

Panel: Changing Your Department: Examples from Revolutionizing Engineering Departments

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Abstract—This panel discussion examines the experiences, change approaches, and initial findings of the 2015 cohort of Revolutionizing Engineering Departments grant recipients. Change in higher education is increasingly achieved through grassroots action. The possibility to create systemic change can hinge on initial successes and areas ripe for flexibility. Through this conversational exploration of experiences, we present both philosophy and actionable steps for others to model.

Keywords—academic change; engineering education; curriculum reform

I. INTRODUCTION

Within the science, technology, engineering, and mathematics (STEM) education community, there are repeated calls for changing the way we educate our students (e.g., the National Academy of Engineering's Engineer of 2020; President Obama's Educate to Innovate program; AAU's Undergraduate STEM Education Initiative). And yet, despite the demonstrated improvements in student learning inherent in innovative teaching strategies, despite many years of funding and development under the auspices of a variety of foundations and corporations, change in STEM education is not pervasive.

The lack of systemic change points to an important problem with the approach to change that the STEM education community has pursued thus far. Change has been targeted at the course and curriculum levels, focusing on teaching and learning methods and proving their efficacy [1]. These beneficial activities have not, however, focused on the important role of the change agent nor have they addressed how the agent must learn new skills and adopt a new mindset, things necessary if the agent is to drive change at the course, program, department, and/or institutional level. Such change strategies and skills, like motivation, persuasion, communication, and collaboration, are well documented in the literature of other disciplines, such as organizational psychology [2] and higher education studies [3], but are not part of the conversation within STEM education in a rigorous, accessible way.

Diffusion of change or innovation requires “plans that promote transitions to stages of adoption beyond awareness” [1]. Further, successful change results from change agents maintaining a focus on stakeholders, rather than attempting to implement a specific activity (meeting the “emergent/environment” category) [1, 4]. Other researchers emphasize the critical importance of grassroots leadership emerging from the faculty level (rather than top-down, mandated change) [5]. This panel addresses these needs in the context of one major national initiative.

II. GOALS AND OBJECTIVES

The primary goal of this panel session is to introduce audience members to strategies for change applied across department and institution types, and their implementation in the first year of the National Science Foundation-supported Revolutionizing Engineering Departments (RED) program. Specifically, the discussion will...

- Explore the diversity of change strategies implemented by the RED teams
- Identify commonalities across the RED teams with respect start-up experiences
- Consider how the cultural explorations of their initial data collection influenced their approach to change
- Discuss challenges associated with working with fellow faculty, IRB panels, institutional expectations and boundaries, etc.
- Articulate the interaction with the institution at larger and the PIs changing roles as change-makers on their campuses

III. REVOLUTIONIZING ENGINEERING DEPARTMENTS

This panel discussion explores the experiences of the Revolutionizing Engineering Departments recipients (from the 2015 application cycle) in administering the first year of their academic change projects. The Revolutionizing Engineering Departments program emerged as a premier program from the Improving Undergraduate STEM Education activities. The explicit focus of the RED program is influencing the technical

core in the second and third years, while creating departmental structures and culture that promote inclusion [6].

The 2015 RED recipients are...

- Arizona State University, Polytechnic School: Additive Innovation: An Educational Ecosystem of Making and Risk Taking
- Colorado State University, Electrical and Computer Engineering: Revolutionizing Roles to Reimagine Integrated Systems of Engineering Formation, represented on the panel by Tony Maciejewski, Professor and Department Head of Electrical and Computer Engineering.
- Oregon State University, Chemical, Biological, and Environmental Engineering Department: Shifting Departmental Culture to Re-Situate Learning and Instruction, represented on the panel by Milo Koretsky, Professor of Chemical Engineering.
- Purdue University, Mechanical Engineering: An Engineering Education Skunkworks to Spark Departmental Revolution, represented on the panel by Ed Berger, Associate Professor of both Engineering Education and Mechanical Engineering.
- University of North Carolina – Charlotte, College of Computing and Informatics: The Connected Learner: Design Patterns for Transforming Computing and Informatics Education, represented on the panel by May Lou Maher, Professor and Chair of Software and Information Systems.
- University of San Diego, Shiley-Marcos School of Engineering: Developing Changemaking Engineers, represented on the panel by Susan Lord, Professor and Chair of Electrical Engineering. [7]

The National Science Foundation (NSF) will be represented by Elliot Douglas, Ph.D. Dr. Douglas is the program director for Engineering Education Research and is the primary connection between RED teams and NSF. Dr. Douglas will provide the context relating to NSF's goals and vision for the RED program¹.

The cohort-based approach chosen for the RED programs leverages the experiences of these disparate institutions and technical areas to develop common understanding of strategies leading to both success and failure. Cohort activities have included regular conference calls, sharing documentary production (survey instruments, workshop advertisements, job postings, etc.), and focus group sessions. This work has generated understandings of the processes large-scale change requires [8]. These understandings are meant to be distributed to the engineering education community to promote adoption and adaption.

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IV. SESSION AGENDA

This panel session loosely follows the agenda below. Audience questions are an important aspect of the panel session, as a key goal is to understand the questions others have regarding this significant change experiences.

TABLE I. SESSION AGENDA

Time	General Topic
10	Introduction of participants and RED program
15	Change strategies being used
5	Audience questions
15	Initial results of cultural exploration
5	Audience questions
15	Challenges experienced during start-up
20	Audience questions
5	Summary and final contributions from panelists

V. SUPPORTING RESOURCES

Audience members will receive reference materials including an extensive bibliography, example work emanating from the RED teams (e.g. ASEE abstracts), panelist contact information, and example worksheets supporting key change skills.

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REFERENCES

- [1] M. Borrego, J. E. Froyd, and T. S. Hall, "Diffusion of engineering education innovations: A survey of awareness and adoption rates in U.S. engineering departments," *J. Eng. Educ.*, vol. 99, pp. 185-207, July 2010.
- [2] A. J. Day and K.S. Finnegan, "A bridge between worlds: Understanding network structure to understand change strategy," *J. Educ. Change*, vol. 11, pp. 111-138, May 2010.
- [3] A. Kezar, *How Colleges Change*, 1st ed., New York: Routledge, 2014.
- [4] C. Henderson, A. Beach, and N. Finkelstein, "Facilitating change in undergraduate STEM instructional practices: An analytic review of the literature," *J. Res. Sci. Teach.*, vol. 48, pp. 952-984, October 2011.
- [5] J. Lester and A. Kezar, "Faculty grassroots leadership: Making the invisible visible," *J. Professoriate*, vol. 6, pp. 98-129, December 2012.
- [6] "IUSE/Professional Formation of Engineers: Revolutionizing engineering and computer science Departments (RED)" Internet: https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505105, [May 1, 2016].
- [7] "NSF awards \$12 million to spur an engineering education revolution" Internet: http://www.nsf.gov/news/news_summ.jsp?cntn_id=135379, [May 1, 2016].
- [8] A. Kezar, "Understanding sensemaking/sensegiving in transformational change processes from the bottom up," *High. Educ.* vol. 65, pp. 761-780, June 2013.