Learning to Make Change by Revolutionizing Departments: Initial Team Experiences

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Abstract

The launch of NSF's program "Revolutionizing Engineering and Computer Science Departments" (RED) provided an unparalleled opportunity to examine change in action from its inception. This program charges grantees to achieve "significant sustainable changes necessary to overcome longstanding issues in their undergraduate programs and educate inclusive communities of engineering and computer science students prepared to solve 21st-century challenges" with the goal of creating "coherent professional and technical threads... to ensure that students develop deep knowledge in their discipline more effectively and meaningfully" (NSF Solicitation). To date, thirteen teams have commenced their projects, which range in scale and scope from re-visioning curriculum units to coordinated change across aggregated departments to experimental co-curricular opportunities. The faculty teams enacting this change represent intentionally interdisciplinary groups, with disciplinary experts working with social scientists and engineering education researchers. Their work is supported by our project - RED Participatory Action Research - in that we coordinate activities across awardees and also create cross-institution analyses to develop larger lessons to share with the engineering education community. The work described here explores the initial conceptions of RED team members with respect to readiness to enact change, captured via focus group interviews and informal discussions conducted within six months of their award being granted.

We found that the teams reported significant negotiation at the onset of the project. First, teams reported the need to re-situate their collective understanding of the project itself, including how the project fit into the current vision of the operations of their institution, since almost nine months had passed following final submission. Second, teams negotiated communication strategies and key messaging to outside parties (e.g. the remainder of the department members). The roll-out of large scale projects like the ones funded in this program hinges on an effective communication approach; developing an effective approach required significant discussion among team members. Finally, teams experienced challenges relating to how they implemented their guiding theories of change (inclusion of which was mandated in the proposal process). For each point, we illustrate with narrative taken from team discussions and connect these points to larger issues of faculty development as change agents and team members. Given the repeated calls for increasing the rate and scale of change in engineering education, this paper contributes actionable recommendations for change agents and team coordinators.

Introduction

Engineering education struggles to change at a needed pace or scale. Research findings in human resources, cognitive science, and education have not translated into widely improved practice as applied to academic organizations, curricula, and day-to-day educational experiences. Further, engineering education continues to be challenged by low demographic diversity, low persistence, and low enjoyment (Pretz, 2016). The consequences of this pattern are the missed opportunities of maximized outcomes for both personal and workforce development. Despite this negative

reality, calls for change hint at solutions and approaches that could begin to remedy this situation. For example, while president, Barak Obama called for the U.S. to lead the way in solving the Grand Challenges of Engineering, and 122 institutions committed to graduate annually 20 students equipped to tackle this level and scale of problem. The National Academy of Engineering's Engineer of 2020 report (2004) showcased the need for societally-conscious and business-competent engineers. 2020 is nearly here, and while these aspects are rare to minor components of typical curricula, more institutions are recognizing the importance of these skills for alumni success and including relevant activities within or beside curricula (e.g. Kern Entrepreneurial Education Network, Engineers Without Borders). While exciting incremental progress is occurring, much work remains to fulfill a global society's need for engineering expertise and engineering-competent citizens.

As an answer to these challenges, the National Science Foundation's Revolutionizing engineering and computer science departments (RED) program seeks to advance the rate, scale, and dissemination of change within engineering education. Focusing intentionally on the middle two years, the program seeks to promote students' technical and professional competency while creating inclusive communities focused on learning (National Science Foundation, 2016). The grants from this program span five years. As of early 2017, thirteen engineering departments or schools have been awarded grants under this program; their projects focus simultaneously on the student academic experience and on creating the organizational structures needed to support innovative models of education. The faculty teams enacting this change represent intentionally interdisciplinary groups, with disciplinary experts working with social scientists to manage and study the change approach and engineering education researchers to provide evaluation and assessment of the outcomes relative to student experiences and learning.

Our project, RED Participatory Action Research (REDPAR), exists alongside the RED grantee departments, in that we provide support for skill development, coordinate consortium activities, and are examining the collective experiences of participants. Much like the social scientists are researching change within the departments for RED programs, our group is researching change across institutions. This cross-team work provides the opportunity for high-level comparison and analysis that would otherwise be lost. The fundamental question of interest is "How can an academic department successfully change?" To explore this question, we asked smaller questions: 1) What lessons can be extracted from their experience to increase the success of change at other institutions? and 2) What features of the change experience are most notable?. The work we report here explores the initial experiences of RED teams as they prepared and began implementation of their change projects.

