

Beyond the Individual Instructor: Systemic Constraints in the Implementation of Research- Informed Practices

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Abstract. Anecdotal evidence suggests that findings of educational research and resulting curricula are, at best, only marginally incorporated into introductory physics courses. Based on interviews with four non-PER physics faculty we investigated why incorporation of research-based curricula is uncommon. We report that these instructors have PER-compatible beliefs about teaching and learning, but largely traditional instructional practices. In this poster we explore the significant role that systemic influences play in this apparent discrepancy and present a theoretical model to describe the interplay between individual beliefs and systemic influences.

Framing the Problem

- PER has been very successful at
 - Developing learning models
 - Devising and documenting successful teaching methods
 - Developing curricula
- But these products are only marginally incorporated in physics classrooms.*
- Research Questions
 - What impedes the adoption of PER findings and products?
 - How can we improve our dissemination efforts?

*We intend to more fully document actual levels of adoption in a future study.

Research Study

- Interviewed four senior, respected faculty whose practice is generally traditional.
- Identified
 - Beliefs about teaching and learning
 - Self-identified practice
 - Attitudes toward PER
- Constructed free-body diagrams of forces on each instructor supporting or resisting changes in practice.

Findings

Unsupported hypothesis about failure to adopt PER-consistent methods.

They are unfamiliar with PER.

False – all were familiar with research-based methods

Instructors goals/beliefs are incompatible with PER

False – all had generally PER compatible goals and beliefs

Instructors are happy with their teaching

False – all felt they were not meeting their goals, three felt they were falling far short

Part of the problem: bad PR for PER

Distrust of PER results

“I went to [a particular university] and learned what [the PER] group does. None of that really seemed applicable frankly. . . You know when I’d asked the graduate students who’d been teaching them, they didn’t think they were all that great for that audience.” –Harry

Feeling insulted by PER

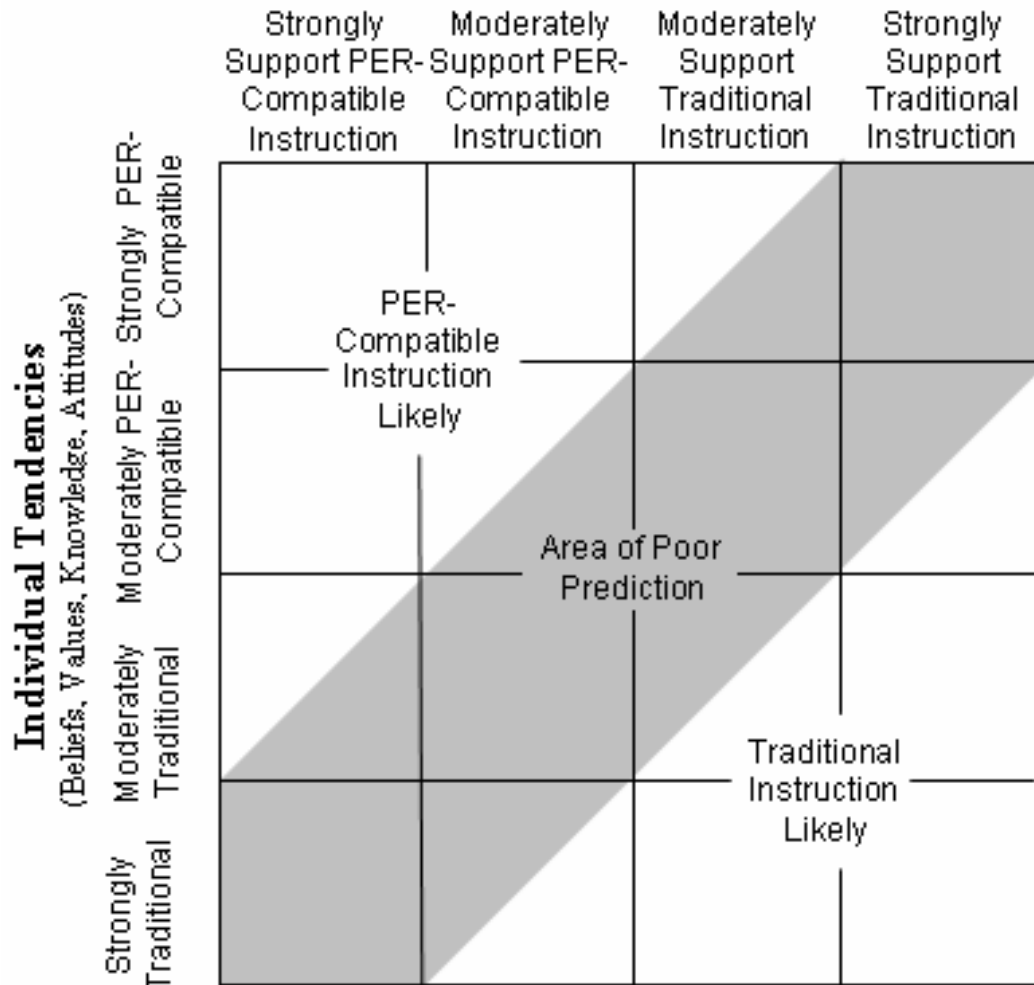
“The first word out of their [a typical PER presenter] mouth is you’re not doing things right.” “If you tell me that you think my teaching is bad that automatically sets up a barrier. If I tell you that the only really good way to teach introductory physics is X, I’ve again set up some kind of barrier. . . I think there’s just too much of that going on right now.” - Terry

Non-constructivist dissemination efforts by PER

“All of those people [PER researchers] seem to think that their way is the only way. . . That the only way that a student’s going to learn is if I stop doing this and start doing that. And I argue that in fact that’s unfair to both teachers and students. I think that . . . teachers teach well in many different ways . . . And I think that the one size fits all is not very good for the whole physics community.” - Terry

Why do thoughtful, dedicated instructors with PER-compatible beliefs/goals, who are dissatisfied with their teaching and aware of research-based alternatives still teach traditionally?

