Curricular and Organizational Change in Engineering Education

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Introduction

After observing curricular change processes on seven different campuses in the first five years (1993-98) of the Foundation Coalition (FC), the management team concluded that the process of curricular change was so important and so inadequately delineated that it merited elevation in status to become one of the key ideas that should guide further curriculum research and development in the second five years (1998-2003). To learn more about curricular change, a qualitative study was initiated in 2001. It included over 150 interviews with faculty members and administrators at the FC partner institutions and has produced several papers [1-3]. Lessons from the study echo other research and are summarized in the six core change concepts listed below. In addition, the study suggests that greater understanding of the research and practice on organizational change is needed across the engineering education community, especially in moving from pilot curricula through institutionalization and finally to sustaining innovation. Synthesis of the literature on curricular and organizational change has identified several core concepts that will be examined briefly in this introduction.

- Change Theories
- Leadership
- Energy and Vision
- Culture and Cultural Change
- Resistance
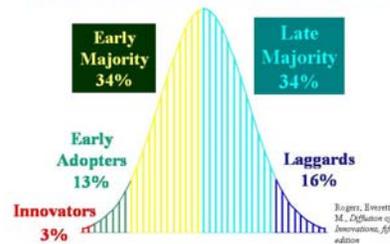- Faculty Development

Change Theories

In a 1998 article, Seymour reminds us of the importance of theories of how change occurs, "Theories reflect the ways in which people engaged in any sphere of activity define that situation and decide what needs to be done ... in reform efforts, the theory or theories that underwrite the chosen forms of actions often remain unstated" [4]. She describes several theories of change: change through shifts in what we value, grass-roots change, change through networks, change through dissemination, change through value-driven institutional leadership, the blueprint model, alignment model, department-focused change, and change leveraged by external agencies. Both individual and organizational changes appear to occur in stages [5-7]. Strategies to promote change should include actions to facilitate each stage-to-stage transition [8]. Systemic reform in engineering education may require clearer pictures of the stages involved and better understanding of tactics that facilitate transitions between stages.

Clearer understanding of change theories aids in reducing "change without difference" [9]. Status quo outcomes at implementation in spite of extensive planning for change often the result of "first-order change" philosophy or activities that assume the status quo is basically sound but can be improved. "Second-order change" assumes that fundamental transformation is needed in the organization – in terms of goals, practices, structures, and roles. [10].

Application: What are your theories about how an instructor or team of instructors might initiate and sustain change in a course or curriculum? What do your theories assume about students or faculty members as decision makers?

In his classic text on diffusion Everett Rogers [11] identified five groups that play roles in any diffusion process (see diagram at the right.) The Gaussian distribution curve of adopters leads to an S-shaped curve for adoption over time. The review of diffusion processes by Strang and Soule [12] suggests appropriate models of diffusion require more research from a variety of perspectives.

Type and Distribution of Adopters. Innovators 3%, Early Adopters 13%, Early Majority 34%, Late Majority 34%, Laggards 16%. Rogers, Everett M., Diffusion of Innovations, fifth edition.

Culture and Cultural Change

Relationships between change and culture are illustrated by the following quote.

"Culture eats change for breakfast" [13].

Although culture is frequently mentioned as a source of resistance and cultural change is frequently called for in systemic reform of engineering education, clarity about both is frequently missing. Synthesizing definitions from Schein [14] and Petersen and Spencer [15], the following definition of an institutional culture might provide a starting point.

> Organizational culture is the pattern of basic assumptions held and shared by people in an organization that reflect the values, beliefs, feelings or ideologies about their organization and their work. These assumptions form the "glue" that binds an institution together, and contributes a sense of meaning and identity to its members.

Changing a culture is described by Seel [16] as changing almost every conversation, formal or informal. Eckel and Kezar [17] indicate that transformation requires getting people to think differently. Both ideas suggest the magnitude of effort required to change a culture.

Application: Understanding the culture before actively promoting change is essential to successful change. Tierney [18] provides a conceptual framework with six dimensions: environment, mission, strategy, information, socialization and leadership, to help organize inquiry into the culture of an institution. Also, the institution and its culture are not static entities, but will change concurrently change is being initiated and, possibly, sustained.

Leadership

Leadership plays a critical role in curricular change. Leadership is one of the five core strategies identified by Eckel and Kezar [17]: (1) senior administrative support, (2) collaborative leadership, (3) flexible vision, (4) staff development, and (5) visible action. However, as Heifetz and Laurie remind us "Leadership takes place every day. It cannot be the responsibility of the few, a rare event, or an once-in-a-lifetime opportunity" [19]. Nor should leadership solely be identified with positions at the top. Meyerson [20] shows how people in the middle of an organization stimulated organizational change. Faculty members,

who understand of goals and processes for curricular change, can move curricula and engineering education forward.

Application: Meyerson [20] provides strategies and numerous examples for provoking organizational change through small wins. Similar strategies might encourage broader curricular change.

Resistance

Since resistance is inevitable, its occurrence should not surprise change agents. Attempts to steamroll or overpower resistance almost always provide more energy to sources of resistance with the result that resistance is strengthened instead of being eliminated. Instead, resistance should be anticipated and addressed. In an innovative approach, Maurer [21] explores change almost entirely through the lens of resistance and suggests novel ways in which resistance may be understood, addressed, and engaged. Senge et al [22] identify ten processes that tend to limit change: (1) no time, (2) no help, (3) irrelevance, (4) lack of demonstrable managerial support, (5) fear and anxiety, (6) negative assessment, (7) isolation of innovators, (8) lack of change in administrative structures, (9) lack of diffusion, and (10) lack of strategic engagement and ways to reduce resistance through each process. If change agents understand more about the sources and mechanisms of resistance, they can anticipate and prepare accordingly.

Application: Cooper et al [23] identify sources of student resistance to change to cooperative learning and offer approaches to address potential and actual resistance.

Energy and Vision

Change requires energy. Energy is generated from the tension between the vision of what could be and what currently exists. In their work on learning organizations Senge et al identified the disciplines of *personal mastery* (direction and rate for individual change) and *shared vision* as necessary components of learning organizations [22,24]. Similarly, Eckel and Kezar [17], in their study of transformation at six educational institutions, identified *flexible vision* (articulating direction and rate initially, but allowing others to modify) as a core strategy for change.

Application: When trying something different in your course, help students to understand what you plan to do and why you're changing to encourage them to align their visions for the course with yours.

Faculty Development and Systemic Change

Systemic reform implies change across the system, and faculty members are the most important component of the system of higher education. Therefore, systemic reform implies faculty change. Woodbury and Gess-Newsome have examined the paradox of change without a difference and suggest that "Reform initiatives ... must focus on encouraging and supporting change in teachers' work as the center of reform efforts" [10]. If changing faculty thinking about education is the core of reform efforts, then clearer understanding of current thinking about learning, teaching, and assessment and processes that promote changes in faculty thinking are required.

References for Further Information

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Whether you're just getting started or looking for some additional ideas, the Foundation Coalition would like to help you incorporate more information about curricular change into your innovation efforts through workshops, web sites, lesson plans, and reading materials. For suggestions on where to start, see our web site at

http://www.foundationcoalition.org or contact: Jeffrey Froyd at froyd@tamu.edu or 979-845-7574.