

Have you read the regular [TA Manual](#), but want some additional help with explaining? See below!

There is a manual on this web site called “[Teaching Scientific Concepts & Problem Solving](#).” Most of the material in that manual is included in the regular TA manual. There are a few sections that are NOT in the regular TA manual. They are below. If you have the TA manual, you don’t need the whole manual on teaching scientific concepts, etc. – you only need the parts below.

MORE ON USING THE BLACKBOARD (& Other Media)

8. Planning Ahead & Using other Media.

If you are going to explain something complex, you should think through your presentation carefully before you do it. You need to consider what you will write or draw, where on the board you will draw it, what steps to include, etc. It helps to think it through as carefully as if you were making overheads or preparing a Power Point presentation. If you don’t think it through in advance, you may find yourself without room to complete your diagram, trying to compare things on boards that are at opposite ends of the room, erasing things you need to refer to later, etc.

If you feel the subject is complex enough, or requires better drawing ability than you have, then you might consider using PP or overheads instead of the board. However, using the black board gives you much more flexibility, and makes it easier to pace yourself so students can take notes. Presentations with PP or overheads look prettier, but they easily become too static or “canned,” especially if you have to turn the lights out. It is also very easy to go too quickly and explain too little if you use prepared materials. So if you use overheads or PP remember that it isn’t enough to show the pictures – you have to slow down and explain them even if they look completely self explanatory.

What ever medium you decide to use, be sure to adjust the pace and level to your audience. You might want to provide the students with a handout lacking some of the details, as explained above.

MORE TIPS ON EXPLAINING

7. A General Principle -- try to think like a student, not like a professor. Remember that they probably haven’t taken a lot of advanced classes or worked in a lab. So they are lacking in both basic facts and general background. (You are explaining how to make scrambled eggs to someone who has never cooked. Or maybe never even seen an egg.)

8. Provide a road map. What is coming, and why? Set up a “frame” for what you are going to say.

Before you attempt to explain anything, say, in advance: (a) what you are about to explain, and (b) why you are bothering to explain it.

Why (a)? Listeners feel much more comfortable when they know what is coming and approximately how you are going to get there. What is the major point, and how are you going to address it? It is much easier to pay attention and to follow the argument when you know what the “destination” is, and when you know something about the route. (First you say “Let me explain how to get to Brooklyn – it will take 3 trains.” Then you go into the details of which you take first, where you transfer, etc)

Why (b)? Listeners will be much more willing to concentrate on details if they know why they matter. Why are you talking about this apparently obscure case or example? Why is it important? What does it illustrate? Why are we going to this destination and/or why are we taking this detour to get there? In the context of the class, how does this issue fit in to what has already happened? How does this relate to what will come next? Why do you need to explain it now? (Why do we want to go to Brooklyn in the first place? Why go now?)

9. Look Out for Potential Sources of Confusion

When you explain things, it is often worth while to draw attention to certain issues or concepts that are easily confused with others, or mistakes that are easily made. (“When you get to Times Square, be sure to take the 2, not the 3.”) Foreseeable problems may arise from difficult concepts, but they often come from problems of terminology or inconsistent use of symbols. For example, what does $C \rightarrow Y$ mean? Signal C goes to structure Y? Compound C turns into compound Y? Structure C makes Y? C donates electrons to Y? In biology it can mean any of these. See “Famous Difficulties & Misunderstandings” for confusion that arises from problems of terminology.

Note: It is sometimes necessary to get the students to see the problem first on their own before you can

straighten them out. In other words, some mistakes have to be made, and corrected – they can't be avoided. But many common errors can be circumvented.

A BAG OF TRICKS YOU MAY FIND USEFUL

These are things that work very well for me, but they may not work for everyone

1. Analogies. I compare the situation to something that is familiar to the students. For a complex process I use cooking or an assembly line. (Try to vary your analogies so that students of all stripes can relate. Don't do all sports or all sewing.) For DNA vs RNA I talk about reference works vs. Xerox copies. For tRNA vs mRNA I talk about hardware vs. software.

