

BARRIERS AND PROMISES IN STEM REFORM

Part I: Examining the Development and Dissemination Change
Model

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STEM education R&D has been very productive



- .. Research provides
 - ✘ Documentation that the traditional lecture-based approach is ineffective.
 - ✘ Demonstrations of alternative successful methods.
- .. Development provides
 - ✘ Tested strategies and curricular material that is widely disseminated and easily available.
- .. We know the problems.
- .. We have solutions.

But ...



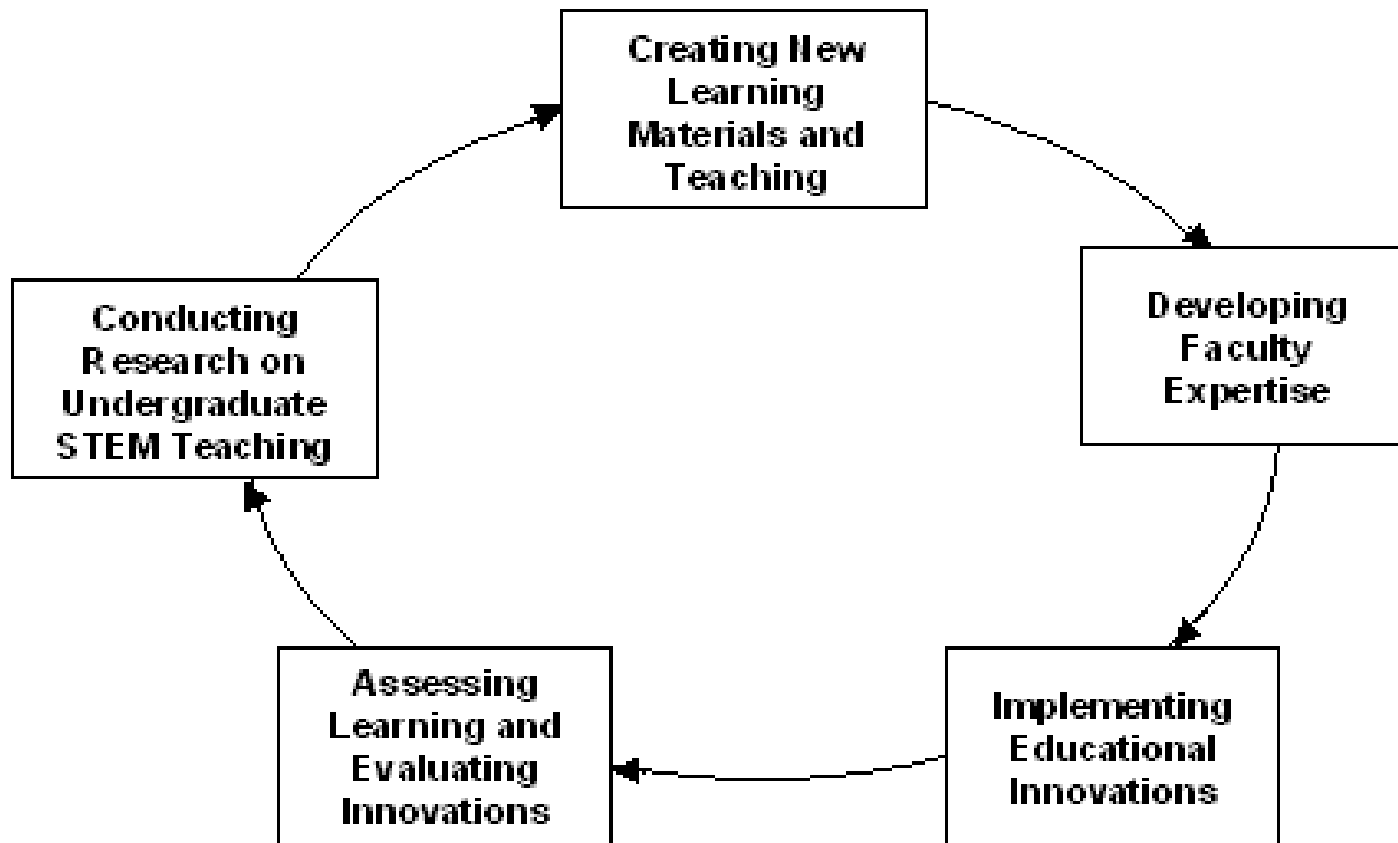
- .. Available evidence suggests our work is only marginally impacting the typical STEM classroom.
- .. Is it because change is just slow and difficult?
 - ✧ Educational change can be swift and sweeping
 - Testing and Accountability Movement (NCLB)
- .. Barrier: STEM change strategies are primarily based on a development and dissemination change model

The Development and Dissemination Model



- .. Education researchers develop and test specific instructional innovations.
- .. Promising innovations are disseminated to instructors.
 - ⌘ Show instructors data that old method is ineffective and that new method is better.
 - ⌘ Instructors expected to adopt innovation without extensive modifications.
 - ⌘ Instructors are not an important part of the development process.

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

Change Agents Blame Instructors for Problems

- Myth #1 – Instructors use traditional methods because they believe traditional methods are effective.
 - ✘ Instructors often recognize traditional methods are unsuccessful even though they use methods.
- Myth #2 – Instructors use traditional methods because they are unaware of research based reforms.
 - ✘ Instructors awareness of reforms is documented to be higher than their use of the reforms.
- Myth #3 – Instructors are mostly interested in research and are not willing to spend time improving their teaching.
 - ✘ Instructors generally do care about teaching.
- Even when instructors want to change and are familiar with research-based innovations, they often fail to implement the reforms. Blaming instructors does not solve the problem.

