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Developing a Teacher Identity: TAs' Perspectives About Learning to Teach Inquiry-based Biology Labs

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Becoming a teacher involves a continual process of identity development and negotiation. Expectations and norms for particular pedagogies impact and inform this development. In inquiry-based classes, instructors are expected to act as learning facilitators rather than information providers. For novice inquiry instructors, developing a teacher identity may be fraught with contradictions. Inquiry-based learning approaches have been widely adopted in university biology laboratory courses. Teaching assistants (TAs) teach the majority of these labs. Despite TAs' importance in university science instruction, we know little about their teacher identity development. This study analyzes interviews and written reflections to explore how teaching science as inquiry figures into TAs' teacher identity formation. Through five case studies, the study characterizes the trajectories of TAs who made or did not make inquiry teaching practices their own. Most TAs made progress toward developing an inquiry-oriented teacher identity by shifting their focus to student learning. These TAs came to see their students as doing science rather than simply participating in a lab class. Findings also highlight beliefs that conflict with inquiry practices in order to inform strategies to support TAs' changing conceptions about science teaching and the development of inquiry teacher identities.

Teaching assistants (TAs) play an important role in university science instruction, especially in terms of teaching laboratory courses. In recent years, laboratory courses have frequently been the focus of education reforms. Inquiry-based learning is a pedagogy that has been adopted in many college biology laboratory courses (Beck, Butler, & da Silva, 2014; Sundberg, Armstrong, & Wischusen, 2005). This active engagement instructional approach engages students in problem solving as they develop and test their own hypotheses (Chinn & Malhotra, 2002; Minner, Levy, & Century, 2010). In inquiry-based labs, students take more ownership for their learning, including information-seeking and building conceptual understanding, while supported by the instructor's guidance through questioning and facilitated peer learning (Minner et al., 2010; Winter, Lemons, Bookman, & Hoese, 2001). This pedagogy is more authentic to the practice of science research than traditional "cookbook-style" lab curricula (Sundberg et al., 2005). Moreover, numerous benefits for student learning have been documented (Beck et al., 2014 and references therein; Brickman, Gormally, Armstrong, & Hallar, 2009), and graduate TAs enhance their own research skills as a result of teaching inquiry-based labs (Feldon et al., 2011). We have some knowledge about pedagogical development strategies to best support TAs' implementation of inquiry (Gormally, Brickman, Hallar, & Armstrong, 2011; Hughes & Ellefson, 2013; Miller, Brickman, & Oliver, 2014; Winter et al., 2001; Wyse, Long, & Ebert-May, 2014). However, our knowledge about TAs' lived experiences of learning to teach science as inquiry is limited (Volkmann & Zgagacz, 2004). In particular, we know little about the trajectories of TAs developing teacher identities through this process.

Becoming, and in fact being, a teacher involves a continual process of identity development and negotiation (Eick, 2009; Simmons et al., 1999; Saka, Southerland, Kittleson, & Hutner, 2012). Teacher identity formation serves as a touchstone for teachers, a foundation for making professional decisions and guiding classroom teaching behavior (Eick, 2009). Settlage, Southerland, Smith, & Ceglie (2009) describe teacher identity development as "a continual project of forming and reforming oneself." Identity is ongoing construction; it is neither singular nor static (Gee, 2000-2001; Varelas, House, & Wenzel, 2005). Identity development can be considered as a trajectory that an individual constructs from her experiences in her lived worlds, allowing her to be recognized as a certain type of person (Holland, Lachicotte, Skinner, & Cain, 1998; Saka et al., 2012; Settlage et al., 2009). Beginning to see oneself as a teacher is radical departure from one's long-term identity as a student.

Expectations and norms for pedagogy impact and inform teacher identity development (Varelas et al., 2005). In inquiry-based classes, instructors are challenged to acclimate to atypical expectations for student-teacher roles, to facilitate rather than instruct: facilitating group dynamics to support peer learning and facilitating discussion to reveal student thinking (Gormally, Sullivan, & Szeinbaum, 2016; Gormally et al., 2011; Winter et al., 2001). Most novice instructors have never experienced inquiry-based learning themselves as learners. So, depending on their learning histories, instructors may not have memories of role models to leverage as they develop teacher identities. Additionally, some instructors may be uncomfortable with the "messiness" of inquiry as students work to find their own solutions (Crawford, 1999). Therefore, for

novice inquiry instructors, teacher identity development may be fraught with contradictions. Yet these contradictions in themselves are not inherently problematic. In fact, if these contradictions are discovered, examined, and discussed, they become opportunities for learning and reflection (Varelas et al., 2005). Moreover, these teaching practices potentially align well with TAs' (those of whom are graduate students) burgeoning identities as scientists.

Teacher identity development is also influenced by one's beliefs about teaching and learning. Though many TAs are novice teachers, they may hold deeply ingrained beliefs about teaching and learning developed during their "apprenticeship of observation" as students themselves (Lortie, 1975). These beliefs may reflect teacher identities, for example, seeing one's self as the "keeper of knowledge" or as a "collaborator learning with students" (Simmons et al., 1999). Understanding teachers' beliefs can also be important for predicting classroom decisions (Luft & Roehrig, 2007) about classroom management and curricula (Pajares, 1992). This is important because TAs' long-held beliefs may be in conflict with essential tenets of inquiry, e.g., shifts in teacher-student roles such that teachers are not the major source of authority or information (Meyer & Crawford, 2011). While beliefs do not necessarily always translate into teaching practices (Crawford, 1999; Luft et al., 2011), beliefs are important as they may structure *how* as well as *what* novice TAs learn about teaching (Crawford, 1999).

While there is a wealth of literature about pre- and in-service K-12 teachers' pedagogical beliefs and inquiry teacher identity, we know little about TAs' teacher identities. TAs' career trajectories, unique dual-identities as scientists and educators, and teacher-training contexts are markedly different (Brownell & Tanner, 2013). This project was driven by the desire to learn from TAs in order to more effectively support them as they develop as teachers. Additionally, knowledge about TAs' teacher identity development and beliefs can inform more effective pedagogical development programs. The project focuses on TAs teaching introductory biology labs, who have a large but often 'underappreciated impact on future citizen scientists' (Gardner & Jones, 2011; Sundberg et al., 2005). These labs are characteristic of large universities: large student enrollments, multiple lab sections, and novice TAs. The project's intent was to listen to TAs' voices—their lived experiences of learning to teach science as inquiry—in order to understand their developing teacher identities, ultimately with the goal of better supporting TAs to teach inquiry. The following research questions guided this study: How do TAs describe who they are as teachers? How does teaching science as inquiry contribute to their teacher identity? What is the trajectory of their teacher identity formation?

