

Teach Talk

TA Training Bootcamp Reinforces Curriculum Innovations and Improves Recitation Experience in Freshman Chemistry

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THROUGH A GRADUATE-STUDENT teaching-assistant (TA) training “bootcamp,” a modest time investment by Chemistry teaching staff prior to the semester is resulting in 5.111 TAs with outstanding teaching skills, confidence, enthusiasm, and effectiveness throughout the term. In considering innovations recently incorporated into the 5.111 freshman chemistry curriculum that highlight the underlying chemical principles in examples from biology and medicine, we realized that any work to improve the 200-plus-student course must be reinforced by improved TA training.

Our goals in creating a bootcamp for the 10 TAs assigned yearly to this course included improving teaching in the TA-led recitation sections by increasing the TAs’ confidence in and enthusiasm for the material and for teaching, and by creating a community of support and collaboration among the TAs. While our program was designed for a chemistry course, the bootcamp structure and activities are relevant for any subject with TA-led recitations.

Bootcamp Design and Components

The bootcamp consists of five part-day sessions (~ 20 hours total) throughout the week prior to the start of classes. An initial concern in designing a bootcamp was the limited time that most professors have available to devote to TA training. To reduce faculty time requirements, the schedule is organized to split the activities among course instructors, former TAs, and others involved in the course or department. While significant time was spent designing the program, the time commitment of executing the bootcamp

is modest. Program activities address teambuilding, teaching skills, and exposure to the course material and philosophies, while generating excitement for the course content and for teaching. A sample

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schedule is shown in the table (next page), with a more detailed version available on the MIT 5.111 OpenCourseWare Website: ocw.mit.edu/OcwWeb/Chemistry/5-111Fall-2008/CourseHome/index.htm.

Teambuilding. A supportive group dynamic can reinforce the dedication and excitement of individual TAs and provide an environment where TAs build off of each other’s strengths. Bootcamp begins with a discussion-based teambuilding exercise in which each TA and faculty member answers questions such as *What was your first college chemistry course like?* and progresses, as the comfort level of the group increases, to *What is your biggest fear or concern about teaching MIT undergraduates?* In addition to specific teambuilding exercises, teamwork and community building is stressed throughout bootcamp as the graduate students participate in all activities together.

Teaching skills. Strengthening teaching skills is addressed through an active learning workshop, utilizing the book *Scientific*

Teaching by J. Handelsman et al., through a workshop on diversity in the classroom, where TAs discuss “A barrier of mistrust: how negative stereotypes affect cross-race mentoring,” an excellent chapter from

Improving Academic Achievement, and through a microteaching experience in which each TA presents a 10-minute problem-set example to the group. Microteaching is a successful training activity that has been used for many years in the MIT Chemistry Department and throughout the Institute with first time TAs. Typically, each TA is taped teaching a selected problem, and receives immediate feedback from the group in addition to an opportunity to view the tape themselves. (Video equipment is available through MIT Audio Visual Services at studentlife.mit.edu/dsl/es/av.) We expanded on this model by introducing a practice session prior to the taping, which enables the TAs to adjust their teaching based on initial critiques from the group.

Common challenges in leading recitations and working with MIT freshmen are explored through two bootcamp sessions (3 hours total) led by former course TAs. 5.111 students have diverse backgrounds, including some students with weak high school chemistry preparation, and many of the freshmen struggle to

Sample Bootcamp Schedule

Day 1 (5 hours)

- Welcome and introduction to 5.111 (1 hour) (F)
Introduction of the 5.111 faculty. Discussion of course and TA training goals and resources.
- Discussion-based teambuilding exercises (1 hour) (F)
- Chemical principles in biology and medicine (1 hour) (I)
Presentation of representative biological examples that will be introduced during 5.111 lectures.
- Activity-based teambuilding (2 hours) (I)

Day 2 (5.5 hours)

- Recitation challenges: Discussion and role playing with former 5.111 TAs – Part I (1.5 hours) (T)
- Q/A on summer practice problems and selection of microteaching problems (1 hour) (I).
- Tour of the 5.111 classroom, chemical education office, and recitation rooms (30 min) (I)
- Diversity workshop (1 hour) (F, I, T, or guest speaker)
- Strategies for teaching difficult problems, such as acid-base titration problems (1.5 hours) (F)

Day 3 (3 hours)

- Microteaching Practice Session (3 hours) (F)(T)

Day 4 (4 hours)

- Recitation time selection and Q/A on TA graduate course selection (1 hour) (I)
- Classroom clicker demonstration and overview of 5.111 clicker policies and competitions (1 hour) (I)
- Active learning workshop (1.5 hours) (I)
- Recitation challenges: Discussion and role playing with former 5.111 TAs – Part 2 (1.5 hours) (T)

Day 5 (4 hours)

- Microteaching taping (3 hours) (T)
- Wrap-up and assessment (1 hour) (I)

Activities labeled with (F) are lead by faculty, (I) are lead by an instructor or head TA, and (T) are lead by former 5.111 TAs. (Faculty participation is beneficial in any of the activities, but only necessary for those indicated.)

adjust to the workload at MIT. Bootcamp provides an opportunity to prepare the TAs for the unique blend of academic and emotional support required to help freshmen thrive both in 5.111 and as MIT students. Each of eight former TAs leads a discussion and role-playing scenario on topics such as dealing with disruptive students, helping freshmen manage their time, responding to suspected cheating, helping failing students get on track, encouraging class participation, reaching out to students with weak high school backgrounds, and balancing TA responsibilities with lab obligations and coursework.

