**Biology Teaching Assistant Project**
**2018 Virtual Conference**
**Monday, October 29, Noon – 4:00 PM EST**

# Talk Abstracts

## 12:05 – 12:50 Conference Keynote

*Building a Better Future STEM Faculty: How Teaching Development Programs can Improve Undergraduate STEM Education*

**Mark Connolly**, University of Wisconsin, Madison

To help prepare future faculty in science, technology, engineering, and mathematics (STEM) to teach undergraduates, more research universities are offering teaching development (TD) programs to doctoral students who aspire to academic careers. Using social cognitive career theory, we examine the effects of TD programs on early-career STEM scholars' sense of self-efficacy as postsecondary teachers. In 2011, a survey questionnaire was administered to 2156 people who in 2009 were doctoral students in STEM departments at three U.S. research universities; 1445 responded (67%). Regression analysis revealed positive relationships between TD participation and participants' college teaching self-efficacy and positive interaction effects for women. These findings may be used to improve the quality and quantity of TD offerings and help them gain wider acceptance.

## 12:50 – 4:00 Invited and Submitted Presentations

### 12:50 – 1:10

*The Impact of a Pedagogy Course on the Teaching Beliefs of Inexperienced Graduate Teaching Assistants,* **Star Lee***, University of California, Riverside

Little attention has been given to teaching beliefs of graduate teaching assistants (GTAs) even though they represent the primary teaching workforce for undergraduate students in discussion and laboratory sections at many research universities. Using a concept map exercise, this study characterized inexperienced GTAs' teaching beliefs about student learning and how they change with a science-specific pedagogy course. Data were collected the first day the course and at the end of the course, and they were later analyzed using the Teacher Beliefs Protocol (Luft & Roehrig, 2007). GTA teaching beliefs were characterized as traditional (providing information to students), instructive (providing activities for students), and transitional (focusing on student-teacher relationships). At the start of the course, traditional, instructive, and transitional beliefs were emphasized comparably in the concept maps and presentations of inexperienced GTAs. At the end of the course, although GTAs' beliefs remained mostly teacher-focused, they were more instructive than traditional or transitional. GTAs included teaching strategies and jargon from the course in their concept maps, but provided minimal explanations about how opportunities for active student engagement would be effective for student learning. These results suggest there is a need to provide ongoing discipline-specific professional development to inexperienced GTAs as they develop and strengthen their teaching beliefs about student learning.

### 1:10 – 1:30

*Exploring Biological Evidence by Training Lab Instructors to Focus on Theory Understanding and Theory Application when Undergraduate Students Test the Hardy-Weinberg Equilibrium Model with Zebrafish*, **Nancy Peleaz**, Chaonan Liu, Ala Samarapungavan, Kari Clase, Stephanie Gardner, Shiyao Liu, Soo Won Shim, and Sharleen Flowers, Purdue University

Understanding the scope and quality of biological evidence and using biological evidence appropriately are essential for lab instruction in undergraduate biology. Recent studies suggest that sound evidentiary reasoning depends upon and is contextualized in disciplinary knowledge. In this study, two introductory biology undergraduate lab instructors were studied as they introduced how to apply the Hardy-Weinberg Equilibrium (HWE) principle to in the topic of population genetics. The instructors designed and evaluated the impact of varied types of disciplinary scaffolds to support students' considerations of methodology in evidentiary reasoning. One instructor implemented general evidence scaffolds (GES) while the second instructor implemented disciplinary evidence scaffolds (DES). Two research questions were addressed: 1. How do biology lab instructors create and implement GES/ DES scaffolds for inquiry tasks focused on the HWE principle, and 2. How do students think about and use evidence in the context of GES / DES scaffolded biological inquiry tasks designed to help students use biological evidence to answer practical questions related to the HWE principle? Findings revealed student difficulties with Theory to Evidence as well as Evidence to Data relationships during the learning process, according to the Conceptual Analysis of Disciplinary Evidence (CADE) framework. Results provide a starting point for a further investigating how undergrad lab instructors can be trained to help students learn to use biological evidence to explain and apply theory in the real world, in order to improve introductory biology lab teaching in the future.

## 1:30 – 1:50

*Characterizing GTA Epistemic Beliefs in Science as a Social Endeavor*, **Linda Fuselier*,** Justin McFadden, and Kat Ray-King, University of Louisville

This exploratory study was conducted to characterize science epistemological beliefs among biology Graduate Teaching Assistants (GTAs) with a focus on the role of the community and social aspects of science. Researchers sought to understand how GTAs conceptualize science as a social process, specifically with respect to the role of the community in knowledge construction. A Q-Sort strategy was used to characterize GTA views of scientific knowledge construction and post-sort interviews to further support the Q-sort interpretation. Two general "ways of thinking" about science as a social process were identified from this exercise. All except one of the GTA participants were in the group that believed in a stronger influence of social and cultural values on scientific outcomes. Only one GTA was in the second group that felt strongly that science was a pursuit of existing truths. All GTA participants agreed that scientific knowledge falls somewhere between objective and relativistic, but the actions and processes of science are not divorced from societal influences. GTAs did not hold strong beliefs about how a community works to create knowledge. These stances are contradictory to their appreciation of cognitive diversity in scientific communities. What we concluded from this analysis is that some instruction about subtle workings of personal values, and social and cultural experiences on the practice and outcomes of science would benefit our GTA's understanding of science in general. In the future, we will include this type of instruction in our GTA professional development and examine how epistemological understandings impact classroom practices.