Methods

Study Context and Research Participants

The study was conducted at a large public research university with high research activity located in the United States. The study focused on TAs who taught laboratory sections of two large-enrollment introductory courses, general biology and organismal biology (Table 1). Both labs were guided inquiry-based, utilizing questioning to guide students through the experimental process (Brickman et al., 2009). Research participants were recruited at the beginning of Fall 2011; a total of 22 TAs participated (Table 1). Participants were asked to choose pseudonyms. Most research participants (21 of the 22) had never been a student in an inquiry-based laboratory class.

Each TA taught two lab sections of the same course, teaching in pairs. Most often, TAs taught with two different TAs for their two labs. TAs for both labs were supported by weekly 1.5-2 hour laboratory preparation meetings (hereafter referred to as *Lab Prep*). Both Lab Preps were facilitated by the lab course instructor (the author). About 25-30% of both Lab Preps involved reflective professional development, including discussion and activity related to inquiry teaching practices (e.g., facilitating group dynamics). Reflective professional development included responding to reflective prompts in either writing, small group discussion, or whole Lab Prep discussion. For example, reflective prompts during week 2 of Lab Prep included, "What did you learn about teaching?," and, "What did you do to begin to get know your students?" During week 3, we discussed the prompt, "How do you know when your students are learning and what is your role in this?" For the majority of the Lab Preps, TAs discussed how to support student learning in tandem with the upcoming lab activity (e.g., identify potential experimental designs; anticipate challenges; brainstorm questions to guide students).

Data Collection and Analysis

A narrative approach was used to understand TAs' experiences in their "particular lived world" of teaching biology (Holland et al., 1998, p.42). Moore (2008) eloquently describes two pertinent benefits of narrative research: first, "it gives access to privileged information" and second, "the process of engaging in discussion about teaching provides…opportunities to reflect on past experiences learning, teaching, and developing as science teachers" (p. 688). Studying TAs' development through narratives 'gives access to privileged information' that has been relatively unexplored but is critical for improving TA preparation.

Table 1
TA Profiles

TA	Prior teaching experience	Course taught
Beth 4th year undergraduate student European-American Female Career goal: M.D.	Organized an after-school tutoring program serving primarily Spanish-speaking middle school students for 2 years during high school.	Intro organismal biology
Knox 4th year undergraduate student Asian-American Male Career goal: M.D. or medical researcher (PhD)	Peer-tutor for a number of introductory science classes at another university attended prior to State Tech. Concurrently a TA for a lecture-based recitation class in another science department for the 3rd semester.	Intro organismal biology
Quanah 1st year graduate student European-American Male Career goal: PhD/faculty	TA for 2 biology courses during his baccalaureate degree, which he completed at an international university	Intro organismal biology
Samantha 1st year graduate student Indian Female Career goal: PhD/faculty	Informally tutored students while in college	General biology
Sarah 3rd year undergraduate student Indian-American Female Career goal: M.D.	None	General biology

Four sources of data were utilized: written reflections, videotaped self-guided narrative interviews (TAs self-interviewing), semi-structured interviews (TAs interviewed by the author), and a researcher reflective journal. TAs wrote pre- and post- semester reflections in response to open-ended prompts about teaching and learning (Appendix A). During the first and last weeks of the semester, TAs individually conducted a videotaped self-guided narrative interview (Appendix B). TAs responded to interview guide questions about interest in studying science, learning experiences, beliefs about teaching and learning, self-conception as an instructor, and classroom experiences. Self-guided interviews were modeled after participatory videos (Prosser, 2011) as an opportunity for TAs to reflect and reconstruct their beliefs about teaching (Patton, 2002). TAs viewed their pre-semester video prior to recording their post-semester video, an additional opportunity for reflection. All TAs participated in the self-guided interviews as part of Lab Prep. Research participants' videotaped self-guided interviews were transcribed.

TAs were interviewed by the author at the end of the semester. The semi-structured interviews, lasting about 45 minutes, began with questions to elicit TAs' initial interest in science, and they included general questions that focused on TAs' experiences in science learning, beliefs about science teaching and learning, and lived experiences of teaching inquiry. A basic interview guide was used; however, the informal nature of the conversations allowed TAs to take the conversations in different directions given their own experiences (Appendix C). Interviews were audiotaped and transcribed.

Transcripts of interviews and self-guided interviews were read and coded with the research questions in mind: How do TAs describe who they are as teachers? How does teaching science as inquiry contribute to their teacher identity? What is the trajectory of their teacher identity formation? This was an iterative process, with codes identifying categories related to inquiry teaching and beliefs about teaching

and learning and teacher identity. Data was coded around stories TAs shared. A second level of analysis was conducted to classify the coded data using the teacher-centered to learner-centered typology developed by Luft and Roehrig (2007) from their Teacher Beliefs Interview (Table 2). Then, within-case and cross-case tables were constructed to explore, describe, and analyze the data (Miles & Huberman, 1994). The tables were used to consider TAs individually and collectively, to identify similarities and differences between TAs' experiences, and thus to select case studies.

Table 2

Representative Examples of TAs' Beliefs About Teaching and Learning, Classified Using the Teacher Beliefs Interview Typology (Luft & Roehrig, 2007)

Type		TA Beliefs	
Student-centered	Traditional (info transmission)	"I think the best way for [students] to learn is to make sure the teacher knows a lot about the topic. [I]f you know a lot about a certain topic you can throw out random facts and hopefully keep their interests. But I think they learn best if the teacher is prepared." (Knox)	
	Instructive (providing experience; teacher decides)	"…And you have spoken about forty minutes actually initially and [students] are still like 'why are we doing this again?' So at those points you have to explain to them why they are doing it and what exactly they are looking for this time. So even if you explicitly told it to the whole class sometimes you have to come and reinforce it [with small] groups. Some concepts are I guess hard." (Samantha)	"After we talked about the different types of crosses, we talked about how to set up all the crosses so what I think went well was the students knew what they were doing. I think my co-TAs and I did a good job of telling them exactly what you do. So there was no question about what to do and why they were doing it." (Sarah)
	Transitional (Teacher/student relationships; affective responses)	"[W]hen I walk around I just talk to them because they are just so excited about what they are doing. And they have all these different reason for why it couldn't work and they always want to try it again. And so I like that they are all motivated and they work together really well." (Sarah)	
Teacher-centered	Responsive (Collaboration, feedback)	"They learn to appreciate [their group members] as a valuable source of information and that is very important because at this stage in life they are going to realize that 'you know my teammate is going to be able to help me and I don't have to always run to the TA." (Samantha)	"I think the most important thing they're trying to learn in this lab is how to ask a question, how to address that question, and how to reflect upon it, and what it means to the actual concept, and learning the scientific method of experimentation, developing a hypothesis, how to analyze your hypothesis, and how to tie it back to the question you're asking." (Quanah)
	Reform-based (Mediating student knowledge, interactions)	"That's the whole point of the inquiry-based lab: to allow them freedom to look at whatever they wanted. They had to understand the material to come up with these really creative ideas." (Beth)	

