
-other family considerations	10	
Tenure	24	36%
Research success	21	31%
-funding	11	
-productivity	10	
Personal preferences	18	27%
-geography	7	
-ability to balance career and personal life	7	
-ability to incorporate teaching and research	4	
Professional experience	17	25%
-professional training	9	
-opportunities for teaching and/or mentoring	8	
Professional satisfaction or success	17	25%
-with job and/or work community	9	
-impact, respect, and growth potential in position	6	
-personal, company, or team success	6	
-mentoring received	2	
Available opportunities	7	10%
Professional network	5	7%

In addition, 17 interviewees referenced their personal satisfaction or success in a particular position as an important influence on their career decisions or “career potential.” Most of these interviewees (9) discussed their contentment with the work community they were a part of. In addition, respect and opportunities for growth in their position, the success of the larger team or organization they were a part of, and occasions for mentorship would also be important factors—

I think it's having a successful team...and if [what we develop is] a bigger step change for the company...I think that will be very favorable. Because again one of those things is not only being able to develop improvements, but those improvements have to be implemented and actually used. So I think if that actually works, I think that will be pretty favorable for me. If my team is successful this year in getting [our work] implemented, our site will also benefit from that. ...And so I'm hoping that eventually, like I said, I can move into a different group, and then try to make improvements there as well.

Some of the interviewees who are already in faculty positions (24) discussed underscored the importance of tenure in their ability to realize their professional and career goals and to lead satisfying careers—

Getting tenure...I'm starting to think about some different things like if I got tenure I wouldn't have to worry quite so much about student evaluations and I can start being a little bit more experimental in teaching if I want to. So I'm kinda enthusiastic about that. I'm looking at changing some research directions that I just do not want to do that during the tenure process. And some of my grants are running out and I'm either going to get tenure or not in a couple months so it's a good time to be thinking about what I want to be good at because I can choose and I don't need to meet anybody's expectations at this point.

In relation to this, others (21) emphasized the success their research endeavors. Specially, the ability to secure funding for a research program (11) or to conduct productive research (10) would be important for interviewees' opportunities. One interviewee discussed how essential productivity would be to the development of her career, "It's always publish or perish so I'm sure the number of papers I publish will probably affect a lot of things." Another participant felt confident about the value of her research program but asserted that funding would be a lynchpin to her success, "If I can get funding to do all this [research], this is gonna be a sure winner. 'Cause I've already got the passion and I can attract the right people. But I just need to sustain the program and the people through funding."

Personal preferences that would influence job choices were also important for some interviewees (27%). Among these, wanting to be in a particular part of the country (7), the ability to lead a balanced life between career and personal priorities (7), and a desire to balance teaching and research in their professional work were interviewees' most reported personal preferences—

I think it'll be how much I enjoy the job [will matter]. A lot of that is the science that's going on, and the company atmosphere, whether I really like that or not. Also kind of the work/life balance, I don't want to be a slave to my job in the long run, and if working at one of these big companies, if I'm expected to be there long days, 7 days a week, I don't really see myself enjoying that at all.

Interviewees also believed the context in which their careers were unfolding could not help but influence the opportunities they would have access to. From the economic environment to the availability of jobs in their particular subfield, seven interviewees related that choosing among accessible positions would inevitably guide their career paths—

Well we got a five hundred million dollar budget cut just the other day so that may matter a lot. So finances—state budgets—that's an issue because we're funded by the legislature. And if our life becomes more expensive 'cause we have several children that are just getting older and bigger and eating more... occasionally jobs will come up in the Midwest that pay almost identically to what I get paid here but the cost of living there is about thirty percent or twenty percent less. So I could move there and make no actual dollar amount increase but still get a you know ten percent increase in pay or twenty percent increase. So that may be an issue in the future.

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I'm in a pretty specific field. So there's not a lot of choices...What you want is not always what you get?...So I would try for some sort of research scientist role. But when it comes down to it when push comes to shove, there needs to be something to pay the bills. So that would be my first choice.

