

Promoting Instructional Change: Beyond an Emphasis Curriculum

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Three Groups Focused on Change in Undergraduate STEM Instruction

Disciplinary Science Education Researchers (SER)

Housed in the science disciplines in College of Arts and Sciences

Faculty Development Researchers (FDR)

Housed in Center for Teaching and Learning (if at all)

Higher Education Researchers (HER)

Housed in College of Education

How do these three groups compare in terms of?

- Goals for changes
- Focus of research
- Actions designed to bring about change

Three Recent Literature Reviews

Disciplinary Science Education Researchers (SER)

Seymour, E. (2001) Tracking the process of change in us undergraduate education in science, mathematics, engineering, and technology. *Science Education* 86, 79-105.

Faculty Development Researchers (FDR)

Emerson, J. D. and Mosteller, F. (2000) Development programs for college faculty: Preparing for the twenty-first century. In *Educational media and technology yearbook 2000* (Vol. 25) (Branch, R.M. and Fitzgerald, M.A., eds.), pp. 26-42.

Higher Education Researchers (HER)

Kezar, A. J. (2001) Understanding and facilitating organizational change in the 21st century: Recent research and conceptualizations. *ASHE-ERIC Higher Education Report* 28 (4), 1-162. (Available online: <http://dx.doi.org/10.1002/aehe.2804>)

First Observation

No overlap in references! → No communication between groups

Field	Article	Number of References
[SER]	Seymour (2001)	77
[FDR]	Emerson & Mosteller (2000)	34
[HER]	Kezar (2001)	280

Three Groups - One Common Goal

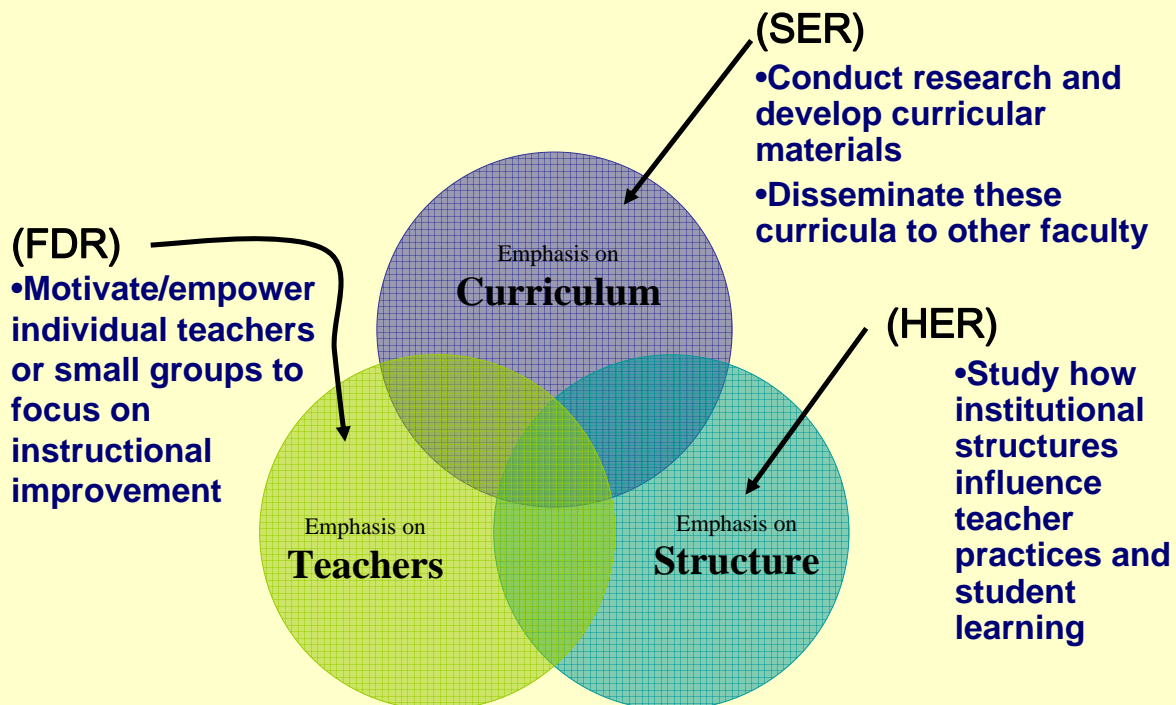
Transform undergraduate education from the instruction paradigm to the learning paradigm.

