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Making Academic Change Happen-Any Way We Can?

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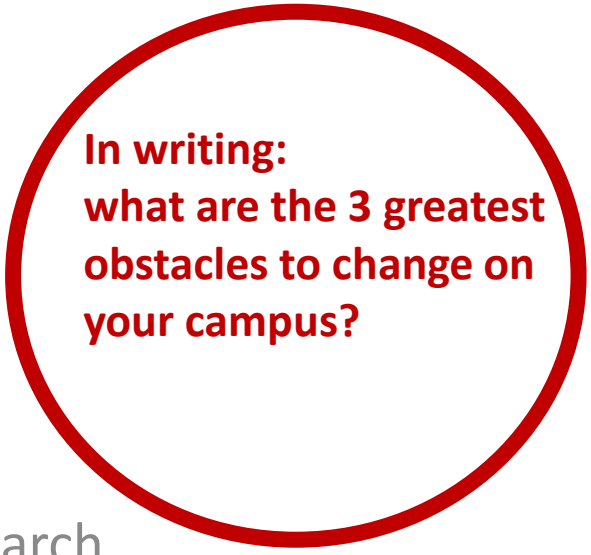
Making Academic Change Happen—Any Way We Can?



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Rose-Hulman Institute of Technology

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Dun Aonghasa (Aengus), Aran Islands, Ireland

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What will future generations excavate from our academic settings?
What sense will they make of what they find?

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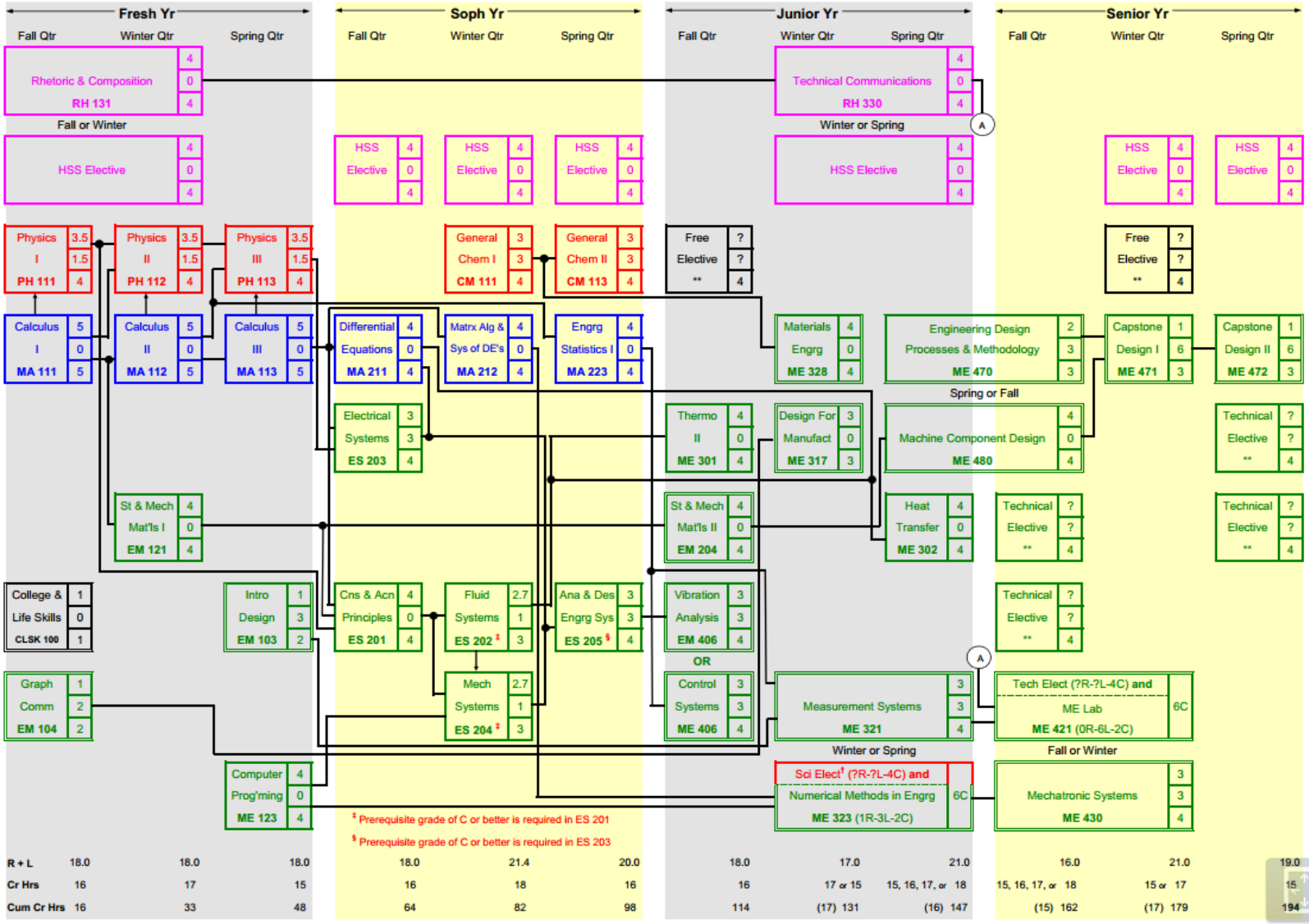
Mechanical Engineering Curriculum Flowchart

Student: _____

Keys: Prerequisite — — Co-requisite † ME/EM courses offered this quarter only ☐

R = R Recitation Hrs. / Wk.
L = L Laboratory Hrs. / Wk.
C = C Credit Hour Course



	Fresh Yr			Soph Yr			Junior Yr			Senior Yr		
R + L	18.0	18.0	18.0	18.0	21.4	20.0	18.0	17.0	21.0	16.0	21.0	19.0
Cr Hrs	16	17	15	16	18	16	16	17 or 15	15, 16, 17, or 18	15, 16, 17, or 18	15 or 17	15
Cum Cr Hrs	16	33	48	64	82	98	114	(17) 131	(16) 147	(15) 162	(17) 179	194

** 28 credits in electives composed of 20 credits in technical electives and 8 credits in free electives. A technical elective is any course (at the 200 level or above) in chemistry, computer science, engineering, engineering management, geology, life science, mathematics, or physics that is not cross-listed with HSS or similar in content to a required course. † A science elective is any course in biology, chemistry, geology or physics except those courses that are cross-referenced with an engineering course.

