

Applying Classroom Assessment Techniques in Electromagnetics Courses

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Classroom assessment techniques (CATs) are simple yet powerful learner-centric assessment strategies providing immediate feedback to the instructor about how students are grasping materials in the lectures (T. A. Angelo and K. P. Cross, "Classroom assessment techniques: A handbook for college teachers," 2nd ed., Jossey-Bass.) While the concept has been around for over 20 years, modern teaching technologies provide unique opportunities to effectively respond to CATs and maximize the learning experience of students.

CATs can take many forms, including word journals, surveys, concept checks, and so on. The idea is that by performing frequent conceptual checks, problems in student comprehension can be identified early, and corrective strategies deployed while the confusion is still fresh. This is clearly useful in electromagnetics courses, where failure to understand a single concept can doom the student from an early stage. This paper focuses on the use of the "muddiest point" CAT. Students are asked what the most difficult concept to grasp from the lectures is. As a complementary question, students are also asked what lecture concept they found most interesting. The CAT is performed once a week, a good frequency balanced between tedious and tardy.

Technology provides unique mechanisms to deal with the results of CATs. First, responses to the CATs are compiled so that students could see a word cloud projected on the screen of the most interesting and most muddy concepts of the week. This gives students a sense of ownership of the material and importantly, makes them more comfortable when they see that other students are having difficulties with the same concepts. More importantly, measures can be taken to clear the muddiness. Lectures and tutorials can be re-vectored if necessary, and significantly, technology provides unique response mechanisms. Supplementary material in the form of pencasts, videos, and notes can be posted online in learning management systems to bring clarity to students.

The use of CATs was explored in two courses: a 3rd year electromagnetic fields course for engineering science students, and a 4th year elective on microwave systems for ECE students. CATs provided unique insights into student comprehension, and allowed a range of responses to be formulated. For example, screencasts showing interactive use of the Smith Chart were provided when students indicated that visualizing impedance on the complex plane was a muddy concept for them. Advanced derivations, for example of the dispersion relation for plane waves, were provided when students sought deeper understanding of plane waves than the lecture topic allowed. These and other examples will be discussed in more detail during the conference presentation.