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## The Cases

### Project 1: Expanding Undergraduate STEM Research Experience

Institution:	Community college
Goal:	Develop pathways in the natural and social sciences that infuse authentic research experiences into the lower division curriculum
Background:	<p>Pilot institution for another large grant, which introduced this project, in 2012. In 2014 entered a partnership/program with a local state university with the goal of increasing diversity of students pursuing careers in biomedical research. Members of the institute team assembled the original, larger team of college faculty. In 2016, these faculty attended Course-Based Undergraduate Research Experience (CURE) workshops. The number of courses developed/approved is growing (4 in 2017).</p> <ul style="list-style-type: none"> <li>• This project is part of larger college academic master plan (2016-2021) to address deficiencies in graduates.</li> <li>• Administration sees CUREs as examples of real-world learning that will help persistence.</li> <li>• College at a point of institutional change with new long-term academic plan.</li> </ul>
Challenges:	<ul style="list-style-type: none"> <li>• Lack of institutional funding. Only external funding has supported the project.</li> <li>• As a community college, they “lack a research history and culture.” Administration lacks understanding to support these initiatives. Lack of organizational infrastructure (no IRB).</li> </ul>
Team composition:	<ul style="list-style-type: none"> <li>• Dean of STEM</li> <li>• Chemistry department head/liaison with state university project</li> <li>• English professor and assessment liaison</li> <li>• Dean of Social Sciences and Fine Arts</li> <li>• 5 professors (biology, chemistry, psychology, anthropology) with connections to partnership with state university</li> </ul>

**Project 2: Implementing Sustainable STEM Curriculum Design**

Institution:	Large R1 State University, one STEM department
Goal:	<ol style="list-style-type: none"> <li>1. Improve communication about teaching among department faculty in order to ensure student and faculty clarity on outcomes for undergraduate degrees, improve consistency of course content, and align the curriculum across courses in sequence,</li> <li>2. Support long-term implementation of curriculum changes in department's undergraduate degrees,</li> <li>3. Increase engagement between department's undergraduate students, alumni, and faculty,</li> <li>4. Evaluate the effect of changes on student outcomes, including learning, satisfaction, career readiness, and likelihood of continuing in STEM fields.</li> </ol>
Background:	<p>The department convened a Curriculum Redesign Committee in response to two college-wide reports. These outlined a vision statement and recommendations for improvement of undergraduate education:</p> <ul style="list-style-type: none"> <li>• Recommended that departments define learning outcomes for their undergraduate degrees and clarify how students can achieve the outcomes as they work toward their degree.</li> <li>• Proposed that faculty in departments define the outcomes for degrees by considering not only discipline-specific knowledge, but also essential skills.</li> </ul> <p>Department team began work on their degree plans in August 2017 They also have monetary support from college. Major milestones:</p> <ul style="list-style-type: none"> <li>• Disseminated knowledge surveys to students and alumni in March 2018.</li> <li>• Wrote program learning outcomes for department degrees, defined performance indicators, and constructed rubrics to distinguish among introductory, developing, and mastery levels.</li> <li>• Following survey, realized not all graduates had same levels of knowledge with the same degrees.</li> </ul>
Challenges:	<ul style="list-style-type: none"> <li>• Some faculty are not supportive of curriculum redesign.</li> <li>• Need long-term meaningful change but no increase in long-term budget.</li> <li>• Not sure what timeline is realistic.</li> <li>• Not sure which assessments might be most valid or useful to assess effectiveness of change efforts.</li> </ul>
Team composition:	<ul style="list-style-type: none"> <li>• 4 Associate Professors in the department</li> <li>• STEM Instruction Consultant</li> <li>• Alumnus of department</li> <li>• Department Associate Chair</li> </ul>

## The Change Dashboard: Desired State

The desired state represents changes in conditions rather than goals. What are the outcomes you want to see across your institution?

<i>Dashboard sections</i> Consider desired conditions at these levels	<i>Possible target issues</i> What specific things do you want to change at each level of the Dashboard?
External Institution College Department/program Individuals	Curriculum Pedagogy Student learning practices Student assessment practices Policies Budgets Non-financial resources (i.e., space, equipment, etc.) Departmental structures Institutional structures Decision-making structures Language used at the institution Stakeholder relationships Norms of interaction between individuals and groups Other:

## The Change Dashboard: Current State

The current state represents the actual state of those areas listed in the desired state.