Research Approach

The work described here explores the initial conceptions of RED team members with respect to readiness to enact change, their perspectives on the team development process, and other topics relating to large scale projects. These conceptions were captured via focus groups and informal discussions conducted within six months of their award being granted; RED teams opted-in to the focus group at their discretion. One member of the REDPAR team facilitated each focus group discussion, while a second member took notes and transcribed. This study was granted

exempt status from the University of Washington Human Subjects Division; verbal consent was acquired from all focus group participants.

After reviewing the focus group transcripts, we developed a coding scheme based on the Kezar and Eckel (2002) results that implicate sensemaking as an essential feature of organizational change. This scheme helped identify themes related to the initial stages of the RED projects, then we selected quotes to illustrate these themes. When quotes identified a specific project or person, we made very slight modifications to the wording to protect confidentiality (e.g., replacing "his" with [project director's]). The intent of each quote remains consistent with the original.

Team and Project Negotiation

Given that the teams had submitted large scale proposals (~$2M each for 5 years), we anticipated significant alignment among team members regarding project goals and approaches. However, team members from most institutions reported that re-establishing the conceptual basis and the planned operations of the project was an important step in the development of their team dynamics. The significant time lag between submitting the proposal and securing funding (almost nine months) was proffered as a major causative factor in the need to re-align project goals and approaches. One team reflected:

> Our proposal was based on what we thought the future might look like. When we would write a sentence, we put four things in that sentence, and the sentence makes it look like they're all equal, but they aren't. And in different areas, some topics have more weight than others. So we have to be a little more flexible [now that the project is funded].

The significant negotiation that teams accomplished at the onset of the project centered on re-situating their collective understandings of the projects themselves and exploring how the projects fit into the current visions of the operations of their institutions.

Teams also needed to quickly structure project management, which often times involved hiring project coordinators and therefore re-negotiating their budgets. At one school, within just a couple of months, this decision led to "a budget revision [submitted] to NSF, to devote more to a project manager type of role and a staff person." Another team's member reported that the project management role was important but conflicted with other professional expectations:

> Because of how we're spread out across the college, there wasn't any admin we could go to, so a lot of that fell on my shoulders. While some of that was to be expected, it has been detrimental to my own research and my career, which is what being a [researcher] is supposed to be about...I caution everyone from tying up a [researcher] with too much project management.

These large scale projects, with hundreds of moving parts, require significant project management. It is likely that all PIs/co-PIs have existing responsibilities; finding the expertise and skill to coordinate the project might require intentionally allocated resources.

As an extended example of re-negotiation, one team described how the success to date of their project has emerged, in part, from the alignment of the project goals with the strategic planning happening on campus and with campus-wide activities relating to their philosophical focus. A team member detailed:

The buzz is big, that's what I want to say. CoE [College of Engineering], in our strategic planning, for the first time they put in a goal around inclusion and diversity. The dean is putting in resources around seeing this come to fruition. Our dean was quoted last week in *Chronicle of Higher Education* on recruiting a more diverse faculty. The value is explicit, and then there are resources. They just created a new dean position around diverse hiring, changing [promotion and tenure] to be reflective of the strategic plan, and also professional development. RED has been invited to come and talk about pedagogies to increase inclusive spaces. So all this has been going on which makes our efforts a lot easier.

Finding natural points of connection with existing institution- or college-wide activities was a strategy adopted by several teams.

Embarking on a major change project, especially with distributed team members with widely varying areas of expertise, makes team formation and negotiation important aspects of the project development process. Major points of negotiation include roles and responsibilities, philosophical frameworks, workload expectations, and keeping track of day-to-day activities.

Strategic Communication

The general themes that emerged in this area focused on decisions about messages and branding, timing of communications, and strategic decisions about who communicates what content. The teams recognized that the roll-out of large scale projects like the ones funded in this program hinges on an effective communication approach. Further, how each approach operated relied on significant discussion within the team.

The choice of messaging language around the project became an important issue for one team. While their project proposal used a proprietary eponym well known within engineering and computer science departments (like "xerox" to mean making copies with any machine), the term is trademarked and therefore unusable. The rebranding effort allowed the team to establish a new identity, including developing imagery and a focus on the philosophical theme of the project. Other teams noted the difficulty of finding the right descriptors or metaphors for their work - short, evocative, descriptive, unambiguous, and memorable.

