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A Bridge to Knowledge: A Practical Workshop for Teaching Fellows

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A Bridge to Knowledge emphasizes the role of knowledge dissemination and acquisition in the academic and professional teaching career of a future faculty member. The workshop trains graduate students to become effective teachers. We provide background in pedagogy to help graduate students understand what teaching and learning are and to elucidate teaching tools. The workshop has three functional sections: a practical introduction, exercises to introduce new teachers to various pedagogies, and professional development. There are several opportunities to help PhD students analyze their own performances as a teacher, including discussions, written assignments, and peer classroom evaluations.

Keywords: teacher training, graduate student, graduate teaching assistant

Introduction

The purpose of this workshop is to help graduate student teaching fellows (TFs) become effective and efficient teachers. In this seminar, we define an effective teacher as someone who mentally prepares, physically prepares, and assesses their teaching with an open mind. We believe the best way to become a better teacher is to practice teaching and to get feedback. Therefore, many activities in this workshop involve analyzing what good and bad teachers do as well as making TFs aware of their own performance in the classroom.

This workshop also is intended to provide the TF with some background in pedagogy to help deepen one's understanding of teaching and learning. We elucidate some teaching tools, including active learning strategies. Some of these tools may not be appropriate for a present teaching situation, but they should be useful at some point during a teaching career. Every student appreciates a teacher who can provide a variety of instructional techniques.

A final goal of this workshop is to provide professional development. First-time teachers may not realize that the skills they learn as a teacher can be transferred to any job, including non-academic jobs. Inevitably, everyone has to give a presentation, explain how to use a piece of equipment, or critique a paper.

For scientists participating in this workshop, it may be tempting to believe that some of the in-class activities and homework assignments are not analytical enough to be effective tools for learning about teaching. The in-class activities are not intended to be mind-bending, cathartic or time-consuming. The purpose of these activities is to help analyze one's development as a teacher and to make one aware of attitudes towards teaching and learning.

We reiterate to TFs that teaching is not easy. However, seasoned teachers will tell you that it is much easier to teach well than to teach poorly. We believe it is also much more rewarding to be a good teacher. Besides the feeling of accomplishment, nothing beats the look of sudden comprehension on a student's face or when a student says thank you.
We present three activities to prepare new graduate students be effective teachers and help them become well-versed in classroom management, active learning, and stress management.

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Notes for the Instructor

Exercise 1: Classroom Management

Related to classroom mechanics is classroom management. There is no benefit to preparing a list of classroom activities, providing an outline, and incorporating new learning techniques if a classroom is unruly and the students unmanageable. Regardless of how nervous a TF may be, they should confidently control their classroom at all times. A controlled classroom is an effective classroom. Obviously, TFs want to encourage spontaneous discussion among students, but they also want to stem disruptive behaviors. Fortunately, at the college setting, they do not encounter many disciplinary issues. This exercise is designed to help TFs work on your class management skills and gain the confidence to handle the most common problematic situations. We run this exercise by handing out the different "issues" to pairs of TFs. After discussing for 5 minutes, we share and elaborate the "solutions" as a class. This exercise leads to a rich discussion about classroom dynamics. If the "answers" are provided to students it is important to point out that they are suggested solutions and that there are many acceptable ways to handle the situations.

In-Class Activity 1: Learning classroom management through case studies

Sample issues for discussion

Issue 1: A student comes up after class to tell you that you grade the hardest of any TF she has had. However, you know that your class averages are in line with the other TFs in your course. What do you tell the student?

Issue 2: Twenty minutes into your lab lecture, you notice that students throughout the room are whispering to each other and generally not paying attention. What do you do?

Issue 3: During the semester, you notice that a trio of students consistently talks during class, are not efficient group members, and are often disruptive to the rest of the class. What should you do?

Issue 4: During a lab quiz, you think you see a student's eyes looking at another student's quiz. You are not positive that he/she is cheating, so you don't want to unjustly accuse the student of cheating. What should you do?

Issue 5: While grading lab reports, you come across one that seems very familiar, like one you graded three hours ago. When you go back to the previous paper, your hunch is correct; the papers are nearly identical. What should you do?

