

Strategies for Leading Weekly Teaching Assistant Meetings: Undergraduate Student Perceptions after Implementing Pedagogical Change

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Laboratory course coordinators are tasked with training teaching assistants to deliver quality instruction across laboratory sections. However, teaching assistants are hired with varied levels of content knowledge, motivation, and awareness of pedagogical best practices. At the 2019 mini workshop, participants discussed the challenges of training teaching assistants at their home institution and learned strategies to meet these challenges. To maximize the effectiveness of graduate teaching assistant (TA) instruction, I have changed the Graduate Teaching Assistant Teaching Professional Development (GTA TPD) provided during the weekly preparatory TA meetings for a neurobiology lab at the University of California, Irvine. The new GTA TPD spends less time performing student experiments and invests more time in standardizing grading practices, training in providing effective feedback, and instruction in active teaching strategies in a collaborative learning environment. Data on undergraduate student satisfaction and perceptions were collected and were discussed in the mini workshop. Participants discussed the merits and limitations of the implemented pedagogical changes and learned from the collective wisdom of workshop participants.

Keywords: Graduate teaching assistant, teaching professional development, effective feedback, active teaching, transparency

Introduction

Institutions often rely on teaching assistants to lead laboratory sections. The success of biology laboratory instruction relies on each teaching assistant (TA) effectively guiding student inquiry and executing the experimental logistics. More so than science faculty, TAs are often the representative on the instructional team whom students ask questions. Therefore, TAs need to be prepared to answer questions regarding the conceptual framework tested by experiments, guidelines for scientific writing, tips on successful hands-on manipulations, as well as logistical directions on where to locate supplies. Nevertheless, TAs are often novice educators who need guidance and mentorship.

As pedagogical standards sweep biology education, it is also important for TAs to receive guidance and mentorship on implementing pedagogical change. The AAAS Vision & Change report (AAAS, 2011) has highlighted the need for class activities that engage students as active participants rather than passive recipients, defined learning goals which help focus student

attention on key concepts, and effective feedback in student-centered learning. These practices create a student-centered learning environment which is interactive, cooperative, and focused on helping students succeed. Transparency in articulating exercise purposes and standards of excellence have been shown to be effective in promoting student success, especially for first-generation, low-income, and underrepresented college students (Winkelmes *et al.*, 2016).

While educational experts and disciplinary associations have identified evidence-based best practices, student responses to pedagogical change have been mixed (Anderson *et al.*, 2013; Nagel and Nicholas, 2017; Evenhouse *et al.*, 2018; Wiltbank *et al.*, 2019). It is widely acknowledged that students often do not appreciate instructional practices that have been tested and shown to best improve learning gains. Moreover, faculty and students often have disparate perceptions of instructional practices (Beck and Blumer, 2016). It is not well studied how students will respond to pedagogical change introduced to teaching assistants. Previous work found that student perceptions of curricular change were positively

correlated with the perceived quality of the teaching assistant (Casem, 2006). It is possible that students may respond favorably to the graduate teaching assistant who receives Graduate Teaching Assistant Teaching Professional Development (GTA TPD) provided during the weekly preparatory TA meetings. The present study sought to examine undergraduate student perceptions as pedagogically supported teaching practices were taught to graduate teaching assistants in weekly teaching assistant meetings.

Challenges to Training Teaching Assistants

As laboratory course coordinators oversee standardization across laboratory sections to ensure instructor quality and grading policies are fair across sections, they face a number of challenges. The participants of the 2019 mini workshop discussed challenges they face training teaching assistants at their home institutions.

Participant Demographics

Lab course coordinators from different institutions convened for the workshop. Workshop participants worked with different compositions of TAs, with many needing to address diversely prepared TAs simultaneously during TA meetings. Fifteen percent of participants reported that their TAs were undergraduate students who had successfully completed the taught lab course. Thirty-five percent of participants reported that their TAs were graduate students who had low or moderate technical expertise in their course content. No participant reported that all their TAs had high technical expertise in their course content, rather 50% of workshop participants reported that their TAs were composed of a mixture of the populations above.

