A Manual for Teaching Assistants

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INTRODUCTION

This manual is a collection of advice, tips, and miscellaneous helpful information for teaching assistants. Much of the information was contributed by Columbia Biological Sciences Department members and compiled initially by Prof. Debby Mowshowitz. Some came from the Physics Department and the Center for Teaching and Learning. Some advice is from graduate students who served as teaching assistants, and some from professors who depended on teaching assistants to help with their courses. Most of this advice was obtained in response to the questions, "What would you tell a new TA?" and "What should a TA know?" The material has been organized by topic, so you can look up advice on whatever subject concerns you.

Executive summary

1. **Ask the instructor**: All exceptions and regrades should be decided by the instructor.
2. **Be prepared**: Understand more than you plan to explain.
3. **Draw**: create a picture or diagram on the whiteboard or iPad whenever possible. A picture = 1000 words.
4. **Ask questions**. Don't give students the answer. Rather ask them a question or give them some information to help them answer it.
5. **Think-pair-share**: use active learning to engage students in critical thinking and collaborative discussion. This involves three steps:
   a. **Think**: The instructor poses a question or problem, and students take a moment to reflect and develop their own responses independently.
   b. **Pair**: Students pair up with a classmate to discuss their thoughts and compare answers, encouraging peer-to-peer learning and diverse perspectives. Allowing a minute of discussion will facilitate student responses.
   c. **Share**: Collect responses to think-pair-share questions using Poll Everywhere. You can also ask students to hold up the correct number of fingers (1, 2,3, etc). This method is better than asking students to raise their hand if they agree with an answer, as the entire class can see who responds, making students shy about responding with the wrong answer.
6. **Be honest**: If you don't know the answer, tell the student you will find out & get back to the student.
7. **Avoid blackboard carpentry**: Don't draw a picture and then erase parts of it to show the next step. Instead, draw the first step, an arrow, and then draw the next step.
8. **Encourage group work**: If you have a sheet of questions, hand out one copy per group, not one per person. This facilitates teamwork.
9. **Encourage questions**: Never tell a student their question is stupid or bad.

The teaching process will help you hone skills that are valuable across many career paths. Here are some of these transferable skills:

1. **Leadership:** In the classroom, you will guide groups of students, motivate students, and take the initiative to help students achieve the learning goals of your courses. You will be a role model for students pursuing graduate degrees.
2. **Communication:** You will practice explaining concepts clearly, provide constructive feedback to students, and effectively interact with colleagues.
3. **Interpersonal skills:** You will build rapport with students, create a positive classroom environment, and show empathy.
4. **Collaboration:** Encouraging peer-to-peer learning and group projects allows you to develop the ability to guide students in collaborative environments, a valuable mentoring skill.
5. **Teamwork:** You will collaborate with instructors and colleagues to support student learning. You will learn to support students with diverse learning styles and backgrounds within one classroom.
6. **Organizational skills and time management**:You will learn to structure class time, prioritize tasks, and meet deadlines.

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PART 1: PEDAGOGY

TOPIC 1 -- WHAT DOES A TA DO IN RECITATION OR LAB SECTION? (General TA expectations)

1. The TA discusses the course material, finds out what students are confused about, and explains. The goal is to get the students to speak up and to tell you what they need to know so you can zero in on the trouble spots.

If there are assigned questions or problems, the TA goes over them. If there are no assigned questions, the TA answers the students' questions or covers whatever seems important and difficult from the lecture material or readings. The two significant rules are (1) be selective and (2) be responsive to the students' needs -- find out from the students what they need help with.

2. The TA tells students whatsi essential – what is stressed on exams, what is worth reading, what to memorize, and so on. Teachers differ greatly in what they expect of the students, and the students become anxious as a result. The TA can usually get the necessary information from the teacher or from last year's TAs in the course. Some successful TAs have acted like coaches on a sports team, urging their students to victory with tips on exam taking, studying, etc. For many students, the moral support and encouragement provided by a TA can be as important as the scientific information that the TA provides.

3. Some TAs are expected to present material that is not covered in the lecture (or by the lab instructor). This means that some TAs give short lectures and/or lead discussions of articles.

4. Some TAs are expected to discuss a specific article assigned by the instructor. There are many ways to do this. One way is to split the students into groups and have each group discuss a figure from the article. After a few minutes, the class returns, and each group presents its figure.
Let the students know before they start their small group discussion of their designated figure:
i. Agree on a title that states the most important finding in the figure and which subfigure best supports this finding.
ii. During each group's discussion and explanation, students should spend more time on important subfigures and little, if any, time on fluff subfigures.

iii. All students in each group are expected to speak, so they can divide the material during their discussion.

5. What about Lab TAs? A laboratory TA does all of the above, guides the students through the actual experiments, and helps prepare materials and reagents for the lab. During a lab, a TA should circulate between the students, answering questions about concepts and helping students with techniques. Students will often ask questions if you walk by but won't ask if they have to seek you out in your corner. Secondly, catching them before they make a mistake is better than afterward.

TOPIC 2 -- How to run a recitation with active learning

Active learning is an instructional approach that actively engages students in the learning process through meaningful activities and interactions. It emphasizes critical thinking, problem-solving, and collaboration. Instead of passively receiving information, students participate in discussions, group work, or hands-on activities that foster analysis, synthesis, and the application of knowledge. In this model, the teacher's assistant role transforms into that of a facilitator, guiding and supporting students in their exploration and learning journey

Most students are used to listening, and most teachers are used to talking. So, you have to be quite careful to keep the recitation from reverting to a lecture. Students would rather be passive, but the whole point of a recitation or lab is to get students actively involved. Try to emphasize questions – yours and theirs. In other words, "Ask, don't tell." It may be hard to get them to either ask questions or to answer yours at first, but if you stick with it, you should be able to establish a friendly, inquiring, and non-intimidating atmosphere.