Issue 6: When you come in to teach your first lab of the week, your room has been left in shambles by the previous TF and your room is not appropriately supplied for your lab. What should you do?

Issue 7: As a TF, you are expected to contribute 20 hours per week to teaching on average, including grading. However, it seems like every week, you are spending most of your time teaching and not enough time on your own classes. What should you do?

Issue 8: After the first few weeks of class, you decide to look at your class averages so far. Your calculations indicate that both of your sections have an 87% average. Should you be concerned?

Issue 9: After turning back lab report #2, a concerned student comes up to you after class to ask you the class average on the report. How can you deal effectively with this student's anxieties about their grade?

Issue 10: A student cuts his hand on a glass pipette in the lab. How will you manage the situation?

Issue 11: Every week, a student of yours tells you that the labs are boring and that he has already done them in previous classes. You are concerned that his attitude will have a negative effect on other students' impressions of the course. What should you do?

Issue 12: You have become terribly ill from the various flu infections transmitted by your students. You don't think you can teach your lab in the morning. What should you do?

Suggested answers or solutions to sample issues

Issue 1 answer: Tell the student that all TFs are held to a grading standard so that all sections are graded consistently. Your class is no more difficult or easy than any other section. Maintaining the grading standards is much easier than dealing with displeased students.

Issue 2 answer: Your lab lecture is too long and boring. Stop right now, and get the students doing something active. Go around to students whose opinion you trust and ask them what you can do to improve the intensity of your lectures. Alternatively, ask a fellow TF or your lab coordinator to evaluate your performance in the lab.

Issue 3 answer: Talk to the students after or outside of class and tell them that their lab demeanor is disruptive, and specifically how it is disruptive. If that doesn't help, assign random seating every week and ask that students work only with the people next to them. Tell the students you are trying

to facilitate a community spirit in the room by allowing them to meet other class members.

Issue 4 answer: Simply ask the student to move to another seat. Ask the student whose work is being copied to cover his/her paper. Make a public announcement to the class to keep their papers covered. Check the two papers after class. If the answers are too similar, discuss the matter with your lab coordinator.

Issue 5 answer: Grade both papers as fairly as you can. Inform your lab coordinator of the situation. Make photocopies of both papers and return the graded photocopies to the students. Tell the students what you see. Plagiarism should not be tolerated and should be dealt with according to your department's policies and culture.

Issue 6 answer: First, find the curatorial staff. If the curator is not immediately available, find the lab coordinator, who will ensure that you have the necessary supplies and that your room is neat.

Issue 7 answer: At the next prep session, discuss the issue with the other TFs and the lab coordinator. If everyone is experiencing this problem, then the class workload should be assessed. If this appears to be a personal issue, you and your lab coordinator should work together and talk about grading.

Issue 8 answer: You should definitely be concerned. This problem should be remedied very quickly. Talk with other TFs about how they grade assignments, and talk with your lab coordinator about grading.

Issue 9 answer: It is advised not to give out the averages for each assignment. The purpose of grades is not to assess your ranking compared to other students, but to assess individual progress. Tell the student that the class average is maintained consistently between sections. If they have specific questions about the assignment, you would be happy to discuss them with the student.

Issue 10 answer: Remain calm! If the cut is serious enough, call the campus police immediately. Do not touch other's blood with bare hands. Find a quiet place for the student to wait for help, and have someone else stay with them, the lab coordinator, or someone from the curatorial staff. If the cut is minor, have the student wash it thoroughly and place a Band-Aid on it. Make sure an accident report is filled out!

Issue 11 answer: Recommend to the student that he/she take an upper-level course if possible. If this is not possible, tell the student that his/her previous experience would be a great help to the other students in the class. Tell him/her that this class should be easy and he/she can help other students with the material. Perhaps that student could take on a peer-tutorial role.

Issue 12 answer: Call your lab coordinator at home (or in the office during working hours) as soon as possible so that a substitute TF can be arranged. If you know another TF who is available, call them. You or your lab coordinator should work out how to compensate the substitute for his/her time. Remember – your class is your responsibility.

