Promising Models and Practices to Support Change in Entrepreneurship Education

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epicenter
National Center for
Engineering Pathways to Innovation

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ABOUT EPICENTER

The National Center for Engineering Pathways to Innovation (Epicenter) is funded by the National Science Foundation and directed by Stanford University and the National Collegiate Inventors and Innovators Alliance (NCIIA). Epicenter's mission is to empower U.S. undergraduate engineering students to bring their ideas to life for the benefit of our economy and society. To do this, Epicenter helps students combine their technical skills, their ability to develop innovative technologies that solve important problems, and an entrepreneurial mindset and skillset. Learn more and get involved at epicenter.stanford.edu.

ABOUT BROAD-BASED KNOWLEDGE, LLC

Broad-based Knowledge, LLC (BbK) is based in Richmond, CA. It aims to assist faculty members in their evaluation of innovations in higher education, especially in the area of science, technology, engineering and mathematics education. BbK is committed to exploring, identifying and promoting what works in order to make long lasting and relevant changes in higher education. BbK focuses on consulting with constituents to implement effective and far-reaching strategies for disseminating educational innovations. We also provide evaluation services for grant-funded projects focused on the use and deployment of technology-assisted teaching, learning and community building.

SUGGESTED CITATION

Promising Models and Practices to Support Change in Entrepreneurship Education

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Executive Summary

INTRODUCTION

This technical report presents findings from the complementary topic areas of faculty development and change in higher education, which will guide the design and implementation of an Epicenter/NCIIA faculty development program to integrate innovation and entrepreneurship education into formal and informal engineering curriculums in higher education.

RECOMMENDATIONS

1. Create faculty development interventions of a sufficient duration as to support multiple opportunities for active learning and meaningful peer interaction because it can take five to ten years before the impact of large change efforts begins to manifest.

2. Construct faculty development interventions around learning theory and principles of instructional design in order to assess if learning has occurred.

3. Ensure staff members have content knowledge and leadership skills to support and facilitate change, and ensure adequate levels of staffing to support participants at all stages of change. Volunteers are not always the best team leaders.

4. Choose incentives that are specific, motivating, and meaningful enough to engage faculty members, who may be at different career stages, to participate in and own the change process. Recognize that the best incentives cannot overcome structural or organizational barriers.

5. Plan for evaluation activities at every stage of a faculty development intervention using, for example, a logic model to help identify short- and long-term outcomes and to help guide when, and with what frequency, results are reported.

FINDINGS

Components of Meaningful Faculty Development Interventions

- The combination of duration, experiential learning opportunities, and peer interaction are factors that contribute to meaningful faculty development interventions.
- The content and activity of faculty development interventions should be constructed around a learning theory and principles of instructional design.

- Evaluation, beyond satisfaction, is not conducted programmatically in faculty development interventions, and while there is no evidence that faculty development efforts have a significant effect on organizations, evaluation should be incorporated into every stage of a faculty development intervention, including pre-planning activities.

Fostering Change in Higher Education

- Change is less about the thing being changed (i.e., innovation, curriculum) and more about changing beliefs about teaching and learning.
- Context and environment matter at all stages of the change process.
- Curriculum change must be viewed systemically. It is not merely a matter of adding-on or adding-in missing or new curriculum components.
- Theories of change must guide the work of making change. A theory of change makes it possible to evaluate the success of particular approaches or the impact of the effort.
- Change takes time; plan for the long term.
- Working collaboratively, building partnerships, and creating networks among collaborators, partners, and participants are key to establishing support and buy-in for change.
- Communicate early, often, and broadly to build support and buy-in and to reduce potential alienation of allies.
- Facilitators are essential to managing group processes. An effective approach to creating a less stressful learning environment in situations that require faculty members to question their approaches is to engage a facilitator external to the institution.
- During the change process it is important to show success in the short- and long-term to help keep participants and stakeholders motivated.

