

BEYOND DISSEMINATION: SUSTAINED REFORM IN STEM

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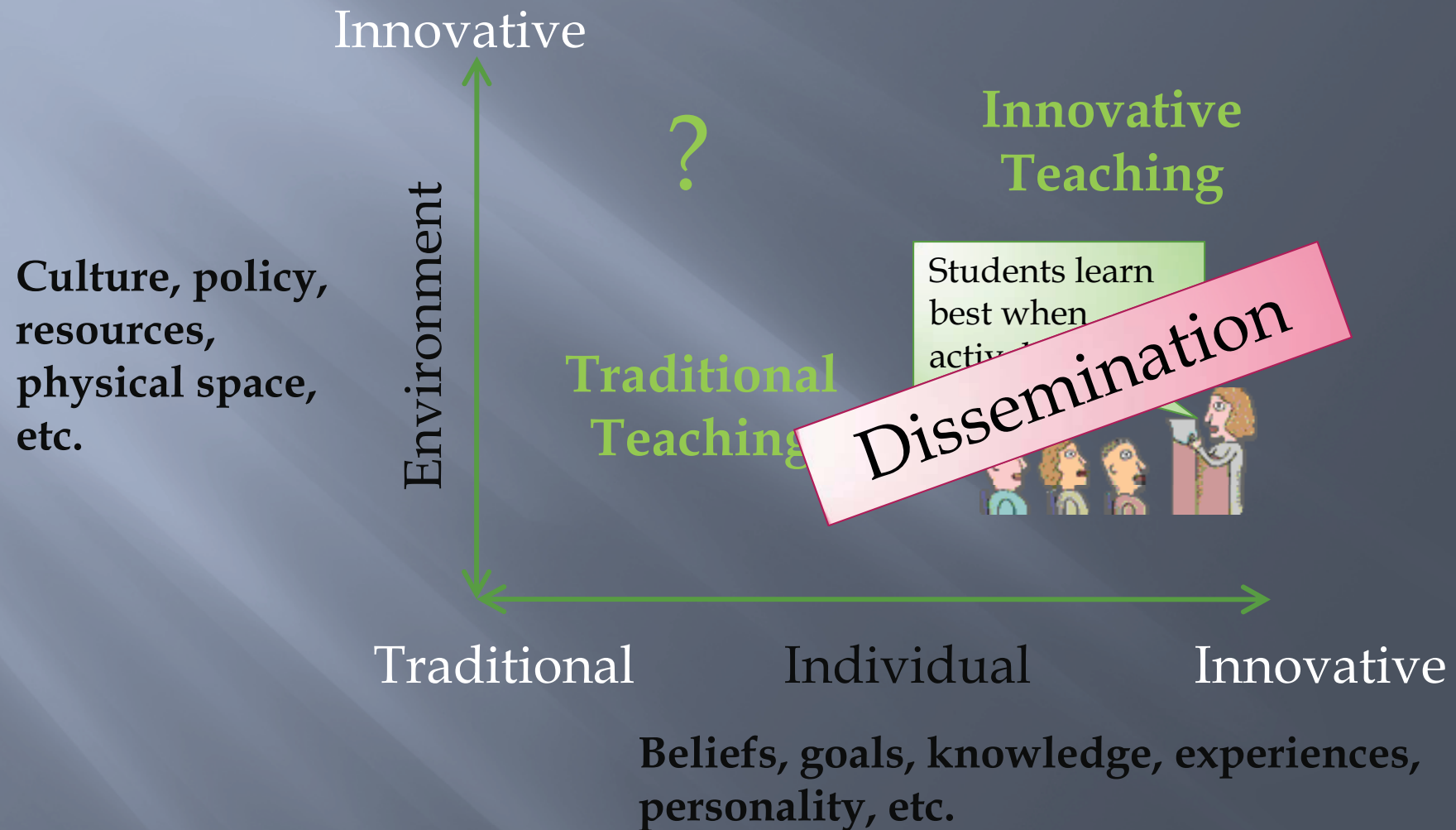
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Findings from Physics*

- ▣ Faculty recognize the traditional approach is ineffective and want to improve the quality of their teaching.
- ▣ Faculty are often aware of research based alternatives and willing to try them.
 - 87% report knowledge of at least one research-based strategy.
 - 48% report trying a research-based strategy.
 - 70% report being interested in using more research based strategies.
- ▣ **Mainstream teaching is generally still instructor focused.**

**Dancy, M. & Henderson, C. (submitted, 2009), Henderson, C. & Dancy, M. (2009), Henderson, C. and Dancy, M. (2008), Henderson, C. and Dancy, M. (2007)*

Reform is complicated!



Dissemination alone unlikely to produce sustained reform!