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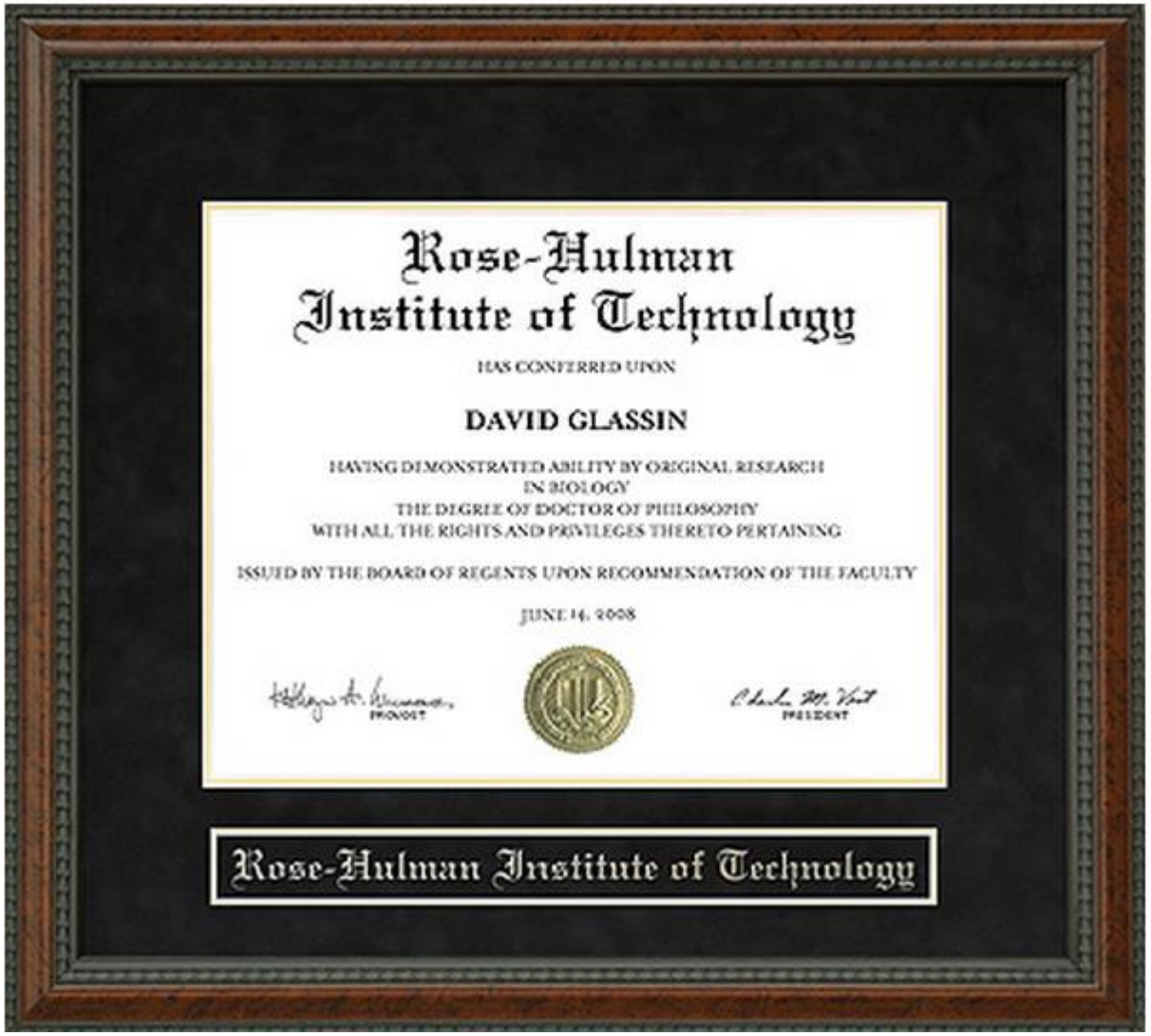

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GENERAL CRITERION 3. STUDENT OUTCOMES

The program must have documented student outcomes that prepare graduates to attain the program educational objectives.

Student outcomes are outcomes (a) through (k) plus any additional outcomes that may be articulated by the program.

(a) an ability to apply knowledge of mathematics, science, and engineering

(b) an ability to design and conduct experiments, as well as to analyze and interpret data

(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

(d) an ability to function on multidisciplinary teams

(e) an ability to identify, formulate, and solve engineering problems

(f) an understanding of professional and ethical responsibility

(g) an ability to communicate effectively

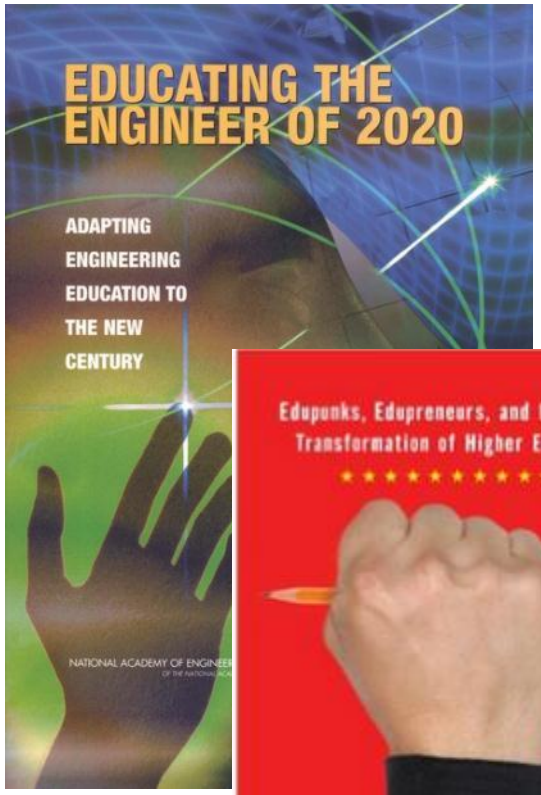
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

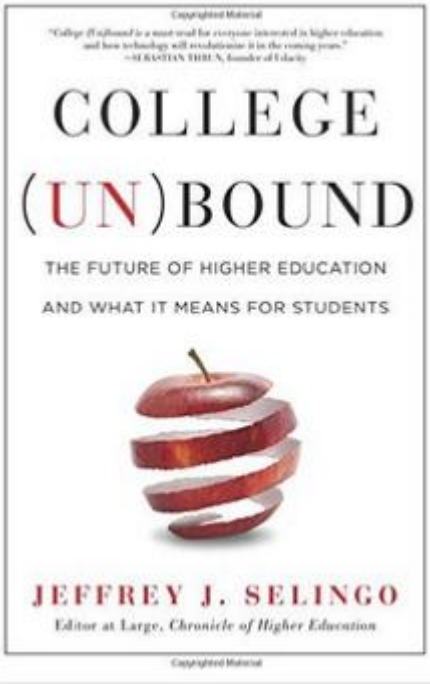
(i) a recognition of the need for, and an ability to engage in life-long learning

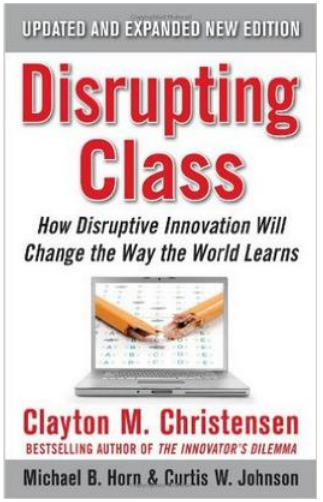
(j) a knowledge of contemporary issues

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Higher education today is defined largely by calls for change.







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Rose-Hulman Institute of Technology has been recognized as a leader in innovation in engineering education.

Diffusion of Engineering Education Innovations: A Survey of Awareness and Adoption Rates in U.S. Engineering Departments

MAURA BORREGO, JEFFREY E. FROYD[a], AND T. SIMIN HALL
Texas A&M University[a], Virginia Tech

BACKGROUND
Despite decades of effort focused on improvement of engineering education, many recent advances have not resulted in systemic change. Diffusion of innovations theory is used to better understand this phenomenon.

