Goals of PER

Teaching and Learning Physics, Fall 2015

Postmodern Philosophy

- There is no absolute truth, we can not act independently of culture, values, power structures, etc.
- Every thing you do (or don't do) is embedded in and sends messages about culture and power.
- Even science.
  - Why did the apple fall from a tree on a white European guy of upper socioeconomic class in the 1600's?
- It is not possible to teach "objectively", to remain neutral around values, beliefs, culture or power.

Education is political

whether we like it or not

Assumptions / Principles related to Power & Status:

- Who do we educate?
- What do we teach?
- Why? How?
- Who funds our work? What are the reward structures?

If we do not answer these (and other) questions,

others will

others have

Mahajan and Fish

- "Did any one else find this piece [Mahajan] profoundly disturbing? Should I not be in grad school for PER, preparing for a career of "serving the state," and producing other such servants? This article is the polar opposite of the Fish piece. Is there middle ground?"
- "Prior to reading this article I wouldn't have really thought about the points he's bringing up, but now I really, really want to have a discussion about what he's brought up. Even if 95% of what he says in this article was completely pulled out of his ass, I still want to talk about that 5% of truth."

Sanjoy Mahajan

I am Associate Professor of Applied Science and Engineering at Olin College of Engineering and Visiting Associate Professor of Electrical Engineering and Computer Science at MIT. I am interested in improving how we teach science, mathematics, and engineering.

I was once Associate Director at MIT's Teaching and Learning Laboratory.

I was also assistant professor in the physics department at the University of Cambridge, in David MacKay's Inference group; a fellow of Corpus Christi College, Cambridge; and the first curriculum director of the African Institute for Mathematical Sciences in Cape Town, South Africa.

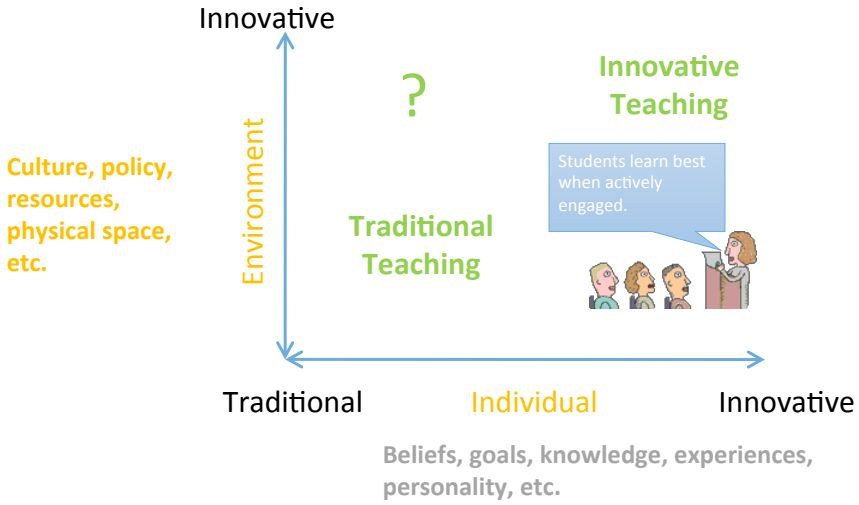
Here is a somewhat recent CV

- Fish – Academics is free of politics, don't bring it in.
- Mahajan - Teach social context in addition to physics content.
  - "After the thing went off, there was tremendous excitement at Los Alamos. Everybody had parties, we all ran around. I sat on the end of a jeep and beat drums and so on. But one man, I remember, Bob Wilson, was just sitting there moping. I said, "What are you moping about?" He said, "It's a terrible thing that we made." I said, "But you started it. You got us into it." You see, what happened to me-what happened to the rest of us--is we started for a good reason, then you're working very hard to accomplish something and it's a pleasure, it's excitement. And you stop thinking, you know; you just stop. Bob Wilson was the only one who was still thinking about it, at that moment." – Feynman
- Mahajan - Teach to empower.
  - "One could argue that PER teaches students to be better independent thinkers and to NOT blindly follow others. Also, "power" doesn't just have to mean the ruler of a nation. Professors also have power, but PER-based curricula moves the physics classroom away from the model of the teacher as the source of all knowledge and gives more power to the students." – fellow student

Conflicting Goals of Education

- Democratic Efficiency (produce citizens who can participate in a democracy)
- Social Efficiency / Economic (prepare and sort students for the workforce)
- Social Mobility (Provide opportunity for individuals to obtain desirable social positions).
- Socialization (Pass along cultural knowledge, values, norms and expectations)
- Individual Empowerment (enrich the lives of individuals)

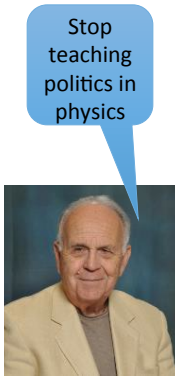
Why are things the way they are?



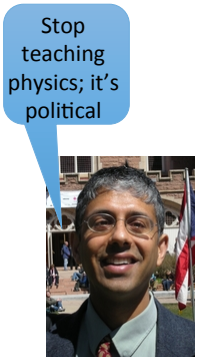
Traditional problem solving	Alternative problem solving (Refs. 37,38)
Formulaic problem solving (problems with known solutions that the problem solver has seen before or are similar)	Creative problemsolving (problems with known solutions novel to problem solver, problems with unknown or open-ended solutions)
Solution requires only small pieces of knowledge and is often based on idealizations	Solution requires combining knowledge from several areas
Problems have little application to the life of the solver	Problems are related to the life of the solver
Well-defined problems that only provide information necessary for the solution	Ill-defined problems or problems with excess information
Solutions expected to include a correct numerical answer	Solutions expected to include explanation, prediction and/or application

If ____ were the only goal, what problem solving would be taught? Why?

Democratic Efficiency (produce citizens who can participate in a democracy)
Social Efficiency / Economic (prepare and sort students for the workforce)
Social Mobility (social movement of individuals)
Socialization (Pass along cultural knowledge, values, norms and expectations)
Individual Empowerment (enrich the lives of individuals)



Engage in the Debate



Given that Fish and Mahajan are thoughtful academics and have points worth considering (aside from my absurdist reduction of their views), what would they say about?

- Classroom practices and goals?
- Roles of the faculty (and students) ?

What would they say to each other?