Synchronization Difficulties Between Traditional Faculty and Education Researchers

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Abstract

To identify barriers to the dissemination of innovative instructional strategies we conducted interviews with 5 physics instructors who were likely users of educational research. One significant barrier appears to be that faculty and educational researchers have different expectations about how they should work together to improve student learning. This discrepancy was expressed directly (and often emotionally) by all of the instructors we interviewed. Although different instructors described different aspects of this discrepancy, we believe that they are all related to a single underlying issue: educational researchers expect to disseminate curricular innovations and have faculty adopt them with minimal changes while faculty expect researchers to work with them to adapt knowledge and materials for their unique instructional situations. We will explore this claim and the evidence found in the interview transcripts. We will also discuss implications for the educational research community.

Physics Education Research

- Physics Education Researchers have developed:
  - Pedagogical knowledge base
  - Research-based curricular packages
  - Significant dissemination efforts
- Yet, most physics faculty teach traditionally

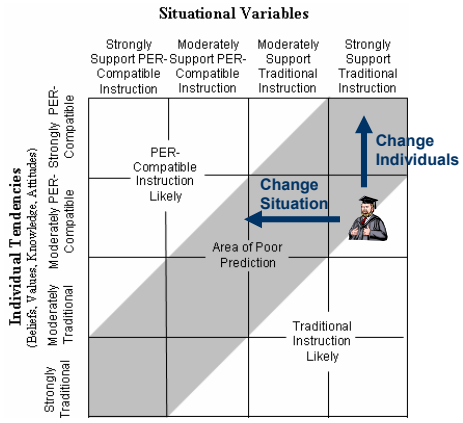
Current Study

- Open-Ended Interviews
  - Five instructors, four institutions
  - Tenured
  - No formal connections with PER
  - Thoughtful, reflective, well-respected

➔**This type of instructor is highly likely to be interested in educational research**

Previously Reported Findings

- Faculty beliefs are more consistent with PER than their self-reported practices
- Instructors face many situational constraints to PER-compatible teaching



Henderson & Dancy, 2005;
Dancy & Henderson, 2005

Divergent Expectations

Cause problems in many relationships

- Husband-Wife*

  Men: discuss problems to solicit advice

  Women: discuss problems to build relationships

- Teacher-Student

  Teacher: students are active during class

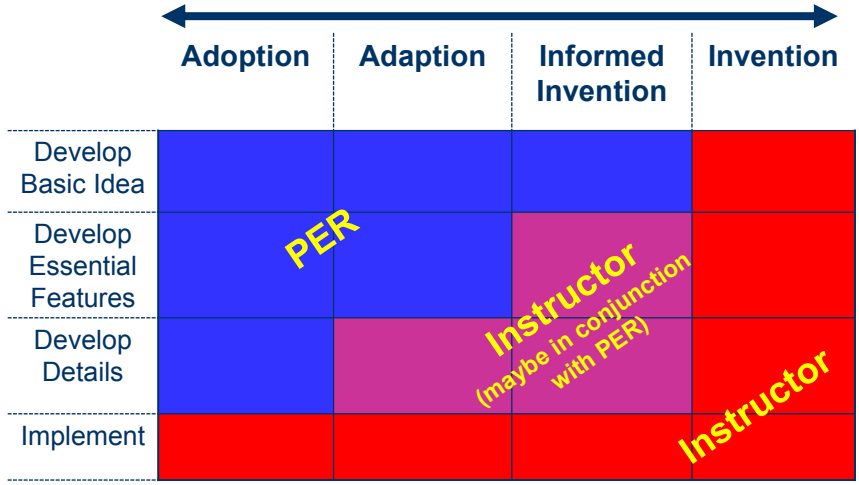
  Student: students are passive during class

*Tannen (1991) You Just Don't Understand

Adoption-Invention Continuum:
Possible Relationships Between PER and Faculty

Adoption	Adaption	Informed Invention	Invention
The change agent develops all of the materials and procedures and gives them to the instructor to implement as is.	The change agent develops the materials and procedures and gives them to the instructor who changes them slightly before implementing.	Instructor uses the ideas of the change agent but significantly alters them or develops fundamentally new procedures based on the change agent ideas.	The instructor develops materials and procedures that are fundamentally based on his/her own ideas.

Adoption-Invention Continuum:
Possible Relationships Between PER and Faculty



Example – Peer Instruction

Adoption: Use "as is" (maybe change some details)

- Take Mazur's book, follow recommendations and use available materials.

Adaption: Change some details to suit individual situation

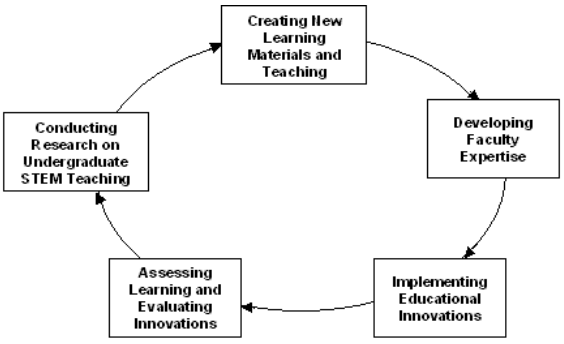
- Instead of multiple choice CTs, use free response questions.