PURPOSE (HYPOTHESIS)
Research questions include: How widespread is awareness and adoption of established engineering education innovations? Are there differences by discipline or institutional type? How do engineering department chairs find out about engineering education innovations? What factors do engineering department chairs cite as important in adoption decisions?

DESIGN/METHOD
U.S. engineering department chairs were surveyed regarding their awareness and department use of seven engineering education innovations. One hundred ninety-seven usable responses are presented primarily as categorical data with Chi square tests where relevant.

RESULTS
Overall, the awareness rate was 82 percent, while the adoption rate was 47 percent. Eighty-two percent of engineering departments employ student-active pedagogies (the highest). Mechanical and civil engineering had the highest rates, in part due to many design-related innovations in the survey. Few differences by institution type were evident. In the past, word of mouth and presentations were far more effective than publications in alerting department chairs to the innovations. Department chairs cited financial resources, faculty time and attitudes, and student satisfaction and learning as major considerations in adoption decisions.

CONCLUSIONS
The importance of disciplinary networks was evident during survey administration and in the results. Specific recommendations are offered to employ these networks and the engineering professional societies for future engineering education improvement efforts.

KEYWORDS
change, diffusion of innovations, faculty development

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Table 12. Number of times the following colleges and universities were cited by department chairs for innovative engineering education practices. A few department chairs provided vague comments such as: "Top undergraduate universities, with or without doctoral program."

Institutions	Mechanical	Civil	Chemical	Computer Science	Electrical	Others	Total	Overall U.S. News Rankings	Disciplinary U.S. News Rankings (selected)
Rose-Hulman Institute of Technology	7	5	3	1	7	4	27	1[1] (tie)	
Purdue University	6	1	4	1	1	7	20	9[2]	8[4]
Massachusetts Institute of Technology	4	0	1	3	4	2	14	1[2]	
Carnegie Mellon University	2	2	1	5	2	0	12	7[2]	4[3]
Georgia Institute of Technology	2	1	2	4	1	1	11	5[2]	9[3]
Franklin W. Olin College of Engineering	3	0	1	1	1	4	10	8[1] (tie)	
Stanford University	3	1	1	1	1	1	8	2[2] (tie)	2[4]
Harvey Mudd College	3	1	1	0	0	3	8	1[1] (tie)	
North Carolina State University	1	1	3	0	0	2	7	26[2]	
University of Washington	1	2	1	2	0	1	7	23[2]	6[3]
Michigan State University	2	0	2	0	0	3	7	45[2]	
Rowan University	0	0	6	0	0	1	7	15[1]	

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Change efforts have been focused primarily on curricular improvement, rather than developing a shared vision.

		Intended Outcome	
		Prescribed	Emergent
Change Focus	Individual	**Disseminating Curriculum & Pedagogy** Tell individuals about new teaching strategies or practices and encourage adoption (30.4% of research)	**Developing Reflective Teachers** Support individuals in development of new teaching strategies and practices (33.5% of research)
	Environment	**Enacting Policy** Enact new system or approach that requires or encourages new strategies or practices (27.7% of research)	**Developing Shared Vision** Empower stakeholders to together form new systems that encourage strategies (8.4% of research)

Henderson, et al., "Facilitating Change in Undergraduate STEM Instructional Practices: An Analytic Review of the Literature," *Journal of Research in Science Teaching* (2011).

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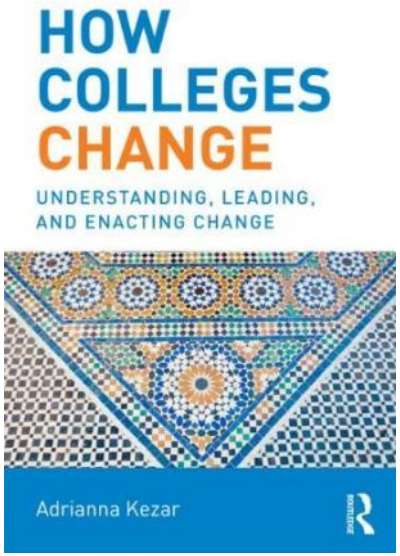
Successful change requires new competencies and new models, many of them drawn from fields that are not located within our disciplinary expertise.



Approach to change

- Scientific management
- Evolutionary
- Political
- Social cognition
- Cultural
- Institutional

(Kezar 2014)

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Making Academic Change Happen Workshop

Rose-Hulman Campus
June 8-10, 2016
www.rose-hulman.edu/mach

NSF support for Emerging Educators

Awards

National Science Foundation 2014 grant recipient.

KEEN
KERN ENTREPRENEURIAL ENGINEERING NETWORK

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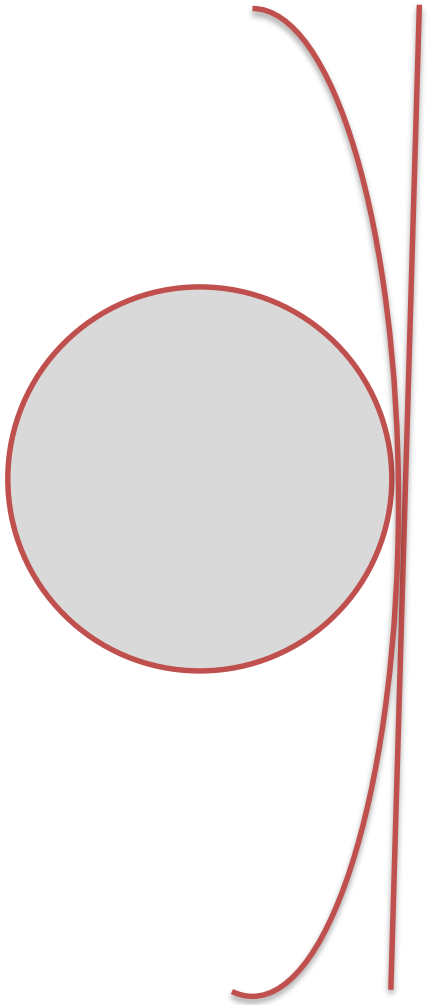
Successful change requires faculty and administrators to develop and practice new competencies.