Try to establish the right participatory atmosphere at the very start. If you let the students act passively at the beginning, it will be hard to change the pattern later. Here are some tips on how to maximize student participation and minimize passivity.

1. Names. Learn the students' names and use them as much as possible—when calling on them, referring to earlier points, summarizing, etc.

2. Be explicit. Say, "I don't want to do all the talking. That's the lecturer's job, not mine."

3. Student Questions. You can ask each student to email a question via Canvas before class.

4. Student Presenters. Have the students take turns going to the board and explaining problems. This works well if the students have already worked through the problems for homework or discussed them in small groups.

5. Pre-discussion. Think-pair-share: Ask them to speak to their neighbor and give them a few minutes (the length depends on the type of questions). Poll student answers: Have students respond using PollEverywhere.com or raise the correct number of fingers. They can easily do this in front of their chest, so not everyone sees their answer. This increases both the amount of participation and the quality of the comments.

6. The Silent Majority. What if the same few students tend to do most of the talking, and the others don't speak up? How do you deal with this? In addition to doing Think-Pair-Share, mentioned above:

A. Wait until a few hands are up before calling on anyone. This gives the students more time to think and increases the number of volunteers.
B. When the same students raise their hands again, say, "I'd like to see three hands from people who have not talked yet." Wait until you get the three new volunteers and then call on them.
C. Don't always rely on volunteers.

(1). You can go around the room and make the students speak in order or try to answer a problem or principle. This way even the reluctant students can be ready when their turn arrives. Going around the room in order is fair, and you clearly aren't picking anyone.
(2). You can randomize the order in which you call on the students. This way they don't know when their turn is coming, so they have to pay attention. When possible, let them know ahead of time that you will do this so the students can come prepared.

8. Follow up with an answer to a question. ("Ask, don't tell.") When students answer a question or explain a point, they are asked to elaborate to facilitate discussion. Ask a follow-up question such as "Why do you think that is so?" or "What do you mean by 'it'?" or ask for more information encouragingly so that the student feels rewarded for speaking and doesn't feel attacked.

7. Humor. A little humor helps but be careful not to embarrass anyone or make fun of ignorance. Never belittle a student, no matter what the question. It's okay to defer answering a question, but don't insult the student who asked it.

TOPIC 3 -- PREPARATION

1. Be Prepared! You need to know the subject you are discussing one layer deeper than you expect to talk about. In other words, you need to know the right answer and why it is right, and you should be able to explain why it is right.

2. You <u>don't</u> need to know everything! Which is fortunate since you can't know it all anyway. If you are confident, it is ok to say, "I don't know" or "It doesn't matter" (if it really doesn't matter). It is much better to admit you don't know than to bluff. If you don't know, and it does matter, say you'll look it up and then <u>do it</u> promptly.

3. Plan Ahead. It is good to look in advance for trouble spots where confusion, misunderstanding, etc., can arise. You might keep this in mind when listening to the lectures – in addition to trying to follow the lecture, you might note any points that you think will need to be clarified in recitation.

4. How to Prepare a Problem. When you go over a problem in preparation for class, you should understand:
(a) The general principles on which the specific problem is based, not just the answer to that particular problem, and
(b) How do you get the answer? The process of getting there is just as important as the result. Remember you are trying to teach the students how to solve problems for themselves.

5. Attend Lecture. Attending lectures is well worth it. Although it seems very time-consuming, it is much faster than learning all the material on your own, and it is the best way to learn the lecturer's strengths, weaknesses, and emphases.

TOPIC 4 – COMMON MISCONCEPTIONS

A. Problems of terminology

1. Confusing technical meanings and ordinary meanings of words.
Some scientific terms have technical meanings that are vastly different from their commonsense meanings. For example, "spontaneously" in chemistry does not mean "very quickly" or "all by itself" -- it means "without net input of energy." So, students think spontaneous reactions occur rapidly &/or without an enzyme. This type of difference between technical and ordinary meanings often leads to confusion because the TA, book, or lecturer uses the term in the technical sense. In contrast, the student uses the same term in its nontechnical, common sense meaning.

2. Using words that have technical meanings and not even realizing it.
Some ordinary English words are used as technical terms, as explained above, but experienced scientists (such as graduate students and lecturers) are so used to using these words that they often forget that these words have special

meanings. So, the scientists don't define the terms and are surprised when the students don't know what they mean. For example, what is a "strain" of bacteria? Do all bacteria of the same strain have the same genes &/or alleles? Are the genes in the same order? A graduate student who works with bacteria will consider these questions so obvious that s/he will not realize that the answers are not common knowledge.

3. Getting confused between similar but not identical terms.
Certain terms seem to be difficult to get straight, for example, gene vs allele and chromosome vs chromatid. Many such pairs of terms are very similar in meaning and are often used sloppily even in scientific writing (and speech). To make it worse, some of these terms are synonyms in common speech, such as "inhibition" and "repression." A good way to clear up confusion is to "compare and contrast" -- compare what is similar between the two terms and contrast what is different.

B. Other types of common conceptual difficulties
1. Finding unlikely &/or complex solutions when ordinary, simple ones will do.
There is a saying in medical school: "When you hear hoof beats in Central Park, you don't think of zebras." In other words, when you hear hoof beats in the park, it is probably a horse, even though it could be a zebra. A person who thinks it is probably a zebra (or equally likely to be a horse or zebra) does not understand the situation. When solving problems, always look for the "horse" -- the simple, obvious solution, before you start worrying about the "zebra" -- the possible, but unlikely solution. Students often produce very improbable (but possible) answers and don't understand why their answers are unlikely or why unlikely answers are not as good. Usually, their problem is a lack of general background -- if you don't know much about New York, you might not realize that horses are relatively common here and zebras are rare. Sometimes the answer IS a zebra – maybe it escaped from the Central Park Zoo! But students should always rule out horses first.

