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Teaching is an iterative process of instruction, assessment, and feedback. I believe that it is important for the student to gradually assume the role of teacher, and my classroom is set up so that the above three activities point students towards an independence in learning and teaching. I have found these principles to be just as valid whether teaching first generation college students, honors engineering students, students for whom English is a second (or even third) language, as well as the regular group of freshmen calculus students.

**Instruction** can mean standing at the front of a classroom talking about math. But that's so boring! I doubt students get much from it, either. In my experience, students learn more and retain that knowledge better when they figure something out for themselves and then explain it to their peers.

**Assessment** can mean giving quizzes and tests throughout the semester. But that's so boring! Students don't find out that they're not doing well in class until it's too late, either. A better way is to provide multiple, frequent opportunities for low risk assessment, including student self assessment. Frequent assessment helps both student and teacher know where they stand so that there are fewer surprises when test time comes around.

**Feedback** can mean that the teacher hands the students back tests or homework with grades on them. This is an important kind of feedback that students take seriously, but it's not the only kind of feedback. It's probably not the most important, either! Feedback from student to teacher is crucial for keeping the teaching train on its tracks.

Here are some ways I've applied these three in my teaching. I'd like to focus on three groups of students I've taught during my time at the University of Texas:

**First generation and historically underrepresented college students:** I participated in the Supplemental Instruction program at UT for three semesters. This is a nationally recognized program which aims to improve student performance, increase retention, and enhance graduate teaching. These classes contain students who are first generation college students and those in a special program for students historically underrepresented at UT. Students in this program have lots of innate ability, but they also generally have a poor background in mathematics and lack the study skills that many of their peers come to college with.

Because these students have a difficult time organizing their studying, it's important to spend time discussing *how to learn* the material. For example, at the beginning of class I might ask the students how they're studying for the test. The list of responses (which might include things like doing old homework problems, doing old test problems, doing problems from the book, reading the book, studying in a group, etc.) helps give everybody a good idea of some of the many ways to prepare. Exhibiting good and bad answers to test questions can

help students understand what's expected of them before the test, and by using suitably anonymized answers from previous semesters it's possible to model the expected behaviors realistically.

Some students don't even realize that they don't understand the material. That's why it's important for me to get regular feedback from the students on whether they will be able to do the problems they're expected to do. In a classroom with 20–30 students, it's possible to have students work a problem during class and spend a moment talking with each student individually. Simply glancing at their work can often tell me whether they're on the right track or need help. With this method it's easy to see trouble spots early on. This type of assessment, which happens every class period and involves individual student attention, is one of the most important tools I have learned at UT.

**Honors students and select highly motivated students:** For two semesters I was the instructor of record for Emerging Scholars Calculus, a challenging adjunct to the traditional calculus sequence for a select group of high achieving students. I also taught Honors Differential Equations to a group of bright engineering students one semester. Both of these classes were fun to teach, and challenging in different ways from other classes.

These groups of students mostly understand the material. The difficult is in challenging them to understand it *at a higher level* and to keep up with a fast pace. One way I accomplish this while providing instruction and assessment for the students and feedback for myself is to have the students work in groups during class. By pairing strong students up with weaker ones and then asking them to present their work at the end of class, every student gets the opportunity to act as teacher. The strong student (usually) leads the discussion and problem solving, explaining how to think about the problem and solution to the rest of the group. Later in the semester, when everybody understands how the process works, I can call on the weaker students to explain their answers in front of the class. This type of leadership and students-modeling-behavior activity works very well in every class I've used it in.

Office hours are another great time to practice student centered learning. I have the students explain very carefully what their problem is, working it out on the board as far as possible. If they get stuck, I encourage other students to help out. In fact, often students can conduct their own office help session with very little input from me. I'm there to keep things focused and on track, but ultimately it's the students teaching themselves the material.

**International students and ESL students:** For two years I was a teaching adjunct at the Texas International Educational Consortium. In this capacity, I helped students from Southeast Asia and the Middle East prepare for standardized tests and entrance exams for undergraduate and graduate degrees. These students ranged in age, English ability, mathematical ability, and background. In some cases reaching them was difficult, but there is an enormous payoff for this work. For example, learning simple things like the fact that “thirty seven

hundredths” is 0.37 can make the difference between getting an easy question right or wrong on the SAT.

Many of these students understood the necessary mathematics quite well and just needed some help with vocabulary. (When I started, I was stunned at the *huge* vocabulary required to discuss even basic mathematics.) Other students needed help with the concepts. Again, doing simple types of assessment like in-class worksheets can give both the students and me good feedback. In order to get the students to constantly practice and exhibit the behavior they will be tested on, we often worked on practice problems pulled from old standardized exams.

This job made me appreciate the importance of developing communication skills – both the students’, and also *mine*.

**Conclusion** I enjoy teaching for two reasons. First, it’s challenging. Like chess, teaching is easy to do badly, but *really hard* to do well. Adapting to the classroom and material while encouraging a positive classroom dynamic really keeps me on my toes.

In addition to being challenging, teaching is also incredibly rewarding. It’s always great to see a student go on to be a math major or learn some beautiful part of mathematics. But it’s just as fulfilling to see a student use, for example, test preparation skills they learned in my class and apply it to their other classes.

I believe that learning how to learn is one of the main things students should take away from their higher education. Instruction, assessment, and feedback are the ways I implement a strategy to help students learn by becoming teachers themselves.