



# Two Models of Institutional Change in STEM Departments

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## INSTITUTIONAL CONTEXT

### CU BOULDER

R1 public university 26,000 undergraduates 6,000 graduate students  
Working in 3 departments: **Integrative Physiology** (1700 majors), **Mechanical Engineering** (800 majors), **Physics** (200 majors, 2500 students/year in service courses), with more (2-4) to come.

**Science Education Initiative (SEI):**  
improved teaching of science at CU (2008-2013)

### AAU UNDERGRADUATE STEM EDUCATION INITIATIVE

**GOAL** To influence the culture of STEM departments at AAU universities so that they will use sustainable, student-centered, evidence-based, active learning pedagogy in their classes, particularly at the first-year and sophomore levels.



### REVIEW OF THEORIES OF CHANGE

“[Leveraging] relevant shifts in departmental values and practices is the critical factor in determining whether the efforts of faculty—as individuals and groups—and of their institutions, will be able to improve the quality of [STEM] education[.]” —Seymour, *Sci. Educ.* 86, 79–105 (2002)

### REASONS WHY FACULTY USE PEER INSTRUCTION

“[D]ata was generally only a confirmation of what they already believed and not a strongly convincing factor... dissemination should focus on methods that involve direct and personal contact with faculty[.]” —Dancy, Turpen, and Henderson, *AIP Conf. Proc.* 1289, 117 (2010)

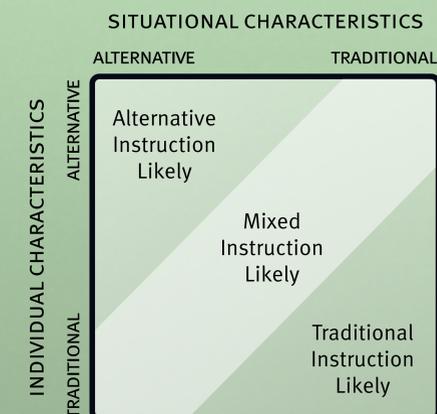
## KEY FINDINGS IN CHANGE LITERATURE

### REVIEW OF 191 HIGHER ED INSTITUTIONAL CHANGE ARTICLES

		INTENDED OUTCOME	
		PRESCRIBED	EMERGENT
ASPECT TO BE CHANGED	INDIVIDUALS	Disseminating Curriculum & Pedagogy 30.4%	Developing Reflective Teachers 33.5%
	ENVIRONMENTS	Enacting Policy 30.4%	Developing Shared Vision 8.4%

Henderson, Beach, and Finkelstein, *J. Res. Sci. Teach.* 48, 952–984 (2011)

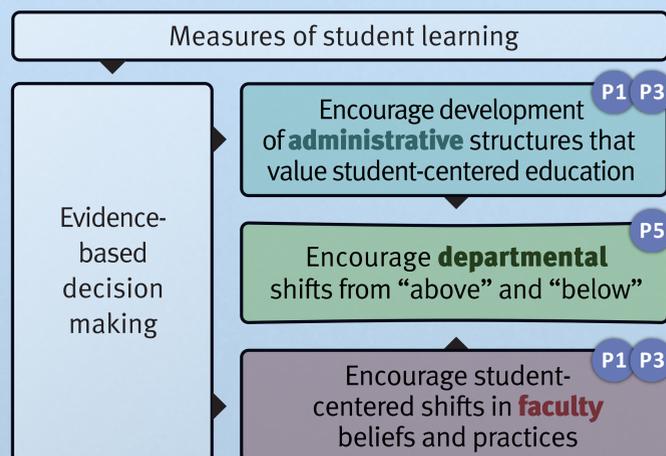
### BARRIERS TO THE USE OF RESEARCH-BASED INSTRUCTION



Henderson and Dancy, *Phys. Rev. ST Phys. Educ. Res.* 3, 020102 (2007)

## SQUEEZE MODEL IMPLEMENTATION

### FOCUS ON MEASURES OF STUDENT LEARNING



### DEPARTMENTAL ACTION TEAMS (DATS): (P2, P4, P6, P7, P8)

- Work with **teams of faculty** over a year to identify and address common problems, with a focus on collecting data and building community/teamwork
- Achieve **stability** that allows DATs to continue after support is withdrawn, ideally integrating into departmental governance
- Draw from SoTL, FLC, and SEI knowledge