2. Not seeing how the parts relate to each other or to the whole.
Students often understand what specific items are or what they do but do not understand how they relate to each other or how the details relate to the big picture. For example, students may understand the structure of DNA, that genes are made of DNA, and that chromosomes carry genes, but they may have trouble figuring out how the DNA fits in the chromosome. (How many copies per chromosome? How many strands? What's a strand?)

TOPIC 5 -- HOW TO START A CLASS DISCUSSION

There is no perfect way to start a discussion that works for every leader in every situation. Different methods work best for different people and different occasions. Here are some suggestions:

1. Collect Questions
Ask the students for specific questions, topics, or terms they want you to review. Write the questions &/or topics on the board. Do not immediately answer the questions that were asked. Keep collecting questions until you have a reasonably long list. Once you have the list of questions/topics on the board, you can look at the list and decide in which order to answer the questions**.**
The first few times you do this, getting the students to speak up will be difficult. So be patient and give them plenty of time to come up with questions. If they don't seem to have any questions, suggest that they look through their notes or text to find unclear points.

Use index cards or a Canvas assignment
Ask each student to come to class with at least one question written on a 3 X 5 card. Collect the cards at the beginning of class and use the questions to organize the session.
Or ask the students to submit questions on Canvas/assignment or Google Docs the night before. This gives you more time to compose your thoughts, decide which questions to use, and look up the answers.

2. Ask Them a Question

Ask the students a question, preferably about an experimental situation. For example: Suppose you have two strains of pea plants that are true-breeding, and you consider one gene that controls flower color. The pea plants on one strain have white flowers, and the pea plants on the other strain have purple flowers. How will you determine which phenotype is dominant?

You can then ask the students several questions:

1) What is a strain?
2) What does true-breeding mean?
3) What do you need to know to determine dominance relationships?
4) What kind of cross do you need to set up?
5) How do you figure out the genotype of F1 offspring?

After you have discussed what information you need, you can conduct the experiment to get the answer. This exercise will reveal student misconceptions, reveal their level of knowledge, and show their level of insight.

3. Pair them Up

This method works well if the teacher has assigned questions, but the students have not had time to go over them. In other words, this works even if the students are not prepared. Divide the students into pairs, have each group review the assigned questions, and prepare an answer sheet for the entire group. You can also do this by making up your own questions and handing them out. While they are working, you should walk around the room and listen to what they are saying. If they have made mistakes, ask them leading questions. At the end, go over the questions or summarize. If you have a sheet of questions, this seems to work best if you give out one copy per group, not one per person. You can have extras, so everyone gets a clean copy to take home at the end.

Variation: The "Interrupted method." Have the groups do the problems, case studies, or scenarios in steps and summarize or discuss after each step. Do what it takes to get everyone straight on the issues in part one before they go on to part two. Once the class has agreed on the solution to part one, the individual groups discuss part two, then bring them together to go over part two as a class, and so on.

TOPIC 6 -- PROBLEM SOLVING

1. What's the Point? Before you try to explain a problem, ask yourself "What is the point of this problem or experiment?" Get certain facts or relationships straight? Gain familiarity with a concept or procedure? Make certain distinctions clear. It will be much easier to explain the problem when the big picture is clear to you.

2. How do I solve it? A common response to a complicated problem is, "How am I supposed to answer this?" So go over (a) what information is needed to solve the problem and then (b) explain how you use the information. Students often know the correct information but know so much irrelevant information that they can't pick the right pieces. So go over how you figure out the answer to "What do I know (or need to look up) that's relevant?" Once you have shown the students what information they need, review how to use it to get the solution. It is important to realize that explaining how you get the solution is different from explaining the solution itself.

3. What is meant by "Explain your answer?"

On tests & problem sets students are often asked to explain the reasoning behind their answers. They are often frustrated and/or confused by "explain." What & why are they supposed to explain? Here is one answer:

It isn't enough to get the right answer -- you have to be able to explain the logic you used to solve the problem. Try to explain as if you were talking to a fellow student in the class but can't figure out this particular question. Explain your reasoning step by step. Don't just repeat all the related facts in the book or notes--try to pick out the relevant points, put them in a logical order, and explain (or diagram) how one leads to the next.

4. Problem-solving tips to pass on – Useful if your class does "Classic Word Problems."

Below are the things the students should learn to do. You may demonstrate them the first time, but the students should learn to do them for themselves.

A. Draw a picture or diagram whenever possible. You may draw the picture for the student the first time. However, the goal is to get students to learn how to draw their pictures. The relationships between the various parts and pieces of information are often not readily apparent until you get the words translated into pictures. Once you understand the relationships between the terms, facts, steps, etc., you will find the individual pieces are much easier to remember.

B. If you don't succeed at first, try again. If you have a complex problem to solve, don't try to solve it in one shot. Read it through and then make an educated guess at the answer. Then, go back and see if your solution explains all the data given. If it doesn't, refine/adjust your solution and try again.

C. If one approach doesn't work, try another one. The following list comes from a math class and is a helpful list of problem-solving approaches: guess and check, draw a diagram, look for a pattern, make a model, use easier numbers, make an organized list, make a chart, use logic, and work backward.