Table 3
Summary of TAs' Conceptions of Their Teacher Identities

	Quanah	Beth	Samantha	Sarah	Knox
Motivations for teaching	▪ Inspire students to be passionate about biology	▪ Inspire students to be passionate about biology	▪ Wants to do a good job	▪ Inspire students to be passionate about biology	▪ Leading students in class ▪ Getting to know students ▪ Revisiting biology content
Evolution of teacher identity	▪ Shift to sharing control for learning with students ▪ Seeing science learning as problem solving	▪ Shift to sharing control for learning with students ▪ Shift in sense of responsibility for sparking students' interest ▪ Shift to become facilitator of group dynamics	▪ Shift to sharing control for learning with students ▪ Seeing science learning as problem solving ▪ Shift to become facilitator of group dynamics	▪ Shift in sense of responsibility for sparking students' interest ▪ Developed more confidence	▪ 'Already knew about grading and things like that from being experienced in TA-ing.'
Teacher identity	▪ "a big brother" ▪ "want to get my students' fire for biology going"	▪ "I don't act like I'm smarter than [my students] to be a good TA. I talk to my students like they're my friends."	▪ "I'm approachable." ▪ "I learn from my students." ▪ "I feel less and less like a teacher and more like a student who is guiding them."	▪ "I'm enthusiastic." ▪ "I use simple language to break down ideas."	▪ "I know the material enough to where I can teach it." ▪ "My main strengths are speaking up and being heard by students."

A case study approach was used in order to illustrate in-depth accounts of TAs' archetypal teacher identity trajectories of learning to teach biology as inquiry. Case studies are useful for exploration, as they provide rich descriptions of different perspectives of an event or experience (Patton, 2002). This research strategy complemented the research questions, which were exploratory in nature. Five individuals were selected as case studies: Quanah, Beth, Samantha, Sarah, and Knox. These TAs' trajectories embodied aspects of evolving and resisting becoming a more learner-centered teacher, representing the range expressed by the TAs (Table 3). TAs' developing teacher identities were considered in light of established conceptualizations of teaching science as inquiry ([NRC], 1996).

Efforts to Ensure Credibility and Study Limitations

Efforts to ensure credibility and trustworthiness of findings are particularly important in qualitative research studies (Patton, 2002). Patton (2002); Ely, Anzul, Friedman, and Garner (1991); and Corbin and Strauss (2008) recommend incorporating the following measures to ensure credibility: triangulation of data sources, member-checking by participants, audit trails, feedback from colleagues, and personal disclosure statements about biases and assumptions as related to the research study. Here I describe how I incorporated these measures into this work, beginning with personal disclosure statements.

As a researcher committed to ethical standards and personal accountability, I took conscious measures to insure trustworthiness. I recognized that this was particularly critical I was the solo researcher, author, and facilitator of both Lab Preps. I recognized the inherent power I held as the Lab Prep facilitator and acknowledged from the start of undertaking this project that this could potentially cause conflict or bias. I felt the weight of this responsibility throughout the research process and so examined and approached my various roles with care. This meant I spent much time reflecting on my role and obligation to TAs and research participants, as well as my own teacher identity. For example, both before and after beginning the process of interviewing TAs, I spoke with colleagues familiar with qualitative research methods to anticipate potential conflicts and debrief about the interview process.

I also spent much time reflecting about my teaching philosophy and, consequently, the dynamics of my position in relation to TAs. As the facilitator of the Lab Preps, I approached my role as supporting and learning from and with TAs. I was mindful of sharing my power in order to create an environment in which we were all responsible for learning. The Lab Preps were not neither graded nor courses; Lab Prep was a required part of TAs' teaching assignments. My goal for the Lab Preps was to build a teaching-learning community. I used bell hooks' commentary on building a teaching community as a guiding principle:

> When I enter the classroom at the beginning of the semester the weight is on me to establish that our purpose is to be, for however brief a time, a community of learners *together*. It positions me as a learner. But I'm also not suggesting that I don't have more power. And I'm not trying to say we're all equal here. I'm trying to say that we are all equal here to the extent that we are equally committed to creating a learning context (Hooks, 1994, p.153).

As a researcher, I worked on the assumption that research participants felt comfortable to choose to participate or not participate, and to share their honest perspectives, explicitly designing the research study in such a way that it was not evaluative. However, I took steps to check and challenge this assumption. First, multiple sources of data were triangulated, including participants' written reflections, self-interviews, and interviews. It should be noted that these types of qualitative data have limitations. Interview data and, indeed, written reflections as well depend on the participant's ability to interpret and respond to a question and articulate their perspective. That said, research methods such as direct classroom observations and surveys were not appropriate given the research questions and were beyond the scope of this study.

Second, research data (all interview transcripts) and the manuscript were shared with the research participants. Participants were invited to comment on the conclusions, and their feedback was incorporated. This member-checking enriched the data analysis and supported the validity of the findings (Ely et al., 1991; Patton, 2002). Third, I also kept audit trails: notes of the study process recorded as a researcher reflective journal. This included notes on the interviews as an additional source of data triangulation. Finally, at multiple stages of data analysis and writing, I asked two uninvolved colleagues to critically review the work to address potential concerns. Together, I think these efforts contributed to trustworthy findings.

Finally, two limitations to this research should be noted. First, despite my best efforts to ensure credible data, it is possible that TAs communicated statements that were biased toward wanting to please me or "say the right thing." Additionally, this study focuses on five case studies. Analysis techniques have been selected with this approach in mind in order to leverage the strengths of case studies while minimizing the possibility that study findings are overextended or generalized where that would be inappropriate.

