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Reflective Practices in Mathematics Courses (Part 2)

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In Part 1 of this discussion, we began examining some basic assumptions in pedagogy that seem to inhibit the learning and retention of even bright, eager students. We provided an example of a student, Amir, who demonstrated proficient knowledge while taking a Calculus III course, but later revealed that he had not retained the benefits of that knowledge once the course ended. We noted that the pedagogical assumption that teaching is primarily about information transfer affects both the problem and our attempted solutions of it. Here, we begin to explore more deeply the assumptions we often hold about teaching, and how we might overcome the problems stated above by developing creative ability alongside technical competency in our students.

Two Assumptions in Pedagogy that Shape Our Courses

In our discussion last time, we noted that teaching is often regarded as a process of information transfer. This is the result of the common pedagogical assumption that the most important component of a course is *content*. While I do not deny that the specific content of a course is fundamental to it, the (largely unquestioned) assumption that it is *the most important part* of the course seems to result in the course becoming primarily about information transfer. This can lead to a superficial and incomplete understanding of course material on the part of the students due to the attitude it fosters in them: memorize, regurgitate, and move on. Yet this assumption is so ingrained in the way that we teach that we tend to yield to it readily. I admit that there have been many times that I have been lecturing, and after having noted only five minutes left of class time, I hurriedly wrote down (without much explanation) the remaining content that I needed to get through that day to fit everything in. The pressure to cover everything on the syllabus is so great that I feel I must get everything written on the board, lest I fail in my duty as the professor of the course. Yet this strict mindset of covering the content in entirety seems to benefit students only minimally, if at all.

A second observation I have made is that there seems to be a discrepancy between the processes of research and teaching in the viewpoints of many members of academia. All of us as professors have achieved our status by engaging in some sort of research, and all of us can attest to the fact that such a process is at times vague, confusing, frustrating, compelling, and ultimately rewarding. Doing research involves a creative process of trial-and-error, whereby we test different ideas through a variety of techniques, slowly and carefully refining and redefining our processes to ultimately arrive at a conclusion. Interestingly, however, once the research is completed and the results become knowledge (however many years later), they are delivered to the students as facts to be learned, removed from the processes of inquiry with which they were once indistinguishable. As researchers, we learn our results through experimentation and discovery, creating motivation and insight for us, yet we often expect students to develop this motivation and insight without the requisite experimentation and discovery.

Reflective Practice

What we seem to miss when we regard our classes as forums for information transfer is that education is more fundamentally about developing an *attitude of questioning and learning*, not so

much about storing facts. In the book *The Reflective Practitioner* by Daniel Schön¹, the author attempts to articulate and measure what he calls the process of being a “reflective practitioner,” an individual capable of successfully solving problems in their professional field by the use of observation and insight. Schön noticed that what distinguishes successful individuals is *not* the amount of information that they can recite, but rather the ability to effectively *question and engage* with a given situation that they are facing – essentially their ability to employ creative processes. Of course reflective practitioners do not shy away from information, but rather use it as part of a process to understand new situations that they have encountered, very much akin to academic research.

In line with this idea of education, then, it seems that our classes should teach skills of reflective practice alongside the teaching of course content. In other words, in addition to learning the specific material of a course, students should also be required to use such information to experiment effectively and to problem-solve situations on their own. The key is to ask the appropriate question while designing the lesson: rather than “Am I forming a complete list of all the content in my lecture?” one could ask “In what way will the students be more effective in their articulations of and actions in the world?” Once the question is set, the actual classroom practices can take a variety of forms, from interactive discussions to journal-writing practices. In my Calculus I courses I am currently formulating a way to have intricate, week-long homework problems be part of the course, taking the place of some of the emphasis on timed, in-class exams. My intention here is that the students develop their creative capabilities by wrestling with more of the fundamental issues of problem-solving, beyond just applying formulas given in class to some template-based problem.

Let me emphasize that pursuing this question *itself* is an opportunity to engage in reflective practices for ourselves. The ideas presented here are not meant to be didactic points but instead directions for dialogue. There is no one way to teach, nor can one be outlined in a simple essay. Nonetheless, engaging in the questioning of our attitudes can be beneficial for the students as well as ourselves. This semester, my teaching assistant and I are meeting weekly to design homework assignments for our Calculus I students that go beyond just drill problems to include “beautiful” or “elegant” problems, as well as broader problems outside of just the technique-of-the-week. These meetings with him make a difference for the students, and keep me engaged in the reflective process myself. The result is that teaching my classes has become more interesting, as it brings about opportunities to explore creative processes for both the students *and* myself. If nothing else, let us keep these questions as part of our conversations rather than letting them slip into unquestioned assumptions. Perhaps that will make a difference for students like Amir.

***Share with us your experiences by contributing to the New Chalk Talk series,
or by simply sending comments/suggestions to:
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¹ Daniel Schön, *The Reflective Practitioner*, Basic Books, 1983.