

Meaningful Engagement and Assessment of Technology: Balancing Scaffolding and Discovery

Often in mathematics courses, computational skills are attached to advanced Calculus ideas, Linear Algebraic techniques, or statistical software. Sometimes the learning is complemented by the computation tool, but often times it is difficult to determine whether the students have a mathematical or computational block. When computational courses exist, there is the issue of how to best integrate the mathematics and the appropriate level needed to highlight the ability of the tools without alienating students from a diverse mathematical background. Therefore, there are two main challenges: how to organize a computational course for mathematical students to support and assess the computational skills you want them to develop and separating students' mathematical blocks from computational blocks as a part of a course.

First, when considering the computational course, I've only taught this class one. The software, Maple, was chosen for me and the projects/topics were aligned to Precalculus through Modeling. I'd hoped that assessing a student's computation skills and learning would be best done through integrated homework and project-based assignments. Unfortunately, I found that the mathematics (usually Calculus I material) stumped that students in the assignments and projects. They could use the commands in the program; however, there were not addressing the mathematical question. For example, plotting multiple functions on a graph and tangents lines at certain points required more mathematical instruction than I had expected. I addressed this challenge by re-teaching the students certain Calculus topics or having them do prep-work on the topic.

Second, when using technology as part of a course, I have found that students have limited knowledge of Excel and online mathematical software (except maybe WolframAlpha) and limited patience. There are many online math homework systems that frustrate students because they require some basic syntax (often written on the problem). When working with Maple, Excel, WebAssign, WebWork, MATLAB, Mathematica, etc., I've found students unwilling to explore and figure things out. Yet, if there is a math problem they can't solve, then Google is always the first and foremost in their minds. I'm not sure of the disconnect to "look things up." Perhaps they feel they *should* know technology because society has deemed them the tech generation. While I haven't managed to solve this problem, some ways I've combatted it is to create worksheets where students are told to look something up online while we are in class. Of course, on the issue of assessment, one is then left with the question as to whether the student should be able to look something up during an assessment activity. I haven't solved that problem yet. I would hope that writing low-threshold/high-ceiling problems would be too different to find online, but have clear access points that a student could research how to start the process.

While technology has always been a small part of my classes, there have been few courses (Applied Linear Algebra, Symbolic Computation, and Senior Seminar) where computation tools were at the forefront of our study. Challenging students while scaffolding assignments and then appropriately assessing those assignments and student learning continues to be a place of growth.