Results

To address the research questions, each case is organized around *developing a teacher identity:* TAs' evolving beliefs about teaching and perspectives about teaching science as inquiry (Table 3). Then, the discussion highlights key themes that emerged and implications for pedagogical development opportunities.

Case 1: Beth—Helping Students "Forge" into Inquiry

> You need to be open-minded. You need to be a problem-solver. You need to know the material so that you can apply it in any way that they come up with... Inquiry-based, that's what you're trying to do...You're trying to find new paths, or let them forge, but you have to be there to support them (post-semester self-guided interview).

Beth began teaching as a senior (Table 1), aspiring to her elementary teacher's enthusiasm for biology, saying that her own students might think she's "an overactive hamster." As the semester progressed, Beth recognized that engaging students was more challenging than she expected. With this recognition, Beth came to see her role as an open-minded peer-mentor who listens to students' idea in order to share the responsibility for engaging in learning:

> You don't have to act like you're smarter than them to be a good TA... I didn't give them the answers. I think that's one of my strengths, I want them to understand it. I'm also very enthusiastic about it, so I'd like to think I encouraged creativeness…I was open to helping.

"Helping" to Beth meant constructive dialogue between the TA and student, as well as between students. Honing her ability to "think on your feet" to offer critical feedback through questioning for each group's unique experiment was key to this constructive dialogue. Beth also emphasized students' roles as they "forged" into biology: students had to "be willing to talk to one another," to take the first step to volunteer their ideas and constructively critique a group

member's opinion, seeing her own role as actively mediating group dynamics to support this process. Consequently, students took ownership for their experiments, as described in her post-semester self-guided interview:

> That's the whole point of the inquiry-based lab, to allow them freedom to look at whatever they wanted, and it was really cool when they came up with these really creative ideas that really stretched the lab and made it worthwhile for them. Because first of all, they had to understand the material enough to come up with these ideas and second that they wanted to put the time in, because usually the more creative ones were more time-consuming, that they were interested enough to put the time in, was really, really awesome to see.

Beth saw her role change from motivating students by contagious enthusiasm to facilitating students' ownership for their learning (Table 3). She took actions that gave more responsibility and "freedom to look at whatever they wanted" to her students. Moreover, she was "open to helping" by asking questions to offer constructive criticism. By sharing control for learning, Beth supported her students as they "forged" into inquiry, developing "really creative ideas that really stretched the lab."

Case 2: Quanah—Engaging Students in Doing Science

> …I think the most important thing they're trying to learn in this lab is learn how to ask a question, how to address that question, and how to reflect upon it, and what it means to the actual concept, and learning the scientific method of experimentation, developing a hypothesis, how to analyze your hypothesis, and how to tie it back to the question you're asking" (post-semester self-guided interview).

Quanah was beginning his first semester of graduate school as he began to teach (Table 1). Quanah began the semester feeling that he "was the one who was supposed to give them knowledge." At the end of the semester, he described a shift in his teaching stance:

> Now I feel like it's a two way street more… Sometimes the students just have ideas about even a certain thing that they are doing that I hadn't thought about like I hadn't looked at it from that angle. … that's just part of having lots of minds thinking about the same subject…one mind can't think of all the things that two dozen minds can.

Quanah began to see his role as creating a classroom atmosphere in which students felt comfortable asking questions and contributing ideas. He strived to ask questions to "spark their interest, to get their creative juices flowing" and "to get students' minds going." Quanah, like his own teachers who "got his fire going," wanted to inspire students to think outside of the box, "but not directing or guiding them." Like Beth, he noted the importance of being able to "think on your feet" to brainstorm questions to support students through trouble-shooting experiments. He saw his students learning in moments as they wrestled with problems, thinking through what happened in order to redesign their experiments:

> And then they are like, 'This is going wrong,' and then I will say, 'Well, think about why it's going wrong' and then try to push them along. And then when they get it, when they try it again and it works out because of what they altered, then I think they probably learned best then. I don't know necessarily if it's better to get it right the first time 'cause then you didn't consider all the angles, you just considered one, and it was right.

He contrasted how students learned through thoughtful trial and error in an inquiry-based lab with traditional step-by-step lab activities, explaining that in the latter case, "It's really easy for people to not learn anything…I don't think it really requires much abstract thought."

Quanah appreciated that students "being willing to talk to one another" was key for a group to work together successfully. Unlike Beth, however, who saw her role as a TA as facilitating group dynamics, Quanah expected that the responsibility for developing this "good group chemistry" rested with students. He explained that he was not sure how group chemistry developed, that perhaps it depended on the particular mix of students or if students happened to be friends outside of class. Relatedly, his most challenging teaching moments were when students were disengaged, and he struggled to determine his role in this process.

As Quanah became more learner-centered in his teacher identity, like Beth he began to share control for learning with his students (Table 3). While he recognized the importance of group dynamics, unlike Beth he did not recognize how he as a TA might shape group dynamics. However, Quanah recognized that his students had the opportunity to learn science in the way that scientists do science. He saw that his students were learning, especially in moments that involved failure, when students recognized, "this is going wrong." Quanah saw his role as using questions to support students through problem-solving.

Case 3: Samantha—"Science is Done in Collaboration."

> I understand that some people can't work in a group so I talk to those people who can't gel in a group…I explain to them that's not the point, it's not a question of whether you can do it alone, it's a question of working with people— that is a skill you have to acquire. And the sooner you acquire it, the more you adjust to people, the better it is for you, because science is done in collaboration…You have to talk to people. You have to find out flaws. When you talk to people you find out a hundred million things that you didn't think of (end-of-semester interview).

Samantha was a first-semester international graduate student when she began teaching (Table 1). Samantha began the semester so nervous that she would follow a checklist—"I had to do ABC, have I done it, tick, tick, tick. Go to D"—in a mechanical way to be sure that she had covered all the content. As the semester progressed, her role shifted:

> I feel like less of a teacher and more of a student who is sort of guiding them rather than a teacher. 'Cause a teacher sort of has a fixed role and tells them 'these are the things' and is very stern in my head. It may not be true. But I feel like less of a teacher now.

Like Beth and Quanah, she began to develop her ability to think on her feet to help students to problem solve. Like Beth, Samantha described that her interactions with groups varied depending on whether or not students were making progress in carrying out their experiment. Samantha, like Beth, noted the importance of being open-minded through this process, being willing to incorporate ideas that are different from your own. Samantha noted, "Even though you are teaching this course, you can learn a lot from your students."