Workshop participants also differed in the degree of autonomy that they had over TA selection. Fifteen percent of participants reported that their TAs were people whom they had selected for the position. In contrast, 20% reported that their TAs were people who were assigned to be their TA and they had no control over the selection criteria. The large majority reported that their TAs were composed of a mixture of these two populations.

Challenges Raised During Workshop

During the workshop, participants raised challenges that they face when working with their TAs. TAs often have no or partial knowledge of the pedagogy underlying strong laboratory education. As a result, they lack teaching skills. These TAs often focus on the “right answer” or non-essentials. Some TAs also have minimal interest in teaching, or face pressure from research faculty who expect the TAs to spend minimal time on teaching. Regardless of the teaching interest level, TAs also possess minimal understanding of the preparation required to teach a biology laboratory. Workshop participants reported that some of their TAs

lacked experience with the content or skills that they were expected to teach. This applied both to the scientific content as well as the writing skills that are often expected of TAs to teach to their students. A number of times, workshop participants remarked that their TAs wanted to be liked. TAs focus on attaining affirmation from their students more than helping them achieve learning goals.

Because of these challenges, course coordinators observe a lack of consistency across lab sections. Although policies can help to standardize lab sections, workshop participants also noted that this must be balanced with some autonomy given to the teacher-in-training. Lab coordinators are faced with the challenge of determining an appropriate amount of autonomy.

Features of New Weekly Teaching Assistant Meetings

In order to meet a number of challenges described by Gardner and Jones (2011) and workshop participants, I redesigned the format and content of the weekly teaching assistant (TA) meetings. The new meetings spent less time performing experiments and more time standardizing grading practices, training in providing effective feedback and instruction in active teaching strategies. These weekly TA meetings incorporated GTA TPD elements by introducing best pedagogical practices in their current teaching context. Students were given guidance on providing effective feedback, trained to provide transparent learning outcomes and equipped with pre-designed active teaching strategies to apply immediately in their role as a TA for a neurobiology laboratory class taken by students in the School of Biological Sciences at the University of California, Irvine.

Guidance on Providing Effective Feedback

Well-meaning, novice instructors tend to provide an overwhelming quantity of feedback to students. In their eagerness to help students improve, they often overload students by pointing out all areas in which the written assignment needs improvement. This is time-intensive for novice teaching assistants and intimidating to students. Overmarking can backfire on the well-meaning instructor by discouraging the learner.

During the weekly TA meeting, I dedicated a portion of GTA TPD to training TAs on how to provide effective feedback which maximized both the TA's time and the students' likelihood to apply instructor feedback. TAs were instructed to address higher-order concerns. Rather than marking every minor mistake, TAs were instructed to practice minimal marking that only addresses two or three global issues found in the writing. When practicing minimal marking, instructors do not need to mark every instance when they notice an error, especially low-priority errors such as grammar. Instead, a portion of the student writing

is marked with an improvement area and students are asked to transfer this correction to other portions of the writing. For example, the instructor may edit one paragraph thoroughly for minimal errors and then comment on the margin that it is the student's responsibility to fix these errors throughout the rest of the assignment. Minimal marking encourages students to be actively engaged in correcting their own writing, resulting in better retention of the feedback they received (Hyland, 1990).

Effective feedback also practices transparency. All writing assignments in the UC Irvine neurobiology laboratory course are designed so that the prompts are transparent about our expectations. Rubrics are made available to students so that they know what the instructional team values and how they will be assessed in achieving the learning goals (Jönsson and Prins, 2019). To maintain transparency throughout the process, TAs are encouraged to have the rubric on hand, so that their comments and grading reflect the articulated criteria for the specific assignment.

