Models of Change and Implementation
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Overview
- Conceptual models of change
- Factors influencing STEM adoption & implementation
- Breakdowns in managing change
  - Do you fix the organization to fit your model? or
  - Do you change your model to fit the organization?

Henderson Typology of Change Categories

<table>
<thead>
<tr>
<th>Aspect of System to Be Changed: Individuals</th>
<th>Intended Outcome: Prescribed</th>
<th>Intended Outcome: Emergent</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Developing: CURRICULUM &amp; PEDAGOGY</td>
<td>Change Process: Tell/Teach individuals about new teaching conceptions and/or practices and encourage use.</td>
<td>Change Process: Encourage/Support individuals to develop new teaching conceptions and/or practices.</td>
</tr>
<tr>
<td></td>
<td>Examples: dissemination/training (SER, FDR), focused conceptual change (FDR)</td>
<td>Examples: reflective practice (FDR), curriculum development (SER), action research</td>
</tr>
<tr>
<td></td>
<td>(30% of articles)</td>
<td>(31% of articles)</td>
</tr>
<tr>
<td>II. Developing: REFLECTIVE TEACHERS</td>
<td>Change Process: Encourage/Support individuals to develop new teaching conceptions and/or practices.</td>
<td>Change Process: Empower/Support stakeholders to collectively develop new environmental features that support new teaching conceptions and/or practices.</td>
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<tr>
<td></td>
<td>Examples: reflective practice (FDR), curriculum development (SER), action research</td>
<td>Examples: institutional transformation (HER), learning organizations (HER)</td>
</tr>
<tr>
<td></td>
<td>(31% of articles)</td>
<td>(5% of articles)</td>
</tr>
<tr>
<td>III. Developing: POLICY</td>
<td>Change Process: Empower/Support stakeholders to collectively develop new environmental features that support new teaching conceptions and/or practices.</td>
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<td>Examples: policy change (HER), strategic planning (HER)</td>
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<td></td>
<td>(14% of articles)</td>
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</tbody>
</table>

Source: Henderson, Preliminary Categorization of Literature Promoting Change in Undergraduate STEM, 6-3-08
1. What model of change in STEM do you have in mind?

2. How does the process of change unfold in your model?

3. What breakdowns are you experiencing in implementing your model?

Questions about facilitating change in undergraduate STEM

Process Models of Organization Change

Note: Arrows on lines represent likely sequences among events, not causation between events.
Source: Van de Ven & Poole, Explaining Development and Change in Organizations, AMR, 1995.
Example of Planned Change: Kotter Model

1. Establish a sense or urgency
2. Form a powerful guiding coalition to work as a team
3. Create a goal or vision to direct the change effort
4. Communicate the new vision to people
5. Empower others to act on the vision & get rid of obstacles
6. Plan/create short-term wins or performance improvements
7. Consolidate & continue improvements by hiring, promoting & developing employees who implement the vision
8. Institutionalize the change by showing the connections between new behaviors and corporate success.


Example of Life Cycle Stage-Gate Process

Stage-Gate® Product Innovation Process

- Idea Screen (Gate 1, Stage 1)
- Second Screen (Gate 2, Stage 2)
- Go to Development (Gate 3, Stage 3)
- Go to Testing (Gate 4, Stage 4)
- Go to Launch (Gate 5, Stage 5)
Example of Dialectical Model: Schon’s Political Model of Public Policy