Samantha appreciated the realistic perspectives about the nature of science that her own teachers had shared. She sought to share this perspective with her own students, particularly during challenging lab activities. Like Quanah, she recognized these moments of failure were also moments for learning:

> I had to constantly reassure them and tell them that that's how science is done. Failure is a part of the process. You have to learn from the failure; you can't be all upset. Let's see what you can take away from this...we had to basically get them out of their frustration and then tell them that it's okay if things don't work out, that's how it normally is…Sometimes there may not be something that you can salvage from it. That's fine.

Like Beth, Samantha saw collaboration as the key to successful problem solving and recognized her role as helping students to develop an effective group dynamic. Samantha told stories about "keeping an eye on" the dynamic: monitoring and intervening to model effective group behaviors. Samantha explained that students have to learn to listen to people, and "bringing them to this level has to be mediated by a third person":

> The most important thing is to hear what the other group members have to say. There are some groups in which just one or two people get away with talking because they are the assertive ones. They say 'we want this done, we are working on this hypothesis.' There might be four hypotheses on the table but no one will hear them…it is good if you catch it and say, 'hold on there I want to actually listen to what the other people want to say. And maybe they have a better idea than you. I'm not saying your idea is bad but I want to listen to the other ones.

As Samantha became comfortable teaching in the classroom, she described teaching practices that were shifting toward learner-centered. Samantha viewed collaboration as an essential part of what it means to do science (Table 3). Consequently, Samantha viewed her role as facilitating and modeling effective group behaviors in order to help her students to establish collaborative working groups to really do science.

Case 4: Sarah—From "Information Overload" to Thinking about Student Learning

> When I was learning biology...I learned a certain way…and I'm very thorough in what I'm doing. But I feel like when I have to teach it, sometimes the way I learn might be a little overwhelming for some people...And when I used to [teach in that way] …I realized that a lot of them got a little lost. So now as I'm teaching, I realize I kind of need to break things down…So teaching has kind of made me think of other perspectives to learn the concepts" (end-of-semester interview).

Sarah was teaching for the first time as a third year undergraduate (Table 1). At first, Sarah saw her role as being a source of information for students. She began the semester with trepidation about her ability to take on this role, concerned about answering students' questions effectively: "I won't be seen as a very knowledgeable source to the students." She began with the belief that enthusiasm was key to sparking students'

interest. However, as the semester progressed, Sarah, like Quanah, recognized that her enthusiasm alone was not enough to engage students. She identified this recognition as the most important thing that she learned:

> I had all these goals about motivating all my students and making them all into biology majors and become so passionate about biology like I was... But really what I've learned, realistically speaking, it just doesn't happen that way. There are many of my students who just want to get out of there as quickly as possible... And so probably the most important thing that I've learned is that it's not really my job to engage students, it's to present the material, and if they get engaged along the way, that's great, and I should do my best to facilitate engaging students, but I stopped beating myself about it when they didn't engage themselves.

While Sarah expressed a shift in her sense of responsibility for engaging students, she struggled with how to engage students in learning. Sarah identified that students' interest in the lab activity was a critical factor affecting a group's ability to work together. She continued to rely on her own enthusiasm to engage her students in learning biology, but she also described working to be more effective at what she saw her role to be, "to present information" by providing examples to relate concepts to students' prior knowledge, "to make biology seem to them like something that they could use in the future, that makes sense, you know, relevant to what they are studying."

Unlike Beth, Quanah, and Samantha, Sarah did not express a shift toward sharing control for learning, though she identified a change in her sense of responsibility for students' successes or failures. She explained that the biggest challenge she faced in her first semester of teaching was reconciling the feeling that "I want all my students to do well, so not having […] perform adequately in class is another challenge, because I have to make it less personal."

As the semester progressed, Sarah recognized that her strategies for learning differed from strategies that worked for her students. Sarah was able to function on "information overload," but her students understood new ideas better when she broke biological concepts into smaller chunks of information. As a result, Sarah began to incorporate multiple strategies to help her students learn biology. Describing herself as an auditory learner, she began to step outside of her comfort zone, using diagrams and graphs to communicate ideas. Sarah included relevant examples to connect concepts to everyday issues and to show relationships between biological concepts. She shared one story where a group of students were struggling to understand a concept. After Sarah gave them a number of "farfetched examples" to illustrate the concept, the students started explaining the concept, demonstrating that her examples helped them understand.

At the beginning of the semester, Sarah was concerned that she wouldn't be able to answer students' questions, that she "wouldn't be seen as a very knowledgeable source to the students." As the semester progressed, Sarah's descriptions of her teaching practices began to shift toward learner-centered approaches. Significantly, she recognized that the strategies she used to learn biology were not effective for her students. Sarah began to think about how her students learned, and she described planning to teach with this in mind. Her role as the keeper of knowledge, "a knowledgeable source" shifted as the semester progressed to a transitional, more learn-centered stance as consideration for student learning shaped how she explained concepts (Table 3). However, Sarah continued to see her role as the person who provides the explanations.

Case 5, Knox: Developing an Atmosphere of Approachability

> I think I am a better speaker and have really worked to improve the way students see me. I want to be on their level by understanding their problems, but I also want to maintain that connection that lets them know I am the person to come to when they have questions. When I speak, people tend to quiet down and listen (end-of-semester interview).

Knox was beginning his fourth year as an undergraduate when he began teaching for his first semester in biology. Knox was a peer-tutor for a number of introductory science classes at the first university he attended. He was also beginning his third semester as a TA for a recitation class in another science department. Knox had little interaction with students in this lecture-based class, explaining that "the students were unresponsive, and [it was] kind of difficult to get them to answer questions that you ask... the students have to be interactive, they can't be quiet all the time. They have to want to learn."

Knox, like Beth, Quanah, and Samantha, emphasized the importance of "thinking on one's feet" as a TA, specifically, being a "quick thinker, a creative thinker." However, Knox's explanation for why this ability was critical differed substantially from the other TAs' understanding of the importance of this skill:

> [Recalling the beginning of the semester] "A lot of the students didn't know how to approach creating an experiment…I would give them ideas and they

> were surprised at how many creative ideas I knew and they were like, 'Well, he's the TA for biology, he probably knows, he probably thinks of a lot of these ahead of time,' but that wasn't true; I literally think of them on the spot. So you have to be a quick thinker, a creative thinker, and that's basically what inquiry-based labs are all about."