Technical Report

1. OVERVIEW

Epicenter, a joint project between Stanford Technology Ventures Program and NCIIA, seeks to determine best practices in conducting team-based faculty development interventions. The goal of these interventions is to encourage and support integrating innovation and entrepreneurship education into formal and informal engineering curriculums in higher education.

Broad-based Knowledge conducted a literature review (June-August 2013) with the objective of identifying effective models and promising practices to guide the design and implementation of the model for an Epicenter/NCIIA faculty development intervention.

This technical report presents findings from the complementary topic areas of faculty development and change in higher education, which were the focus of the literature review. It is supplemented with an Annotated Bibliography where resources are described by a citation, abstract from the paper, comments, and tags denoting the topic area(s) covered. Appendix A contains a subset of resources that highlight promising faculty development models or change processes.

2. METHODOLOGY

Broad-based Knowledge searched the web and reference databases from the library systems of New York University and the University of California at Berkeley during June-July 2013 to identify resources for the literature review. To develop a result set of relevant resources, we employed an iterative process that involved:

- Conducting exploratory searches using combinations of keywords and/or subject terms that were drawn from meeting notes, the scope of work, and model resources;
- Conducting known-item searches for relevant authors or organizations; and,
- Assessing the results continuously to further refine search terms and parameters and to make comparisons across the existing results set for relevance-to-topic.

Starting with broad topic areas, we searched electronic databases of peer-reviewed publications in education (ERIC, PAIS) and STEM disciplines (Scopus, ISI Web of Science, and the ACM Digital Library); business literature is also indexed in education and STEM databases. We used popular search engines to identify "grey" literature (i.e., white papers, technical reports, and meeting notes). Exploratory searches were date limited (2000-2013) to ensure that the factors, contexts, and findings described in the literature would better match the settings that the Epicenter/NCIIA faculty development intervention would encounter; known-item searches yielded resources that were published pre-2000.

The following phrases generated result sets that were broad but mostly relevant: "faculty development model" (Scopus; ISI Web of Science); "professional development" (ERIC). We identified more precise result sets by combining the above with the following phrases and terms: curriculum design; curriculum implementation; change strategies; entrepreneur; and, engineering. Preference was given to resources with these additional contextual factors: programs situated in higher education, in the U.S., and in STEM disciplines.

The first assessment of the initial results set resulted in resources being grouped into three topic areas: Faculty Development; Fostering Change; and, Revising Curriculum. The baseline we established for an on-target resource included the following criteria: The resource should describe and report the evaluation of

a national faculty development intervention that supported participants in adopting or adapting (entrepreneurship and innovation) curriculum, which was subsequently implemented in higher education contexts and that yielded successful changes that were demonstrated through institutionalization of the curriculum and changed attitudes, knowledge, and practices in faculty and students. Though there was some overlap between A and B or B and C (Figure 1), we did not find any on-target resources, which suggests there is ample opportunity for conducting research to fill this gap.

Our assessment process also included regular phone conferences with Epicenter and NCIIA staff. Subsequent to a discussion of the initial results set, the topic area of Revising Curriculum was given a low priority since the literature primarily contained examples of institution-specific curriculum revision efforts that reported outcomes but that did not analyze the change process. Additionally, efforts to identify resources that addressed Faculty Development *and* Fostering Change were minimized. Our strategy for the remainder of the search process focused not on identifying an exhaustive set of resources but rather on identifying effective models within the two discreet areas of Faculty Development and Fostering Change (Figure 2) which were most relevant to the Epicenter/NCIIA effort.

