

## *An examination of conceptions of teaching and learning physics in graduate TAs and undergraduate LAs*

**Proposed Funding** for Benjamin Spike: 25% RA appointment

**Advisor:** Professor Noah Finkelstein, Physics

### **Project proposal:**

Ben's research focuses on the conceptions of teaching and learning expressed by the graduate Teaching Assistants (TAs) and undergraduate Learning Assistants (LAs) in physics, as well as the changes in such conceptions over the course of a semester. The teaching practices demonstrated by TAs and LAs reflect their ideas about teaching and the overall sophistication of their educational model. Since these instructors spend the most time directly interacting with introductory physics students, their beliefs regarding the nature of instruction play a critical role in the success of reformed teaching methods. As part of this study, we seek to understand where changes in pedagogical conceptions and attitudes originate, in order to improve our overall method of training physics instructors. This Conceptions Study will begin by analyzing interviews of 10 graduate TAs and LAs around common questions of teaching practice – using both the FASCI, scenario based instrument, and a stimulated recall protocol where TAs / LAs watch videos prepared by researchers at the University of Maryland. These collected data will be supplemented by existing survey data from several semesters of written TA/LA reflections, which will be coded along dimensions of contextual sensitivity, student-centeredness, and attention to prior knowledge, nature of knowing, and attitudes/motivation. These written surveys guided the development of the audio-recorded interviews in order to elucidate instructor ideas and provide a deeper foundation for study. These results will be supplemented by available data such as LA reflections and training session field notes to paint a clearer picture of how and why certain teaching conceptions develop.

A closely related study, the Prediction Study, centers specifically on demonstrated differences in the ability of TAs and LAs to anticipate common student difficulties in introductory physics. This study aims to describe how the ability of our TAs and LAs to anticipate common student difficulties evolves as a result of the weekly training session, as survey responses indicate that TAs and LAs differ in how they perceive aspects of the weekly training sessions and incorporate them into their teaching. Comparisons can then be made between TAs and LAs, across training environments, and longitudinally from week to week. These findings have implications for how weekly tutorial training sessions should be conducted in order to best prepare our recitation instructors to teach using Tutorials. A four-week study of prediction of student difficulties was conducted, and the results will be compared to a smaller pilot study from a previous semester [1]. In this four week study TAs and LAs were asked each week to make predictions about student difficulties with the Tutorial materials. The survey was asked weekly three times: pre-training, post-training, and post-teaching.

**Timeline:**

Analysis of the described body of data will take place over Summer 2009. We expect preliminary findings to be presented at the Physics Education Research Conference and the American Association of Physics Teachers annual meeting during Summer 2009, and subsequent findings will be presented at regular opportunities thereafter. Additional data will be collected over Fall 2009 and Spring 2010, with a particular goal of tracking the evolution of conceptions of teaching and learning in new TAs over the course of their first year of teaching. In Fall of 2009, Mr. Spike will replicate the preliminary studies described above, increasing his sample size from 10 TAs / LAs (in the Predictions and Conceptions studies) to roughly 25 TAs/ LAs. Based the findings from the summer and Fall studies, interventions for TA preparation will take place in the Spring.

Additional 25% funding for Mr. Spike will be provided by the physics department and GTP, as he serves as Lead TA. This additional appointment will provide direct access to the courses that involve TAs and LAs. His work will influence the preparation and training of TAs and LAs by the department in the future.

**Outcomes of this project will include:**

- studies of student conceptions of teaching, the impact of differential preparation (in Tutorial and non-Tutorial environments)
- studies of the differential impact of these environments on students predictions and conceptions of teaching for TAs and LAs
- suggestions about TA/ LA preparation to enhance the development of student understanding of teaching and their understanding of student difficulties around conceptual materials.

These results will be published in appropriate venues in physics education research (AJP, Physical Review, JCST, and the Physics Teacher), as well as presented at the I3: STEM Education annual symposium.

Ben is currently a graduate student in the Physics Department at CU-Boulder. He has completed level I of his departmental comprehensive exams and will have completed level II by the end of Summer 2009. He will also have completed his required physics graduate level coursework by the end of Fall 2009.

[1] “Anticipation of Student Conceptual Difficulties: An examination of TA/LA training methods.” B.T. Spike, 2008. (unpublished)

Fall 2008, online TA/LA reflection survey

**Have your ideas about teaching and learning changed over the past semester? What specifically (events, practices, people, etc.) affected your ideas about learning (even if they have not changed)?**

**Describe one effective teaching strategy that you learned this semester. (Or, one that you already knew that was positively reinforced.)**

Consider the following scenario: Your students are working in groups of four to discuss a conceptual question you provided them at the beginning of class.

**How might this activity facilitate student learning?**

As the activity proceeds, one group gets frustrated and approaches you. They've come up with two solutions but can't agree on which one is correct. You see that one solution is right, while the other is not.

**Describe both what you would do and what you would expect to happen as a result.**

**If the approach you described above did not produce the results you anticipated by the end of that class session, what would you do in the next class session?**

Think back to your weekly TA/LA meetings (the meetings with a professor to prepare for the next recitation).

**What specific aspects of the meetings did you find the most helpful and why?**

**What specific aspects of the meetings would you change and why?**

Spring 2009, sample survey from single week of predictions study

*[Given before training session]*

The topic of the next tutorial will be "Conservation of angular momentum". Please describe three common student difficulties that you associate with this topic. (That is, what do you think students usually have trouble with when learning this topic?)

*[Given after training session, but before teaching]*

The topic of the next tutorial will be "Conservation of angular momentum". Please describe the three most common student difficulties that you expect to face on the day of the tutorial. (That is, what specifically do you expect your students to have the most trouble understanding?)

*[Given after teaching]*

You are done teaching "Conservation of angular momentum". What were the three most common student difficulties that you observed? (That is, what specifically did you spend the most time on or answer the most questions about?)