Some also discussed the importance of their professional network (5) as a source of validation for the work they wanted to do, of information about available opportunities, and of support for their ongoing development—all of which would influence their job prospects and preparation. For example, one interviewee reflected on the role of his network in his ability to secure a post-doctoral fellowship, "Political connection [matters]...who we have network connections to in our departments and how they're connected to post-doctoral advisors that we're also interested in. That's what matters in our opinion the most."

Another interviewee succinctly summarized the range of factors many interviewees will negotiate as they pursue their career paths, "The number of publications that I have. The number of presentations I've

given on my research. The network of people that I know in my field. And also a demonstration of being an effective teacher. And a teaching philosophy.” This statement well captures interviewees’ concerns and considerations about their ongoing career development.

3.12.4 What Participants Would Do Differently

In preparation for their intended career trajectories, **the largest group (33%) reported that they would have participated in more teaching development**, particularly in the form of additional mentoring or teaching experience, to better prepare for careers after UW-Madison. (See Table 3.12.2.) Another 12 would have changed nothing about their training. More than half of those who wanted more teaching development (12) were interested specifically in getting more hands-on experience, either with teaching or mentoring—

I wish I could have got more formal experience in the classroom. So not just as a TA but actually teaching. And not just as a guest lecturer. But teaching either a larger component of a class that would prepare me for designing syllabi and designing tests and things like that...something that covered longer topics in the classroom. So more formal experience in the classroom is probably the one thing that I feel is lacking on my resume as I look for jobs. People want teaching experience, and so even to [lecture] one class, people want teaching experience.

A quarter of the interviewees would have changed aspects of their academic experience at UW-Madison. Within this group, most (7) would have taken courses in areas that would have complemented the skills they were already developing (e.g. in writing, computer science, educational statistics, leadership)—“I spent a lot of my time in graduate school focused on chemistry research, when I probably would have benefitted from additional work in developing assessments and evaluation programs, and then analyzing statistical data...so much of my research now involves these things!” Others (4) would have trained in a different program or department to better prepare for what came after UW-Madison—

I would've probably enrolled myself as a grad student in the education department, and tried to get a job TAing in math. That probably would have been the better long-term decision. Like take math classes more on the side and have that extra specialty in there.

Four other interviewees also mentioned that they would have spent more time focused on academics (i.e. studying and reading more) given that the time to do so is much more limited once employed—

I had a tendency to focus a lot on research...so I tended to be a little bit cavalier about class work back in the day...In hindsight I probably should have found a balance that worked a little bit more towards the academic side. Just from the standpoint that I find myself looking up in books that I should probably remember.

Table 3.12.2: What Participants Would Have Done Differently

	# of Interviewees	Percent
Experience more teaching development	22	33%
<i>-more practice with teaching/mentorship</i>	12	
Change aspect(s) of academic experience	17	25%
<i>-different courses</i>	7	
<i>-different program/department</i>	4	
<i>-more time studying/focus on academics</i>	4	
Change aspect(s) of research experience	16	24%
<i>-different research project</i>	6	
<i>-more publishing</i>	4	
<i>-different research group or lab</i>	3	
Alter approach to graduate school/post-doc	13	19%
<i>-be more forceful</i>	4	
<i>-be more thoughtful</i>	3	
Make different professional decisions	10	15%
<i>-find a teaching-focused post-doctoral fellowship</i>	4	
<i>-more networking</i>	3	
Would not do anything differently	12	18%

Nearly a quarter of interviewees (24%) would have changed elements of their research experience. For several interviewees (6), this meant choosing a different research project either during graduate study or as part of their post-doctoral training—

If I had known that this is what I wanted earlier on I would have started working on developing a research program that would be more appropriate for an undergraduate institution earlier on...something better suited to a smaller institution...I would have thought a lot differently about the type of research that I do a lot earlier on. Because then I feel like I would have been prepared to actually take a faculty position right out of graduate school rather than having to do a more extended post-doctoral fellowship.