Exercise 2: Using Active Learning in the Classroom

Active learning is a supplemental method to lecturing that engages the students in the material presented. Teaching methods that use discussion-based activities facilitate learning that requires students' active participation. Role-playing, games, or case studies are examples of exercises that achieve this active participation. Active learning can introduce information or review information as an in-class activity.

There are many benefits to using active learning techniques in the classroom for both the teacher and the student. It requires no work for the teacher other than the preparatory work of designing the exercise since there are no assignments turned in at the end of the activity. Active learning techniques can be used in a variety of settings: lectures, laboratories, or discussions. Students evaluate their own and others' opinions, they verbalize material (a proven method to learn material), they get prompt feedback, and they think more deeply by making associations between new and previously learned material.

Below are some examples of active learning categorized into three different learning levels.

Factual questions/trivia games
- Can get students thinking about the relevant material in a relatively easy format
- But there is high risk for students to answer the questions (right or wrong answers)
- Can be boring for students at a higher learning level

Application/interpretation questions/case studies
- Good way to help students see the importance of the information
- High interest level for students
- But need to make sure all students are at that level

Problem solving/role-playing
- Also good way for students to see relevance
- Holds high interest for students
- Again, need to make sure all students are at that level

Active learning can be highly successful, especially when both the environment and the activity are student-focused. Use the following tips in your active learning activity. You may also find these tips useful if you're conducting a discussion section.
- Give students time to write answers before opening up for discussion
- Get students into smaller groups to discuss answers before having a class discussion

- Remove the element of risk for students by not asking factual or rhetorical questions
- Demonstrate progress to the students:
  - Verbalize the goals at the beginning of the section
  - Summarize the main points often by writing them on the board
  - Have a minutes-taker who verbalizes the points made at the end of class or the beginning of the next class

In-Class Activity 2: Incorporating Active Learning into your Classes

In this activity, TFs need to decide how they will incorporate active learning into their class, given the problem presented. With one or two partners, they design an activity that should liven up a class. They present both the problem and solution to the class with their partner(s). Pairs of students are assigned one of the following problems.

Problem 1: You are teaching the 8 AM Friday morning class in introductory biology, and your students always seem tired when they arrive. They also have a hard time getting motivated to do things that early in the morning. You think that something fun, yet on topic, would get them interested. How can you jump-start them into the activities for the day?

Problem 2: You are lecturing on a very difficult concept for freshman biology students - replication of DNA. A lot of the students seem overwhelmed and confused, though not all of them. You want to avoid having the entire class come to office hours. How can you help the students right now in this class period while facilitating active learning?

Problem 3: Your lecture on the comparison of the four major macromolecules appears to be overwhelming the students. How can you help students summarize all of that information in one place while involving the students in the activity?

Problem 4: You need to prepare a quiz for your lab, but with your own class responsibilities, you don't have a lot of time. In general, your students don't seem to understand mapping restriction sites on a plasmid, so you would like to incorporate a question about it on the quiz. During the lab previous to the quiz, the students have an incubation time for which they have nothing else to do. How can you help them understand the problem while getting your quiz written at the same time?

Problem 5: As the work piles up, your students become lazy in their preparedness for your discussion class. You feel certain that most of them have not read ahead of time. What can you do in future classes to encourage or motivate students to prepare for class without appearing like an ogre?

Problem 6: You are teaching a physiology lab where students review case studies and perform urinalysis tests to determine what is wrong with a case patient. Because most of the students in your class are pre-med students, you want to demonstrate to them the relevance of this activity to their future careers. How can you do this?

Problem 7: In your discussion section, you have a couple of students who rarely talk. You think that they are prepared and intelligent, but that they are probably very shy or timid. How can you find out your entire class's opinions about the discussion in a non-threatening way?

Exercise 3: Handling Stress

If there is one thing that graduate students are familiar with it is stress. The aim of this exercise is to encourage TFs to identify and manage their stress effectively. Stress usually comes from a lack of time to accomplish a set of goals or tasks. Sometimes this lack of time can come about through ineffective uses of time: procrastination, indecision, disorganization, lack of direction or purpose, perfectionism, distractions and interruptions, Parkinson's Law (work expands to fill the time available), fatigue and sickness.