TOPIC 7 -- PROBLEMS WITH NUMBERS

1. The case of the over-mathematical student

Some students are very at ease with numbers and greatly prefer numerical plug-in problems to thinking problems. These students can miss the biological point because they are so busy manipulating the numbers. They can solve anything that uses a formula but tend to overlook the meaning of the formula. With these students, you must be careful not to lose the biology in the number crunching.

2. The case of the un-mathematical student

Some students are just the opposite—they prefer words and discussions to numbers. These students often get the general idea but have trouble doing specific numerical examples. They are often unaware that biology is a quantitative science and are surprised to find out they will have to do problems with numbers.

3. Most classes have both types of students!

4. Estimate first and calculate later (if necessary)

Please encourage students to estimate instead of relying solely on their calculators. Estimating makes the math seem less formal and intimidating to some of the nonmathematical, and it discourages the overly mathematical from plugging blindly into formulas. In other words, using estimates often helps keep the focus on biology and what makes sense instead of math.

TOPIC 8: USING THE BLACKBOARD OR IPAD

1. How to write on the board

A. Both words and diagrams should be large and clear. Use colored chalk as much as possible.
B. Use diagrams as well as words (see below).
C. Erase carefully.

(1). When you have filled up the board, erase a large area thoroughly before continuing. Don't keep writing in the corners and edges of your old, filled-up board.

(2). When you need space, try to erase the oldest writing, not the most recent. You and the students may want to refer back to the most recent writing, so leave it up for a while.

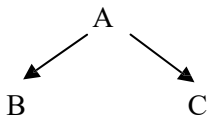
2. Timing

Don't worry about wasting time. A pause is usually welcome if the general pace is lively. Remember that the students write things down and usually write more than you do since they are copying your lists and pictures and taking notes on your explanations.

3. Using Diagrams
Diagrams and pictures are helpful, both to you and to the students. A diagram helps the students because it can convey almost impossible relationships to put into words. It helps you because you can refer to it over and over. Artistic talent is not required but remember the colored chalk and draw clear pictures.
Drawing allows you to show what you mean in pictures while simultaneously saying what you mean in words. So, drawing and explaining a diagram as you go along makes the best use of the board. It is much better than just writing down the words that you say.

4. What to write
Don't write everything you say on the board. While it is good to write all the important points and terms on the board, it is not necessary to write down all the details. It usually works best to write a term, draw a picture, and then explain verbally.

5. Showing relationships
When you write down the important points or terms, try to write them in a way that shows their relationships. Suppose you are explaining terms or concepts A, B, & C. Suppose B and C are subcategories of A. (Example: A is transport, and B and C are types of transport. Or A is a structure made of two parts, B & C.) Then, a simple diagram like the one below shows the relationship between A, B & C, and is much more informative than just writing a list with A, B & C (or writing A, B & C in random order).



Avoiding "blackboard carpentry"
Many problems in biology involve comparing two very similar situations -- normal vs. mutant, before adding a drug vs. after adding a drug, with oxygen vs. without, etc., **or** explaining a sequence of events. In these situations, it is tempting to draw the picture for the first case or step and then alter the picture by erasing or adding a little here or there (that's the carpentry) to convert the picture into the next case or step. It is usually much better to draw each case or step separately. It does take time, but it's worth it. Why bother to draw each situation individually?

(1) It is much easier to compare and contrast the two stages if you have both pictures on the board at the same time. If you modify the first stage to get the second, the first one is gone! You can't go back and point out the critical differences or show how the two cases compare. You can say it, but you no longer have the two pictures.

(2) It is much easier for the students to take notes if you redraw the pictures. If the students are trying to take notes so they can capture the essence of your explanation, they can't keep modifying the picture (using pen and paper) the way you can on the board (with chalk and eraser). They have to draw it over again & still keep up with your changes.

If the picture you are drawing is complex, and you want to be sure the students can follow, you might consider providing a handout with the main steps or features. You can also post annotated slides made using an iPad as note-taking templates. In the age of computers, we do not need to hand out everything you discuss. However, handing out a few important pages that you then add to the board to emphasize the steps or what is important can be more impactful.

6. Miscellaneous Advice on using the Blackboard
A. When you are facing the blackboard, stop talking. Don't talk into the blackboard.
B. When you write an essential point or term and then explain it, don't stand in front of what you have just written.

TOPIC 9 – EXPLAINING

1. Improving Clarity: Avoid pronouns and use nouns instead. Don't say "it" -- say "mRNA" or "gene" or whatever. You should be careful not to use too many pronouns yourself, and you shouldn't let the students do it, either.

For example, suppose a student says, "The gene is transcribed, and then it goes to the cytoplasm, and it is translated, which uses tRNA and mRNA." Now, the student may or may not understand how genes are expressed, but you can't tell whether s/he knows because "it" could mean gene or mRNA, and "which" could mean transcription or translation. In this example, the student may know the correct answer, or the student may not even realize that s/he is unclear in their own mind. So, if you want to express yourself clearly and be sure that your students have everything straight, use as many nouns and as few pronouns as possible, even if it sounds a little repetitious.

2. Probe First. Before explaining a topic or problem, find out where the student is stuck. This will save you from wasting time and energy explaining things that are clear and allow you to zero in on the real problem.

3. Explain at the Right Level

a. Don't Start too Far Back. When a student asks a specific question, try to answer it without reviewing a lot of background material. If a student asks you to explain hydrophobic bonds, don't start with atomic structure. Assume s/he knows what electrons and covalent bonds are and proceed from there.

b. Don't assume too much. Remember that your students may not have as much background as you do, so you may have to explain things that seem obvious to you. (Of course, this contradicts (a) – you don't want to overdo it in either direction.)

4. Explain in Small Bites. Explain a short piece of a problem at a time and then don't go on until (a) you are sure that everyone understands what you explained, and (b) you are sure that you need to explain the rest.