Knox saw his role as a TA as being the source of knowledge for students, "being able to answer questions on the fly." He explained that the best way for students to learn was for the teacher to be well prepared: "I know the material enough to where I can teach it to the students and kind of apply it to real-world examples." For Knox, classroom management and conveying a sense of authority was also an important part of his role as a TA. While he sought to be seen as an approachable teacher, Knox simultaneously reinforced his role as the authority, asserting that creating an atmosphere of approachability was important because he wanted to "maintain that connection that lets them know I am the person to come to when they have questions." Further, Knox recognized the importance of student engagement but struggled to engage students consistently. Noting the importance of students working together effectively, like Sarah, he explained that interest in the lab activity was the biggest factor affecting a group's ability to work together:

> I would say that my favorite moment in the class was probably when I noticed that all the students were enjoying the labs that they were doing, because a lot of the labs this semester didn't really engage the students, even though they were inquiry-based, a lot of students felt like they'd rather have a step by step method. So when…the students actually enjoyed the lab… that kind of made me feel good, that I did a pretty good job in teaching them…it felt like to me that they learned stuff.

Unlike the other four TAs, Knox did not believe that his sense of being a teacher evolved as the semester progressed (Table 3). Of the five TAs, Knox began the semester with the most teaching experience. He explained that while teaching biology was a new experience, he had not "learned a whole lot" since he had prior teaching experience, but that he had gained "a bit more social skills in connecting with students" and "refreshed my memory on the basic biology." He commented on differences between his teaching experiences, explaining that he got to know his students in biology "because the day consists of you walking around the lab and making sure they're on track and learning." Knox described:

> I've gotten a little bit more comfortable talking to a large group of students… I've noticed that whenever I speak up, the students tend to settle down and listen to what I say. …My main strengths are probably what I said before: speaking up and being heard by the students... (post-semester self-guided interview).

As the semester progressed, four of the five TAs expressed changes in their views about teaching and learning. While these four TAs' conceptions became more aligned with inquiry tenets, each TA's views as a whole were not consistently learner-centered. Each case highlights one aspect involved in learning to teaching science as inquiry: Beth shared control for learning with students as they "forged" into inquiry, Quanah described the struggle to engage students in the process of science, Samantha facilitated collaborative learning, Sarah began to think about how students learn, and Knox balanced creating an approachable classroom climate with his role as the authority figure. Likewise, their teaching strategies described reflect their shifting beliefs and teacher identities.

Discussion

This study triangulates different sources of data, especially reflective data from TAs to explore and understand the trajectory of TAs' teacher identity formation as they teach biology using inquiry teaching practices. Analysis revealed that despite starting with traditional teacher-centered mindsets, by the end of the semester most TAs have progressed along a trajectory to develop a more learner-centered teacher identity (Table 4, 5). Here, hypotheses about commonalities amongst TAs' trajectories that propelled them to make this progress are discussed. I also discuss questions and hypotheses raised by this case study analysis. Finally, I make specific recommendations for supporting the development of inquiry (and learner-centered, more generally) teacher identities as well as avenues for additional research.

From the very beginning, each TA emphasized that they valued being a good teacher. While they all began with a teacher-centered mindset (Table 4), their conceptions of a "good teacher" included engaging students in learning biology. However, it is important to note that TAs' early conceptions were not closely aligned with conceptualizations of teaching science as inquiry. TAs' early visions illustrated that the weight of learning rested on their shoulders as teachers. By the end of the semester, TAs shifted their thinking from this early, fairly narrow teacher-centric perspective to one that focused on their students' experiences of learning (Table 4, 5). I hypothesize that this shift in focus to students' roles in class and student learning was key

for the four TAs who made big shifts in their teacher identities. TAs' conceptions of a "good teacher" became more complex, expanding from initial concerns about being a reliable source of information to considering how to create an environment for learning in their lab classroom. This perspective shift about what it means to be a "good teacher" has the potential to be leveraged as a tool for reflection for pedagogical development.

For the three most inquiry-identified TAs (Beth, Quanah, and Samantha), analysis suggests that this shift in focus to student learning led them to make lab class a more authentic experience for their students. For these TAs, lab class came to life: they saw lab not simply as a class but as an opportunity for students to really do science. Samantha and Quanah saw their students as doing science, identifying that this process included failure, problem solving, seeking constructive feedback from multiple perspectives, and asking questions: a process paralleling their own experiences of research. Along with Beth, they often emphasized the skills that their students were developing: collaboration, problem solving, and creativity. Making lab come to life also included its share of frustrations, reflecting the frustrations inherent in scientific research. For example, Samantha described one frustrating lab when each group failed to get results:

> I had to constantly reassure them and tell them that that's how science is done. Failure is a part of the process. You have to learn from the failure; you can't be all upset. Let's see what you can take away from this. (post-semester self-interview)

These case studies suggest that TAs (especially graduate TAs) may often leverage their own research experiences in the classroom in order to illustrate the commonalities between students' work and genuine research experiences. Further research is needed to investigate the relationship between TAs' multiple identities as students themselves, teachers, and scientists in order to better understand how we can support the development of integrated research-teacher identities.

Moreover, this shift to seeing their students as doing science, as opposed to working to get one "right" answer in order to finish a lab activity, necessitated sharing control for learning. Sharing control for learning meant that TAs began to value different teaching strategies. Rather than simply being well-prepared to share information with students, Quanah became a TA who "thinks on his feet," not to generate answers, but to develop questions to support students through the process of problem solving. This skill of "formulating and using questions effectively" is a critical component of inquiry teaching practices that many instructors find challenging (Winter et al., 2001). In contrast, Knox, who did not develop an inquiry teacher identity, defined the skill of "thinking on your feet" as brainstorming creative ideas to tell students, reflecting a continued focus on teacher-centric teaching rather than learning.