<i>Dashboard sections</i> Consider current conditions at these levels	<i>Possible target issues</i> What specific things need to change in order to reach the desired state at each level? What was listed in the desired state above?
External Institution College Department/program Individuals	Curriculum Pedagogy Student learning practices Student assessment practices Policies Budgets Non-financial resources (i.e., space, equipment, etc.) Departmental structures Institutional structures Decision-making structures Language used at the institution Stakeholder relationships Norms of interaction between individuals and groups Other:

Example Cases:

- Are each of the levels addressed appropriately?
- Are the Desired States descriptions of changed conditions rather than goals?
- Would the Desired States be more helpful if they were more specific?
- Do the Current States provide sufficient information to understand the context and what will need to change to reach the Desired States for each project?

**Project 1: UR STEM Research Experience – Desired State**

<i>External</i>	<ul style="list-style-type: none"> <li>• Robust research collaborations/pathways with a variety of academic disciplines with transfer institutions</li> <li>• Reliable funding sources</li> </ul>
<i>Institution</i>	<ul style="list-style-type: none"> <li>• Development of functional IRB and other aspects of institutional support integrated into guided pathways, robust faculty development resources incorporating research</li> </ul>
<i>College</i>	<ul style="list-style-type: none"> <li>• Shared understanding that research is a core strategy to help students learn and complete and expand their vision of possibilities</li> <li>• Ongoing assessment, improvement of research-based courses</li> </ul>
<i>Department/ program</i>	<ul style="list-style-type: none"> <li>• All relevant research-based disciplines incorporating CUREs (Course-based Undergraduate Research Experience)</li> </ul>
<i>Individual</i>	

**Project 1: UR STEM Research Experience – Current State**

<i>External</i>	<ul style="list-style-type: none"> <li>• Collaborating with Nearby State University and Nearby Local State University regarding research-based pathways</li> </ul>
<i>Institution</i>	<ul style="list-style-type: none"> <li>• Lack of clarity about rules/responsibilities</li> <li>• Largely unaware but supportive and enthusiastic</li> <li>• Active learning incorporated as an intended result in academic plan</li> </ul>
<i>College</i>	<ul style="list-style-type: none"> <li>• Limited funding</li> <li>• No research infrastructure</li> <li>• Competing priorities – our project has risen to high priority yet</li> </ul>
<i>Department/ program</i>	<ul style="list-style-type: none"> <li>• Multiple departments involved</li> <li>• Still many departments and key individuals unaware</li> </ul>
<i>Individual</i>	

**Project 2: Sustainable STEM Curriculum Design – Desired State**

<i>External</i>	<ul style="list-style-type: none"> <li>• Program perceived well externally by board of regents, graduate programs, incoming students, peer institutions, prospective faculty, etc.</li> <li>• Want teaching reputation to approach research reputation</li> </ul>
<i>Institution</i>	<ul style="list-style-type: none"> <li>• Address equity issues (ex. Embed curriculum)</li> <li>• Experiential learning</li> </ul>
<i>College</i>	<ul style="list-style-type: none"> <li>• Increased career skills preparation</li> <li>• Maintain support for curricular initiatives</li> <li>• Dedicated neuro advising and enhanced communication with advisers to support curriculum recommendations</li> </ul>
<i>Department/ program</i>	<ul style="list-style-type: none"> <li>• Cooperative, integrative approach to curriculum</li> <li>• Metrics for measuring success</li> <li>• Increased skills instruction (quantitative, communication, etc.)</li> <li>• Neuroscience majors feel like proud community</li> </ul>
<i>Individual</i>	<ul style="list-style-type: none"> <li>• Transfer of knowledge and skills (student)</li> <li>• Clear path to success (student)</li> <li>• Increased appreciation for importance of teaching (faculty)</li> <li>• Can identify career paths that use students' skills (faculty and students)</li> </ul>

**Project 2: Sustainable STEM Curriculum Design – Current State**

<i>External</i>	<ul style="list-style-type: none"> <li>• Young department trying to form reputation</li> <li>• Not a lot of alumni contact and engagement</li> <li>• Flat rate tuition</li> </ul>
<i>Institution</i>	<ul style="list-style-type: none"> <li>• Push for improving 4 year graduation rates</li> <li>• Mandated flags in curriculum, students often take outside the college, gaps in student savvy in navigating inclusion of lags in the degree plan</li> <li>• Underrepresented groups are underrepresented</li> </ul>
<i>College</i>	<ul style="list-style-type: none"> <li>• Inconsistent student advising</li> <li>• 21<sup>st</sup> Century Education initiatives with resources</li> <li>• New Dean of Natural Sciences</li> <li>• High fraction of students interested in health professions/med school</li> <li>• Increased enrollment, not corresponding resource increase</li> </ul>
<i>Department/ program</i>	<ul style="list-style-type: none"> <li>• Culture of autonomy around teaching</li> <li>• Lack of consistency and integration in the curriculum</li> <li>• Uneven skills training</li> <li>• No capstone course</li> </ul>
<i>Individual</i>	<ul style="list-style-type: none"> <li>• Frustrated by misdirection (students)</li> <li>• Frustrated by lack of knowledge, having to reteach (faculty)</li> <li>• Poor awareness of course options (students and faculty) and how skills can be applied</li> </ul>