For part (a), asking, "Does everyone understand?" usually doesn't get a satisfactory answer. You have to look at the students' faces or ask a specific question about what you have just said to find out if they understand.

For part (b), you may discover that you don't have to explain the whole thing because the part you just explained was the only hard part, and the student has now come "unstuck."

5. What should you do if you don't know the answer?

A. Go look it up next time. You aren't expected to know everything, but you are expected to be able to figure everything out eventually.

B. If you start to explain and realize halfway through that you are stuck, it usually pays to stop and admit it. The best strategy is to stop before you get even more profound, go home, figure it out, and then write to your students. The fact that you need to look things up has its bright side. It's useful for students to see that learning is a continuous project that doesn't end when you finish the course or when you graduate.

PART 2: PEDAGOGY – active learning tips

Topic 1: Facilitating article discussion

An entire class period is dedicated to each article.

Article discussion format:

A. An introduction to each article occurs during the lecture a week before the article is discussed. Students are asked to review the article before they arrive, so the introduction isn't totally foreign to them. That's fine if they don't understand some of it.

B. On the day of the article discussion, students turn in homework questions regarding the article. These questions ensure that students come prepared to discuss the article. One of the first questions frequently asked was what the authors needed to show to prove their claim. For example, what 2-3 characteristics did they need to demonstrate to show that they had produced iPS cells?

C. At the beginning of class, each table (4-6 students around a table) is assigned a figure and asked to come up with a title that states the figure's most important finding and the sub-figure that best supports that finding. TAs circulate to help facilitate discussion and answer questions. Students at a given table are considered experts at their assigned figure. Students usually spend 5-10 minutes at this first table.

D. Students then move to different tables (TAs count off the table number for each student) so that every table contains at least one person who is an expert at each figure. Each student briefly explains the point or main finding of their figure. Students are asked to focus on the sub-figures that support the critical findings of that figure rather than explaining every sub-figure.

E. Each table is then asked to answer questions on a worksheet, which is handed out to each pair of students about 15 minutes after students switch tables. These questions stimulate discussion and focus on essential aspects of the article. The questions on this worksheet can be more open-ended, which facilitates discussion. These worksheets are collected before we begin Poll Everywhere.

F. Poll Everywhere questions (developed with a provost grant), facilitated by the instructor, are used during the last 20-25 minutes of class to discuss the main point(s) of specific figures or the entire article and to relate the article to course materials. Half the points for the poll everywhere questions are for answering the question regardless of the correctness of the answer, to promote participation. One advantage of polling everywhere is that it is anonymous, which promotes participation even among weaker students. Secondly, the immediate student's responses enable me to tailor my class-wide discussion to their responses. Finally, the instructor can display the pooled results, giving the students instant feedback on their answer's validity and letting them know if they are among the few who didn't grasp a specific concept.
This combination of relaxed group discussion followed by graded anonymous Poll Everywhere questions is the proper mix to motivate the students to read the article in depth beforehand without intimidating the students.

Topic 2: Active learning tips using introductory biology recitations as an example.

A typical Intro Bio 2-hour recitation consists of the following elements:
A. A minilecture (~30 minutes) covering the most complicated concepts from the previous week of lectures. TAs sometimes survey their students about which topics to include. TAs use various methods to deliver this minilecture: slides, iPad, chalk/whiteboard, etc.

B. A quiz on the course material from the previous week of lectures. These questions are usually somewhat "low Bloom" and are intended to ensure students keep up with the course material and attend recitation.

C. A set of questions from the previous week of lectures that were solved in small groups facilitated by the TAs. These questions are generally more complex than the quiz questions and are often old exam problems. Usually, there are groups of questions based on a new scenario for the students, but the concepts studied in class are tested. Multiple-choice questions are answered using an IF-AT form (similar to a lottery scratch-off form), which gives immediate feedback about correctness and allows the students (though multiple attempts if necessary) to be confident about the answer before moving on to the next question.

D. Student presentations of answers to these questions. For ideas on how to facilitate, see Topic 2 above.

E. A Q and A session where students have an opportunity to ask the TA questions.

Topic 3: Active Learning tips from the Physics Dept

Recitations should implement the educational philosophy of active learning. Active learning is a pedagogical style in which students are invited to participate fully in the learning process. They are encouraged to think, discuss, and investigate the material on their own under the guidance of an instructor. In active learning, students will practice skills, solve problems, generate solutions, and explain ideas in their own words. Education research has shown that incorporating active learning strategies into university courses significantly enhances student learning experiences (Freeman et al., 2014; Theobald et al., 2020). With this mindset in place, here are some ideas on structuring a recitation.

1. **Learning Goals**: These should clearly explain what students should get out of that week's recitation. Make these learning objectives explicitly measurable, meaningful, and accessible to all students (Stanny, 2016).

2. **Warm-Up**: These are simple, usually conceptual problems that should take no more than five minutes to complete.
They prime students for learning that week's class and help with classroom management (Collins, 2020).

3. **Exam-Style Problems**: There are usually two, sometimes three, problems available to practice. You do not have
to get through every single question. Modify them as time permits.
4. **Reflection**: On the last page, students are asked to reflect on their learning by writing down problem-solving strategies they learned and any issues they still have with the topic at hand. (Chang, 2019).

Being an Active TA
As a TA, your main goal is to guide students through their learning - so you've got to be active too! Your classroom should not look like a lecture hall with you on the board and your students quietly listening. It should be a dynamic space where you walk around and listen to your students discussing the problems. If you hear students who sound confused or see students who aren't working on the problem, you are responsible for guiding them with active questioning.

