Eliciting Student Explanations in an Undergraduate Biology Course

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Abstract: Our research described discourse patterns during a planned elicitation discussion in an undergraduate biology laboratory course taught by undergraduate teaching assistants (TAs). We examined how discourse patterns changed from the first to the second semester of the TA's appointment. Conference participants will discuss the usefulness of organizing discourse patterns within a two dimensional space along axis of TA talk moves for visualizing change in ambitious science teaching practice and the implications for TA professional development.

Keywords: ambitious instruction, elicitation discussion, teaching assistant, professional development

Undergraduate biology laboratory courses and scientific discourse

Visions for undergraduate biology education and sociocultural theories of learning highlight student participation in scientific discourse as a cornerstone for learning (AAAS, 2011; Lemke, 1990; Warren et al., 2001). However, supporting discursively rich scientific experiences in the classroom is challenging, especially for novice teaching assistants (TAs). To support TAs in this challenge, we drew on ideas of ambitious instruction that have been described for K-12 teachers and may also be fruitful for postsecondary TAs (Windschitl et al., 2012). Teacher preparation programs for elementary and secondary teachers have incorporated ideas of ambitious instruction and some research examines how teachers appropriate and implement moves associated with ambitious instruction (Stroupe, 2016; Thompson, Windschitl, & Braaten, 2013). However, there is a need for research describing how postsecondary TAs implement ambitious science teaching practices. This research focused specifically on the practice of eliciting student ideas as a basis of instruction. We asked two research questions: (1) What patterns of discourse emerged across multiple iterations of a planned "elicitation discussion" in a biology lab course? and (2) How did discourse patterns for the same planned "elicitation discussion" change between a TA's first and second semesters teaching the course?

Methods

Study context and participant selection

The course was a biology lab for non-science majors taught by undergraduate TAs at a large research university in the Southeastern United States. The curriculum included 12 labs where students collected evidence to construct a scientific argument in response to a guiding question. We used a criterion sampling strategy (Miles and Huberman, 1994) to select participants that met the following criteria: (1) they taught the course for the first time in Fall 2015 and (2) they taught for a second time in Spring 2016. Thirteen of the 21 undergraduate TAs met the criteria. TAs attended weekly 2-hour professional development sessions to learn biology content, to witness models of ambitious instruction and discuss instructional moves to enact ambitious instruction, and to anticipate what students may say or do in response to instruction. Additionally, TAs were required to observe a peer teaching the lab investigation each week and keep a reflective teaching journal. All 1000 students enrolled in the course each semester were asked to participate in the study and 75% agreed each semester.

Data sources and analysis

Each lab investigation began with a planned "elicitation discussion" intended for TAs to elicit students' initial ideas about a phenomenon (Michaels & O'Connor, 2012). The data sources included transcripts of the Lab 2 elicitation discussion from each semester for the 13 participants and each TA's reflective teaching journal. We analyzed the Lab 2 elicitation discussion to allow TAs and students to adjust to course norms during Lab 1 before we captured the discourse patterns in their first semester as a TA to compare to discourse patterns of the same discussion one semester later. The planned aspects of the Lab 2 elicitation discussion were: (1) students have a common experience with the "fight or flight" response, (2) the TA elicits student observations of their physiological responses to the stimuli, (3) the TA presses students for possible explanations of how these physiological responses occurred, (4) students observe an earthworm and a cricket's response to stimuli, and (5) the TA presses students to consider how the explanations they co-constructed for humans may or may not apply to other organisms. The transcripts were blinded and analyzed using an a priori coding framework based on the classroom talk literature (e.g., Oliveira, 2010; Windschitl et al. 2012) and for explanatory rigor of student talk

(Thompson et al., 2016). Cases were individually developed for each TA, compared, and categories were developed iteratively to qualitatively describe common discourse patterns that emerged, how discourse patterns changed over time, and how change in TA practice was connected to teaching reflections.

Findings and implications

Four distinct discourse patterns emerged from the analysis: "Mostly Facts", "Mostly Observations", "Facts, Observations, and Explanations", and "Observations and Explanations". The poster presentation will include figures and further discussion of the discourse patterns. The patterns of student contributions were related to patterns of TA talk moves. To portray these relationships, we positioned each of the four student discourse patterns on a two-dimensional plane based on how the initial question elicited student thinking (horizontal axis) and how the TA response extended student thinking (vertical axis) (see Figure 1A). This framework allows us to locate a TA's practice within this space and could be useful to design professional development to support TA practice along the appropriate axis (initial questions or responses) to elevate explanatory rigor. We examined change in TA practice over time by mapping maintenance (O) and movement (→) within this space and patterns of change corresponded to the focus of TAs' reflective teaching journals (e.g. classroom and time management, classroom climate, student thinking) (see Figure 1B). Further discussion of these connections and the utility of this framework for designing TA professional development will be held at the poster session.

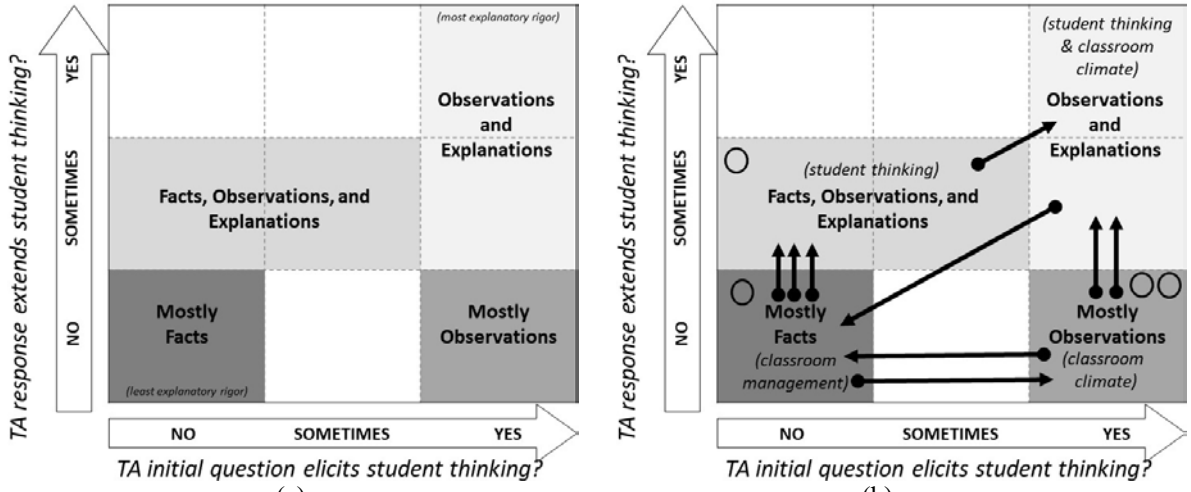

Figure 1. The four discourse patterns mapped onto TA talk move space (a) and TA change within that space (b).

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