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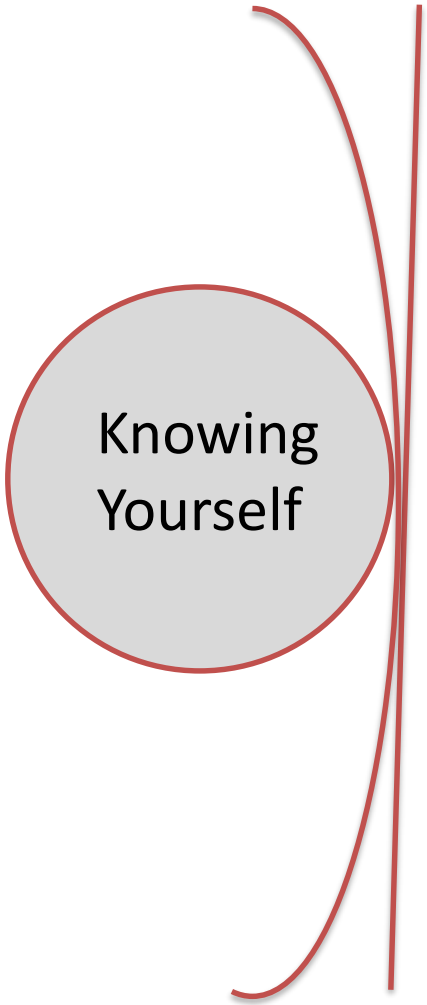

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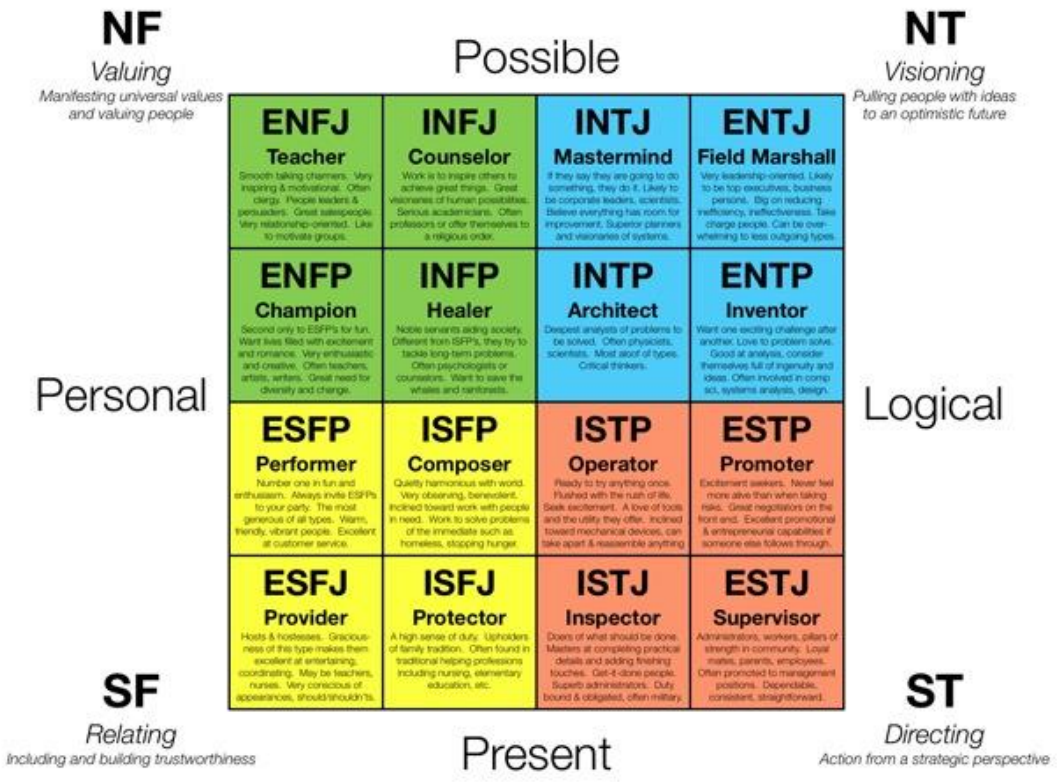
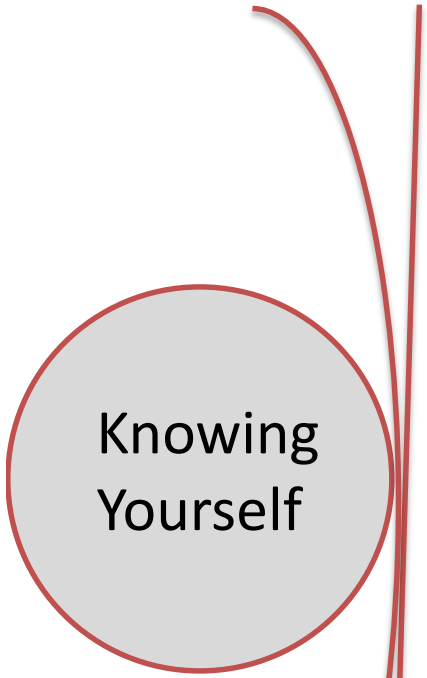
Participants defined their own goals and perceptions through Keirsey Temperaments.





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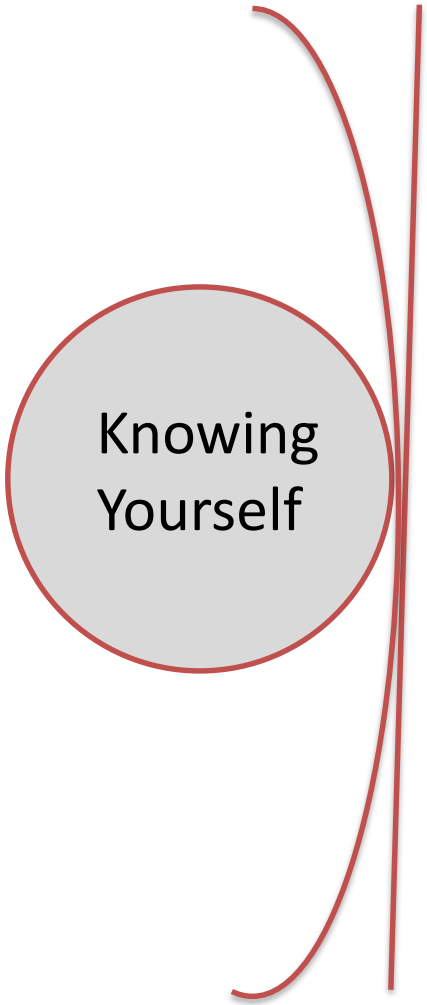

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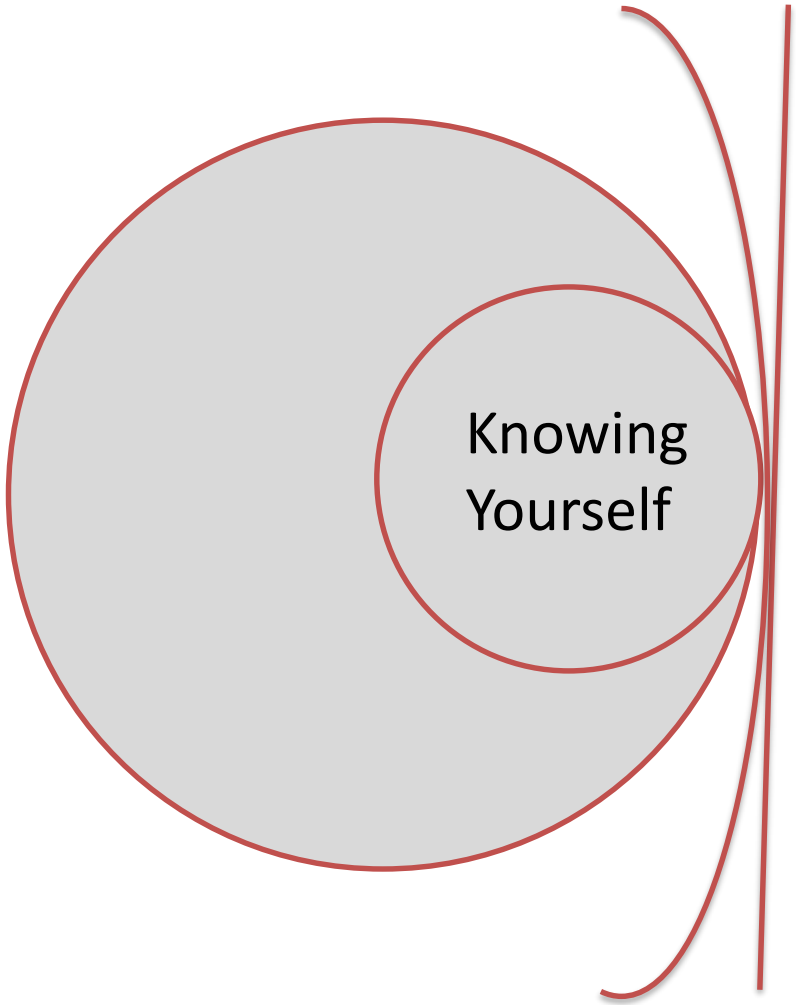