CHART 1
COMPARING EDUCATIONAL PARADIGMS

The Instruction Paradigm	The Learning Paradigm
Mission and Purposes	
<ul style="list-style-type: none"> ➤ Provide/deliver instruction ➤ Transfer knowledge from faculty to students 	<ul style="list-style-type: none"> ➤ Produce learning ➤ Elicit student discovery and construction of knowledge
<ul style="list-style-type: none"> ➤ Offer courses and programs ➤ Improve the quality of instruction ➤ Achieve access for diverse students 	<ul style="list-style-type: none"> ➤ Create powerful learning environments ➤ Improve the quality of learning ➤ Achieve success for diverse students
Teaching/Learning Structures	
<ul style="list-style-type: none"> ➤ Atomistic; parts prior to whole ➤ Time held constant, learning varies ➤ 50-minute lecture, 3-unit course ➤ Classes start/end at same time ➤ One teacher, one classroom ➤ Independent disciplines, departments 	<ul style="list-style-type: none"> ➤ Holistic; whole prior to parts ➤ Learning held constant, time varies ➤ Learning environments ➤ Environment ready when student is ➤ Whatever learning experience works ➤ Cross discipline/department collaboration
<ul style="list-style-type: none"> ➤ Covering material ➤ End-of-course assessment ➤ Grading within classes by instructors ➤ Private assessment ➤ Degree equals accumulated credit hours 	<ul style="list-style-type: none"> ➤ Specified learning results ➤ Pre/during/post assessments ➤ External evaluations of learning ➤ Public assessment ➤ Degree equals demonstrated knowledge and skills

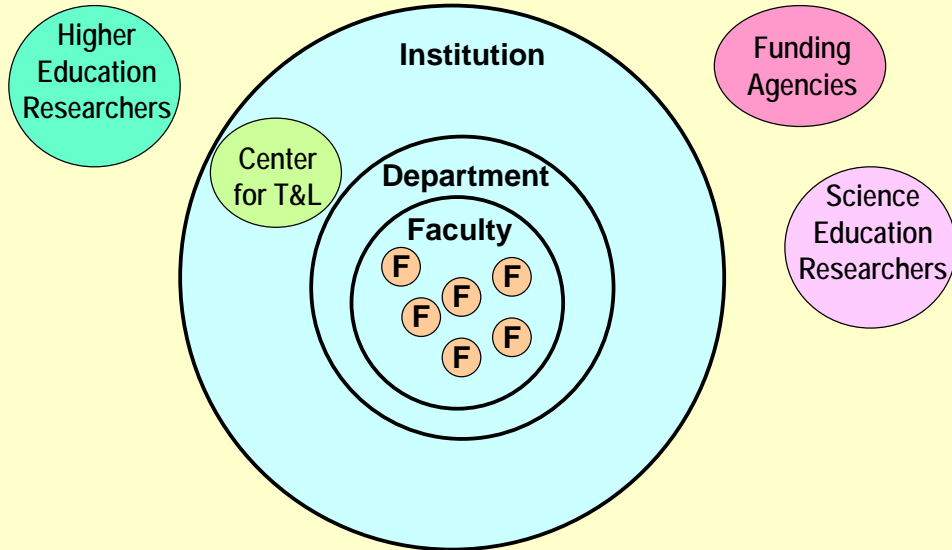
From Barr, R. B. and Tagg, J. (1995) From teaching to learning - a new paradigm for undergraduate education. *Change* (November/December), 13-25.