Four of these interviewees mentioned that that would have chosen a different post-doc, preferring instead to find one that focused on teaching instead of research—“I might have chosen a post-doc that would allow me to do a little bit of research and a little teaching as well...I realize how disconnected I feel from the teaching learning community that I will need to have for applying for a permanent position.” A few (3) would have chosen a different research group or lab to change the kind of experience they had while at UW-Madison.

In addition, four interviewees also reported a desire to have published more or to have done so more strategically, which for at least one participant would have meant publishing less—

I can see in the ed sciences literature on climate that the important results that came out of my Delta internship—because they were not published—have not contributed to the body of

knowledge in the field and they fill an important gap. And they were conducted at an important time. [But]...I did not attempt to get IRB approval for [it]...Even if it meant graduating later [getting that] published in a timely fashion in a top notch ed sciences journal, that's the biggest change I would make...It's not necessarily out of career preparation it's just part of advancing knowledge of certain fields.

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If you look at my C.V. right now I have a lot of papers [but] I don't have like the *Science* or *Nature* paper. I have a pretty good body of scholarship, but I don't have like, "Okay, if I wanted somebody to know the one thing about me here's what it would be"...That's what I'm working on now. But that's something I coulda done a lot earlier...Where I'm at currently it would be really helpful to have some high-impact stuff out. So that's what I'm focusing on now, is trying to get fewer, bit more important publications out the door.

Several interviewees (19%) related a desire to change more personal aspects of their experience—to be more forceful about what they wanted out of their training (4) or to more thoughtful about the ways in which they pursued this training (3)—

I really would have pushed harder to do more teaching related activities. I probably would have pushed to actually take one of the Delta courses and do a Delta Internship. I was a young graduate student, and I didn't feel like I could push my mentor very much, and say this is really what I want to do. She wanted me working in the lab and producing data. And I was in a very small lab, so most of the data that was produced in the lab was mine. So there was a lot of pressure there to stay in the lab and really do research. And I wish I would have pushed harder to do more teaching activities.

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I could have...been a little bit more explicit with my advisors and the people around me about what I wanted out of my career...you kind of end up getting like swept along in these sort of like tides, right? So there's a pool of money here that can fund your dissertation or your doctoral studies and of course you should go and get it because it's kind of unclear as to whether or not TAing is going to pay for everything. But then once you get it, you find yourself having your dissertation topic assigned to you, for instance, and you find yourself surrounded by people who are grant-getting research machines that want you to be in that system, too, and expect that that's what you're gonna do, and aren't really terribly interested in this idea that you want to go somewhere different.

Others would have liked to have been more practical (1), less stressed (1) or to have had more fun (1). Another 15% of the interviewees would have made different professional decisions, like choose a teaching-focused post-doctoral fellowship (4) (as noted above) or to have engaged in more networking (3) to identify potential mentors and/or job opportunities—

There are people that I wish I had pursued [who would have been] incredibly useful to talk to or are great scientists or they're just great people. And I wish I had known them then or I had pursued them more heavily and made them my mentors or my collaborators...I had a lot of really great peers to talk to in grad school, but I didn't really have a huge number of professors or people in a position of authority to bounce ideas off of or get ideas from and I feel like I would have really benefited from that.

Two interviewees would have tried to gain grant writing experience, which is relevant to their ability to continue to fund a research program.

3.12.5 Summary

Most participants reported a desire to have careers that involved education and teaching, especially as professors in a range of higher education institutions. Almost 80% of those who wanted to work in a

university environment also wanted to maintain positions in which both teaching and research played significant roles.

Familial concerns were the most cited in terms of what would influence participants' career decisions and trajectory. In particular, a spouse or partner's career or requirements for raising children were the most pressing of these familial concerns. Participants also anticipated that their professional experiences, satisfaction, and success would influence their career trajectory. Tenure, and the productivity of their research endeavors, was particularly salient for participants in academic positions.

Additional teaching development experiences was the most often cited change that participants would have made to better prepare themselves to achieve their career goals. Others would have changed aspects of their academic or research experiences, including choosing a different academic trajectory or selecting a different research group to work in.