Instructors Blame Change Agents



- .. Interviews with five tenured physics faculty considered by peers to be dedicated and accomplished teachers.
- .. Findings
 - ⌘ Education research viewed as dogmatic.
 - ⌘ Education research says I'm a bad teacher.
 - ⌘ Instructors want to be part of the solution.
 - They have valuable ideas.
 - They know their situation and their students better than someone at State U.

Adoption-Invention Continuum:

Possible Relationships Between Researchers and Faculty



Adoption	Adaption	Reinvention	Invention
Instructor implements reform as is.	Instructor modifies reform slightly.	Instructor develops fundamentally new procedures based on reform ideas.	Instructor works independently.



Developers
Expectations



Faculty
Expectations

Researcher-Instructor Partnerships

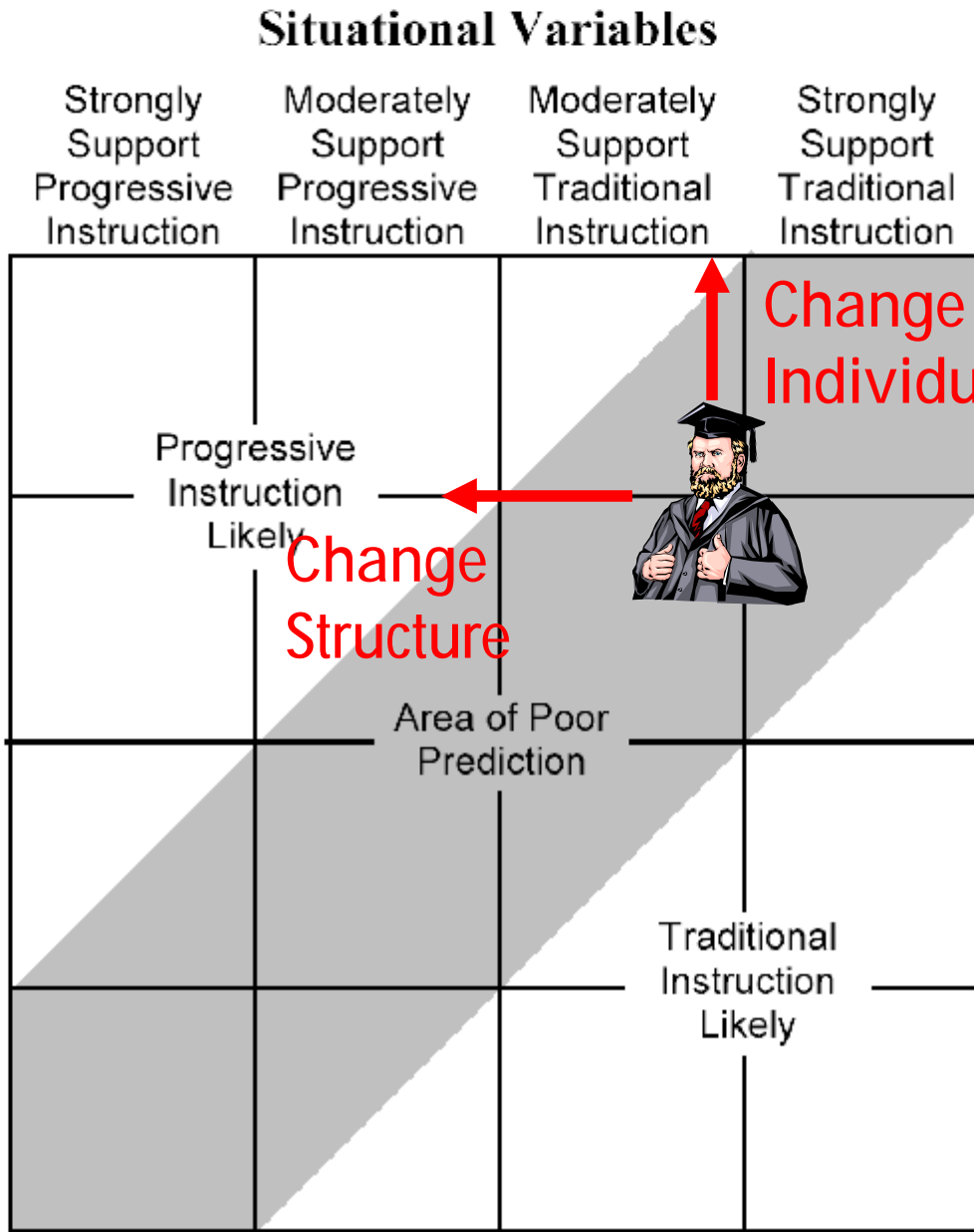


- .. Provide easily modifiable materials.
- .. Focus on dissemination of research ideas in addition to curriculum.
- .. Explicitly research the conditions for transfer.

Belief/Action Disconnect

Individual Tendencies

(Beliefs, Values, Knowledge, Attitudes)



Change Structure



Identified Systemic Barriers




- Expectations of Content Coverage
- Lack of Instructor Time
- Departmental Norms
- Student Resistance
- Class Size and Room Layout
- Time Structure

Implications/Recommendations



- Change Strategies Must Address the Strong Situational Conditions that Favor Traditional Instruction
 - ⌘ Acknowledge the existence of situational barriers.
 - ⌘ Help instructors identify when situational barriers (rather than the curriculum or themselves) are creating implementation problems.
 - ⌘ Help instructors overcome situational barriers.
 - ⌘ Work toward policy level changes to change situational factors to support reform.

Toward more effective reform efforts...

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- .. Treat reform efforts as “scientifically” as we treat pedagogy (data collection and analysis, hypothesis, theory building, etc.)
 - .. Need to move beyond the unsuccessful development and dissemination model of change.
 - .. Intensify effort to develop research-based models of change to inform change strategies.