

Teaching Summary

Descriptions of statistics courses in university calendars often give the impression that each course forms a separate block of knowledge delivered to students by an instructor. However, I expect more from students than that they memorize facts and formulae one course at a time. I have had the opportunity to teach a variety of courses at both the undergraduate and graduate level, and I believe that teaching at all levels should help students to their analytical skills. I achieve this by: 1) defining clear learning outcomes for students, 2) designing learning activities that help students to meet these outcomes in an active manner, and 3) developing methods of assessment that allow both the students and myself to continuously evaluate their progress toward achieving these outcomes.

The first thing I do when planning a new course is not to list the topics I want to teach but to identify the skills that I want the students to develop. I then define learning outcomes based on these skills, both for the course overall and for each separate unit. For example, I expect students in an introductory statistics course to go beyond the recipes for computing sample statistics or conducting hypothesis tests. I want them to understand the concepts that underlie these methods and to be able to apply the methods to simple data sets. I hope that undergraduates in statistical inference will do more than memorize the theorems in a textbook and be able to understand new theory presented at their level, and I want graduate students to go even further and begin developing theoretical arguments themselves.

I then use these learning outcomes to develop the rest of the course. I list the overall objectives on the syllabus so that students are aware of them at the start of the course, and I provide more specific goals when we start each new unit. I then design activities that will help students meet these goals. There are times when it is useful to present knowledge to students in lecture format, and I do this most frequently in advanced courses with a lot of mathematical content. However, I believe that students learn best when they are active and engaged in the classroom. A large body of educational research has shown that active learning is more effective than passive transfer of knowledge, and this is supported by my own experience as both a student and instructor.

Designing learning activities can be a difficult process of trial-and-error, but it can also be a lot of fun. Here are two examples of the types of activities that I have developed:

1. One of the objectives in my STA 672 course at the University of Kentucky (design of experiments for non-statistics graduate students) is that the students gain experience designing and conducting their own experiments. I have designed several activities to facilitate this, but one activity stands out for me. On the first day of the course, I ask the students to conduct an experiment to determine if different flavours of chocolate dissolve in their mouths at different rates. I originally intended this as a fun activity that would help the students to start thinking about designing an experiments. However, I was amazed to see the students intuitively apply the basic concepts of design the first time I ran this activity. This provided a perfect way for me to introduce the key ideas in the course. Knowing that they had already thought about these issues I could ask questions like “Why did each member of your group test the flavours in a different order?” to introduce randomization or “Why did each member of your group test all flavours of

chocolate?” to introduce blocking.

2. Designing engaging activities for theoretical courses can be more challenging, but I believe that it is equally as important. When I first taught STA 607 at the University of Kentucky (statistical inference for statistics graduate students) I found that some students could replicate the proofs I had shown them in class but could not develop arguments on their own. I did not expect them to construct entire proofs, but I hoped that they would be able to put the pieces of an argument together. To help them with this, I designed several activities that required the students to order the steps of a proof themselves. In one activity, I created a handout for students by typing out a proof before class and then rearranging the steps. The students worked in groups to reconstruct the argument, and then we reviewed the entire proof together. Each student had a complete copy of the proof at the end of class, as if they had copied it from the board, but the activity forced them to engage more with the material and to develop some of the argument themselves.

Following these activities, I use different methods of assessment that help myself and the students to evaluate their progress toward the learning outcomes. Most statistics classes rely on a combination of assignments and examinations to assess performance, and I believe that these are important tools. Assignments, in particular, provide students with regular feedback and help to direct their learning outside of the classroom. However, assessment from assignments often comes too late. Assignments are often not returned until several weeks after the material has been covered in class, and, in my experience, it is very difficult to review material and correct errors in the students' learning at this point.

I have used several alternative methods of assessment to provide students with feedback about their learning and to get feedback on my teaching more quickly. Sometimes, I have asked students to complete short surveys or one-minute papers to help them review specific material or to tell me what concepts they found most challenging. Surveys also help to identify simple problems early in a course – like whether students in the back of the room can hear my voice or read the writing on the board. At other times, I have used short, daily exercises which I grade and return as soon as possible so that I can check students' understanding of specific content and provide immediate feedback. If several students identify the same issue or struggle with the same exercise then I can review that material in class or through assignment questions. These techniques also provide me with feedback on my teaching which I use to make changes to courses over time. In addition, I will often use custom teaching evaluations to get feedback from students on the specific learning activities that I have developed for a course.

These three concepts form the basis for my work in the classroom, but I see teaching as a continuous process of development and I am always looking for new ways to improve. One of my goals is to make better use of instructional technologies in my classes to help engage students and to provide more immediate feedback. I have watched other instructors use Classroom Response Systems (clickers), and I see many ways that I could use these tools myself. I would also like to incorporate the use of statistical software packages within the classroom so that students can apply what they learn immediately without waiting for homework assignments or labs. Helping students to learn is a very rewarding part of my academic career, and I look forward to developing my teaching skills further.