Exposure to Course Material and Philosophies. Incoming Chemistry graduate students begin teaching at the start of their first semester. Some of these new graduate students express anxiety over teaching material with which they are not completely confident, and worry that the undergraduates will ask questions they can't answer. In addition, it was observed in previous years that certain challenging topics (namely acid-base titration problems) were poorly understood by some TAs, and that students in those TAs' recitations were less successful on related test problems. To provide TAs extra time to digest the relatively dense material in

general chemistry, for which MIT combines two semesters' worth of material into a single semester, practice exams are mailed to the TAs to complete over the summer. During bootcamp, a block of time is devoted to reviewing the most difficult concepts, including how best to approach and teach those types of problems.

Course innovations and technology are also discussed during bootcamp. For example, the TAs are given a presentation that introduces many of the cross-disciplinary examples used during the semester, a new element of the course. Bootcamp also includes a demo on classroom response devices, or clickers, that are used in 5.111 lectures (chemistry and physics both use RF clickers from Turning Technologies, www.turningtechnologies.com).

Bootcamp Assessment

A detailed assessment of the bootcamp and its impact on the TAs and undergraduate students was carried out by the Teaching and Learning Laboratory at MIT (web.mit.edu/tll). The primary assessment subjects were the 20 TAs who participated in the 2007 and 2008 bootcamps and the more than 350 undergraduates enrolled in the course who provided the student perspective on the recitation experience. Due to the small TA sample size, multiple methodologies were employed to provide credible and stable findings. Methodologies included TA surveys, two TA interviews (post-bootcamp and post-course), and a student survey for each year of the program.

The post-course student survey probed how the 5.111 students viewed their TAs and recitation experiences. Mean scores on a seven-point rating scale are shown in the table on the next page. As a comparison point to calibrate the 5.111 student ratings, the mean overall course rating for 5.111 in the five years previous to the TA training program, 2002 to 2006, was 5.4 for the fall and 3.7 for the spring semesters. The 2007 and 2008 TA recitation performance ratings, with an overall mean of > 6 across all items, were extremely high, confirming that the TAs

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connected with students through support, enthusiasm, and preparedness. Responses further indicate that the TAs led successful recitations in which students were com-

success of bootcamp, team-building activities, discussions with former TAs, and microteachings stood out most.

Correlating with the positive responses in the TA assessment, the number of applicants to the 5.111 bootcamp program indicates that many research stu-

tion complaints, leaving more time for positive interactions with the students, such as discussing research and career opportunities in chemistry. To quote Drennan, "Hours spent in TA training paid off three-fold in hours saved dealing with problems during the semester.

TA Recitation Performance: Means and Standard Deviations (SD) of 5.111 Students' Responses* to Recitations Questions of the 5.111 Student Learning Experience Survey

TA Recitation Performance Scale & Items	2007			2008		
	Mean	SD	N	Mean	SD	N
TA Recitation Performance Scale.**	6.1	1.1	185	6.0	1.0	165
My TA wanted us to do well.	6.6	.80	190	6.5	.74	168
My TA was enthusiastic about chemistry.	6.5	.79	191	6.2	1.1	168
My TA was well prepared.	6.2	1.1	191	6.2	1.1	168
My TA explained the material well.	6.0	1.4	187	6.0	1.3	168
My TA was helpful.	6.1	1.3	191	6.2	1.1	168
I found recitation an effective learning experience.	5.7	1.6	191	5.7	1.6	168
I felt comfortable asking questions.	6.1	1.2	191	5.9	1.3	168
I found recitation useful.	5.8	1.5	191	5.8	1.6	168
The recitation made me think.	5.6	1.6	191	5.5	1.7	168
My TA discussed the lecture concepts.	6.1	1.1	191	6.2	1.0	168
My TA explained solutions to the problems well.	6.0	1.4	190	6.1	1.3	167
Recitation complemented lecture concepts and attitudes.	5.9	1.3	191	6.0	1.3	166

*Students use a seven-point rating scale to indicate how well they agree with each statement: "1" = "strongly disagree," "4" = "neutral," "7" = "strongly agree." **Coefficient alpha for the TA recitation scale = .96.

fortable asking questions, and felt the TAs explained solutions well and were enthusiastic about the material.

The TAs attributed the positive recitation experiences in large part to their training. Through the surveys and interviews, the TAs expressed tremendous support and enthusiasm for bootcamp. They reported that the experience was positive, effective, and relevant, and they believed that bootcamp allowed them to gain confidence in teaching, develop teaching skills, and evolve into a team. Their increased confidence made them less afraid of teaching and more willing to engage students in ways they would not have considered prior to bootcamp. By participating in bootcamp, the TAs strongly believed they were better prepared than TAs for other courses. Although the TAs identified a number of positive factors that contributed to the

students are actively interested in gaining teaching skills. For the fall of 2007, 25% of incoming MIT Chemistry graduate students applied for the 5.111 TA positions, and that number rose to 39% in 2008. Several TAs identified the TA training opportunity in 5.111 as an important factor in their decision to come to MIT.

From the instructor perspective, the time investment in TA training resulted in less time spent troubleshooting TA and student problems throughout the term, which may be at least partly attributed to TAs who were equipped with a better understanding of student resources, teaching strategies, and course material. For example, in comparison to the seven years that Prof. Drennan taught 5.111 without bootcamp, in the two years with bootcamp she observed a drastic reduction in students asking fundamental problem solving questions or approaching her with recita-

Investing one fun hour to replace every three stressful ones is an easy decision."

While we feel that the small group size of the training led to significant benefits in creating supportive and closely-knit teaching teams, many of the activities are amenable to larger groups of TAs. In fact, several workshops planned for the 5.111 TAs were incorporated into department-wide TA training. By offering a TA training program, departments may attract more top graduate applicants to their research program, all while strengthening teaching within the department, and providing a valuable training experience for the TAs. ■

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