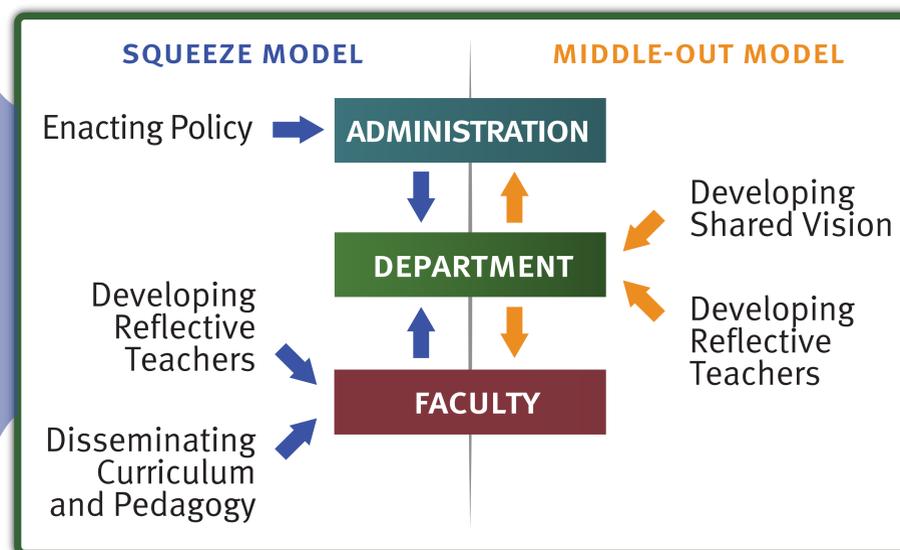
### FACULTY SENATE: (P4)

- Develop a **framework for teaching excellence** that can be adopted and contextualized by departments in promotion and tenure guidelines

### SENIOR ADMINISTRATION: (P7)

- Require **evidence of student learning** in tenure and promotion decisions

## CHANGE MODELS AND PRINCIPLES

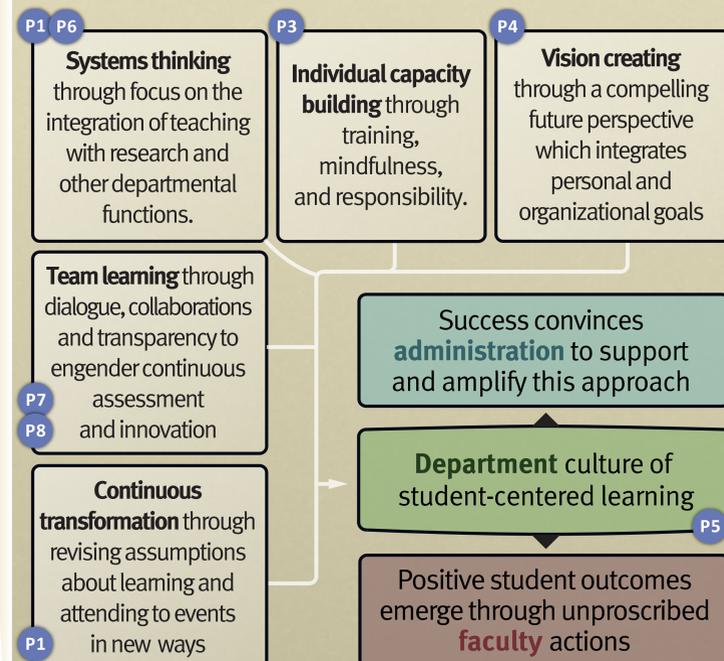


### EFFECTIVE CHANGE EFFORTS:

- P1** align with or focus on **changing the beliefs** of the individuals involved
- P2** involve **long-term** interventions (a semester or more)
- P3** require design that is compatible with the **complex nature** of the university ecosystem.
- P4** have an **emergent component**, giving individuals or groups agency in the change process.
- P5** take the **department** as the key unit of change.
- P6** leverage and create **community** centered on teaching and learning
- P7** lead to difficult-to-revert **structural changes** aligned with the change effort
- P8** are maintained by **internally-driven processes** that lead to continuous refinement

## MIDDLE-OUT MODEL IMPLEMENTATION

### FOCUS ON ORGANIZATIONAL CHANGE STRATEGIES



### ONE TO TWO YEAR TIMELINE

- SOON**
  - A one or two day **retreat** to develop a vision, mental maps, assessment criteria, and a process going forward.
  - Create **working groups**, e.g. establishing program learning goals, revising reward systems, and creating a supportive environment for innovations and positive relationships.
- 30 DAYS**
  - Assess** progress, **reflect** on successes and lessons learned, and **adjust** process at regular intervals.
- 90 DAYS**
  - Assess, reflect, adjust. (P2)
- 1 YEAR+**
  - Assess, reflect, adjust.