Instructor comments have the greatest potential to benefit students when they convey a student-improvement mentality rather than a student-assessment mentality. A student-improvement mentality considers the student on the pathway toward excellence, and the tone of comments conveys an expectation that students desire to improve and will improve. Comments provide concrete applications which help the student change. In contrast, a student-assessment mentality is focused on evaluating and identifying the current status of the student's work. At best, these comments state clearly the weakness of the work, but the student receives no guidance on how to be different.

These pedagogical guidelines are taught to TAs during one of the weekly TA meetings. Guidelines are also summarized on a 1-page handout, so that TAs are not overwhelmed. See the appendix for the 1-page handout given to TAs.

Transparent Learning Outcomes

The 2011 AAAS Vision and Change report recommends clearly articulated learning outcomes which are aligned with forms of assessment. Often some form of learning outcomes is incorporated in curricular materials, but they fail to be specific, or fail to be utilized when exams or other forms of assessment are given to students. For example, previous to the pedagogical change that I brought to UC Irvine, our lab goal was stated as "understand the fundamentals of experimental pharmacology." Moreover, the lab goal was buried in the lab manual and easily overlooked by students. In our revised curriculum, the lab goal was stated specifically in three parts: "interrogate synapse function using neuropharmacology tools and muscle contractions as a visual output of synapse function; practice troubleshooting experiments when experiments do not proceed as planned; gain hand-eye

coordination and tissue preparations." Moreover, these lab goals were highlighted during the weekly TA meetings and TAs were instructed to highlight these during their lab sections. Rather than letting learning outcomes fall into the background, they are brought into the spotlight so that students use them to frame their time in lab.

For those new to writing and communicating clearly identified learning outcomes, consider using verbs in Bloom's taxonomy so that it is clear to both you and your students at what cognitive level you expect your students to engage with the material. It may be helpful to have a list of verbs in Bloom's taxonomy handy as you write the learning outcomes. Also, be transparent to students about what you hope students will gain from the experiment and be explicit to TAs about communicating learning outcomes.

Pre-designed Active Teaching Strategies

Many TAs face time pressures. Whether in doctoral programs in the United Kingdom or United States, many graduate TAs feel their teaching duties take up too much time and they are not adequately compensated for the time they spend teaching students (Park and Ramos, 2002). The task to design pedagogically sound teaching strategies can be time-consuming, especially for a novice instructor. To facilitate implementation of best pedagogical practices across sections, I distributed pre-made powerpoint slides with embedded active learning exercises. These pre-made exercises allow easy implementation and promote consistency across laboratory sections.

For example, a think-pair-share question was embedded into a powerpoint slide which was aimed to introduce student to the idea of empirical and falsifiable evidence. Rather than simply giving students a definition of empirical evidence and a definition of falsifiable evidence, the provided powerpoint slide also included a prompt for students to determine whether the statement, "Neurons grow faster when they are grown on a scaffold of two glial cells," is an example of empirical evidence and whether it is an example of falsifiable evidence. The question prompt presses students to apply a definition of a concept to a particular instance, thereby demonstrating that students have acquired knowledge at a greater cognitive complexity (Krathwohl, 2002; Schönborn and Bögeholz, 2009). Importantly, the discussion asks students to grapple with the definitions of empirical and falsifiable and de-emphasizes whether students get a "right answer." In fact, based on the limited information given in this statement, students can argue that the statement is empirical evidence if it was derived from observation and data collection. However, it is also possible to come to this conclusion by using logic and theory based on known constraints of neurons and glia, in which

case it would not be empirical evidence.

Collaborative Learning Environment

The weekly TA meetings are also conducted in a collaborative learning environment where TAs are asked to raise their concerns and questions intermittently during the sessions. Just as we recommend that our TAs engage with their students as active participants in learning biology; similarly, the TA meetings themselves are also organized so that the TAs are treated as active participants in learning how to teach biology. TAs have a voice in steering their training in areas to which they would like the instructor to give more attention. During post-lab debriefings, I also ask TAs to share recommendations for future quarters of TAs. These recommendations are then collected and used to shape how I run the GTA TPD in following quarters. Therefore TAs also have a voice in steering future cohorts of biology instructors and students.