Timing of communications is another consideration. Timing became a major issue for one team. To allow authentic baseline data to be collected, the team didn't make large scale announcements upon receipt of the grant. This decision allowed the in-house commentary to take over the project's narrative. As a result, "grouchy people" and "people [not associated with the project directly] felt things were secretive, and also they felt like people [working on the project] weren't honoring what was already done." Consequently, this team no longer describes their project via the RED acronym, instead using language consistent with an institutional initiative. Another team remarked that the timing of communications should be short, repeated, and just-in-time: "It's a constant set of micro-conversations that you are having. We want people to come in for whatever amount of time they have energy...membership [with the project] is not permanent, so it's permeable. Those same people can also get out." Matching the timing of communications to

the project's goals while maintaining control of the narrative was a challenge recognized by these teams and others.

Who does the communicating was specifically addressed by three teams. In one case, the team explained that while administration's support is critical for large scale projects, "we're trying to take a more bottom-up approach with the change, using word-of-mouth and soft sell, and clueing the students into what is going on." In the second case, when the RED team realized that the baseline data collection could be quite sensitive, the team decided that the social scientist should be responsible for soliciting participation in the research: "[The social scientist] really personalized the invitation to the point where people felt that their opinion was really important." Finally, a third team, noting the challenges of communicating about multi-faceted projects, took the step of hiring "a communications specialist who is not an engineer but trained in communication and is part of our department and sees what we do but can communicate that to those outside the department." The intentional decisions regarding not only what is communicated but who is communicating has become an important part of the projects' operations.

The major implication of these findings, in the aggregate, centers on the need for communications to enhance projects and promote inclusion rather than exclusion. Further, uniformity of messaging, with specific people responsible, can be a component that promotes overall success.

Embracing Conflict and Tension to Promote Change

The program solicitation for these grants specifically identified the need for a change process, guided and assessed by both a social scientist and engineering education researcher. These requirements created teams and proposals quite different than past large scale efforts (e.g. typical curriculum reform efforts as would be funded under previous NSF programs). These projects intentionally set out to map theory to practice in an attempt to demonstrate how change might occur "on the ground." Their experiences have varied significantly in how they implemented their guiding theories of change.

In the beginnings of their projects, several teams observed productive tension between curricular change and cultural change. Most faculty, especially those likely to apply for this grant opportunity, would be familiar with the work-a-day updating and restructuring of curricula necessary for programs to remain relevant and forward-looking. However, these projects sought to do more: the idea of following a change process with the specific intent of impacting organizational culture was novel and generated situations with no clear path to follow. One team noted, "One additional challenge is making sure the project is about culture change, and conceptualizing that and not focusing on curricular change, which it seems like the rest of the team is focused on. How to work with that is a question we are working on." Similarly, a PI from another team stated:

> From my perspective, if you don't have tension, you are not doing the right thing. If you say let's re-examine the culture, the question creates immediate tension—what does it mean that we keep the technical content the same? It radiates out. The faculty involved

comes back and say "forcing change of the syllabi"—that tension is good and bad if you know how to handle it. The tension creates some dialogue.

These same themes were present in a slightly different way in a third team; one member said:

The biggest change is a challenging one, more than a curricular change, it is the culture. I think from the curriculum point of view there were numerous attempts in the past to do things different from the traditional way of teaching it. A lot of them failed not because it was not good enough or innovative enough, it's just because there is no culture in the department to support it. If we succeed in this, it will create a completely different culture in the department.

A member of a different team described the challenge of having different perspectives present in a discussion, emphasizing a focus on the outcomes:

Everyone teaches a course and they have their view of it, they think they are doing it right...Then you get in a room and say these are the five concepts for the course and you have some healthy discussion about what should be there. This does create friction, but it comes from the same good source that everyone is trying to do what is best for the students.

Overall, the team dialogues expressed an underlying theme of exploration, negotiation, and recognition of challenges, consistent with their discussions regarding communications.