Informed Invention: Take basic idea, but drastically change or eliminate at least one essential feature

- Have one CT at end of class
- Eliminate student-student discussion

Invention: Do something completely different

PER Expects Adoption/Adaption



Cyclic model for knowledge production and improvement of practice in undergraduate STEM education

From 2005 NSF-CCLI Solicitation

PER and Faculty Agree on Problems

Instructional Problem	Instructors T	H	M	G	B
Students don't get much from traditional lecture.	■	■	■	■	■
Different kinds of students learn differently.	■			■	■
Students have misconceptions that are not simple to change.	■	■		■	
Many students have poor problem solving skills		■	■	■	
Assessment difficulties – getting the right answer does not mean that a student understands			■		■
It is helpful to tailor explanations to individual students, but this is difficult/impossible in a large class		■			
Students have great difficulty learning the basic concepts of physics		■			

Describes Details | Describes Existence

Faculty Aware of PER Solutions

Potential Solution	Instructors T	H	M	G	B
Peer Instruction	■	■	■	■	■
Physlets	■		■		■
CUPS/CUPLE	▪				
Washington Tutorials	■	■			
Workshop Physics	■	■			▪
Real-Time Physics and Interactive Lecture Demonstrations	■				
"Army" method. Pose question, pause, call on student.				■	
Have students write down answer after posing a question.				▪	
Discussion-based teaching techniques				▪	
FCI/CSEM as an assessment instrument	■	■	■		
Modeling/discussing expert thinking related to problem solving			■		
Individual interviews with each student – motivational			▪		
White boards to encourage students to interact during class.			■		
Problem solving framework.		▪	▪		
Small group work		■	■		■
Physics by Inquiry		■			
Scale-UP					■
Matter and Interactions					▪
Personal response systems			▪		▪

Adoption | aDaption | iNformed invention | Invention

Faculty Engage in Informed Invention

Instructional Strategy	Instructors T	H	M	G	B
Peer Instruction	N	N	N	N	N
Physlets	D				D
"Army" method. Pose question, pause, call on student				N	
Discussion-based teaching techniques				N	
"Exercises" to guide students through solving a problem				I	
Different instruction for different student abilities				I	
FCI/CSEM as an assessment instrument	A	A	A		
Modeling/discussing expert thinking about problem solving			N		
Small group work		N	N		D
Solicits questions from students		I			
Lecture-based questions					I

Why Informed Invention?

Faculty do not believe an externally developed curricula can match their unique style, preferences, skills, and teaching situation

- "M*any* [PER Curricula] *don't transport very well out of the environment in which they were developed because they were developed for certain set of teachers in a certain educational environment with a certain set of students*." (Terry)
- "*I mean a lot of things I won't even bother trying because I know I'm not the right person to do it*." (Harry)

Divergent Expectations → Problems

- From Faculty Perspective
  - Each PER practitioner is selling a particular curricula and not interested in them or their students
  - PER does not recognize/value faculty skill and experience
- From PER Perspective
  - Faculty are not interested in our work and, thus, must not care about teaching
  - Faculty inappropriately modify our curricula

What do Faculty Want?

- **PER and faculty work together**
  - *"I've spent my life doing this* [teaching] *and part of my teaching is in fact to be aware of all of the things that are going on, but I want it to be useful and meaningful to that discourse.*" (Terry)
- **PER to develop more theory than packaged curricula**
  - *"I have a good feel for the conditions under which [optical phenomena] occurs . . .I don't have an intellectual framework around which to organize innovations in teaching. . . . If I had a framework like that then I could answer my own questions [about teaching].*" (Harry)
- **PER to communicate openly/honestly**
  - "*It's really frustrating if somebody just falls behind a smokescreen and will start using jargon and will start talking about papers that you don't know what's in the paper.*" (Mary)

K-12 Change Agents Know This

- **What faculty describe is considered best practices in K-12 professional development**
  - "Teachers should have opportunities for structured reflection on their teaching practice with colleagues, for collaborative curriculum planning, and for active participation in professional teaching and scientific networks. The challenge of professional development for teachers of science is to create optimal collaborative learning situations in which the best sources of expertise are linked with the experiences and current needs of the teachers." (NRC, 1996, p. 58)
  - "Coaching is a set of continuing relationships and structures for self-help that serves individual, school, and systemic initiatives for educational improvement" (Joyce and Showers, 1988, p. 84)
  - "The content of professional learning must come from both inside and outside the learner and from both research and practice." (Loucks-Horsley et. al., 1998)

Successful Models in Higher Education

All are long-term and focused on instructors' actual practice.

time required

- Course led by change agent, 4 weeks, intensive (Ho et. al., 2001)
- Personalized mentoring by change agent, 1 Semester, intensive (Hativa, 2000)
- Faculty Learning Communities, 1 Year, topic-based, intensive (Cox, 2004)
- Informal change agent-faculty Interaction, at least two years of ongoing interaction (Briscoe et. al., 2004; Van Sickle and Kubinec, 2002)

1 Month

2+ Years

Implications

- Faculty need to be part of the instructional change process if it is to be successful. They currently feel excluded.
- PER should explore ways to move away from transmissionist professional development (adoption/adaption model) and towards constructivist professional development (working with faculty in informed invention).

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