## 1:50 – 2:10

*Impact of a Graduate Teaching Assistant (GTA) Training Program on GTA Approaches, Self-efficacy, and Knowledge of Student-centered Learning,* **Heather Vance-Chalcraft***, East Carolina University

GTA training, when provided, can be a time-intensive effort for both the facilitator and graduate students, yet the effectiveness of this training is rarely assessed. Researchers in this study evaluated their institutions' GTA training efforts to determine if 1) the GTA training sessions impact GTA teaching approaches, self-efficacy, and knowledge of inquiry-based topics; and 2) how the GTAs' approaches, self-efficacy, and knowledge are influenced by the amount of teaching experience and professional development they receive. GTA participants included Biology and Chemistry GTAs teaching introductory courses. Data were collected using the Approaches to Teaching Inventory (ATI), the STEM GTA Teachers' Sense of Efficacy Scale (STEM-GTA TSES), a subset of questions designated as inquiry-focused from the Knowledge Survey, and the Laboratory Observation Protocol for Undergraduate STEM (LOPUS) protocol. Results were analyzed using t-tests and regression model fitting; LOPUS results are in progress. A comparison of pre- to post- survey results showed that GTAs, on average, firmly identified with an information transfer/teacher-focused approach (IITF) before training but intended to use this approach less after training. Additionally, changes to teaching approaches, GTA self-efficacy, and GTA knowledge based on GTA training were significantly influenced by the amount of teaching experience a GTA had and the amount of professional development the GTA attended. Finally, a complex relationship between the amount of teaching experience and amount of professional development in the responses of GTAs to training was identified.

## 2:30 – 2:50

*Assessment of the Teaching Fellows Program and its Impacts,* **Christopher Trimby***, University of Delaware, and Cara Theisen and Janet Branchaw, University of Wisconsin, Madison

The Scientific Teaching Fellows Program at University of Wisconsin was first started in 2003, with a goal of providing graduate students and post-docs from across the life sciences training in the principles of Scientific Teaching followed by an intensive mentored practicum experience. This study investigated if a Teaching Fellows Program increased participant self-efficacy and adoption of scientific teaching practices. Program alumni were surveyed to self-report their perspectives on the value of the program, their current teaching approaches, and their self-efficacy in regards to teaching. Their self-efficacy, current teaching practices, and current teaching philosophies were also assessed. As well, current and future program participants received pre, mid, and post-program assessments on their understanding of scientific teaching. To date, Program Alumni have been surveyed, with an approximately 40% return rate. Data analysis is ongoing with initial results indicating that having to apply what they learned in an actual Biology course, being responsible for creation of an individual course unit, and being responsible for administering a whole course (as part of a team) were the most valuable components of their experience in the Scientific Teaching Fellows Program. These and further results will act as a pilot study and inform the future directions of research into and evaluation of the Scientific Teaching Fellows Program.

## 2:50 – 3:10

*Catching the Wave: Are Biology Graduate Students on Board with Evidence-Based Teaching?* **Emma C. Goodwin** and Erin E. Shortlidge*, Portland State University

Graduate students hold a critical role in responding to national calls for increased adoption of evidence-based teaching (EBT) in undergraduate classrooms, as many not only serve as teaching assistants, but also represent the pool from which future faculty will emerge. Through interviews with 32 biology graduate students from 25 institutions nationwide, we sought to understand the progress these graduate students are making in adopting EBT through a qualitative exploration of their perceptions of, and experiences with, both EBT and instructional professional development. Initial inductive content analysis of interview transcripts guided the holistic placement of participants within stages of Rogers's diffusions of innovations model, which we use as a analytical framework. We found that most graduate students in our sample are aware of and value EBT, but only 37.5% have implemented EBT. Many who were progressing toward EBT adoption had sought out supplementary instructional experiences beyond the requirements of their programs, and 72% perceived an institutional lack of support for teaching-related professional development opportunities. These data indicate that, while many graduate students are already engaged with the movement to adopt EBT, graduate training programs should emphasize increasing access to quality training in EBT strategies.