Undergraduate Student Satisfaction and Perception

Although the pedagogical change incorporated at weekly TA meetings introduces evidence-based teaching practices that are shown to augment student learning gains, it was uncertain how the undergraduate students would perceive the effects of these changes. Student satisfaction is uncorrelated with actual student learning (Feistauer and Richter, 2017; Hornstein, 2017; Clayson, 2018). In fact, Braga *et al.* (2014) found that teacher effectiveness was negatively correlated with students' evaluations.

In order to examine undergraduate student satisfaction and perceptions following pedagogical change, we surveyed students enrolled in Neurobiology Lab at UC Irvine during the Winter 2018 and Spring 2018 quarters. Pedagogical change was implemented during the Spring 2018 quarter. Therefore, Winter 2018 survey responses were analyzed as the pre-test and Spring 2018 survey responses were used as the post-test following the GTA TPD intervention. During the last class meeting, students were invited to provide feedback on the experiments conducted over the course of the quarter. The open-ended survey asked students to circle their favorite lab session, explain why they found it helpful in preparing them for a career in neuroscience, share their frustrations about the lab exercises, and provide any other comments on how to improve the design of the class.

Surprisingly, comparison of the pre- and post-test found that students had a greater appreciation for a wider diversity of labs following pedagogical change. The implemented change also eliminated student complaints that assignments had unclear expectations.

Greater Appreciation for Wider Diversity of Labs

Prior to the implemented change, the majority of

students said that their favorite lab was dissection of a brain (Fig. 1). The majority of students were unable to appreciate the learning goals of the other labs. This is particularly striking, because the brain dissection lab is an introductory lab which does not have a research question. Students simply learn the anatomy of a sheep brain and cow spinal cord. Following the pedagogical change, I saw a prominent shift so that students also appreciated the neuropharmacology, behavioral neuroscience and electrophysiology experiments. Although students had previously expressed disdain for the neuropharmacology experiments, this lab was transformed into one of the more popular labs in the course.

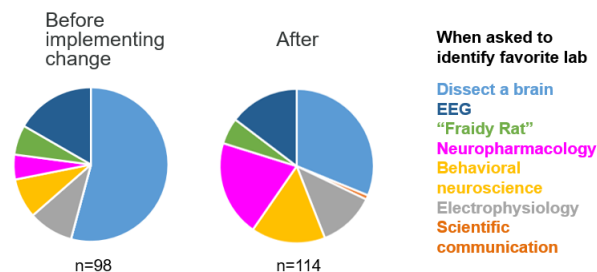


Figure 1. Greater appreciation for wider diversity of labs following pedagogical change. Students (n=98) in Winter 2018 were surveyed for their perspectives prior to the pedagogical changes. Students (n=114) in Spring 2018 were surveyed for their perspectives following the pedagogical changes.

Eliminated Student Complaints That Assignments Had Unclear Expectations

Prior to implementing the pedagogical changes described in this paper, a number of students voiced complaints about the assessments used in the course and confusion about the instructor expectations. For example, one student wrote,

Grading system = hard work does NOT correlate to a good grade in this lab especially

When free responses were coded and analyzed, I found that 15% of students made similar complaints about the grading system.

Surprisingly, I found that 0% of students complained about the grading system following the pedagogical change. In fact, students noted the utility of the highlighted and clarified learning objectives. For example, one student wrote,

The learning objectives help organize learning by telling the big picture of things.

The pedagogical change radically eliminated the student complaints about grades and expectations. The increased transparency in assignments and active learning strategies helped to focus student attention so that they were aligned with instructor priorities.