When you are asked questions, try to respond with guiding questions. This isn't easy at first, but you will improve overtime. You should minimize the time spent lecturing to the students and not solve problems yourself. As you teach, a good phrase to remember is, "Ask, don't tell."

Below is a suggested schedule for recitation.
Before Class
1. Arrive early and arrange desks into groups of 3-4 if you are in a room with movable chairs.
2. Try to anticipate areas of student confusion and think of ways you will respond.
3. Think about how you want to organize problems during the recitation.

During Class
1. Have students begin by working on the warm-up problem in their groups as they walk in. Remind any students it's essential to be on time for those who walk in late, especially for this type of recitation.

2. As students work on the problem, walk around and check in on groups. You should never stand at the front of the room while students work. Be sure to notice if groups are having trouble getting started or if there is not equitable participation from all members. In both cases, it is your responsibility to (1) guide students who cannot begin and (2) ensure that all students are being treated with respect/are being supported in their learning. If you notice someone consistently struggling to follow the discussion or falling behind their group, be sure to email them and follow up in a respectful and supportive way.

3. Discuss the warm-up problem using strategies you will learn and develop during the TA meeting.

4. Present the first mini-lecture. The material should be chunked so that each mini-lecture corresponds to the upcoming problem. Be sure to pause for any questions and ask students if there was anything they found confusing from a lecture that day/week.

5. Give students time to work on Problem 1 from the exam-style questions and then discuss. This looks similar to the warm-up: walk around, check in on groups, and have students present their solutions. As students share their solutions, be sure to interrogate the steps: ask students why they chose a specific equation or set a certain quantity to zero, etc. You will develop question-asking strategies during the TA meeting.

6. Repeat this once again for problem 2.

7. Ask students to write down the problem-solving strategies they learned and reflect on their learning for the day. They may do this with their groups and discuss it together if time permits. You must reserve five minutes at the end of the recitation for this, as this is the ultimate takeaway students are supposed to have once they leave the classroom.

After Class
1. Post the solutions to the worksheet on CourseWorks
2. Reply to students' points of confusion on Ed Discussion, especially if certain concepts appear across multiple students.
Here are a few tips, tricks, and recommendations to keep in mind as you begin teaching,
• Don't be too hard on yourself! You will get better at teaching as time passes, and we know it can be challenging to stop
yourself from slipping back into the passive learning status quo. As long as you're trying, that's what matters.
• Let your personality shine! A joke and general lightheartedness can go a long way if you're feeling funny. Any way you humanize yourself helps bridge the gap between you and your students, especially if you share areas where you had difficulty when first learning the material.
• If you have the time, scheduling 5-minute one-on-one meetings with your students can establish you as a resource.
• Go to TA meetings! These provide an essential opportunity for you to develop your teaching skills and hone in
Some of the aspects of recitation are outlined above.

Responsibilities & Expectations
1. Create groups and facilitate active group work during recitation (i.e., walk around, ask guiding questions, identify
students with difficulty with the material, etc.). Remember that you are an authority figure, and you are responsible for getting students to participate.
2. Manage your time during recitation so students can complete all problems and the reflection.
3. Create weekly Ed Discussion threads and ensure students post their algorithms and confusion points.
4. Teach your weekly sections and attend the weekly TA meeting.
5. Take attendance at every recitation.

Topic 4: Online teaching

The strategies will vary depending on if teaching that semester is in person or solely online.
A. Classes are in person – what happens in the room takes precedence over what happens online.
   i. Create Zoom sessions in Canvas that will automatically be recorded in Panopto in Canvas.
   ii. Record your mini-lectures. The recordings are helpful for those who cannot attend the lecture due to illness or other approved excuses and for students to review when studying.
   iii. It is up to you to decide whether to record the rest of your review session since recording can decrease students' questions.
B. Classes are all online - If you and your students are now dispersed across time zones and countries, consider providing multiple avenues for your students to seek support, including synchronous options (such as regularly scheduled sessions in Zoom or other video conferencing) and asynchronous options (such as discussions in CourseWorks or using Ed Discussion), to help you meet your students where they are.

Engaging Asynchronously With Your Students
Much learning happens outside synchronous meetings when students can reflect and produce work independently or in small groups. In addition, shifting teaching to asynchronous interactions may be preferable and even necessary with instructors and students scattered across time zones and countries.

To help students make the most of their time beyond class meetings, think about how you can structure this out-of-class time to help them learn. This could mean introducing online tools or activities that help students engage with course content and interact with each other on their own time.

… **Successful technical strategies for Zoom or hybrid/zoom sessions**
Share your screen to display the whiteboard so all students can see your annotations in real-time. Save the whiteboard sessions and share them with students after class.
Connect a document camera to display live handwritten notes or drawings. This is particularly useful for subjects requiring detailed equations or diagrams.

…**Hybrid-Specific Adjustment for Zoom sessions**
The in-person presentation must take precedent over any online additions if classes are in person.
If classes are in-person but lecturers are being recorded (synchronous and asynchronous): Disable the chat function while the instructor is recording their in-person class via Zoom. It is challenging to answer chat questions while lecturing.

a) Shared Visuals: Project shared screens for in-person attendees while online students view via Zoom.
b) Use the classroom microphone or the desktop mic for the Zoom audio.
c) Required recitations: upon request, due to extenuating circumstances, a student can zoom synchronously & receive credit.

If classes are exclusively online:

a) Monitor the chat for questions during discussions
b) Reviewing the chat is difficult while giving a mini-lecture. Let students know that they will need to speak up or use the raise the hand function if they have a question during your minilecture.
c) Check in with the online students to ensure they can hear/see clearly.
d) Many instructors require that students keep their video on (unless the student has internet issues) to improve participation.
e) Use breakout rooms to facilitate discussion
f) Decide if it makes sense to assign breakout rooms (good for prolonged discussion with the same students) or randomize which students are in each breakout room.
g) Review Participation: Zoom attendance or activity logs can be used to track attendance or student engagement.