2. Models. I use simple 3D models made of common objects. I use pre-school toys, tissue boxes, wire left by the repairmen, Velcro strips, bread, etc. . A bagel is a great way to demonstrate a donut shaped hole in a membrane and a tissue box makes a great cell to show where the bagel goes. Giant, pre-school pop beads are an easy way to demonstrate many of the features of polymers. These models are low cost, easily replaceable, easy to see, and have great "wake 'em up" value. They don't have a lot of detail, which makes it easier to demonstrate your point. Thinking about constructing a useful model or working through a good analogy helps me to see the important features that I am trying to explain – it helps clarify things for me as well as the students.

3. Using the Blackboard. I prefer chalk to Power Point or overheads, especially in a small group setting such as a lab or discussion session. This is partially an aversion to technology that doesn't always work and/or requires equipment that isn't always provided. (I am not morally opposed to either one, and I have colleagues who do a great job with them. But I think they are both hard to use properly in classroom situations.) I think that chalk gives you much more flexibility in explaining things. You can vary the order, go into more or less detail, explain things that you never thought would need it, skip what doesn't seem to need explaining, etc. You can do all these things with prepared media, but it's much harder to vary the script. I also find it's easier for students to take notes if I have to write it all on the board. It's also more animated -- somehow a chalk talk is more "live" than any of the other options, and therefore more interesting. PP is great in the right hands, but so is chalk. I solve the problem of presenting complex structures and processes by using handouts.

4. Handouts. I give out several different kinds of handouts – the first type is to help with note taking. I found out early in my teaching career that students have a hard time copying diagrams. It's also difficult for me to draw them perfectly. So I give out handouts – 1 or 2 pp usually per class, with the basic structures and/or processes drawn the way I plan to draw them on the board. I deliberately leave off some of the labels and details. I draw the same picture on the board, and explain (and annotate) as I go. To help me do it right, I make a special annotated copy of the handout for myself. It has the major points and details on it, often in numbered order. The handout helps the students follow and take notes without getting lost. It also helps me as well as the students -- if I make a minor mistake on the board, the students still have the correct structure on their handout. (You could show an overhead or PP slide instead, but it's easier to add details on the board.)

I also make handouts that summarize large areas or compare and contrast related phenomena. I use them to frame the class discussion – in class I "blow up" each area of the picture, and fill in the details. I constantly refer back to the overall hand out to show how the details fit into the big picture. (See tips on explaining.)

A Short List of What NOT to Do -- Nothing Like a Bad Example!

1. Draw/show a confusing diagram like:

HT → TRH → Ant. Pit → TSH → thyroid → TH. → target cells

What's wrong with this? HT, Ant. Pit, thyroid are glands. TRH, TSH & TH are hormones. The distinction is almost impossible to see when the diagram is written as above. The arrows also mean two different things – some arrows mean “releases” and some arrows mean “goes to.” (This is a real example from a real prof.)

How to fix it? One possibility is to put the glands/targets in boxes or circles so it is clear what's released and what's a tissue. Alternatively, draw a longer arrow from each tissue to the next, and write the names of the hormones over the arrows.

2. Do some blackboard carpentry. Draw a picture that shows a normal, baseline situation. Then erase and alter your picture to fit a new situation – more oxygen? with drug? next step in pathway? Don't redraw, just alter the original picture. (What should you do instead? Make a story board -- draw each case or step separately.)
3. Stand in front of what you wrote.
4. Face the board as you talk.
5. Write in corners of board or wherever there is space.
6. Use jargon, abbreviations. (Verbally and on board.)
7. Erase what you just wrote before everyone has finished copying it down. (When there is plenty of other old stuff you could have erased.)
8. Skip important steps. Start explaining in the middle.
9. Take a lot of time explaining the obvious.
10. Write too small or in unintelligible handwriting.
11. Show a slide and wave the laser pointer over it. (But don't explain what's on the slide.)
12. Mumble.
13. Talk too fast.
14. Stare at the floor.
15. Say something very complex (like the pathway above or a description of a complex structure) and write nothing on the board.
16. Insult the students – make fun of them (or their ignorance) when they ask questions, and berate them when they don't speak up.
17. Explain how stupid, worthless, lazy, pampered etc. students are nowadays. Not like when I was a student.

I don't include making actual mistakes – everyone does that! (And it's okay if you admit it.)