Figure 1: Topic Areas of Initial Results Set

The second step of the assessment process involved a two-stage review of resources in Faculty Development and Fostering Change. Two BbK team members independently reviewed all of the resources, which were constantly being added to the results set, and indicated Yes, No, or Maybe for inclusion. Once a body of resources was sufficiently developed in each topic area, team members re-assessed the resources against the topic area corpus and resolved any differences through discussion. Parameters for inclusion were: *best-in-class* examples of faculty development models or change management processes; *thoroughness* in describing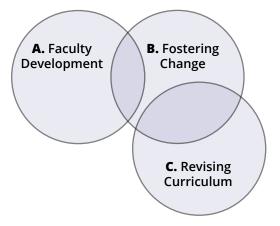 the development processes; *rigor* in model des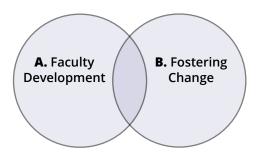ign and evaluation; and, *complementarity* to other resources in the results set. By continuing to organize resources in the final results set into topic areas, we ensured a balanced representation for each topic and provided a high-level point of access into the resources.

Figure 2: Revised Search Parameters

At the conclusion of our iterative search and assessment process, a total of 91 resources were reviewed, including resources that provided context for the Epicenter/NCIIA effort to integrate entrepreneurship education into engineering courses.[12] Ultimately, 26 resources were selected for inclusion: 11 in Faculty Development and 15 in Fostering Change.

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1   Byers, T., Seelig, T., Sheppard, S., & Weilerstein, P. (2013). Entrepreneurship: Its role in engineering education. *The Bridge*, 43(2), 35–40.

2   Shartrand, A. M., Gomez, R. L., & Weilerstein, P. (2012). Answering the call for innovation: Three faculty development models to enhance innovation and entrepreneurship education in engineering. In Proceedings of the 119th ASEE Annual Conference and Exposition. Presented at the 119th ASEE Annual Conference and Exposition, San Antonio, Texas: American Society for Engineering Education.

3. OBSERVATIONS ABOUT THE LITERATURE ON FACULTY DEVELOPMENT AND CHANGE

The findings below are organized into the topic areas of Faculty Development and Fostering Change, and the context is higher education in the U.S. While there is some overlap between these areas, we found that rarely did authors link faculty development interventions with larger change efforts. Faculty development resources discuss successful projects at the local level to improve teaching with technology or revise curriculum to promote specific STEM topics, and these articles focus on process with little discussion of outcomes or evaluation. Organizational change articles often describe larger efforts, e.g., national initiatives or campus-wide efforts, and they report the outcomes of change efforts while avoiding detailed discussions of the change processes.

We have tried to find a balance with resources that complement the benefits and compensate for the shortcomings of these respective topics. One discipline that does make connections between faculty development and fostering change is medical education. Steinert[3] effectively shows how change processes are integral in the design of faculty development interventions (Figure 3).

DESIGNING A FACULTY DEVELOPMENT PROGRAM

- Understand the institutional/organizational culture
- Determine appropriate goals and priorities
- Conduct needs assessments to ensure relevant programming
- Develop different programs to accommodate diverse needs
- Incorporate principals of adult learning and instructional design
- Offer a diversity of educational models
- Promote "buy-in" and market effectively
- Work to overcome commonly encountered challenges
- Prepare staff developers
- Evaluate - and demonstrate - effectiveness

Figure 3. From: Faculty Development - A Brief Introduction

4. FINDINGS FROM THE LITERATURE

Faculty development

The literature on faculty development has a tree/forest ratio problem. While faculty development can lead to changes in engineering education and is a worthwhile activity to focus on to achieve change (Borrego, Froyd, & Hall, 2010), there are a plethora of articles of the "how we did it good," at the tree-level. The site-specific combinations of factors (i.e., context, intervention, content, audience, support, and incentives) make it difficult to extrapolate and apply larger lessons learned, but this is to be somewhat expected since no two locations are the same.

We have selected four resources as examples of faculty development models for their rigor in evaluating and reporting results or for their innovative and thorough design of a faculty development intervention: Brent &

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[3]   Steinert, Y. (2008). Faculty Development - A Brief Introduction. AMEE 2008. Retrieved August 2013 from http://www.amee.org/documents/Introduction%20to%20Medical%20Education%20-%20Steinert.pdf

Felder, 2003; Gjerde, Kokotailo, Olson, & Hla, 2004; Laird, George, Sanford, & Coon, 2010; Reilly, Vandenhouten, Gallagher-Lepak, & Ralston-Berg, 2012. While none of the resources included below address in any detail the process decisions that affected design choices for interventions, one could assume that many factors such as funding (grants or budget allocations), staff expertise, institutional infrastructure, and program deadlines had an impact.