4. Discussion and Implications

One of the most important features of a longitudinal study such as this, where similar questions are asked at two different times, is how new findings fit with previous findings. Do the new findings confirm or disconfirm any of the study's previous findings, and why? What do the new findings describe or explain that was not addressed previously? Do certain claims seem to be especially stable over time?

In the section that follows, we will review and discuss our latest findings with an eye toward what was reported by Bouwma-Gearhart et al. (2007) and Barger et al. (2007) in the last major reports from this study. Using the present research questions (see section 2.1, p. 11) as a guide, we will discuss what this phase of the study found; whether these current findings are related to those findings reported in the 2007 reports; and what we now have learned for the first time that previous studies did not address.

Where are study participants working now?

One of the challenges of studying future faculty (i.e., doctoral students and postdocs) is that the date of their transition into a permanent academic position is so indeterminate. Although science and engineering doctoral students have the shortest time-to-degree, averaging 6.8 years (compared with 7.7 years in the social sciences, 9.3 in the humanities, and 12.7 in education) (Council of Graduate Schools, 2008), it still is difficult to estimate how long it will actually take to finish one's doctorate. Moreover, many of those who finish the doctorate must count on taking at least one postdoctoral appointment, with some stuck in a "postdoc purgatory" of serial appointments, before ever getting to their first permanent academic position.

In the report by Bouwma-Gearhart (2007), only 8 participants had made a *position transition*—that is, had either completed their degree or finished their postdoc. In the intervening four years, however, 84% of initial doctoral students had completed their doctorate, and 92% of those who were postdocs initially were no longer in a postdoc assignment; still, 13% (9 of 67) had not made such a transition at the time of data collection. As Tables 3.1.2 and 3.1.5 show, we know now that 30% of study participants hold positions as tenure-track faculty, with as many employed by research universities as by institutions that are not research-focused.

We also found that 8% of initial doctoral students were not finished but still enrolled part-time and intending to finish, and 8% were not intending at this time to complete their degree. Considering that only 57% of all doctoral students complete their degree within ten years (Council of Graduate Schools, 2008), we were surprised how many participants had actually completed and how few had stopped out.

The current study also found that only one student reported being involuntarily unemployed. This, too, was surprising in light of the constriction of academic job availabilities following the onset of the Great Recession.

Despite having lost 16 study participants since 2007, we nonetheless have richer data about the types of job placements that our study participants have taken. Unfortunately, until the current 13 postdocs complete their traineeships, we will not have a good picture of the institutional dispersal of our study participants. Furthermore, the study does not have a comparison group of doctoral students and postdocs who did not participate in teaching development to see whether their pathways are similar or different. So, while any conclusions about the employment patterns of teaching-development participants must be restricted to the present study participants, it is worth noting how few study participants (not in postdoc appointments) have landed in tenure-track appointments at research-intensive institutions—the kind of “fast-track” positions that Mason et al. (2009) suggest doctoral students are increasingly rejecting in favor of more balanced lives.

What encouraged and discouraged respondents’ participation in teaching development?

Compared with the 2007 reports, the reasons for participating in teaching development have remained largely the same: acting on a strong interest in teaching, wanting to learn more about teaching practices, wanting to feel more prepared for faculty work, and an expectation that it will help them be more competitive in academic job searches. However, the desire to become part of a learning community around postsecondary teaching and learning was mentioned more prominently in this phase as a reason for teaching development.

From the 2007 data, we already knew that advisors shaped study participants’ interest in teaching and teaching development, but from this phase of the study, we learned that advisors—whether supportive or unsupportive of teaching—are by far the most significant influence. One possible reason why advisors were mentioned more prominently in this phase is that most of the participants who had completed their doctorates were no longer working with their advisor and thus may have felt freer or less risk when discussing their advisor’s influence.

In what kinds of teaching development did respondents participate?