Situational Variables



Model for predicting behavior based on beliefs and context. (Adapted from Warner et. al. p. 168.)

PER-compatible beliefs are not enough, the situation must also be supportive of PER practice.

Self-Identified Systemic Forces Affecting Practice

Student Resistance: Students often resist research-based methods. They do not like to interact with each other and are not prepared to think independently.

- *“What I want to do is to turn the class into a real working session. Where it’s just not possible for them to come there and sleep. That may turn off students and decrease enrollment, they may switch courses. I’m a little worried about attrition. That’s another aspect”* .- Harry

Time Structure: Semester system, demands on students’ time.

- *“I think time students can spend on a particular course is one thing [that prevents me from reaching my goals]. Time for every student in the course to reach the same level because they all start at different levels”*– Terry

Departmental Norms: Easiest to do what others are doing, follow role models.

- *“I am more comfortable with being more interactive and, of course, since we’ve started [a grant supported departmental reform]. I’m much more comfortable having them do group work in class, and feeling that that’s a valid way of spending time in class. And I’m more comfortable asking conceptual type questions instead of just problem solving type questions because you know there’s that extra validation of having a group of people doing this and that it is a grant and it’s a research project.”*- Mary

Expectations of Content Coverage: Pressure to cover content does not allow for depth.

- *“The fact that we cut out a lot of the material that we need to cover. Because before, I’d think gee if I don’t cover fluids and the next instructor is expecting it I’m really crippling these students, handicapping them. But as a whole department we said OK, it’s alright for us to cut this material out and spend the time on what you feel is necessary to go more in depth on.... And so the pace was so much quicker that to take a whole class period and potentially have them be a little floundering with group work was just so big of a risk.”*– Mary

Lack of Instructor Time: Large teaching loads and/or research responsibilities impede learning about and integrating new techniques.

- *“It kinda depends on how lazy I am, I will try to write those [test questions that students have not seen before] as much as possible. If I’m in a hurry then I will tend to pick more from the old questions.”* - Gary

If the model is correct, then instructors with PER-compatible beliefs should change practice if systemic forces change.

Mary

- Consistent PER compatible beliefs
- Past practice was generally traditional
- Systemic Changes
 - Department got a grant to do innovative teaching
 - Department decided to reduce content coverage expectations
 - Many faculty began to experiment with new methods
- Mary's practice is now much more PER-consistent.
 - *“I would say that it's not just one thing. There've got to be at least three things. It was the release of time so that I had more flexibility in how to cover a lesser amount of material more in depth. Two that there is a group here doing it. And three that I was exposed to more research on how [cooperative learning] works.” - Mary*

Implications

- Dissemination efforts in PER have concentrated on changing practice of the individual instructor.
 - holding workshops
 - distributing curricular material
 - publishing papers and books
 - giving talks
- This is not enough!
 - Need to understand, classify, and change the systemic forces that inhibit changes in instructor practices.
 - Increasing instructor beliefs from moderately to strongly PER is likely to be difficult and no guarantee of PER compatible practice.
 - Our model predicts that the forces need to be at least neutral.
- System strongly supports traditional practices.
 - Systemic constraints are likely only noticed by instructors when they attempt to move out of the traditional mode of instruction.
 - Most restrictive constraints are probably very difficult to identify (for example, restraints due to the practice of assigning grades)

How can we change systemic forces?

- First step is to understand how/why the system developed.
 - Who influences policy? For what purpose?

A Historical Analysis

- Beginning of state-supported compulsory schools in the USA (1830's)
 - To properly socialize the immigrant population
 - To prepare factory workers
 - Pedagogical methods were authoritarian and teacher-centered
- Early 1900's, Two movements similar to today's PER and Standards movements

	Progressive Movement (John Dewey)	Social Efficiency Movement
Motivation	Humane, Child-Centered Education	Selecting children for adult roles (testing and tracking), Reducing costs of education
Lead by	Education philosophers, researchers	Business Leaders
Directed at	Changing practice of individual teachers	Changing policy
Effect on actual practice	Weak	Strong

Final Thoughts

- Structure of educational systems is often not strongly based on educational research, but rather on “such factors as real or alleged economic considerations, national ideals, social change, the way in which schools are structured, gender, racial, and class distinctions, as well as symbol and ritual” ¹
- PER has largely focused research and dissemination at the local and individual level.
- Reform theory, historical evidence and our data indicate we need to broaden our efforts.

1 - H. M. Kliebard, *Constructing A History of The American Curriculum*, in P. W. Jackson (Ed.), *Handbook of Research on Curriculum*. New York: Macmillan, pp.157-184, 1992.