Example of Evolutionary Change: Miner’s Model of Evolutionary Change

<table>
<thead>
<tr>
<th>Variation</th>
<th>Selection</th>
<th>Retention</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Institutionalized experimentation</td>
<td>1. Goals</td>
<td>1. Active controls</td>
</tr>
<tr>
<td>a. Research and development</td>
<td></td>
<td>a. Budgets</td>
</tr>
<tr>
<td>b. Champion and entrepreneurial roles</td>
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<td>b. Information systems</td>
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<tr>
<td>c. Some total quality experiments</td>
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<td>c. Audits</td>
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<tr>
<td>d. Parallel projects</td>
<td>2. Values</td>
<td>2. Formalization</td>
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<tr>
<td>2. Direct and indirect incentives</td>
<td></td>
<td>a. Rules</td>
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<tr>
<td>a. Innovation norms</td>
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<td>b. Job descriptions</td>
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<tr>
<td>b. Professional individual incentives</td>
<td></td>
<td>c. Procedures</td>
</tr>
<tr>
<td>c. Material individual incentives value</td>
<td></td>
<td>d. Research protocols</td>
</tr>
<tr>
<td>d. Equity interests</td>
<td>3. Project criteria</td>
<td>3. Social values</td>
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<tr>
<td>3. Playfulness</td>
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<tr>
<td>a. Informality</td>
<td></td>
<td>4. Project checkpoints</td>
</tr>
<tr>
<td>b. Skunkworks</td>
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<tr>
<td>c. Slack resources</td>
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<tr>
<td>4. Project checkpoints</td>
<td></td>
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<tr>
<td>5. Competition</td>
<td></td>
<td>a. Shoot-outs</td>
</tr>
<tr>
<td>a. Shoot-outs</td>
<td></td>
<td>b. Managerial competition for resources</td>
</tr>
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<td>b. Managerial competition for resources</td>
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</table>
STEM Example of Evolutionary Change: First Robotics Competition

Vision
“To transform our culture by creating a world where science and technology are celebrated and where young people dream of becoming science and technology heroes.” Dean Kamen, Founder

2008 FIRST Robotics Competition
• 1,501 teams
• 37,525 high-school students
• From Brazil, Canada, Chile, Israel, Mexico, the Netherlands, the U.K., and every state
• 41 Regional events in Brazil, Canada, Israel, U.S.
• FIRST Robotics Competition Championship in Atlanta, GA, April 17-19, 2008
• Robots are built in 6 weeks from a common kit of parts provided by FIRST

Models of Organizational Change

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<tbody>
<tr>
<td>Dissatisfaction, search, goal setting, &amp; implementation</td>
<td>Prescribed sequence of steps or stages of development</td>
<td>Confrontation, conflict &amp; synthesis between opposing interests</td>
<td>Variation, selection &amp; retention among competing units</td>
<td></td>
</tr>
<tr>
<td>Goal, opportunity or threat</td>
<td>Prefigured program regulated by nature, logic or rules</td>
<td>Conflict between opposing forces</td>
<td>Competition for scarce resources</td>
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</tr>
<tr>
<td>Purposeful cooperation</td>
<td>Organic growth</td>
<td>Opposition, conflict</td>
<td>Competitive survival</td>
<td></td>
</tr>
<tr>
<td>Decision Biases, Lack of consensus Group think</td>
<td>Resistance to change noncompliance</td>
<td>Destructive conflict Irresolvable differences</td>
<td>Requisite variety Lack of scarcity</td>
<td></td>
</tr>
<tr>
<td>Critical thinking Rational decisions Consensus building</td>
<td>Obtaining ‘buy in’ Internalizing mandates</td>
<td>Negotiation skills Partisan mutual adjustment</td>
<td>Strategies for competitive advantage</td>
<td></td>
</tr>
<tr>
<td>Rational choice models</td>
<td>Legislated change programs</td>
<td>Political action models of change &amp; protest</td>
<td>Evolutionary models of competition</td>
<td></td>
</tr>
</tbody>
</table>
Resistance to Change

People Resist Change when the Change:
1. is not understood => provide trial demonstrations
2. costs outweigh benefits => make evidence-based case
3. is imposed or threatening => encourage local reinvention
4. incompatible with arrangements => align structures & incentives
5. bogs down => need process facilitators & leadership support
6. process wanders => structure events, deadlines to maintain attention

People are more likely to implement their own innovations than someone else’s.
Positive intentions may motivate negative responses to change. View resistance as constructive suggestions for (not against) change.