When the study was first designed, its sample was built in part on the idea of “dosage,” or the amount of time spent in teaching development activities; participants were selected on the basis of low (1-8 hrs), moderate (30-59 hrs), or high (60-109 hrs) engagement. While it was useful to make this distinction initially, we discovered as the study proceeded that these categories were not stable; as time passed, most study participants continued to seek out teaching development activities, and those initially classified as low and moderate engagement often qualified as moderate and high. As a result, the proportion of low-engagement participants dropped from 33% to 9%, moderate-engagement participants also dropped from 43% to 19%, and high-engagement participants jumped from 24% to 72%. This upward shift in engagement over the past 4 years has meant that disaggregating of data by a characteristic as unstable as teaching-development engagement is difficult and perhaps not very meaningful.

Another sampling criterion was involvement in the Delta Program for Research, Teaching, and Learning; at the start of the study, 51 of 83 (61%) participants had had some involvement with a Delta program. In the most recent phase of the study, the Delta Program was still the most common provider of teaching development (70% of interviewees). Although some programs mentioned in 2007 have since been discontinued (e.g., K-through-Infinity Professional Development Program), still a majority of

interviewees (57%) combined Delta involvement with other programs' teaching development offerings (e.g., the HHMI-sponsored Teaching Fellows Program).

How satisfied were respondents with their teaching development experiences?

As in 2007, the study respondents reported high levels of satisfaction with their teaching development experiences. This time, 88% of respondents reported that their expectations for teaching development were met, with 18% of this group saying their expectations were exceeded. What we learned this time that previous studies could not address concerned a seeming connection between their retrospective satisfaction with their UW-Madison teaching development and the opportunity to apply what they learned; generally speaking, interviewees were more satisfied with programs that helped them put into practice what they had learned. Similarly, respondents were more likely to be dissatisfied with teaching development programs that either did not involve actual teaching experience or did not expose them to new information or activities.

What, if anything, did study participants gain from their teaching development-related activities?

Compared with gains reported in 2007, what we heard four years later was largely the same: learning about instructional and assessment techniques, teaching theories, diversity, and career options. In the current report, we have reported gains using the same framework that focused our interview questions: cognitive, behavioral, affective, and social. In this way, we are able to report what participants said they gained from teaching development with greater specificity.

In 2007, Bouwma-Gearhart et al. found it difficult to link particular gains to particular programs because their interview questions tended to focus on teaching development in general. In designing the 2010-11 phase, we wanted to minimize the "muddy attribution" problem reported in 2007 and thus developed an interview protocol that first gathered specific information about the kinds of teaching development they participated in, then asked them what they gained from each.

Despite these changes, we found our respondents still tended to speak in generalities about what they gained and still had more difficulty than expected in linking what they gained from teaching development with particular programs and events. That is, when asked to recall what had happened as long as 4 to 5 years before, they spoke fairly confidently of what they learned to do, or what they learned about. But when asked in *which program* they learned those things, they were less confident and often framed their response as a best guess, adding that what they learned (e.g., classroom assessment) was sometimes addressed by more than one program. In some cases, it seemed that the more a technique or concept was integrated deeply into a respondent's practice, the harder it was to recall how and when it was first introduced to him or her; in other cases, their recall was complicated by simply the passage of time or the sheer number of teaching development events that some participated in. Similarly, respondents often spoke positively of Delta's programs, but on a few occasions, it was evident they were not always clear in remembering which activities were and were not under the Delta umbrella. It may be a result of this fuzziness over the provenance of some programs that nearly no respondents ever drew a sharp binary distinction between the quality of Delta and non-Delta offerings.

In terms of program quality, it was more common to hear that college-wide TA training events were often of limited utility. Although their emphasis on rules, norms, and procedural knowledge (i.e., what one must do, what one must not do) genuinely helped assuage the anxiety of new TAs, respondents reported learning very little about postsecondary teaching and learning; and often what they did learn

about teaching and learning was so “a-disciplinary” (that is, without a disciplinary context) that it was difficult to actually apply in real settings.