Table 4

How TAs' Beliefs About Teaching and Learning Changed Across the Semester, Classified Using the Teacher Beliefs Interview Typology (Luft & Roehrig, 2007)

	Traditional (information transmission)	Instructive (providing experience; teacher decides)	Transitional (Teacher/student relationships; affective responses)	Responsive (collaboration, feedback)	Reform-based (mediating student knowledge, interactions)
			Beginning of the Semester		
Beth		x	x		
Quanah	x	x	x		
Samantha	x	x			
Sarah	x	x	x		
Knox	x	x			
			End of the Semester		
Beth				x	x
Quanah			x	x	
Samantha		x	x	x	
Sarah		x	x	x	
Knox	x	x			

Note. TAs often held a mixture of beliefs, as represented by x

Table 5
Representative Example Statements From TAs to Illustrate how Their Beliefs About Teaching and Learning Changed Across the Semester, Classified Using the Teacher Beliefs Interview Typology (Luft & Roehrig, 2007)

	Beginning	End
Beth	Transitional "I want to be likeable I want to be a good TA I've had a lot of bad TAs and they've definitely affected my classes so I want to be a good one…"	Reform-based "You need to know the material so that you can apply it in any way that they come up with. You need to be able to adapt…You're trying to find new paths, or let them forge, but you have to be there to support them."
Quanah	Instructive "My biggest fear would be that I would be an inadequate teacher. That my students or the students I'm teaching don't really learn from me like as much as I'd want them to."	Responsive "I think understanding human social dynamics is almost as important as understanding the material because that's so crucial to how the students learn, and how they learn in groups …being able to communicate to all the members of these groups and getting them engaged is really a lot tougher than I expected. …I've also learned that …it's not just you getting up and lecturing the students, it's got to be a two way interaction for it to work properly."
Samantha	Traditional "You just can't take up a paper that someone has already prepared and just go and talk about it. You need to prepare yourself. You need to have a mental outline. You need to know what you're going to talk about. You just can't go and ramble on… I think teaching will definitely test …my ability to pass on the knowledge that I have gained and accumulated over the years to other students."	Transitional "…not even one group had gotten a successful cross, and that lab was very, very frustrating for me, and I had to constantly reassure them and tell them that that's how science is done. Failure is a part of the process. You have to learn from the failure; you can't be all upset. Let's see what you can take away from this."
Sarah	Traditional [discussing her biggest fear, that she won't be able to answer students' questions] "…because of that I won't be seen as a very knowledgeable source to the students. So my biggest fear would not be making myself seen as an effective teacher to my students."	Transitional So my whole goal this semester was to try to make connections between their everyday lives and concepts in biology to help them understand things a lot better. I made this big elaborate example …And all the students found the example really humorous, they really understood what the concepts were, they were able to relay back to me the information they got from the example…"
Knox	Traditional [discussing his biggest fear, when students ask questions and you don't really know the answer to it] "I try to avoid it as much as I can, but I've learned through my teaching experience that you have to kinda just roll it off, you can't treat it too highly, because you'll end up making yourself looking bad in front of the students…"	Traditional "I've gotten a little bit more comfortable talking to a large group of students. I've noticed that sometimes when I teach with my co-TA that I have to be the one who speaks up in front of the class when it gets kind of noisy. I don't know if I have a loud voice or if I just have this ability to make people stop talking but uh I've noticed that whenever I speak up, the students tend to settle down and listen to what I say."

At the same time, sharing control for learning meant that TAs recognized a shift in classroom authority. When asked to elaborate on the meaning and importance of "portraying a sense of authority," TAs' explanations ranged from teacher-centered ("being seen as knowledgeable by students") to learner-centered (describing the need to be confident and patient when using questions to guide students: "It's not that you don't know the answer, it's that you want students to learn"). Some TAs began to see their roles less as "keepers of knowledge" and more as facilitators, in Beth's words, "helping students to forge." For some TAs, such as Quanah, the role of facilitating revolved around guiding students using questions. For Beth and Samantha, facilitation also included mediating group dynamics to help their students to learn from each other more effectively. Beth's and Samantha's views of their teacher identities developed to support a key assumption in inquiry classrooms described by Winter and colleagues (2001), that "through interactions with their peers students may construct meaningful understandings of the subject matter...students learn by

constructing their own understandings." Additionally, inquiry-oriented TAs reported that they learned with and from their students: a major shift from their earlier information transmission identities. More research is needed to understand what prompts this shift in thinking to share responsibility for learning in the classroom.

While four of the five TAs began to construct inquiry-oriented teacher identities, in contrast, Knox did not make much movement toward an inquiry teacher identity (Table 4, 5). What happens when TAs don't "get" inquiry? In contrast to the other TAs, Knox did not believe his sense of being a teacher evolved during the semester, nor did he appear to incorporate learner-centered beliefs beyond developing a classroom atmosphere of approachability (Tables 2 and 3). Instead, Knox describes his conception of the instructor's role in an inquiry-based lab as providing ideas and examples to students (and see Table 2 and Table 5). Unlike the other four TAs, Knox never shifted his focus to thinking about student learning. One hypothesis that emerged from analysis is that without this perspective shift to reconceiving "good teaching" around student learning, instructors may remain fixed in teacher-centered approaches. For Knox, his focus on further developing teacher-centric behaviors reinforced his role as the information authority in the classroom. This conception of the instructor's role may undermine both the classroom culture needed for inquiry and students' motivation to develop their own experiments.

It should be noted that this study did not include direct classroom observations, so analysis does not extend to interpretations about TAs' enactment of teaching practices (but see Gormally, Sullivan, & Szeinbaum, 2016 and similar work). However, making beliefs explicit can reveal how teachers learn as well as their teacher identity, which can suggest the kinds of teaching practices they implement in their classroom (Luft & Roehrig, 2007). For example, in a teacher-centered classroom, the TA may determine the way in which students come to knowledge by establishing herself as the authority or "keeper of knowledge." Alternatively, in a learner-centered classroom, the TA may see learning as a collaborative process shared with students (Simmons et al., 1999). Understanding the frameworks of knowledge that beginning teachers bring to this process can help us to build more effective programs to support learner-centered teacher development (Luft & Roehrig, 2007; Simmons et al., 1999).

Implications for Pedagogical Development

What does it take to develop a learner-centered teacher identity? Prior to their first inquiry teaching experience, TAs' beliefs about teaching and learning were not aligned with a learner-centered paradigm. Yet findings from this study suggest that instructors new to learner-centered pedagogies can reconceive their teacher identity in a relatively short time. The first step down this path involves examining deeply held and often little explored beliefs about teaching and learning (Volkmann & Zgagacz, 2004), such as the idea that the "dissemination of information and the creation of understanding are the same thing" (Winter et al., 2001). Existing beliefs must be challenged and reconciled to align with tenets of constructivist teaching (Haney & McArthur, 2001). These understandings structure expectations for student and teacher roles, and they may constrain instructors' enactment of inquiry teaching practices. As a result of their own learning histories, many TAs and instructors view the teacher as directing students to be sure students learn what needs to be learned. In this study, findings revealed that one of the most challenging aspects of inquiry teaching for TAs to embrace was recognition of their role as a facilitator of group dynamics to support peer learning and, ultimately, further support for students to take control of their learning. The challenge of helping students work together successfully is a common issue in inquiry classrooms (Winter et al., 2001). Helping instructors new to inquiry to recognize their role in mediating group dynamics should be highlighted in training.