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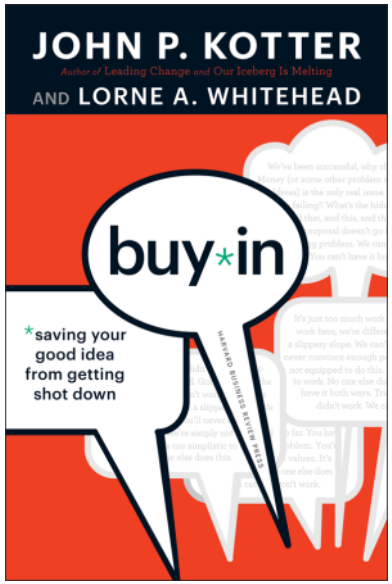
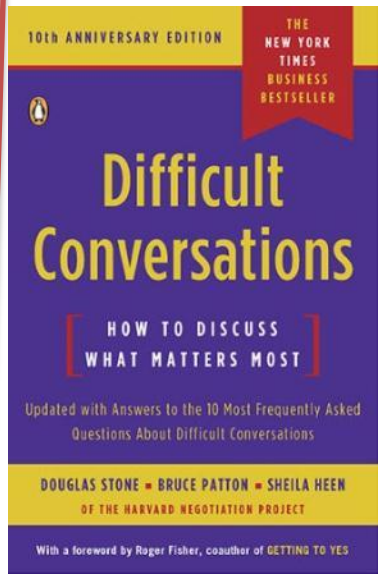
Change agents need to practice social interactions and work with a wider group of change leaders.





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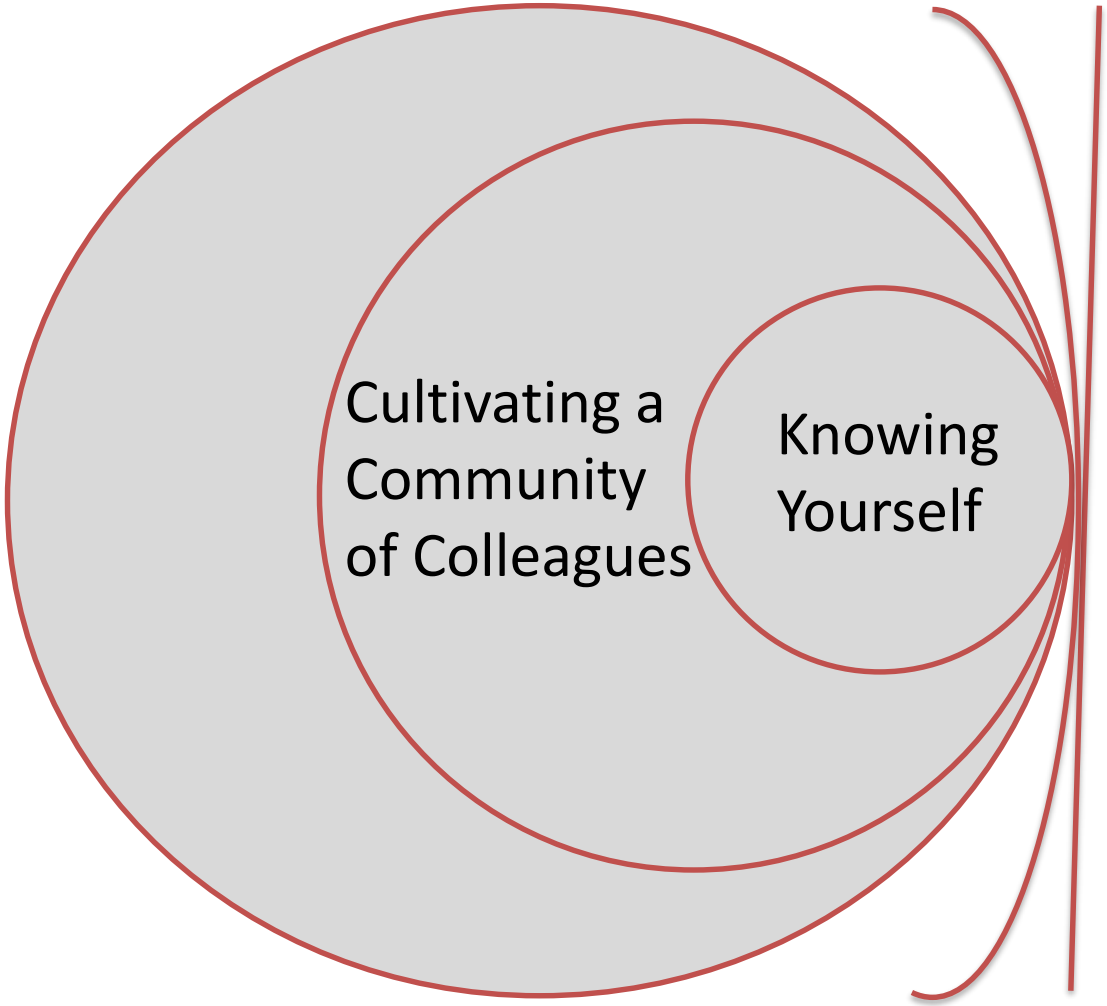