Finally, of 57 who spoke to whether they had left UW-Madison with the kinds of knowledge and skills necessary for their career, 41 (72%) said they possessed what they needed, 12 said they did not, and 4 were unsure. Of the 39 participants who addressed the influence that teaching development had on that sense of readiness, 35 (90%) said it did, and 4 said it did not. Among those that teaching development did help, they reported feeling prepared for the career as a result of gaining increased comfort and confidence, being more reflective and purposeful, acquiring important skills, and being prepared for the job search. Still, some interviewees felt they needed more—namely, teaching experience (11 people), administrative skills (6), and research experience (4). Respondents also reported that teaching development played a positive role in their job search (60%) and in their sense of preparation for their first job after UW-Madison (32%).

How have participants applied what they learned from teaching development at UW-Madison?

In 2007, few study participants had had genuine opportunities to implement what they had learned or were learning about pedagogy, assessment, and so forth. Now we know more: more than 76% of study respondents reported not only that they have been applying what they learned—namely, engaging teaching, assessment, backward design principles—but also that the opportunity to apply is important to their satisfaction with their present jobs. It also is no surprise to learn that the factors that most discouraged the application of instructional skills and knowledge were lack of time and the need to manage competing priorities. A number of respondents who, for various reasons, have been unable to use what they had learned said they expected it was only a matter of time until such an opportunity arose.

Furthermore, respondents were clearer than before about the value of actual teaching experiences that complemented what they learned from their teaching development programs. Many respondents mentioned the value of being able to teach as “instructor of record,” thus gaining authentic experience with every part of actual teaching practice (e.g., developing assessments, creating a syllabus, dealing with student questions and complaints). Many of those who *had* taught as the instructor of record mentioned how helpful it was to both landing their job and getting off to a fast start when teaching; several of those who *had not* had such an opportunity brought up how helpful it could have been when job hunting and teaching for the first time, and added that providing instructor of record-type experiences to future faculty is a change they would like to see.

Did teaching development at UW-Madison influence participants’ career decisions & trajectory?

In 2007, some respondents reported that their involvement in teaching development activities played a crucial role in developing “Plan B”—that is, an alternate pathway when their initial plans either were no longer attractive or viable. Respondents said then that the social networks and learning communities—particularly those linked to the Delta Program—were especially helpful in expanding and pursuing career options.

Four years later, we have better information about the influence of teaching development on career choice and trajectory. We know now that, of those who addressed this question, almost a third (32%) of our present respondents changed their mind about the kind of work they wanted to do, and that 57% of respondents said that teaching development played a key role in their decision about the kind of work to pursue, either confirming existing plans for teaching-related careers or, faced with the seeming

impossibility of balancing research and teaching, led them to focus on one or the other. In other cases, the shifts were in setting: nine interviewees moved away from interest in Research I faculty work, while four became more interested in Research I faculty work, three to liberal arts colleges, and two to industry. Another important function that teaching development played was exposing participants to a wider array of postsecondary institutions (e.g., Madison College, UW-Eau Claire), which several respondents described as eye-opening and extremely valuable.

What impact did teaching development have on participants' early career success?

One of the most important questions to consider as study participants have moved into permanent positions is whether their teaching development activities at UW-Madison have contributed to their early-career success. For our purposes, we have defined early-career success as a high level of personal job satisfaction, a high level of peer support and approbation, and significant involvement in communities of practice, especially those that take teaching seriously.

Based on various findings in the present study, we see that teaching development has positively influenced or contributed to these indicators for many respondents. Delta participants reported being more satisfied with their present jobs than those who had “mixed” or non-Delta teaching development. More than three out of four respondents said that teaching development at UW-Madison had helped to prepare them for work responsibilities, which they said influenced not only their own perceptions of being effective in their job but also those perceptions of their peers.