PART 3: Teaching tips and administrative information from CTL (Edited by Department of Biological Sciences)

You should discuss all situations involving students described below with the course faculty.

FAQs for Teaching Assistants
Please browse our list of frequently asked questions, scenarios, and resources for graduate student instructors. CTL also offers an Orientation to Teaching for Graduate Students, which is available on-demand to all Teaching Assistants in Columbia.

Accommodations – should always be discussed with the course instructor.
…a student wants to turn in an assignment late because the due date falls on a religious holiday?
Encourage students to inform the course instructor about such conflicts at the beginning of the semester. Discuss with the faculty course leader if you have difficulties working out accommodation. See pertinent information under "Student Officers" in Columbia's handbook for Officers of Instruction and Research—related resources: Columbia's Office of Religious Life and Columbia Registrar's Academic Calendar.

…a student gives me a letter certifying a need for an accommodation.
Students registered with Disability Services (DS) will either approach you or the instructor with a letter certifying their accommodation, or the instructor will receive a list of the students on the course with

accommodations. If you receive a letter, you should pass this along to the instructor. ODS publishes an informative online guide to the support, accommodations, and services it offers.
If a student believes they need accommodation due to a disability but does not have a letter from ODS, direct the student to register with ODS.

…an athlete or a musician requests a change in a due date because of a game or performance?
Schedules for sports activities and performances are generally worked out before the beginning of a term, and students should speak with the instructor at the start of the semester if they anticipate a conflict.

…a student wants to withdraw from the course two months into the term?
Ensure the student discusses withdrawing with their advisor at the Berick Center for Student Advising (CSA). If a student does not know who their Advising Dean is, you can find that information on your course's CourseWorks page. Under the "Photo Roster" tab on the left-hand menu, choose the "List/Advisors" tab at the top. CourseWorks will display the name of the Advising Dean for each student. Click on the advisor's name to email the advisor – a mail with the advisor's email pops up.

Columbia students can drop classes with a tuition refund during the Change-of-Program period during the first two weeks of the semester. After this period, they can still drop a class, switch from a letter grade to a Pass/Fail, or withdraw (W) from a class, though no money is refunded for the class. The deadline for dropping a class or switching to Pass/Fail varies across schools.

…a name shows up on my final grade sheet for a student I've never met?
The official roster for your class or section is available through Columbia Student Services Online (SSOL). Once you have met with your students a few times, it is a good idea to check this roster to see if it matches students with the students attending your class or section — and to alert your faculty course leader to missing students.

Course Management
…grading is taking twice as long as I planned?
Efficient grading depends on defining clear rubrics or expectations upfront with your instructor. Give students brief feedback (and the number of points they lost/questioned) on what they lost points for. Visit our website for grading-related workshops at the CTL or request a consultation.

…I disagree with something the faculty instructor has said in class.
This can be an opportunity for a lively and informative conversation between you. Don't mutter to yourself—talk it out after class.

Academic Integrity
…a student turns in a paper that seems plagiarized or generated by AI?
Discuss right away with the faculty instructor. Academic integrity is built on assumptions and standards that may be unfamiliar to your students. To avoid misunderstandings, discuss aspects of academic integrity with them early in the semester— including the ethics of using artificial intelligence (AI) tools in your course (as students may be navigating different rules across each course).

The Academic Integrity website offers a list of Columbia's Academic Integrity resources under the Upholding Integrity tab. The CTL's website also offers a resource on Promoting Academic Integrity and a resource on Considerations for AI Tools in the Classroom.

…I witness two students cheating on an exam?
Document this serious violation of academic integrity and discuss it with the faculty instructor. Incidents of cheating should be reported to the Center for Student Success and Intervention. During in-person tests, you can help prevent cheating by spacing students apart during tests and limiting passage in and out of the testing room.

…I get propositioned by a student, offering favors in exchange for a grade change.
Make your grading rubrics or standards clear from the start, and keep applying these standards fair, transparent, and professional. Discuss egregious lobbying for grade changes with faculty. Depending on the nature of these propositions, you can report the incident to the Center for Student Success and Intervention or the Gender-Based Misconduct Office. If the case is particularly severe and feels like harassment or discrimination, you can also report the incident to the Equal Opportunity and Affirmative Action office. These offices are in close communication. If you file the report to the wrong office, they will forward it to the appropriate office to ensure you get appropriate and timely support.

Personal Issues
…a student start discussing complex personal problems during office hours or over email?
Bring to the attention of the faculty instructor. If you believe a student is in immediate danger and is in NYC, call 911 first, then call Public Safety — Morningside (212-854-5555), Manhattanville (212-853-3333), and CUIMC (212-305-7979). If the student is elsewhere in the country, please determine the student's location, then contact Public Safety, which can help identify the appropriate emergency resource.

You can call Counseling and Psychological Services (Morningside) **at 212-854-2878** and Student Health on Haven (CUIMC) **at 212-305-3400**; both are available for virtual consultations and support 24 hours a day, 7 days a week. The Dean of Students or Student Affairs in your school or your department's Director of Undergraduate or Graduate Studies can also help you connect a student to support.
Additionally, the Office of University Life has compiled a Blue Folder that you can download. In it, they've collected guidance on responding to and supporting students in distress and campus resources available to support mental health and well-being for our whole community.

…I feel overwhelmed by responsibilities and challenges in my own life?
You are not alone: over 60% of Columbia graduate students draw on Columbia's Counseling and Psychological Services (CPS) during their time at the University. For whatever stress, challenge, or personal concern you are having, CPS is a good first step to improving your mental health and general well-being.