Another theme centered on the emergent nature of the projects. Although many pieces were proposed and planned, other elements are clearly "unknown unknowns" and were intended to emerge from the processes of change. This level of ambiguity and difficulty was recognized as challenging for PIs/co-PIs and their colleagues alike. One team reported:

We are building systems and processes where the employees and faculty can keep shifting and changing the portions of the ingredients, maybe adding ingredients, but ultimately the recipe will lead to the desired culture in the college. It will be a culture not imposed but created jointly.

Another team agreed with the focus on the desired outcomes as a way to manage the emotional burden of large-scale change:

This work is hard. We are pushing against a dominant paradigm that is historical and rigid and worked for folks who have been successful. I come here with optimism. These things take decades to happen. In five years, we'll be closer to where we are going, but won't have arrived. More people with ideas in the right direction than ever before here at [institution]. I feel more supported now with colleagues. The battles we face—we are going to get beat up—that is just the way of structural change. Especially these kinds of changes.

These teams, at the outset, recognized that any grant project spanning five years, encompassing faculty through a whole department, involving multiple levels of research, and incorporating intentional, planned change will be met with conflict, disagreement, major wins, and many minor accomplishments. The disposition toward embracing the incremental success and forward march of progress illustrates the need for vision and resilience.

Discussion and Implications

This work illustrates the key issues on the minds of RED team members as they began their cultural and curricular change projects. Negotiating the alignment of goals and strategies, deciding on communication approaches, and embracing conflict and tension were all salient aspects of their experience for many of the schools that participated in the focus groups.

The first two themes, project negotiation and communication, are initial steps that need to be taken when starting a project of this scale. It emerged in the focus groups that sometimes project goals and approaches required team negotiation to get everyone on the same page. Simply re-reading the proposal was not sufficient to begin the project, as proposals reflected a multiplicity of ideas and needed additional refinement and focus for implementation. As teams realized the enormity of the undertaking they had proposed, they began to think more about how to create project roles to keep the work moving all year long, such as hiring a project manager. This realization often meant re-negotiating the budget. Negotiating goals and approaches amongst the project teams was an important first step that needed to come before the projects could be communicated in a strategic way. These results point to the need for groups intending to begin large-scale organizational change projects to spend more than ample time calibrating, recalibrating, and creating internal team structure to support the work (as in Giois and Fhittipeddi, 1991; Kezar, 2013).

Divergent approaches to communication were utilized by the RED teams, as some teams had a plan early on about how to communicate, while others were developing their strategy as they moved along. In some ways, communication strategies may have been taken for granted, at least until teams experienced pushback from various constituents. From the perspective of academic insiders, this component may have been undervalued at the beginning, since branding and marketing are generally not considered critical skill sets of most faculty members. Strategic communication is a fundamental component of many of the later steps in the change process, so creating plans and brands early on can assist in making progress (e.g. Kim, 2015). For teams embarking on a project of similar scale as the RED projects, having a communication plan that acknowledges different needs based on the targets of communications and different needs based on the time in the project is likely to facilitate the change experience.

We were excited to see how many of the teams were embracing the conflict and tension that emerged during their preparatory work and initial outreach to their communities. Team members recognized what the literature on culture change has long described: that dissonance motivates change (as in Festinger 1962). Team members often described culture change as their goal; in the same sentence, they would indicate that they welcomed uncomfortable conversations because these conversations, when approached with openness and listening ears, drew out the best ideas and created a supportive team environment. On a larger scale, we see these discussions as being consistent with Bowe et al.'s (2003) recommendations relating to identifying contradictions and questioning assumptions,

This exploration produced other questions of interest. The words used by the focus group participants suggest an awareness of working toward significant change, but hint at a perspective that is tempered by possible future challenges. Are faculty and staff team members (not just department heads) equipped with change-making skills (e.g. in Baer, Duin, and Bushway's 2015

essay identified as authenticity, boldness, and collaboration with courage)? When a skills gap is identified, how do change agents go about filling that gap - through skills development or changing the team composition? Do RED team members see themselves as change agents? How do faculty or department heads leading change do the work of stepping back from their work-a-day experiences and develop a strategic focus (as modeled in Finelli, Daly, and Richardson, 2014)? How do change leaders balance their autonomy and vision with the need to collaborate and coordinate with others? What aspects of the change process are most concerning to change agents, and how do those concerns evolve? We anticipate exploring these questions and more as teams progress further in their projects.