Overview of How Teaching Development Affected Our Study Respondents

Looking across the various findings we are reporting, we seem to have collectively a significant amount of evidence to support claims related to the impact of the teaching development programs at UW-Madison in which our subjects participated. Among study participants who participated in teaching development activities at UW-Madison, *most* of them—

- sought out teaching development because they expected to become college teachers but felt very underprepared and needed to learn more;
- had their expectations for teaching development activities met and sometimes exceeded;
- sought, received, and eventually applied skills and knowledge related to effective undergraduate instruction (namely, engaging pedagogy, regular formative assessment, and “backward design”)
- perceived that participating in teaching development activities was not only informative and useful, but also helped them clarify, pursue, and successfully compete for the kind of jobs they most wanted;
- were generally feeling good about their effectiveness in their current position, and attributed some of their early-career success to what they learned from their UW-Madison teaching development and the confidence it gave them.

Implications for Teaching Development Providers

While these findings point to the significant and enduring positive effects of teaching development programs on those we interviewed, they also suggest that these programs still could take additional steps to better meet the professional development needs of future faculty. We believe there are two primary

issues for doctoral students and postdocs that we want those who provide teaching development to consider and perhaps address.

First is **ensuring doctoral students and postdocs have easy access** to the variety of practical and conceptual activities they believe will be most useful to their formation as future academics. This means:

- Offering them teaching development experiences that include, or are explicitly linked to, practical teaching experience, *especially those in which they are the instructor of record*.
- Informing them regularly and repeatedly about the *availability, content, and expected outcomes* of teaching development activities, so that they might spend less of their valuable time trying to locate and integrate teaching development activities.

And, because we now better understand the influential role that faculty advisors play in doctoral students' and postdocs' participation in teaching development, the second consideration is **offering more assistance to doctoral students and postdocs in communicating with their advisor about their teaching development**. Supporting future faculty in this area can include both tools (e.g., role-playing workshops) and community (e.g., a support group). Similarly, teaching development providers might also consider providing tools and support to faculty who are advisors; several respondents explained that their advisors were not supportive simply because they did not have basic information or did not have the time to figure out what being more supportive could entail.

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6. Appendix A

Interview Protocol

2010-2011

WARM UP

1. We're curious about where you are in your training...
[*Not for postdocs*] **Have you completed your doctoral training?**
[*or if you know they are still a student,*] **When do you plan on completing your doctoral training?**
2. **Would you tell me a little about your current job?**
 - a. **What would you say are your primary and secondary responsibilities?** Also, *when they took the job, institution name and type, position title.*
3. **How did you find your current position? Why did you choose this job?**
4. **Have you held any other jobs have you held since leaving UW-Madison?**
5. **Have you had or do you now have any teaching responsibilities?**

TEACHING DEVELOPMENT PARTICIPATION

Motivation, Expectations, Experience

1. **As best as you can recall, which kinds of teaching program activities did you participate in while at UW-Madison?**
2. **What expectations did you have for these teaching programs when you signed up?**
3. I'd like to ask you about your motivation to participate in teaching programs while at UW-Madison. I'll list a few popular reasons for participation and then ask if these match your reasons.

On a scale of 0 to 5, with 0 being "not at all important" and 5 being "very important," how important were the following in your motivation?

- a. Improving your knowledge and skills in teaching and learning.
 - b. Improving your chances for getting a job.
 - c. Enthusiasm for teaching.
 - d. Improving your funding prospects.
 - e. Getting the chance to connect with others with interests similar to yours.
4. **Are there other reasons, beyond those we've just discussed, that motivated your decision to participate?**

Gains

Even if participants aren't in teaching roles right now, we're interested in what they might have gained from teaching program experiences.