Reflection and support from a teaching community can play pivotal roles in shifting beliefs. In reviewing this manuscript, Samantha noted that her co-TAs were influential in "challenging my belief that I have to know everything." Reflection was a critical component of Lab prep, and each week TAs responded to reflection prompts in writing and/or discussion, for example, "How do you know when your students are learning and what is your role in that process?" As studies of secondary science teachers (Luft & Roehrig, 2007; Simmons et al., 1999) and TAs (Addy & Blanchard, 2010; Volkmann & Zgagacz, 2004) have shown, unless instructors' beliefs about the nature of science are challenged, their teacher identity will remain unchanged. Reconciling beliefs early in graduate training may be key for affecting change in university science education.

Finally, to better support TAs' developing identities as inquiry teachers, TA preparation instructors should also consider whether TAs are currently undergraduate or graduate students. The case studies presented here include both undergraduate (Beth, Knox, and Sarah) and graduate students (Quanah, Samantha). These two groups may approach teaching from different perspectives. For example, undergraduate TAs may be more familiar with their student population and course expectations but struggle to be seen as authorities while teaching their peers, as described by Beth. Graduate TAs are balancing three identities as students themselves in graduate courses, as

new teachers, and as burgeoning research scientists. Consequently, TAs' views toward teaching science as inquiry may be influenced by their particular trajectory in higher education. Faculty who work to support TA preparation, as well as other researchers, would be wise to consider perspective differences between undergraduate and graduate TAs.

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Appendix A

Written reflection prompts

Pre-semester:

1. Tell me about yourself and where you are from. Describe yourself and how you came to study biology.

Post-semester:

1. What have you learned about teaching this semester? Does this change how you'd define teaching and what's involved in teaching?
2. How do you think you've improved or changed as a teacher? (and: if you've watched your videotaped class session—did you see this reflected in that class—and how?)

Appendix B: Self-guided interviews

Pre- & Post- Semester Reality TV-style "Teaching Confessional"

During the first and last week of lab prep, you will videotape your very own reality TV-style "teaching confessional," following a guided list of questions. There are two purposes to this activity: (1) to reflect on your ideas about teaching and learning at the beginning and end of the semester; and (2) to generate subsequent conversation about teaching amongst introductory biology TAs, to build a teaching community. For the purposes of learning to teach, we are going to start the semester by thinking about why we are here teaching and our ideas about teaching and learning. We will end the semester by reflecting on how our ideas about teaching and learning have changed. I expect you will grow as teachers over the semester, and I think documenting that will be fun!

It may help you to have a better sense of what your self-guided interview might be like by considering StoryCorps, broadcast on NPR, to think of yourself as interviewing yourself about stories or episodes in your own life, or to consider reality TV-style "confessionals." Why StoryCorps-style or reality-TV "confessional"? These ideas are in line with the classroom atmosphere we are creating in introductory biology labs—appreciating the value of listening to others and helping students and ourselves to have voices in the classroom—and becoming reflective teachers, to keep improving. Stories about life remind us of our shared humanity, build connections between people, and teach the value of listening. Stories about our experiences thus far in biology can also be useful to consider as our starting point for this semester.

Pre-semester questions:

1. Introduce yourself. Describe how you became interested in studying science (e.g., pivotal experiences that led you to want to study science, and become a ___?)
2. Describe your experiences in learning biology as a student (this can include both good and bad experiences).
3. In your opinion, what factors affect how students learn and teachers teach?
4. What is your biggest fear about teaching?
5. What do you hope to learn through teaching?

Post-semester questions:

1. Describe your favorite moment in the classroom this semester.
2. Describe your worst or most challenging moment in the classroom this semester.
3. What have you learned this semester through the process of TA-ing?
4. How would you describe yourself as a teacher? What are your main strengths as a teacher? In what areas would you like to continue to improve as a teacher?
5. What are the characteristics or skills needed to be an effective TA in an inquiry-based lab? What would you share with new TAs to help them to develop these skills?

Appendix C

Interview Guide

1. I'd like to start by asking you to tell me about yourself, and how you became interested in studying biology. *Potential follow-up questions include:*
   - Were there pivotal moments that led you to want to become a ….?
   - What are your future career plans and do your plans include teaching?
   - What motivates you to want to teach?
   - Do you have prior teaching experience?

2. How has your experience teaching this semester differed from your own experiences in learning biology as a student? *Potential follow-up questions include:*
   - Can you describe what the learning environment was like?
   - How do you think you learn best?
   - How do you know when you've learned something?
   - How do you think your students learn best?
   - Describe your favorite teacher. Why was s/he your favorite teacher?
   - Before we move on to talking more specifically about teaching, is there anything you'd like to add about your experience in learning biology?

3. What are the most important skills a teacher needs to be successful in teaching? Do these skills differ for an inquiry class?

4. What is it like for you to be a TA at this point in your life? What aspects of your life and experience do you think influence how you teach?

5. What affects your credibility or authority as a teacher? *Potential follow-up questions include:*
   - How does who you are affect your credibility as a teacher?
   - Do you think your credibility has changed over the course of the semester?

6. What factors do you think affect how students learn and teachers teach in an inquiry-based lab?

7. What do you think your students have learned that they will take away beyond the lab classroom? What do you hope they take away?

8. We've been talking about your approach to teaching. I'd like to ask you some questions about the lab class that you videotaped this semester (*note: participants were not asked to view video clips during the interview)*. After watching your videotape, what do you feel went well in this particular lab?

9. What did you feel did not go well with the class? *Potential follow-up questions include:*
   - What is the reason you think these problems happened?
   - How would you modify your teaching next time to deal with these problems?

10. What do you think is necessary for successful group work and for students to learn in groups? *Potential follow-up questions include:*
    - Describe a group that worked well together in this class.
    - Describe a group that did not function well in this class.
    - How do the two groups differ?
    - Describe your interactions with both groups.