Thinking about problem choice for your projects

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Hi All,

As I went through people suggested projects I realized that there's something we haven't talked about explicitly. What follows is for people who plan to videotape people working on problems.

Some problems open up territory for students to think and demonstrate what they understand; some are "maybe you see it, maybe you don't" problems, and if you don't have the right insight, you're stuck. (I love Martin Gardner, but many of his "AHA!" problems are of that type. When someone shows you the answer you're wowed, but until that happens, you sit there going "gee, I'm clueless!" So, one thing you want to think about is problem selection. If you're having people solve problems and you plan to videotape them, is people's work on the problems likely to be interesting? (Think about the problems I use for the course. When I hand them out, there's usually some petty good conversation. That's intentional!)
Some years ago I wrote about my "problem aesthetic," which gives my criteria for selecting good problems for the course. The situation's a little different when you think about problems for your projects, but the criteria may still be useful to think about. Here's what I wrote:

> The problems I use in my courses, and am always on the lookout for, tend to have the following four properties.
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> A. In general, good problems are (relatively) accessible. I like problems that are easily understood and that do not require a lot of vocabulary or machinery in order to make progress on them. Note that these criteria do not constrain me to the domain of the trivial: undergraduates can start work on the four color problem and Fermat's last theorem without knowing too much background mathematics!
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> B. I tend to prefer problems that can be solved, or at least approached, in a number of ways. There are many reasons for this preference. For starters, it's good for students to see multiple solutions: Students tend to think that there is only one way to solve any given problem (usually the method the teacher has just demonstrated in class). Also, I need for them to understand that the "bottom line" is not just getting an answer, but seeing connections. (For example, any of us would be glad to find a truly new proof of the Pythagorean theorem, even though there are hundreds of known proofs. Finding a new proof means seeing new connections.) And on the "process" level, the possibility of multiple approaches lays open issues of "executive" decisions -- what directions or approaches should we pursue when solving problems, and why?
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> C. The problems and their solutions should serve as introductions to important mathematical ideas. This can take place in (at least) two ways. Obviously, the topics and mathematical techniques involved in the problem solutions can be of agreed importance. Equally important, the solutions to the problems can illustrate important problem solving strategies, and serve as a "training ground" for the students' development of heuristic skills.
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> D. Finally, problems used in my course should, if possible, serve as "seeds" for honest-to-goodness mathematical explorations. Open-ended problems such as Problem 4 (discussed above) provide one way to engage students in doing mathematics. Another is to choose problems that are extensible and generalizable. Good problems leads to more problems -- and if the domain is rich enough, students can start with the "seed" problem and proceed to make the domain their own. (One example of a simple start-up problem asks students to fill in a 3x3 magic square. That problem is trivial, but extensions and generalizations have occupied many mathematicians for years!)"

Given the time frame and the fact that you're doing projects, not all these criteria will be relevant. But, they might help you think about whether a problem would turn out to generate interesting behavior for you to analyze. And, when you consider problems, don't forget - pilot them ASAP.

Cheers,
Alan

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Schoenfeld's new book, *How We Think: A Theory of Goal-Oriented Decision Making and its Educational Applications* (Routledge, 2010), is now available.