Dissemination Based Change Model

- ▣ Elicit discomfort with traditional methods.
- ▣ Introduce new methods.
- ▣ Provide curricular materials.
- ▣ Expect change.
- ▣ Wonder why change didn't happen.
- ▣ Assume change takes time.
- ▣ Repeat.

We Need Research-Based Change Models

- ▣ Review of literature on change strategies in STEM. (*Henderson, Finkelstein, & Beach accepted 2009*)
 - Little building on related work.
 - Rarely presented strong evidence of the success (or failure) of the change strategy used.

Successful Change Model

- ▣ Builds communities for curriculum development, dissemination and support.
 - “Modeling” Project, ASU (Dancy, Brewe, & Henderson, 2007)
 - ▣ *“A major part of [the success] is this social aspect, and one of them is raising the level of importance of the teacher. Making it so that it is their theory, getting them involved in developing the materials, and all of that stuff.”*
 - ▣ *“I became absolutely convinced right then, in the first workshop, that the workshop should not be taught by faculty and it must be taught by teachers and this is one of the crucial things that has made modeling work. ”*

Successful Change Model

- Provide modifiable materials*.
 - Faculty want and need the ability to modify curriculum to fit their unique situation.
 - Only 17% of self reported users of Peer Instruction report using it as designed.

**Henderson, C. & Dancy, M. (2009) and Henderson, C. and Dancy, M. (2008)*

Community Building

- ▣ Faculty who learned about and tried an innovation often motivated by a social connection (colleague). (Interview data, emerging)
- ▣ Communities of Support
 - Can help faculty recognize and overcome environmental barriers.
 - Decrease likelihood of blaming the method when things don't go well
 - Help faculty find solutions to difficult problems instead of giving up.
 - Empower faculty!

Successful Change Model: Policy Directed

- ▣ Dissemination is focused on changing individuals.
- ▣ Better model includes departments, schools, fields.
 - Teaching not evaluated based on measures of student learning.
 - ▣ Faculty lack feedback about their own teaching.
 - ▣ High stakes decisions (tenure, promotion, teaching awards, allocation of resources, etc.) are made based on measures not related to effectiveness.

Successful Change Model: Policy Directed

- ▣ Visible public endorsement from influential organizations (professional societies, funding agencies, etc.)
- ▣ Encourage diversity among faculty.
 - Women are significantly more likely than comparable men to learn about and implement research based strategies.*

**Henderson, C. & Dancy, M. (in preparation).*

New Faculty Workshop - Physics

- ❑ NFW participants are much more likely than comparable non-participants to use research-based strategies.*
- ❑ Administrative Support
 - Departments pay for faculty to attend.
- ❑ Personal Connections
 - Workshop is face to face.
 - Developers present and talk with participants.
- ❑ Community Building
 - Many departments have several NFW alumni
- ❑ Respects Faculty
 - Provide an array of curricular approaches, assumes each faculty can decide what will work best for their situation.
- ❑ Dissemination based, but with components that make success more likely.

**Henderson, C. & Dancy, M. (in preparation).*

Ideas for CCLI

- ▣ Support and encourage research on change models.
- ▣ Require “Change Plan” for proposals.
 - Detailed and include a logic model.
 - Focus attention on the issue.
- ▣ Integrated Approach?
 - 1) Conducting research on undergraduate STEM teaching and learning, 2) Creating learning materials and teaching strategies, 3) Developing Faculty Expertise, 4) Implementing educational innovations, and 5) Assessing Learning and Evaluating Innovations.
- ▣ Focus on change process, not just what works.
 - Implementations often fail, these go unreported, undocumented. What could we learn?

More information and links to most papers available at <http://sites.google.com/site/rbisproject>

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- Dancy, M. & Henderson, C. (submitted) [Pedagogical Practices and Instructional Change of Physics Faculty](#), submitted October 2009 to *American Journal of Physics, Physics (Physics Education Research Section)*.
- Dancy, M., & Henderson, C. (2007) [Framework For Articulating Instructional Practices and Conceptions](#), *Physical Review Special Topics: Physics Education Research*, 3 (1), 010103.
- Dancy, M. & Henderson, C. (2008, October) [Barriers and Promises in STEM Reform](#), Commissioned Paper for National Academies of Science Workshop on Linking Evidence and Promising Practices in STEM Undergraduate Education, Washington, DC, Oct 13-14, 2008.
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- Henderson, C. & Dancy, M. (2009) [The Impact of Physics Education Research on the Teaching of Introductory Quantitative Physics in the United States](#), *Physical Review Special Topics: Physics Education Research*, 5 (2), 020107.
- Henderson, C., Finkelstein, N. & Beach A. (accepted). [Beyond Dissemination in College science teaching: An Introduction to Four Core Change Strategies](#). Submitted May 2009 to *Journal of College Science Teaching*.