1. **Cognitive:** Thinking of the teaching programs you just described, what important concepts or ideas did you gain from these activities?
2. **Behavioral:** What did you learn to do or create as a result of your participation in these programs?
3. **Affective:** Did these activities change how you think about teaching?
 - a. *If so, In what ways?*
4. **Social:** Did you gain from the shared learning environment among your fellow participants, program staff, or other professional contacts?
 - a. *If so, What would you say you gained?*
5. [if TEACHING EXPERIENCE] We talked earlier about some of the teaching you've done, I'm curious if you've had the opportunity to put of the knowledge, concepts, or skills from your teaching programs in this work?
 - a. *If yes, can you tell me about a time or example when you know that what you were doing/thinking was motivated by something you learned in one of your teaching related experiences?*
 - b. **What, if anything, has hindered your ability to apply this knowledge or skills?**
 - c. [if NO TEACHING EXPERIENCE] **If you had the opportunity, how would you apply these skills if you were teaching a course?**
6. **Which of your teaching related activities were most significant for you? Why?**

The Delta Program

1. **Are you familiar with the Delta Program for Research, Teaching, and Learning?**
 2. **What do you recall was the purpose of the Delta Program?**
 3. **Were you a Delta Program participant?**
 - a. *If a participant, go to Q4.*
 - b. *If not a participant, skip remainder of Delta Program section. Go to Assessment, Q1.*
-
7. **When you think about what you've gained from teaching-related programs, do you connect those gains to particular program experiences versus others?**

8. The next two questions are about what may have facilitated or hindered your participation in these programs. **Who or what made your participation in teaching programs more likely or easier?**
 - a. **Who or what made your participation in teaching programs more difficult or challenging?**

Satisfaction

1. **Did your set of teaching program experiences meet your expectations and needs? How/Why?**
2. **On a scale of 1 to 5, with 1 being “no help whatsoever” and 5 being “extremely valuable,” what overall rating would you give your teaching program experience? Why?**

JOB SEARCH AND CAREER PLANS

Now I'm going to ask you some questions about changes related to you job search and career choices after your participation in teaching programs at UW-Madison.

1. **Did your change your mind about the kind of work you wanted to be doing after UW-Madison?** [teaching development?]
2. **Did your thoughts about the setting in which you wanted to work change?** [teaching development?]
3. **Did you feel you had the knowledge and skills you needed to pursue your chosen professional goals?** [teaching development?]
 - a. **Were there other skills or knowledge that would have been useful?**
4. **Did you feel confident about your preparation for the professional role(s) in which you were interested?** [teaching development?]
 - a. *If no, What affected your confidence in your preparation?*
5. **Did your teaching program experiences influence your job search and professional choices you made after leaving UW-Madison? If yes, how?**

Early-Career Experiences

In this next section, I am interested in learning more about your current position and how your teaching programs may have influenced your professional experiences.

1. **On a scale of 1 to 5, with 1 being “extremely dissatisfied”, and 5 being the “extremely satisfied”, how satisfied are you with your current position? Why?**
2. **When you started your current job, how prepared did you feel for your related responsibilities?**
 - a. **Did your teaching program experiences help prepare you for any of these responsibilities?**
 - 1) *Probe for instructional elements of their positions and any connection to use of "research-informed teaching practices"*

3. **Do you feel like you are a part of any learning communities whether connected to your current job or other parts of your professional life? Why?**
 - a. **If no, Is this something that is important to you or that you value?**
4. **What do you know about others' impressions of your effectiveness in your current role?**
 - a. **How did you learn about these impressions?**
 - b. **In terms of effectiveness in your current role, how do you think you're doing?**

Career Planning

1. **Please tell me a little about your career plans--what is next for you?**
2. **What do you think will most influence your career path moving forward?**

WRAP UP

1. **Knowing what you know now about your transition into the professional world, what—if anything—would you have done differently to prepare for your chosen field?**
2. I really appreciate you answering all these questions for me. Before I confirm the mailing address where we should send your \$50-check, **do you have any questions for me before we finish up?**
3. Before I confirm your mailing address, I want to ask if you would consider e-mailing me a copy of your most recent CV and a course syllabus that you think best represents your teaching style or philosophy. Just like your interview responses, this data will be confidential and will be one more way we can analyze how participants have been influenced by UW-Madison teaching programs. **Is that something you would consider?**

If yes, You can e-mail me your CV and a syllabus at the address I've been using in our correspondence.

4. **Confirm mailing address. When you emailed me to confirm our interview time, you included an address on xxx. Is that where we should send the check?**

Thank you again for your participation!