Conclusion

Despite anecdotal reports and a few studies that recount how pedagogical change frustrated students, I found that pedagogical change can be well-received by students. There does not need to be a dichotomy between teaching practices that improve learning gains and teaching practices that students appreciate.

Strong pedagogical practices can be incorporated into weekly TA meetings. Although TAs may have varying degrees of pedagogical knowledge, laboratory coordinators can ease implementation by providing short 1-page primers as well as pre-designed teaching exercises. In essence, TAs who lack teaching skills learn through experiential learning, while TAs with minimal preparation time still deliver high quality lessons.

Nevertheless, there are a number of unmet challenges that this study does not examine. Although this study found that pedagogical change can result in greater undergraduate appreciation for a wider diversity of lab experiments and can eliminate undergraduate student complaints, it does not directly address the TA's desire to be liked. Future studies can explore teaching professional development programs that mentor new instructors to

dissociate personal likeability from teaching effectiveness. Participants at the workshop also noted that lab coordinators face challenges supporting TAs who are English language learners (ELL). Since our universities are becoming more multicultural and international, research needs to examine how we can best support ELL instructors in teaching and students in learning these new pedagogical practices. Studies are needed which explore the unique challenges of ELL audiences as well as the challenge of training a heterogeneous population where the audience is not composed solely of ELLs. While previous studies have examined the efficacy of active learning, appropriate feedback and explicit expectations for assignments, this study did not re-examine the efficacy of these implemented changes. The scope of the present study was limited to undergraduate perceptions of the pedagogical changes. It is possible that changes in TA training may not have translated to teaching improvements in practice. Future studies can examine how TA training affects student learning, as well as TA perceptions of pedagogical changes, TA identity as educators, and the likelihood that TAs adopt pedagogical teaching strategies long-term.

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Audrey Chen has been an Assistant Professor of Teaching at the University of California, Irvine since 2018, where she teaches neurobiology to both students without a background in biology as well as advanced students specializing in neurobiology. She directs the laboratory teaching development program for Neurobiology PhD students which provides discipline-specific pedagogical and logistical training for

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Appendix: Feedback Strategies

Students learn by improving based on feedback.

How do we as lab instructors and graders provide effective feedback?

I. Address Higher-Order Concerns First

- a. Try to focus major comments on 2-3 global concerns. These can be addressed in the form of a longer note at the end of the assignment.
- b. Practice minimal marking (http://www.csuchico.edu/ge/faculty/writing_intensive_u/responding_to_writing/responding_to_surface_errors.shtml). Edit one paragraph thoroughly for minimal (i.e., grammatical) errors. Comment in the margin that it is the student's responsibility to fix these errors throughout the rest of the assignment.

II. Practice Transparency

- a. Students write their assignments based on how *we* have written the prompt and shared our expectations. We make our rubrics available to students so that they know what we value and how we will assess whether they have achieved our goals for them.
- b. Have the rubric on hand. Your comments and grading should reflect the assignment's specific criteria.

III. Convey a Student-Improvement Mentality Rather Than A Student-Assessment Mentality with Your Comments

- a. It's great to point out where writing is vague or unclear, but it is useless unless it is also coupled with a concrete suggestion on how the student can fix the problem. Your comments should let them know specifically what important aspects were left out of their vague statement.
- b. Make sure you always have some encouraging praise.

IV. Logistical Tips

- a. Read several papers before you begin grading to establish context for the class interpretation of the assignment. This will help you see common mistakes and calibrate your partial credit.
- b. Keep a timer on hand. These tips will all help you to reduce time spent grading, but if you find yourself getting stuck on one assignment, save it for later and move on to the next, or keep an eye on your timer.
- c. If a writing assignment requires an excessive amount of extra work, meet with the student instead. Talk about the global problems. Recommend that they make an appointment with the Learning and Academic Resource Center (www.larc.uci.edu) or Center for Excellence in Writing and Communication (www.writing.uci.edu/writingcenter.html).

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