Three Groups - Three Foci

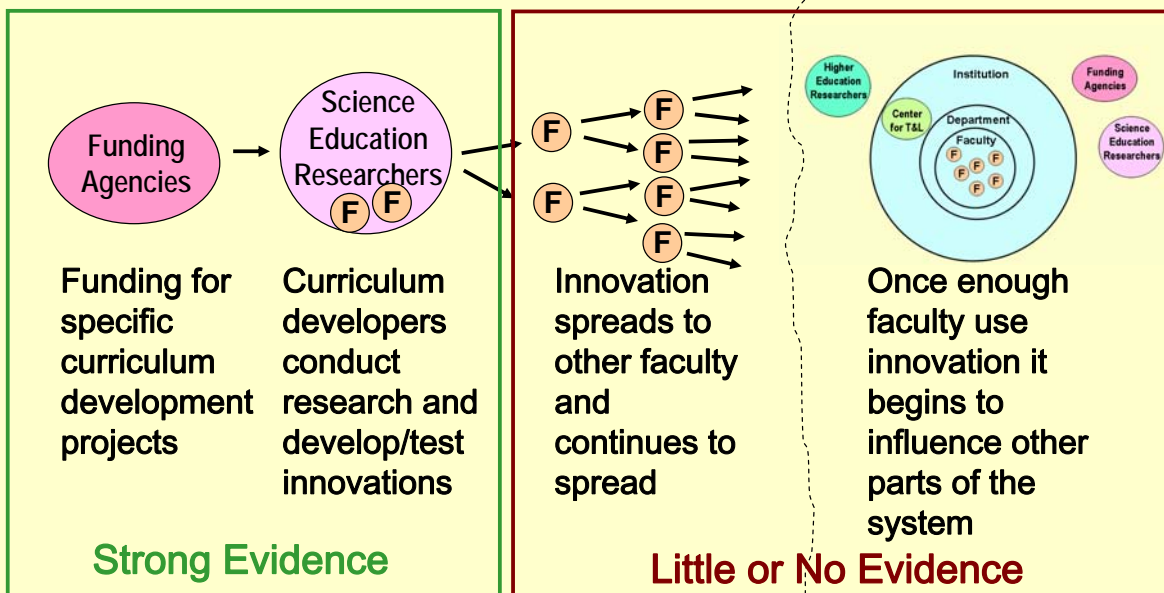


Three Change Models

Important parts of the System



Disciplinary Science Education Researchers (SER): Bottom-Up Change Models (focus on curriculum)

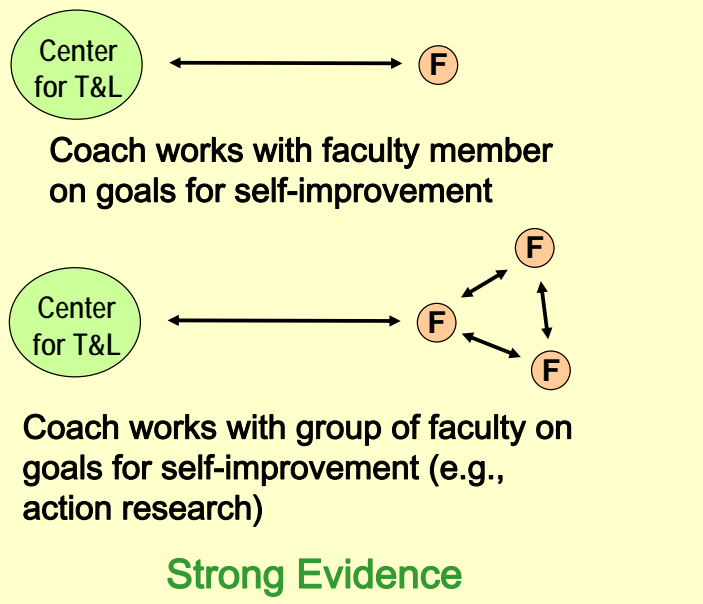


Faculty Development Researchers (FDR): Faculty-Directed Change Models (focus on teachers)

Interventions are effective when they are*:

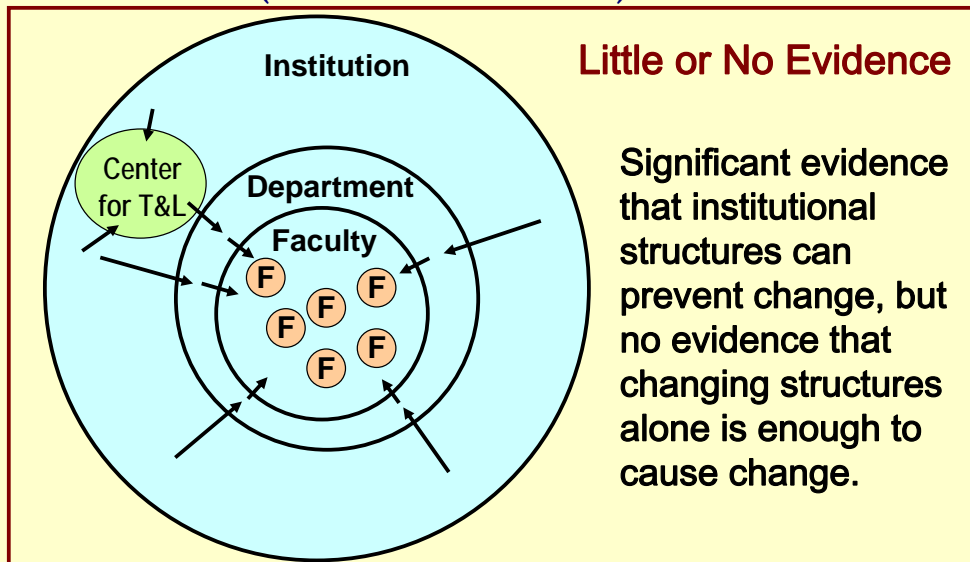
1. Collegial
2. Exist over an extended time
3. Focus on specific goals

No Evidence that this strategy can promote widespread change



*Emerson & Mosteller, 2000

Higher Education Researchers (HER): Top-Down Planned Change Models (focus on structures)



Change institutional reward system to reward faculty for developing and using innovative instruction. Faculty change behavior because of this change in reward system.

Strengths and Weaknesses

	SER	FDR	HER
Focus	Curriculum	Teachers	Structures
Strengths	Developing good curricula is beyond the skills and available time of most faculty	Treats faculty as professionals Customization of curricula is typically necessary	Traditional structures are barriers to change
Weaknesses	Faculty may use curricula inappropriately (or not at all) Most effective curricula conflict with traditional structures	Faculty working in isolation may reinvent the wheel Traditional structures do not reward faculty for a focus on teaching	Faculty may subvert structural changes External structures (e.g., disciplinary cultures) strongly shape faculty work

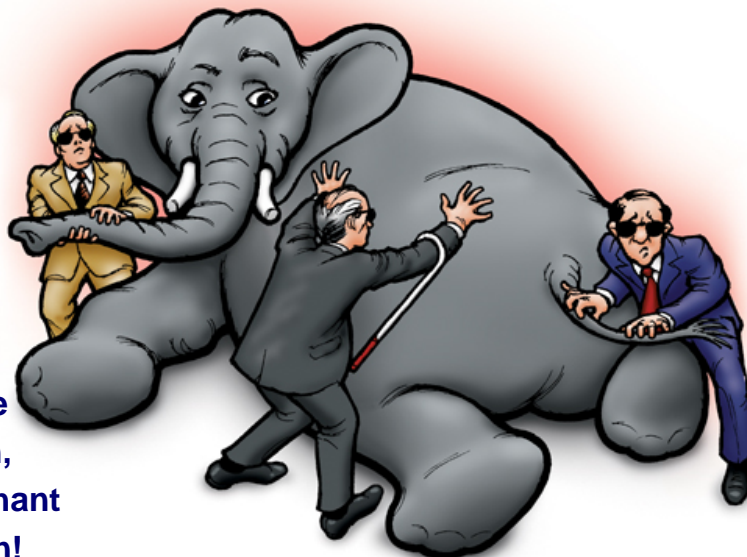
12

Each Group Focuses on an Important Part of the Problem

So oft in theologic wars,
The disputants, I ween,
Rail on in utter ignorance
Of what each other mean,
And prate about an Elephant
Not one of them has seen!