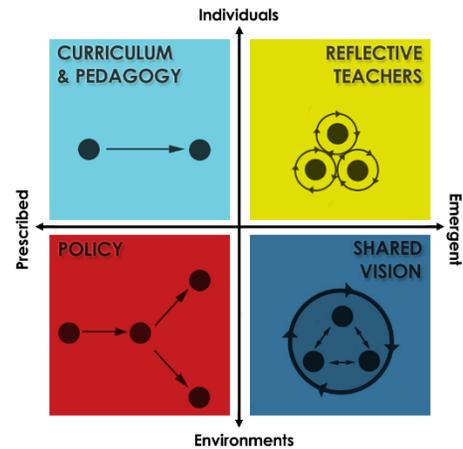
## The Change Dashboard: Change Strategies

A change strategy is a coherent plan of action that guides a change agent’s choice of tactics (e.g., disseminating tested, ready-to-use materials for teaching a specific course). The purpose of a change strategy is to guide your development of change tactics (specific actions) that will take your institution from the Current State to your Desired State.

Determine which quadrant of the foursquare represents the overall goals of your change strategy by answering two questions: 1) is the change more focused on directly changing individuals or environments/structures?; 2) is the desired outcome of the change largely known in advance (prescribed) or is it expected to be largely designed during the change process (emergent)?

Once the quadrant is identified, select a change strategy that fits with that quadrant. Some possible change strategies are: (see Appendix for more information)

- Diffusion
- Implementation
- Scholarly teaching
- Faculty learning communities
- Organizational development
- Quality assurance
- Learning organizations
- Complexity leadership
- Kotter’s 8-Stage Model



Examples:

Change Strategies	
Project 1: UR STEM Research Experience	Kotter's 8 Stage Model/Policy: Develop policies and procedures to expand awareness about and interest in CUREs, as well as motivation for instructors to use CUREs.
Project 2: Sustainable STEM Curriculum Design	Complexity leadership theory: <u>Develop</u> + implement <u>department</u> -level undergraduate curriculum change to improve student outcomes (at this point project is moving into prescriptive phase)

## The Change Dashboard: Change Tactics

Change tactics are the specific activities that change agents use to promote instructional change (e.g., dissemination of textbooks or other materials, or the specific nature, duration, and content of workshops, etc.).

In developing tactics, it can be useful to think about each condition in the Desired State and then identify:

- The gap between the desired and current states
- Resources available
- Tactics that can reduce the gap and are consistent with the resources

### Project 1: UR STEM Research Experience – Change Tactics

Strategies	Kotter’s 8 Stage Model/Policy: Develop policies and procedures to expand awareness about and interest in CUREs & motivation for instructors to use CUREs
<i>Tactics: Strategy 1</i>	<ol style="list-style-type: none"> <li>1. Highlight CUREs as exemplar of active learning at institution                         <ol style="list-style-type: none"> <li>1.1. Gather and evaluate assessment data about students in CURE classes vs. non-CURE classes</li> <li>1.2. Emphasize CURE as active learning strategy in program improvement process</li> <li>1.3. Presenting Institution’s CURE work at national conference</li> </ol> </li> </ol>
<i>Strategy 2</i>	<ol style="list-style-type: none"> <li>2. Identify and pull with more key people into team                         <ol style="list-style-type: none"> <li>2.1. Have CURE experience as criterion in hiring of faculty</li> <li>2.2. Involve AHE officers (faculty union) in CURE professional development opportunities and CURE classes</li> <li>2.3. Expand involvement/participation of instructional leadership in CURE development</li> <li>2.4. Recruit current faculty to participate (campus outreach)</li> </ol> </li> </ol>
<i>Strategy 3</i>	<ol style="list-style-type: none"> <li>3. Embed CUREs within guided pathways                         <ol style="list-style-type: none"> <li>3.1. Develop proposal for CURE expansion and share with relevant committees (Academic Excellence Council, Instructional Planning Team, Guided Pathways Steering Committee)</li> <li>3.2. Consult with AHE regarding incentives and faculty engagement</li> <li>3.3. Identify reliable/stable internal/external funding sources</li> <li>3.4. Encourage faculty/chairs to contact/communicate with faculty at K-12, baccalaureate institutions (to develop more communication regarding entry/exit components of pathways)</li> </ol> </li> </ol>
<i>Strategy 4</i>	<ol style="list-style-type: none"> <li>4. Develop robust assessment scheme that leads to CURE course improvement                         <ol style="list-style-type: none"> <li>4.1. Comparing course success in CURE classes vs. non-CURE classes</li> <li>4.2. Compare retention and completion data</li> <li>4.3. Develop data sharing agreements with receiving institutions about transfer student success and baccalaureate completion</li> <li>4.4. Gather data on continued undergraduate research and interest in continuing education beyond baccalaureate degree</li> </ol> </li> </ol>