However, there are a few research studies that have attempted to describe the extent, and impact, of the forest of professional development interventions. In the past 15 years, two research studies conducted rigorous, comprehensive reviews of faculty development interventions. We have included three resources: one about faculty development efforts reported in the medical education literature (Steinert et al., 2006); and, two about teacher professional development efforts of STEM high school teachers (Birman, Desimone, Porter, & Garet, 2000; Garet, Porter, Desimone, Birman, & Yoon, 2001).

The literature is long on evaluating faculty development interventions according to short-term factors (immediate changes in attitudes, skills, beliefs; satisfaction). However, the literature is short on evaluating the long-term outcomes or impacts of faculty development interventions. To date, rigorous reviews of faculty development interventions in higher education have not identified significant programmatic outcomes that had an impact on organizations. Rather, the interventions described, had an impact on participating individuals.

> **FINDING: The combination of duration, experiential learning opportunities, and peer interaction are factors that contribute to meaningful faculty development interventions.**

Duration

Two research studies (Birman, Desimone, Porter, & Garet, 2000; Garet, Porter, Desimone, Birman, & Yoon, 2001) explicitly noted that faculty, or professional, development that "is sustained and intensive is more likely to have an impact than interventions of shorter duration." This finding is also supported by work from (Steinert et al., 2006) who found that "where positive and/or lasting effects on teacher performance were found, they were often associated with interventions that involved active and experiential learning over time."

While none of the faculty development models included one-off workshops, they implemented interventions of varying durations: from monthly video-conferences and a yearly face-to-face conference over five years (Reilly, Vandenhouten, Gallagher-Lepak, & Ralston-Berg, 2012) to five weekends over one year (Gjerde, Kokotailo, Olson, & Hla, 2004) to four face-to-face workshops over one year, repeated in the second year of the project (Laird, George, Sanford, & Coon, 2010). The model described by Brent & Felder (2003) differed in that the faculty development program embedded at local campuses offered 1.5 day teaching effectiveness workshops and luncheon seminars organized around cross-cutting learning communities.

Experiential Learning

Garet et al., 2001, note that changes in teaching practice result from "activities that are linked to teachers' other experiences, aligned with other reform efforts, and encouraging of professional communication among teachers." And, Birman et al., 2000, reiterated the positive benefits of active learning, such as "increased knowledge and skills and changed classroom practice." Steinert et al., 2006, suggests that "faculty members need to practice what they learn, and that immediate relevance and practicality is key," but also notes that it is best to use a number of learning methods "to accommodate different learning styles… to meet diverse objectives." Significantly, Steinert notes that "where positive and/or lasting effects on teacher performance were found, they were often associated with interventions that involved active and experiential learning over time" (2006).

The faculty development models did not report in much detail the level to which they incorporated active learning methods. However, in Laird et al., 2010, the program goal, encouraging faculty to integrate evidence-based medicine into their classes, meant that active learning methods were used in each workshop. The weekend-long Fellows workshops (Gjerde et al., 2004) combined a mix of individual project work and lectures. Reilly et al., 2012, incorporated very little active learning in their interventions. Participants received handbooks to read, lists of links to visited, and watched video conferences, but their interaction with the material seemed primarily passive. Brent & Felder (2003) recommend that faculty development leaders model the behavior they are teaching, which could include active learning methods.

Peer Interaction

Both Garet et al., 2000 and Birman et al., 2000, note the positive effect of active learning combined with peer interaction on teaching practice (Garet et al., 2000). Birman (2000) defines collective participation as "teachers from the same department, subject or grade" and that interventions that include peer interaction are "more likely to be coherent with teachers' other experiences." In their research study, Steinert et al., 2006, notes that "peers are valuable as role models, for mutual exchange of information and ideas, and for the importance of collegial support to promote and maintain change."