We open the discussion with the question: *Which one of these is the biggest problem for you?*

Learning how to manage stress is crucial. In order to aid graduate students to identify sources of stress, we discuss the following techniques:

1. Make a list each day of things you want to accomplish. Plan to do the harder things first and save the easier tasks for the end of the day.
2. Arrange your schedule so that you have blocks of uninterrupted time to get work done – try to arrange these times for when you tend to be most productive (morning, afternoon, or evening).
3. Find time in your daily and weekly schedule for exercise and leisure activities – everybody needs a break and they may even increase your productivity.
4. Differentiate between urgent and important. Urgent things must be done right away, often for someone else.
5. Write out objectives, both long-term and short-term, and do what you should to attain these goals. Short-term goals should be attainable, realistic, time-bounded, measurable, and worthwhile.
6. Delegation is one way people get around the lack of time – they give their tasks to other people. As a TF, you probably don't have the power to delegate tasks to others, but you do have the power to say no. Learn to say no. However, if you are asked to take on a task, think about whether that task would fulfill, in part, any of your short- or long-term goals.

Pre-Class Activity: Where does the time go?

Lack of time can also come from taking on too many goals or tasks or underestimating the amount time a task takes. Finding out where your time goes can help you organize your time better. Fill in the first empty column in Table 1 below with how much time you believe you spend on any give task. In class, we discuss how much time you think you spend on these activities each week.

Table 1. Students are asked to complete this log ahead of the class by estimating the time they believe they spend on the indicated activities.

Activity	Weekly Estimated Time	Weekly Actual Time
Coursework		
Preparation/Thinking		
Attending class		
Reading		
Problem sets		
Studying		
Teaching		
Thinking/Preparation		
Giving class		
Office hours		
Meetings/prep sessions		
Grading		
Thesis Research		
Thinking/planning		
Library work		
Reading		
Experiments		
Analyzing data		
Supervision of others		
Attending seminars		
Meetings		
Writing		
Personal Time		
Physical exercise		
Meal preparation/eating/clean up		
Relaxing		
Sleeping		
Grooming		
Entertainment		
Personal correspondence (bills)		
Housekeeping/laundry		
Travel time (commuting)		
Family activities		
Other Work		

We ask students to keep a daily log of their activities for each hour of the work day in Table 2. We encourage them to spend about 10 minutes at lunch time, then 10 minutes at dinner each day writing down the activities they performed. After this is complete, they then transfer the total time spent on each activity into the log of actual weekly time spent on each activity in Table 1.

Table 2. Daily log for activities to determine how time is spent.

Time	Activity	Time	Activity
6:00 AM		6:00AM	
7:00 AM		7:00 AM	
8:00 AM		8:00 AM	
9:00 AM		9:00 AM	
10:00 AM		10:00 AM	
11:00 AM		11:00 AM	
12:00 PM		12:00 PM	
1:00 PM		1:00 PM	
2:00 PM		2:00 PM	
3:00 PM		3:00 PM	
4:00 PM		4:00 PM	
5:00 PM		5:00 PM	

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About the Authors

Kathryn Spilios earned her Ph.D. from Cornell University and is currently the Director of Instructional Laboratories in Biology at Boston University. She is involved with teaching at many levels. She works closely with the undergraduate Introductory Biology program and runs a pedagogy seminar for first year graduate students to improve their teaching experience. She also runs professional development seminars to encourage colleagues to explore new pedagogical techniques.

Nathan Rycroft is pursuing his Ph.D. in Marine Biology at Boston University. He has been involved in multiple avenues of outreach including the NSF GK-12 program and hosting high school students in the laboratory of which he is a member. He has taught Introductory Biology, Animal Behavior, and Systems Physiology laboratories.

Angela Seliga earned her Ph.D. in biology from Boston University and is currently the Physiology Laboratory Coordinator at BU, where she teaches, trains staff to teach, and develops curriculum for multiple physiology laboratory courses. As a graduate student at BU, she participated in the NSF funded GK-12 program where she taught biology and chemistry to high school sophomores through seniors with special needs. She designed or oversaw the design of laboratory modules for several outreach programs.

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