Sources: S. Piderit, Rethinking Resistance and Recognizing Ambivalence… AMR, 2000.

People are more likely to Comply with Requests to Adopt Innovations When:
1. A reason is provided for the request
2. Reciprocity exists: provide an initial gift before making request
3. Small initial commitment is made, then rely on consistency
4. Social proof exists that many similar others are complying
5. Request comes from individual they know and like
6. Request comes from legitimate authority
7. The opportunity is scarce, limited, or difficult to attain

Modern life creates cognitive overload because of technical advances, burgeoning information, expanding choices and opportunities, and exploding knowledge.
People use decision shortcuts by relying on simple triggers for compliance. The most reliable triggers are commitments, opportunities for reciprocation, the compliant behavior of similar others, feelings of liking or friendship, authority directives, and scarcity information.

Innovation Characteristics That Influence Its Adoption

1. Relative advantage based on objective evidence,
2. Compatibility with existing practices,
3. Ease of understanding - not complex,
4. Observable to see how it works
5. Trialability and Adaptability to fit local needs.

Source: Everett Rogers, Communication of Innovations, 2003

Organizational Factors Influencing Adoption

Organization Characteristics:
- Resources – money, motivation, momentum
- Ability – training & competence
- Open cross-boundary communications
- Organizational network & supportive infrastructure
- Political processes to push ideas into good currency

Organizational Situations: Adoption more difficult when:
- Decision unit is a complex organization vs. an individual
- Change is implemented in depth vs. in breadth
- Change is externally mandated vs. locally chosen to fit situations,
- System is pluralistic with different mental models for organizing.
Does STEM Scholarship Influence its Adoption?

Central Claim:

We can increase the likelihood of advancing and implementing research knowledge by engaging key stakeholders in four steps of a study:

1. Ground problem/question in reality up close & from afar.
2. Develop alternative theories to address the question.
3. Collect evidence to compare models of theories.
4. Communicate & apply findings to address the problem/question.

Engaged Scholarship Diamond Model

**Study Context:** Research problem, purpose, perspective

**Research Design**
- Develop variance or process model to study theory
- Engage methods experts & people providing access & information

**Criterion – Truth (Verisimilitude)**

**Problem Solving**
- Communicate, interpret & negotiate findings with intended audience.
- Engage intended audience to interpret meanings & uses

**Criterion - Impact**

**Problem Formulation**
- Situate, ground, diagnose & infer the problem up close and from afar
- Engage those who experience & know the problem

**Criterion - Relevance**

**Theory Building**
- Create, elaborate & justify a theory by abduction, deduction & induction
- Engage knowledge experts in relevant disciplines & functions

**Criterion - Validity**

**Model**

**Reality**

Alternative Forms of Engaged Scholarship

Research Question/Purpose

<table>
<thead>
<tr>
<th>Detached Outside</th>
<th>Attached Inside</th>
</tr>
</thead>
<tbody>
<tr>
<td>To Describe/Explain</td>
<td>To Design/Intervene</td>
</tr>
<tr>
<td>Basic Science With Stakeholder Advice</td>
<td>Policy/Design Science Evaluation Research For Professional Practice</td>
</tr>
<tr>
<td>Co-Produce Knowledge With Collaborators</td>
<td>Action/Intervention Research For a Client</td>
</tr>
</tbody>
</table>

Research Perspective

Your thoughts, please

1. What model of change do you have in mind?
2. Do your steps consider the factors that influence innovation adoption and implementation?
3. Does your STEM research & teaching influence its adoption and implementation?
4. What breakdowns are you experiencing in implementing your model?
5. When change does not unfold as expected:
   - Do you change the organization to fit your model? or
   - Do you change your model to fit the organization?

Thank You!
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