We acknowledge that this work has several limitations. First and foremost, this project is based on the experiences of RED teams, by design, and only those who opted-in to the focus group discussions. The RED group is intentionally chosen (by NSF) and is not representative of the diversity of engineering programs. This limitation of course comes with the benefit of having detailed knowledge of and access to the teams and their work. The information garnered from focus groups may be more measured than what we might have heard in individual interviews, yet we felt the focus group approach best captured the team experience. This initial data collection focused on our interests and our research questions; as we plan future data collection, we will engage the RED team members in understanding the issues of importance to them so that the results can speak to their needs and interests. We recognize that our thematic approach for analyzing the results carries assumptions of what counts as important, and we intend to use a variety of coding schemes (for example, capturing elements of various change strategies, as in Henderson, Beach, and Finkelstein, 2011, and Finelli, Daly, and Richardson, 2014) across the entirety of the project to capture emergent themes and represent to the extent possible the experience of these change makers.

We see connections to the research literature in higher education and organizational change in these themes, suggesting that that this external body of work has lessons to contribute to the work of these teams and vice versa. In particular, the research centering on grassroots leadership (e.g. Lester and Kezar, 2012; Baer, Duin, and Bushway, 2015) is quite interesting in the context of these projects, as these projects are clearly a collaborative, faculty driven effort, yet have a defined structure with department heads as PIs. Further, this report emphasizes how change processes and the change itself are quite different (consistent with McKenna, Froyd, and Litzinger, 2014); reorganizing curricula, counting credits, fixing syllabi, and so on may be the activities, but deciding how to operate as a team, working through damaged relationship, preparing intentional communications, and more are the aspects that will make or break the effort. We began with the question "How can an academic department successfully change?". This paper provides a small glimpse into an answer, centered on negotiation, communication, and productive conflict.

Acknowledgements

References

Baer, L.L., Duin, A.H., & Bushway, D. (2015). Change Agent Leadership. *Planning for Higher Education Journal 43*(3), 1-11.

Bowe, C.M., Lahey, L. Kegan, R., & Armstrong, E. (2003). Questions the "Big Assumptions". Part II: Recognizing Organizational Contradictions that Impede Institutional Change. *Medical Education 37*, 723-733.

Festinger, L. (1962). Cognitive dissonance. *Scientific American, 207*(4), 93–107.

Finelli, C.J., Daly, S.R., & Richardson, K.M. (2014). Bridging the Research-to-Practice Gap: Designing an Institutional Change Plan Using Local Evidence. *Journal of Engineering Education 103*(2), 331-361.

Gioia, D.A., & Chittipeddi, K. (1991). Sensemaking and Sensegiving in Strategic Change Initiation. *Strategic Management Journal 12,* 433-448.

Henderson, C., Beach, A., & Finkelstein, N. (2011). Facilitating Change in Undergraduate STEM Instructional Practices: An Analytical Review of the Literature. *Journal of Research in Science Teaching 48*(8), 952-984.

Kezar, A., & Eckel, P. (2002). Examining the Institutional Transformation Process: The Importance of Sensemaking, Interrelated Strategies, and Balance. *Research in Higher Education 43*(3), 295-328.

Kezar, A. (2013). Understanding Sensemaking/Sensegiving in Transformational Change Processes from the Bottom Up. *Higher Education 65*, 761-780.
McKenna, A.F., Froyd, J., & Litzinger, T. (2014). The Complexities of Transforming Engineering Higher Education: Preparing for Next Steps. *Journal of Engineering Education 103*(2), 188-192.

Kim, K.E. (2015). Framing as a Strategic Persuasive Message Tactic. In D. Holtzhausen & A. Zerfass (Eds.), *The Routledge Handbook of Strategic Communication* (pp. 285-302). New York: Routledge.

Lester, J., & Kezar, A. (2012). Faculty Grassroots Leadership: Making the Invisible Visible. *Journal of the Professoriate 6*, 98-129.

National Science Foundation. (2016). IUSE/Professional Formation of Engineers: REvolutionizing engineering and computer science Departments (IUSE/PFE: RED) Solicitation 17-501. https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505105

Pretz, K. (2106). A Look at the State of Engineering Education Worldwide. *Special Report: The State of Engineering Education*, IEEE The Institute. http://theinstitute.ieee.org/career-and-education/education/a-look-at-the-state-of-engineering-education-worldwide