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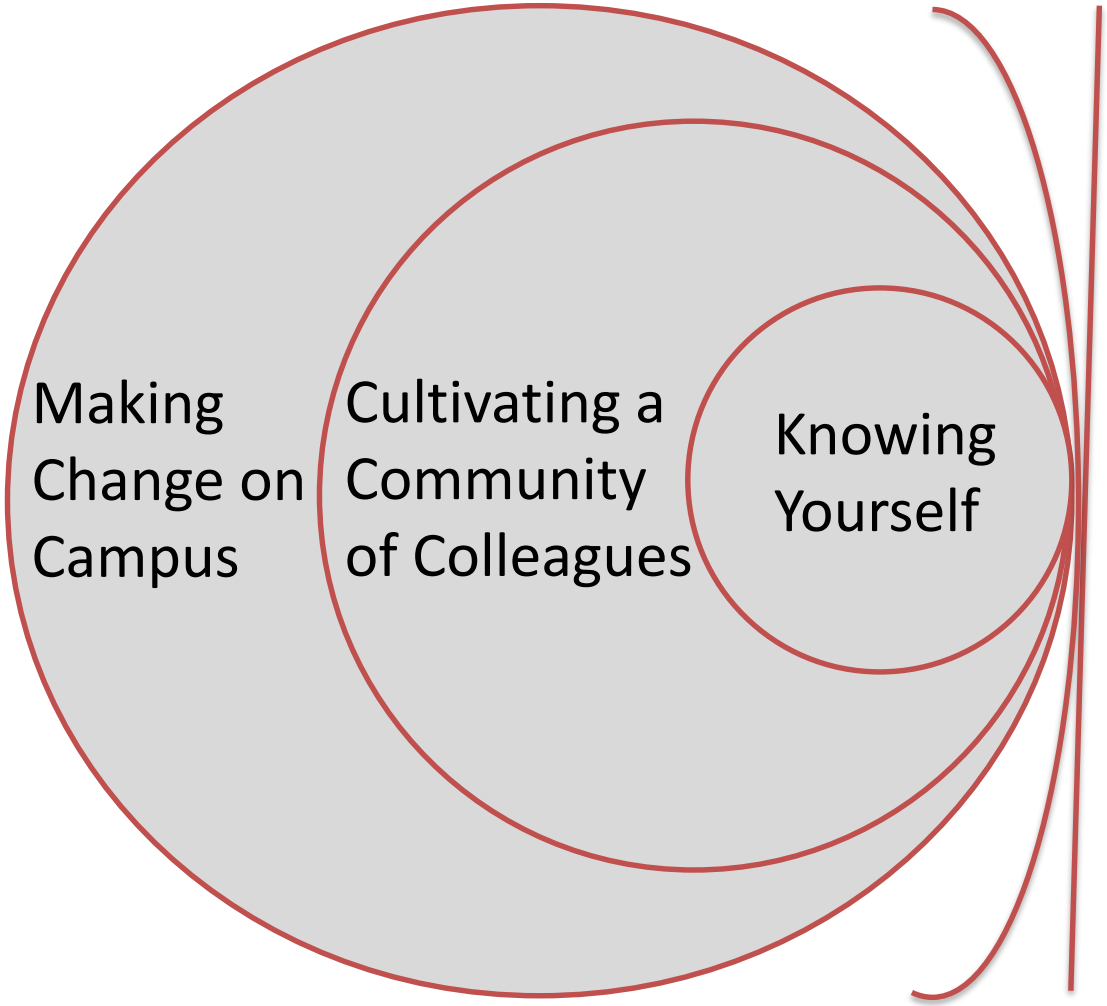

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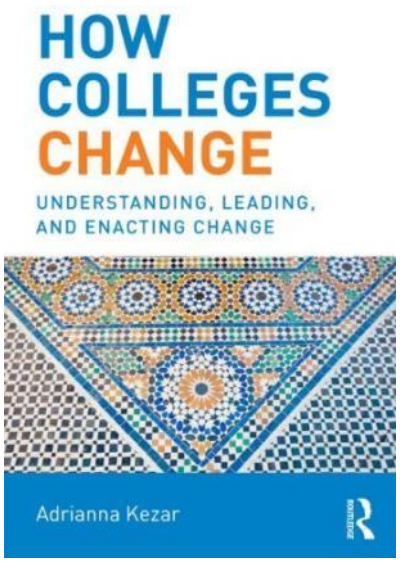
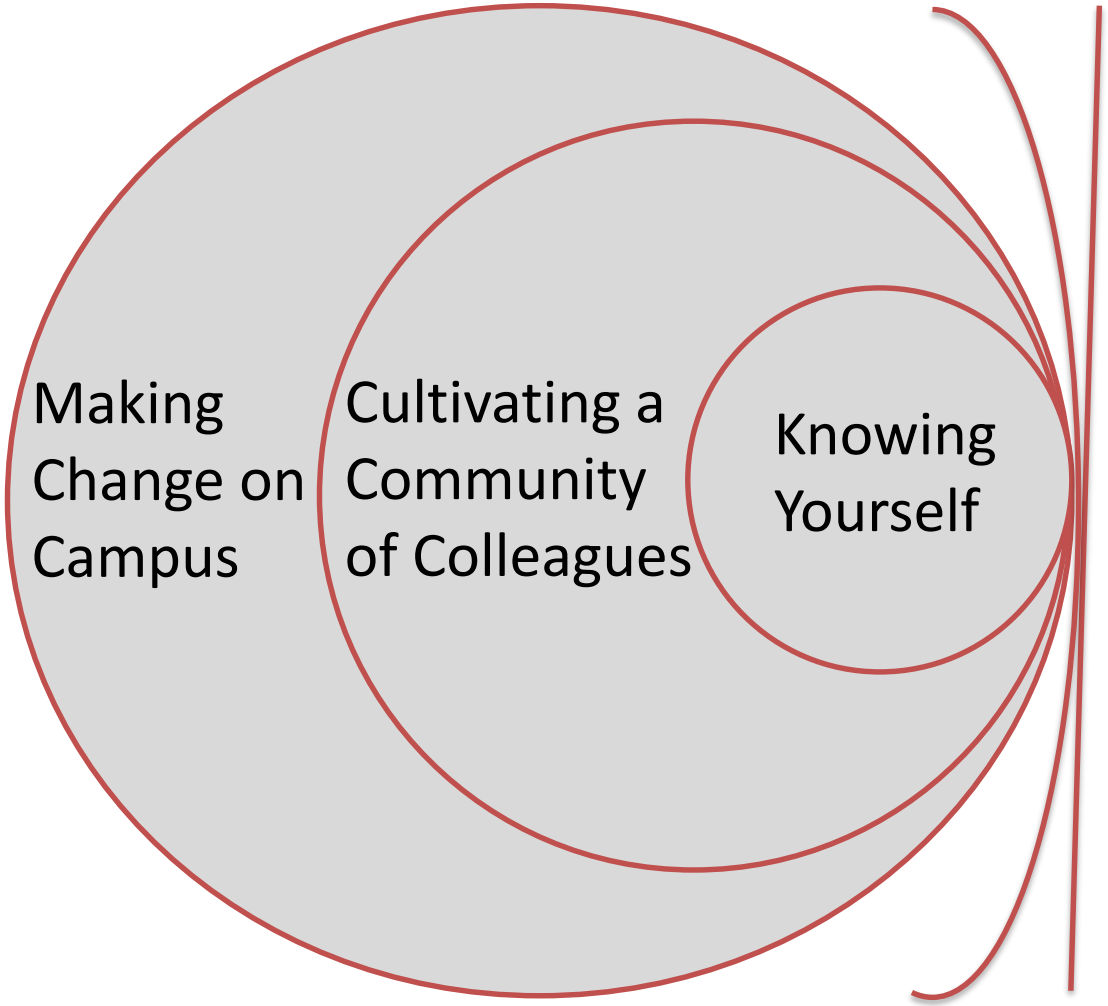
Change agents need to understand their own contexts and use specific change models effectively.





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Change leaders can acquire the long-range view.

Try out ideas on a friendly audience.
Reflect on ways to overcome objections.