## 3:10 – 3:30

*Graduate Teaching Assistant (GTA) Training and Development at Oregon State University,* **Adam Chouinard***, Oregon State University

The goal of this research was to formalize ongoing program assessments of weekly pedagogy training seminars provided to Graduate Teaching Assistants (GTAs) who teach introductory biology laboratories. Data were collected via indirect (self-reported) measures and supplemented with direct measures, products of GTA teaching experiences. Researchers sought to determine if GTAs gain skills and knowledge from training seminars and if they put these skills into practice in their teaching. Self-reported knowledge and confidence scores (four-point Likert scale) for 37 teaching competencies were collected pre- (N=602) and post-term (N=485) for 10 years. Weekly discussion posts in which GTAs reflected on the learning outcomes of the training session were collected for a total of 19 different GTAs over the 2017-2018 academic years. Class captures (N=26) and post-capture reflections (N=11) were also recorded in Fall term (2017); class captures were coded via a modified version of the Laboratory Observation Protocol for Undergraduate STEM (LOPUS; adapted from Velasco et al., 2016). Analysis of ten years of survey data revealed increases in knowledge and confidence in every competency, including significant gains for all teaching competencies except three (those with the highest pre-term scores). Analysis of class captures via LOPUS demonstrated that GTAs use a variety of instructional techniques and pose frequent non-rhetorical questions; qualitative observation also indicated that they do adapt specific teaching strategies explicitly discussed (and modeled) in seminar (e.g. solicitation and follow-up of mid-term student feedback). Curation of weekly online discussions among GTAs demonstrated examples of at least one (or more) GTA speaking to essentially every learning outcome over the year's curriculum.

## 3:30 – 3:50

**Lightning Talks! (**5 minute talks with 2 minutes of questions)

*Graduate Women in STEM Teaching Fellows Program*, **Francesca Williamson and Kerri Donohue**, Indiana University

The Graduate Women in STEM Teaching Fellows Program is a grant-funded, year-long learning community for the teaching and professional development of future faculty and leaders in non-academic settings. With GWiSTEM, we aim to cultivate interdisciplinary peer networks among graduate women; introduce research-based teaching, mentoring, and communication practices; foster teaching self-efficacy; and develop and implement STEM engagement and outreach activities. Participants include two advanced science education doctoral students as facilitators, 12 doctoral students from 11 STEM programs (e.g. neuroscience, ecology, statistics, chemistry, pharmacology), and guest women professionals in academic and non-academic positions with advanced degrees in STEM fields (e.g., tenured science professor, instructional consultant). Data include video recordings of learning community meetings, one-on-one interviews with participations, and program artifacts (e.g., online discussions). We share learning community design features, as well as three preliminary findings from the first year of GWiSTEM: the central role of identity in discussions about teaching and career development, learning community as a site for solidarity for dealing with gendered discrimination, and efforts to redefine success in STEM career trajectories.

*Graduate Teaching Assistants' (GTAs) Perceptions of Introductory Biology Course-based Undergraduate Research Experiences (CUREs)*, **Ash Heim**, University of Northern Colorado

While several studies have explored undergraduate perceptions of CUREs, no previous study has qualitatively described how GTAs feel about teaching CUREs, despite their essential instructional role. Our central research question was, how do GTAs describe their perceptions regarding the benefits and challenges of instructing an introductory biology CURE? We conducted semi-structured interviews with eleven GTAs instructing an introductory biology CURE at a four-year public university. We found that while GTAs perceived professional benefits such as experience in research mentoring and post-secondary teaching, they also described challenges, including the time required to instruct a CURE, motivating students to take ownership, and a lack of expertise in mentoring undergraduates. Feelings of inadequacy in serving as a research mentor, high levels of critical thinking, and challenges specific to a CURE were also cited as perceived issues.

## 3:50 – 4:00 Closing and BioTAP Chat

*Building Capacity for Research on GTA Teaching Professional Development: BioTAP in Action*, **Grant Gardner** (Middle Tennessee State University)**, Gili Marbach-Ad** (University of Maryland), **Kristen Miller** (University of Georgia), **Judith Ridgway** (Ohio State University), **and Beth Schussler** (University of Tennessee, Knoxville)

The Biology Teaching Assistant Project (BioTAP) is a NSF-funded Research Coordination Network (RCN) with the broad goals of facilitating the production of quality scholarship related to the Teaching Professional Development (TPD) of biology Graduate Teaching Assistants (GTAs). One of the primary activities of the project has been a year-long BioTAP Scholars program. Individuals with an interest in research in GTA TPD apply to be a part of the program and participate in a two-day workshop to design and develop research projects. Assistance in implementing these projects is supported by the BioTAP PIs as well as other members of the Scholars cohort through synchronous and asynchronous meetings throughout the year. The goal of the final projects is to continue to build the literature base of evidence-based practices in GTA TPD. By disseminating this research, and building a community centered on the value of research on GTA TPD, BioTAP hopes to advocate for quality GTA TPD at all institutions. We will present a brief overview of our activities to date and take questions about our network.

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