- John Godfrey Saxe

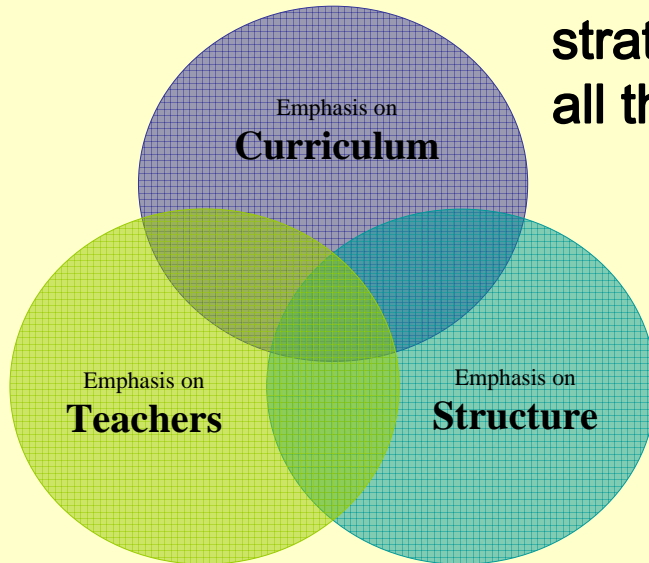
(retrieved from: <http://www.cs.rice.edu/~ssiyer/minstrels/poems/1179.html>)



13

Conclusion

An appropriate change strategy should address all three aspects.

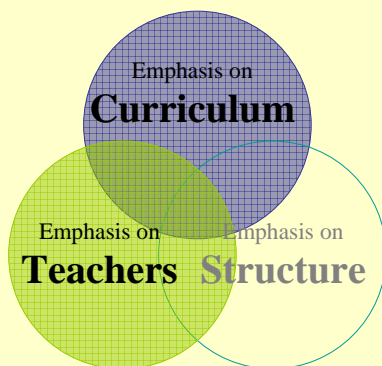


It should be explicit about:

- Which aspects are currently aligned with the proposed change and which will provide barriers.
- How to eliminate or work around the barriers.

14

A Promising Approach: Promote Teacher Customization



Explicitly accept current structural constraints, but provide teachers assistance in customizing research-based techniques to their own unique situations.

Examples:

- Weizmann Institute (Israel) – Ongoing teacher workshops focused on promoting student self-monitoring in problem solving

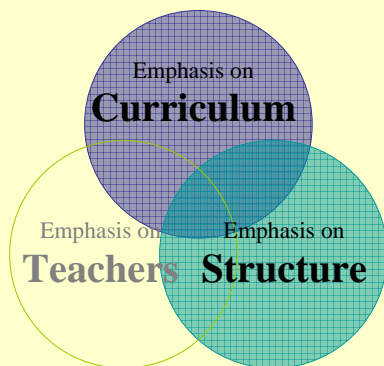
E. Yerushalmi and B. Eylon, "Teachers' Approaches To Promoting Self-Monitoring In Physics Problem Solving By Their Students," Proceedings of the International GIREP Conference on Physics Teacher Education beyond 2000. (2001).

- University of Maryland – Open-source tutorials integrated with professional development materials

<http://www2.physics.umd.edu/~elby/CCLI/index.html>

15

Another Promising Approach: Department-Level Structural Change



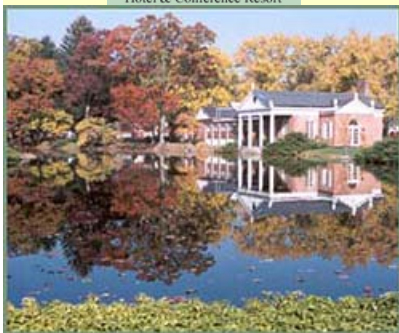
Change departmental structures and curriculum. Ensure that changes do not conflict deeply with faculty or disciplinary beliefs and that it is easier for faculty to go along with changes than to teach traditionally.

Example:

- University of Illinois, Urbana-Champaign – Recreating university physics to align with educational research

D. K. Campbell, C. M. Elliot and G. E. Gladding, "Parallel Parking an Aircraft Carrier: Revising the Calculus-Based Introductory Physics Sequence at Illinois," Forum on Education Newsletter of the American Physical Society. (Summer), 9-11 (1997).
[<http://www.aps.org/units/fed/newsletters/aug97/index.cfm#campbell>]

16



The End

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Thanks to
Noah Finkelstein
R. Sam Larson
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Look for further discussion of these issues at a NSF-sponsored conference in June 2008 in Michigan:

*"Facilitating Change in Undergraduate STEM:
Integrating Multiple Perspectives"*



17