Develop a support group of change leaders.

Do it to know it: practice and feedback develop mastery.

Find partners whose interests you can serve.

Make time for focused work and develop an action plan.

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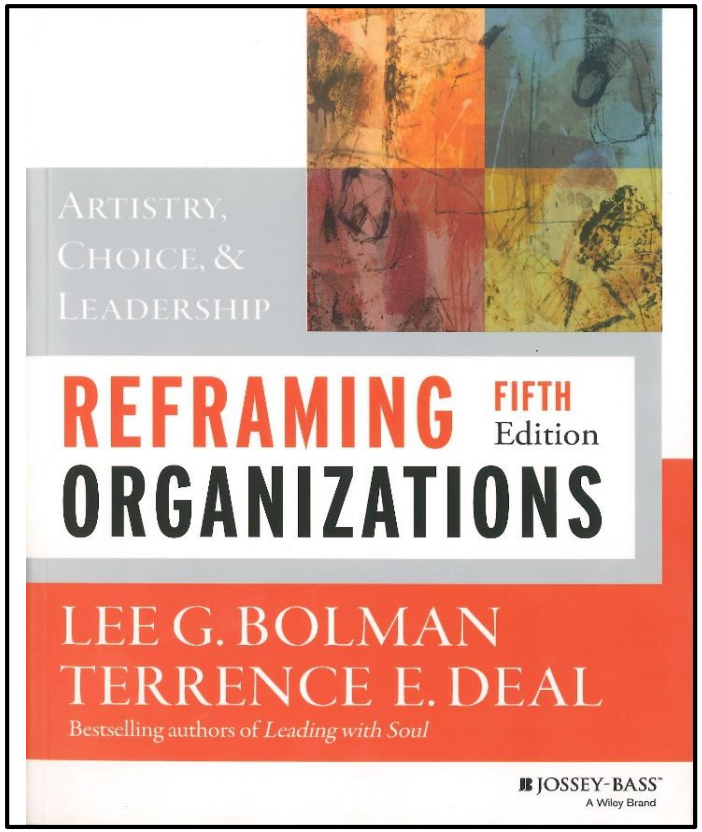
Successful change requires new competencies and new models, many of them drawn from fields that are not located within our disciplinary expertise.



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Structural

Rules, Goals,
Policies, Technology

Human Resources

Training, Programs,
Relationships

Political

Competition, Negotiation,
Agreements

Symbolic

Ceremonies, Rituals,
Stories, Heroes, Metaphors

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A change agent needs to be able to examine their own culture, as well as its underlying values and assumptions.

https://www.flickr.com/photos/29327036@N03/8456217312/ Adapted per CC license

Case Study—Rose-Hulman's effort to assess student learning outcomes is illustrative of the impact of culture on the change process.

Teamwork is essential in engineering disciplines, but assessing students' teamwork skills requires careful consideration…

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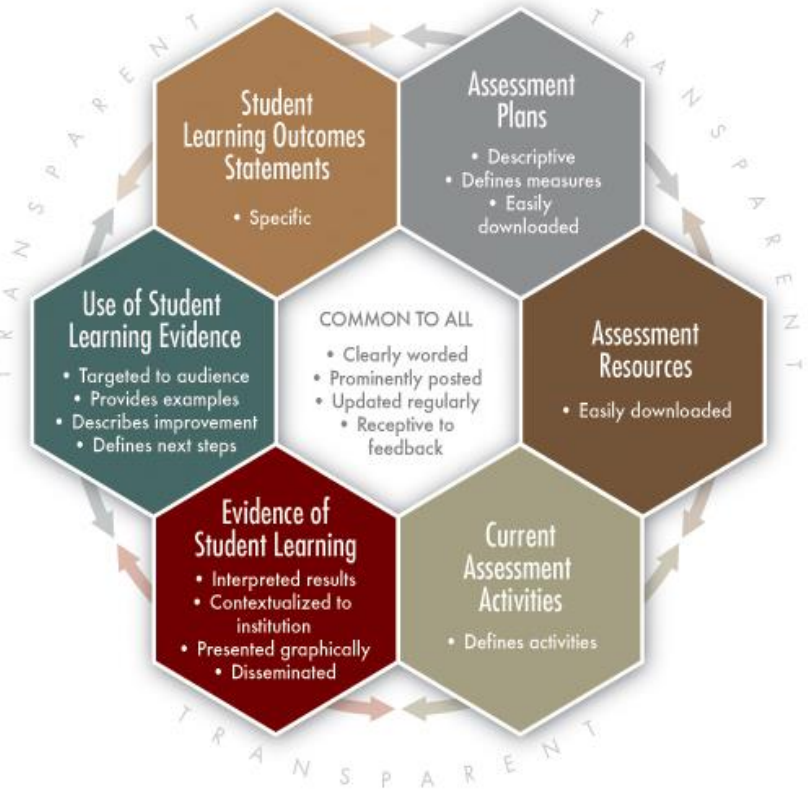
National Institute on Learning Outcomes Assessment (NILOA)

Components of Student Learning Assessment

Structural



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Rose-Hulman Institute Outcomes Assessment Process

IRPA Office

Reports

Academic Departments

Curriculum Map

Artifacts

RosEvaluation Process

Results

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While the structural frame provides the necessary operational requirements for assessment, it is not sufficient without the symbolic, political, and human resources considerations.

Symbolic Teamwork assessment must align with our mission

Human Resources Faculty and staff need help to understand how to assess teamwork effectively

Political Negotiations between departments establish partnerships to achieve the common goal

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RH 2. TEAMWORK REQUIRES COOPERATIVE EFFORT TOWARD A COMMON GOAL WHEREIN EACH INDIVIDUAL CONTRIBUTES IN A PARTICULAR ROLE WHILE SUBORDINATING PERSONAL INTERESTS.

Criterion B1. Demonstrate how you reached a decision as a team.

Primary Traits: A passing submission for this criterion must:

1. Describe the team goal/problem.
2. Provide a description of a specific team decision and describe the process of making that decision.

Potential documents: Documents appropriate for this criterion include (but are not limited to):
Memo or reflective statement on team process from a lab group, design team, service project, etc.

Additional information:

1. The team goal or problem must be related to a technical project. The goal or problem can be either a major goal of a design project [e.g., we need to design a device to assist our client with performing personal tasks] or the goal of a lab project [e.g., we tested the viscosity of the sample].
2. A document should be rated as "exemplary" if students are able to describe how multiple team members contributed to the outcome, how team members' ideas were critically evaluated, or how the ultimate outcome was consistent with the team's decision-making process.

Teamwork Observation Protocol (Video)

Purpose: This rubric is designed to be used to assess basic teaming skills (process not product).
Instructions: While watching the team meeting or video, circle or highlight the level that best describes the observed performance of that attribute. Your assessment might not contain all attributes. To aid in the decision, refer to the task indicator list that is provided with this rubric.