Project 2: Sustainable STEM Curriculum Design - Change Tactics

Strategy	Complexity leadership theory: <u>Develop</u> + implement <u>department-level</u> undergraduate curriculum change to improve student outcomes (at this point project is moving into prescriptive phase)
Tactics	<ol style="list-style-type: none"><li>1. Encourage cooperative faculty to teach courses in alignment with curricular goals</li><li>2. Support, acknowledge and incentivize faculty/implement plan:<ul style="list-style-type: none"><li>○ Incorporate skills training in their courses</li><li>○ Quantitative neuroscience</li><li>○ Update degree plans</li><li>○ Incorporate EBT</li></ul></li><li>3. Increase capacity in neuroscience labs</li><li>4. Establish a formal UGTA training program</li><li>5. Enhance communication between students, alumni, faculty, advisers, college, university leadership, external</li><li>6. Develop assessment plan</li></ol>

## The Change Dashboard: Your Project

Your Project – Desired State	
<i>External</i>	
<i>Institution</i>	
<i>Department/ program</i>	
<i>Individual</i>	

Your Project – Current State	
<i>External</i>	
<i>Institution</i>	
<i>Department/ program</i>	
<i>Individual</i>	

Your Project – Change Strategies & Tactics

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*Change  
Strategy*

*Change  
Tactics*

*Resources*

## Appendix: Some Change Strategies\*

Diffusion (Curriculum and Pedagogy)	Innovations created in one location and then adopted or adapted by others in a multi-stage adoption process. Change agent role: Develop a quality innovation and spread the word.
Implementation (Curriculum and Pedagogy)	A set of purposeful activities are designed to put proven innovations into practice in a new setting. Change agent role: Develop a training program that involves performance evaluation and feedback.
Scholarly teaching (Reflective Teachers)	Reflective teachers: individual faculty reflect critically on their teaching in an effort to improve. Change agent role: Encourage faculty to reflect on and collect data related to their teaching.
Faculty learning communities (Reflective Teachers)	A group of faculty supports each other in improving teaching. Change agent role: Bring faculty together and scaffold community development.
Organizational development (Policy)	Measurable target outcomes are identified and progress towards them is assessed and tracked. Change agent role: Develop new vision. Analyze alignment of parts of the organization with the new vision and identify strategy for creating alignment.
Quality assurance (Policy)	Leader develops new vision and plans a strategy for aligning employee attitudes and behaviors with this vision. Change agent role: Develop measurable outcomes, define success, collect evidence.
Kotter's 8-Stage Model (Policy)	Leadership team develops vision and plan for building buy-in and implementing vision. Change agent role: 1. Establish a sense of urgency, 2. Create the guiding coalition, 3. Develop a vision and strategy, 4. Communicate the change vision, 5. Empower broad-based action, 6. Generate short-term wins, 7. Consolidate gains and produce still more change, 8. Anchor new approaches in the culture
Learning organizations (Shared Vision)	Leader works to develop an organizational culture that supports knowledge creation. Change agent role: Move decision-making further from the top. Invest in developing employees personal mastery, mental models, shared vision, team learning.
Complexity leadership (Shared Vision)	In a complex system, results are not easily predicted. Change agents can create conditions that increase the likelihood of productive change. Change agent role: Disrupt existing patterns, encourage novelty, and act as sensemakers.

\*Adapted from: Borrego, M., & Henderson, C. (2014). Increasing the Use of Evidence-Based Teaching in STEM Higher Education: A Comparison of Eight Change Strategies. *Journal of Engineering Education*, 103(2), 220–252. doi:10.1002/jee.20040



**Systemic Change Institute: Dashboard**



Strategy

**How do we get there?**

Current State	Tactics	Resources	Desired State
External	<div style="display: flex; justify-content: space-around;"> <div style="width: 45%;"></div> <div style="width: 45%;"></div> </div>	<div style="display: flex; justify-content: space-around;"> <div style="width: 45%;"></div> <div style="width: 45%;"></div> </div>	External
Institution			Institution
College			College
Department/Program			Department/Program
Individual			Individual
Notes			



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