…I am tempted to develop a romantic relationship with one of my students.
To quote Columbia's Office of Equal Opportunity and Affirmative Action, "It is the policy of the University that no faculty member shall have a consensual romantic or sexual relationship with a student over whom he or she exercises academic or professional authority. It is also the University's policy that no faculty member shall exercise academic or professional authority over any student with whom he or she has or previously has had a consensual romantic or sexual relationship. This policy applies to all officers of instruction, research, and the libraries, including student officers of instruction and research and graduate and undergraduate teaching assistants."

…I saw/was told off/overheard an act of harassment/discrimination between students?
You are a mandatory reporter as a TA or graduate student in any instructional capacity—even as a grader. Mandatory reporters are required to report any instances of discrimination or harassment—whether it be gender-based or identity-based (e.g., racial or religious identity)—to the University. You should report these incidents at http://bit.ly/GBMOMaxient. Remember, as a mandatory reporter, your responsibility is to report any incidents of harassment or discrimination that you witness personally, that are related to you by a student (even if it is not your student), or that you overhear students discussing.
Gender-based misconduct includes sexual and gender-based harassment, sexual assault, relationship violence, stalking, and similar conduct. After you make your report, a case manager from that office will reach out to the student(s) experiencing the misconduct with information about resources and other services. Students retain complete control over which, if any, services or support they would like to pursue and always have the option not to participate in any investigation or additional process. The various offices that manage these incidents, like Equal Opportunity and Affirmative Action (EOAA), Title IX, and others, work closely together. If you report to the wrong office, they will transfer your report to the appropriate office.

…I feel a student, a fellow graduate student instructor, or a faculty or staff member are harassing me?
Suppose you feel that you, personally, have been discriminated against or harassed by a student, fellow graduate student instructor, or a member of the faculty or staff. In that case, you may report this at http://bit.ly/GBMOMaxient. You can also use this link to report sexual assault, relationship violence, and stalking. If you do not wish to report but would like to know what resources are available to you in response to gender-based misconduct (including sexual and gender-based harassment), or you wish to speak with someone confidentially without reporting at this time, see this list of confidential and non-confidential resources on the Sexual Respect website. For resources and support regarding other forms of discrimination and harassment, speak with your supervisor, Director of Undergraduate Studies or Graduate Studies, or a member of the Student Affairs Office in your school.

Logistics
…I get to my classroom and the door is locked?
For help accessing physical classroom spaces (e.g., the door is locked), call Columbia Facilities on 212-854-2222 & let the faculty instructor know. For digital classroom spaces (e.g., Zoom rooms), try logging in through http://columbiauniversity.zoom.us or contact your faculty or the Department Administrator to set up online class links.

…I get to my classroom and technology in the room does not work?
Columbia University's Information and Technology Office (CUIT) maintains classroom technology. Instructions for reporting equipment problems are often posted in the classrooms themselves. Urgent requests for electronic classroom support can be made by calling 212-854-3633. If the problems persist, let your class instructor know you are having technical difficulties with the room.

…I need equipment (webcam, microphone) to teach my class online?
Contact the faculty member you are working with and/or the Department Administrator to inquire how your department can meet your equipment needs.

… I am having trouble with my home equipment or have problems using Zoom?
Check CUIT's Zoom Support page where you can find links to email CUIT or call their help desk.

…I run into problems using CourseWorks?
Suppose you have pressing concerns about access or technical questions about CourseWorks or another digital teaching tool. In that case, you can contact the CTL directly Monday through Friday from 9 am to 5 pm via phone (212-854-9058) or Zoom (https://columbiauniversity.zoom.us/my/ctlhelp) and speak with one of our learning designers for immediate support.

The CTL also offers a series of workshops, trainings, and documentation to help instructors make good use of CourseWorks. You can always look through CTL's collection of CourseWorks how-to documentation for instructors on our website.
CTL also supports the use of other teaching tools available at Columbia, such as blogs, media production tools, and multimedia analysis platforms.

Inspiration
…I need ideas about teaching strategies, writing a teaching philosophy, or designing a syllabus.
Advice about teaching strategies abounds! The CTL Resources section is a great place to start, whether you are interested in ideas for making your instructional practice more inclusive, exploring a range of pedagogical strategies and approaches, improving your grading and assessment practices, or drawing on technology to teach effectively. If you are thinking about developing teaching-related materials for the job market, browse our Approaching the Job Market offerings.

We also offer a great deal of live CTL programming every semester, ranging from workshops and services to help you learn the fundamentals of teaching to advanced seminars and institutes on a range of topics and a number of informal Lounges, Journal Clubs, and Learning Communities.
The Teaching Development Program is a great way to navigate all these offerings, document your pedagogical growth in graduate school, and get credit for sustained teaching development on your transcript. Visit the TDP website to learn more and sign up.

The Center for Teaching and Learning has many resources for teaching assistants, including these:

On-demand training modules for TAs:
https://ctl.columbia.edu/graduate-instructors/programs-for-graduate-students/on-demand-resources/

Guide for Inclusive Teaching at Columbia:
https://ctl.columbia.edu/resources-and-technology/resources/inclusive-teaching-guide/

Getting started with active learning:
https://ctl.columbia.edu/resources-and-technology/resources/active-learning-basics/

How to use rubrics:
https://ctl.columbia.edu/resources-and-technology/resources/incorporating-rubrics/

Developing poll questions:
https://ctl.columbia.edu/resources-and-technology/resources/poll-questions-stem/

FAQs for TAs:
https://ctl.columbia.edu/resources-and-technology/resources/faq/

Teaching Development Program:
https://tdp.ctl.columbia.edu