As with duration, the examples of faculty development models show how differently each site incorporated peer interactions into their interventions. Across the multi-campus intervention that employed primarily passive learning, each institution had a site coordinator to "maintain regular communication with scholars about the schedule of video conferences, as well as serving as a resource to answer questions and directing scholars to available resources (Reilly et al., 2012). In another model, coordinators of the evidence-based medicine workshops established teams of participants by blending the composition to include two distinct stakeholder groups (Laird, et al., 2010). They also instituted Quality Circles "to obtain critical input on faculty development efforts, to identify opportunities for improvement, and to promote consensus building on the need to integrate EBM." And in the model where participants met for four weekends over a year (Gjerde et al., 2004), peer interaction was built into learning activities (role playing) and was actively scheduled (blocks of free time; mealtimes, including dinner at a faculty member's house).

> **FINDING: The content and activity of faculty development interventions should be constructed around a learning theory and principles of instructional design.**

Of the research studies, only Steinert et al., 2006, found that faculty development interventions that adhered to theories of adult learning and instructional design promoted more effective teaching and learning. However, only two examples of faculty development models were designed around some type of theory. (We note that these articles were published in the later part of the decade and cite Steinert et al., 2006, and Birman et al., 2000). Laird et al., 2010, report how Rogers' theory on diffusion of innovation (1995) was used to structure workshops, specifically around knowledge, persuasion, implementation, but not decision or confirmation. Reilly et al, 2012, does not adopt a particular theory but instead cites best practices from the literature. One of the follow-up questions for Reilly would ascertain their decisions about which best practices to include or privilege in designing the intervention.

> **FINDING: Evaluation, beyond satisfaction, is not conducted programmatically in faculty development interventions, and while there is no evidence that faculty development efforts have a significant effect on organizations, evaluation should be incorporated into every stage of a faculty development intervention, including pre-planning activities.**

In their research study, Steinert et al., (2006) recognized that systematic and rigorous practices are lacking in evaluations of faculty development interventions "making definitive statements about outcomes difficult." Evaluations, when done, are often limited to determining participant satisfaction (Reilly et al., 2012), followed by changes in attitudes, beliefs, and skills. From our review of resources, the most commonly used tools are surveys, usually pre-post intervention, with participating faculty members (Brent & Felder, 2003; Gjerde et al., 2004; Laird et al., 2010; Reilly et al., 2012). So far, no study has been conducted that points conclusively to faculty development having an impact on changing an organization; and, studies report limited results of faculty development having an impact on student learning (Steinert et al., 2006). At most, changed teaching practices are used as a proxy for student learning. However, it was noted in several examples of faculty development models that planning for evaluation was integral to the design of the intervention and two models specifically included a needs assessment of participants during the pre-planning stage (Gjerde et al., 2004; Laird et al., 2010).

Change in higher education

In an effort to go directly to the source, the resources on change in this review were identified primarily in the business literature. The tendency among authors writing in higher education publications is to reference theories of change from the business literature, if they do; unless the authors avoid theory altogether. Avoiding any reference to theory is particularly troublesome given the current emphasis on evaluating the effectiveness and/or impact of change efforts and the critical role that theory plays in this evaluation. Given this state of the research and literature, we privileged articles that reported on projects that built their change efforts around a theory, even if the theory was sometimes implicit rather than explicit.

We also observed that articles reporting on curriculum revision tended to report making changes mechanically, that is, creating a new course here, tweaking an existing course there, and putting them together almost like a puzzle. In contrast, most change in higher education described the process of change systemically. Instead of viewing a curriculum or innovation as a thing, they considered the impact of, for example, curriculum changes on the organization and people it might affect. Change then was much more centered on making sure the people involved, "bought-in" or "owned" the change and that the organization had the types of resources in place to support the change. Change according to these authors is not simply a matter of creating a new class and adding it to the curriculum.

