1. Often when I ask students to draw, they make teeny, tiny drawings that are so small that they cannot be annotated. I ask them to use at least 1/4 of a page for each drawing, but they struggle to do that. Any suggestions to get them to make larger drawings?

Oh goodness, yes! Many people really do like to make tiny drawings.   
I require my BioIllustration students to fill the page with their illustration (they can’t add detail if it’s not large enough)… and it’s a big page (11x14)! I have points associated with the size (and detail) of the drawing.   
I think if we get to the reason behind the tiny drawings, it can help. In my experience, it’s either because students are afraid of other people seeing their work (a tiny drawing can be easily covered with a hand or scribbled out) or because the individual is afraid of making a mistake (if the drawing is “bad,” they can easily get rid of it). I think we should encourage our students to see mistakes as a learning opportunity. Maybe ask for volunteers to show off their “biggest learning opportunity.” That could be fun.  
Or you could try getting them to start with a box of a certain size (like 1/2 sheet), then tell them the drawing should fill the box and labels go outside the box.

When students draw along with me (DOODL-ED), they draw larger because my drawings are not spectacular either! Show them it’s ok not to be perfect!

1. Mentioning textbooks always makes me think about open education, material cost / accessibility, and copyrights. Do you have a textbook for these courses, or are your illustrations part of the provided material? Do you copyright your illustrations? (Just curious; we can chat later if it’s not relevant now!)  
   I actually love textbooks, but I don’t have a textbook for any of my courses. I do provide my drawings to students, or use my drawings in instructions. I don’t copyright my illustrations, but I believe copyright law automatically protects my drawings as their creator. For the students, I attribute their drawings to them, and have a waiver saying I can use them in presentations, etc.
2. Do you provide in-class workdays for time-intensive projects?  
   The students do have “studio/lab” for 3 hours per week. I work with them extensively during that time.
3. Is doodle ed a program or just your name for this process?  
   It’s just my name for it, though I would love to provide more instruction, examples, etc for instructors.
4. Is this a first-year course? Would you recommend a drawing project in a first-year biology course for majors even though students may not have skills for drawing? If so, how much time do you think is required for students to learn drawing for this purpose to produce final product? How would you respond to students who claim they can’t draw? Do you consider yourself an artist? Thank you! Your presentation is tremendously interesting and inspiring.

Thank you! My BioIllustration course is a 200-level course, though all levels can take it. There are no prerequisites.   
I do recommend drawing because I think it’s so helpful for developing observation and visual communication skills.  
My students produce their first illustration in the 3rd week of class (the first week is learning to draw, the second week is learning to research and write). So I think it only takes an hour or two to learn drawing. But it can be emotionally draining for many students (see Q1 above) so it’s good to have breaks. All of my students can produce exceptional work by 5-7 weeks of class.  
My response to “I can’t draw” is “Can you write your name?” Drawing is just making lines and dots, same as writing. What they really struggle with is observation. That’s what I teach.  
I do consider myself an artist. Once upon a time, I was a biological illustrator. But carpel tunnel and a lack of time has reduced my abilities.

1. I love the accessibility and affordances of drawing and learning via creating these illustrations. Wonderful talk! Is there interest in using 3D modeling and printing tools to take these drawing into more dimensions, or creating tangible artifacts?

Thank you! I know of others who use 3D modeling and printing, so I’m sure there’s tons of interest. I like the creation process, so I have done things like building worms out of clay. I think it’s the activity rather than the artifact that is most beneficial and fun. But all these options are great! More tools in the teaching toolbox!

1. How do you recommend that instructors who feel uncomfortable themselves drawing get started using drawing to learn in their teaching?  
   First, if instructors are really uncomfortable, do something else! Teaching should be joyful so use the tools you enjoy.  
   If you do want to use this approach, you can start with a graph. If you want to add little characters to your graph, you can bring printed cartoons or draw a cartoon ahead of time. Sometimes, I’ll make my Doodl-Ed drawing on a post-it that I put next to the DocCam. Then I just copy it.
2. More of a comment than a question… many of the benefits of drawing you describe (as well as some not mentioned - such as surfacing student misconceptions) were also shown as part of a study/project called ‘Picturing to Learn’ by Felice Frankel: <https://www.picturingtolearn.org>

Thank you for the link! I had read Frankel’s work, but I have not seen this site.

1. What types of accommodations do you do for students that need them when you are using Doodl-Ed?  
   Excellent question. The only issues that has arisen was for a student with limited vision. She just needed things larger. So I wrote labels larger. And we worked out a signal that if she could not see the Doodle on the screen, I would casually take the finished Doodle to her desk for her to look at closely. It was much easier for her to see the DocCam than when I wrote anything on the board.
2. I wonder whether you use drawing as a way to introduce more general concepts of ‘visual literacy’ in science (i.e. training students to become more critical consumers of various forms of visual media as they learn).  
   I do not, but that’s a great idea. I do use drawing to introduce ‘study habits.’