Performance Criteria	Attribute	Novice Teams	Apprentice Teams	Master Teams	Notes/Examples
Team members (TM) participate as needed for the tasks at hand.	Participation	One or few TM contribute to the discussion or problem analysis	Most but not all TM contribute to the discussion or problem analysis	All TM contribute to the discussion or problem analysis	
Team meetings have targeted function(s).	Task Identification	The specific task(s) at hand is not defined (e.g. content, scope, or need) at any point in the meeting.	Task definition is informally developed or described and emerge throughout the meeting.	Tasks of the meeting are specifically developed or stated at the outset of the meeting.	
Next steps and further communication are specified.	Follow-up	The meeting ceases before or without identification of monitoring activities.	TM set loose goal(s) or plan to open communication at a later point.	TM specify progress expected and communication strategy in advance of next meeting.	
Decisions taken at meetings represent team decisions.	Collective Decision Making	Decisions result from the thinking of individual TM; processes for decision making are undefined.	Decisions result from contributions of some (not all) TM; procedures are informal and inconsistently applied.	Decisions emerge as a result of TM's interaction; procedures for making decisions are established and documented.	
TM demonstrate positive support and respect.	Support	TM act individualistically; TM advance own agendas; TM use derogatory language.	TM acknowledge contributions; TM occasionally use dismissive language; TM focus on own ideas.	TM affirm contributions; TM seek input from each other; TM use respectful language.	
TM exhibit ability to work with changing parameters.	Adaptability	Team completes pre-determined course of action; no to little discussion of new conditions or consequences.	Team acknowledges new conditions; TM work to fit existing material or tasks into scenario.	Team adjusts strategy given new information or conditions; tasks are reallocated or revised.	
TM specify responsibilities of every individual and TM act in accordance with their assigned role.	Role Assignment/ Fulfillment	Roles are undefined; most TM have no observed role.	Roles are defined by the group and assigned to all members.	Roles are defined informally or emerge during the meeting; TM roles are fluid and are adjusted as needed.	
TM work to establish appropriate goals for team products.	Goal Development	TM accept imposed goals with little discussion; goals are not specified.	One or few TM suggest goals; acceptance requires little discussion; goals are accepted as proposed.	All TM suggest goals or modifications of goals; multiple rounds of goal-making occur.	
TM practice resolution skills in conflict situations.	Conflict Management	Conflict is ignored; TM use blame-giving or derogatory language; TM are openly critical of individual TM contributions.	Conflict is acknowledged; TM explore more than one perspective; TM use neutral language.	Conflict is directly addressed; TM explore positions from multiple angles; TM address ideas not TM.	

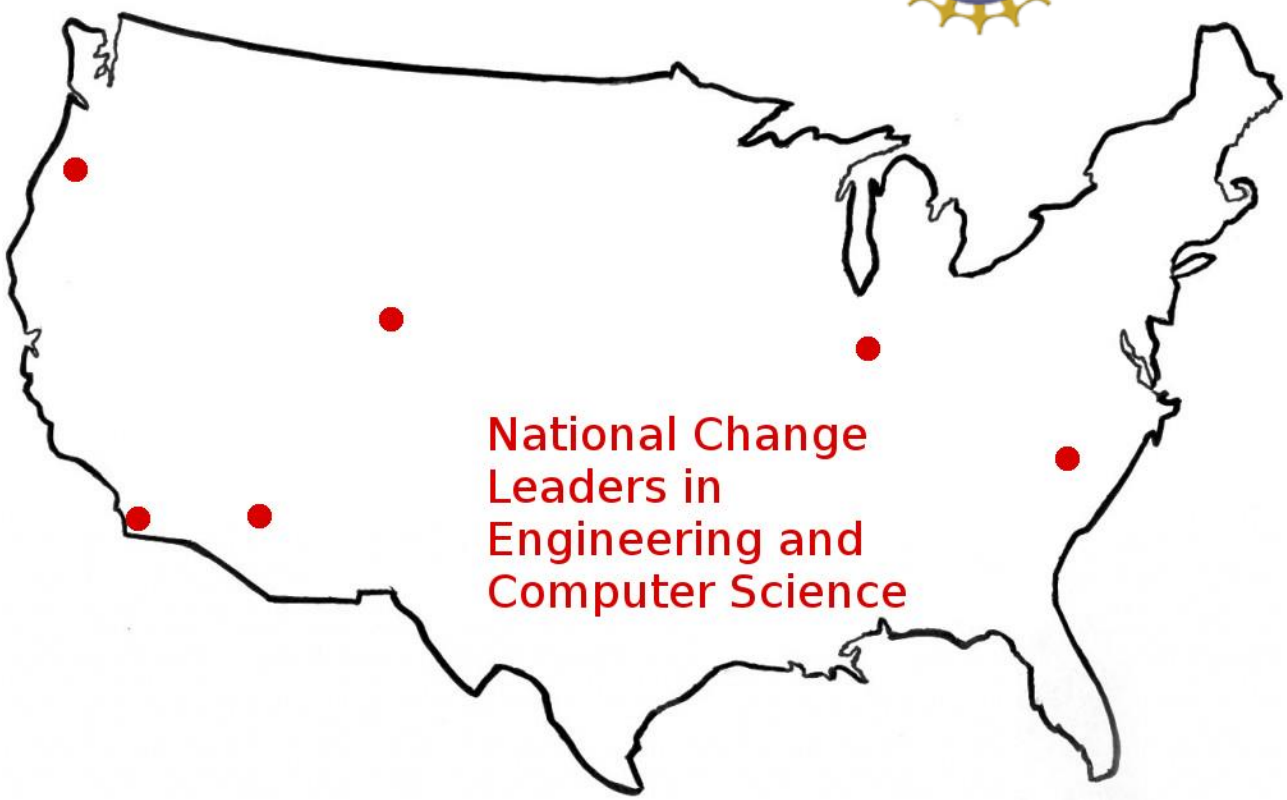
- ▫ All TM are present for the meeting.
- ▫ A team leader is present (or distributed leadership).
- ▫ All TM present contribute at least once/twice/three times.
- ▫ All TM present are on task during the meeting.

What did we learn about students' teamwork skills as a result of the assessment effort?

The MACH EAGER project will support and unify the change success of RED projects.

Leadership Support

Comparative Discussion
Skills Development
Visioning Guidance
External Perspectives



Cohort Unity

Common Experience
Facilitating Connections
Shared Language

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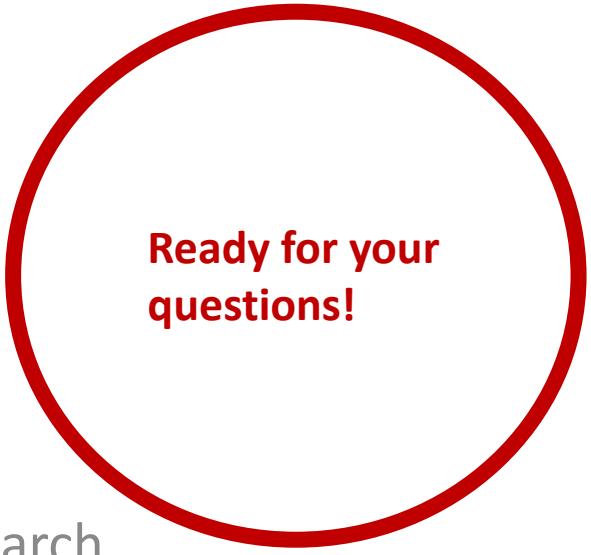

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