While not central to the change literature, it is important to note that there is some overlap with the emerging literature on adoption or adaption of innovation (Borrego for example) and change in higher education. Narrower in scope (this literature tends to focus on the individual rather than the organization) it did provide an entry point to some of the authors who address organizational change.

The set of findings that follows were drawn from the literature that reports on studies of organizational change within business, unrelated to higher education; and, it draws from literature that looks specifically at changing a curriculum or introducing an innovation of some sort into higher education at a specific departmental level.

> **FINDING: Change is less about the thing being changed (i.e., innovation, curriculum) and more about changing beliefs about teaching and learning.**

If there is a central theme in this review, it is that change in higher education requires that the community members (faculty members, administrators and students) change their thinking about learning and teaching.

Almost all of the authors either explicitly or implicitly discussed how sustained change only occurred when the innovation or change was introduced and promoted in such a way that the community members embraced and 'owned' the new way of thinking and/or doing. (Clark at al., 2004; Dempster et al., 2012; Kezar, 2011; Kotter & Schlesinger, 2008; and Steinart et al., 2007)

> **FINDING: Context and environment matter at all stages of the change process.**

This finding is integrally linked to the above. Taken as a whole, the authors of respective resources discussed common tactics, strategies and theories about making change, but they did so within unique contexts and environments. Each effort was organized to meet the needs of the environment and its people, see particularly: Beach et al. (2012), Froyd et al. (2008), Kezar (2011), Kotter & Schlesinger (2008), and Sirkin et al. (2005). The focus on being flexible with regards to strategic implementation is consistent in the literature of business and higher education.

> **FINDING: Curriculum change must be viewed systemically. It is not merely a matter of adding-on or adding-in missing or new curriculum components.**

The organizational change literature from business and higher education perspectives focus on the systemic nature of making change. Clark et al. (2004) and Kotter's (see particularly his 2007 article) research might reflect this aspect of change best. Clark discusses this from an emergent (after the fact) perspective of the change process for the engineering education Foundation Coalition. Kotter looks specifically at managed change from a business perspective. He notes that change must follow an eight-step process (from establishing a sense of urgency to initiate the change, to institutionalization of the new approach) and that to be successful, no step can be skipped. Both research and theoretical approaches highlight the impact of systemic thinking.

> **FINDING: Theories of change must guide the work of making change. A theory of change makes it possible to evaluate the success of particular approaches or the impact of the effort.**

Kezar's articles (2009, 2011, and 2012) are grounded in organizational change theories of higher education and her research reflects that grounding. Other researchers cited here (Dempster, et al., 2012 and Steinert et al., 2007) demonstrate how building change efforts around specific theories (Kotter's for example) allowed for more careful and strategic planning and evaluation of their efforts.

The Connelly and Seymour (2008) article is important in that it takes the stance that change must be driven by a theory of change so that its impact can be evaluated. From our personal experience, this perspective has been highly influential with program officers from the National Science Foundation (NSF) and over time has been incorporated into NSF solicitations.

> **FINDING: Change takes time; plan for the long term.**

A number of authors note the need to create plans and undertake strategies over the long-term. Sirkin et al. (2005) notes that progress needs to be reviewed and reported in the short-term regularly in order to keep participants (from those intimately involved to peripherally involved) engaged and supportive of the change effort. Beach et al. (2012) and Kezar & Lester (2009) also note that the time for change to 'take hold' ranges

from five to ten years. All agree that planning and implementation needs to be done in consideration of where the project is located in terms of its development, i.e., is it early in the process or many years into the effort?

Change also takes the time of participants in the process. Authors agreed that participants, (especially leaders tapped to guide the change) need to be freed from other job requirements to focus on change efforts. Sirkin et al. (2005) provides good detail and argument on what characteristics change leaders need and how they should work with teams.

> **FINDING: Working collaboratively, building partnerships, and creating networks among collaborators, partners, and participants are key to establishing support and buy-in for change.**

The higher education literature tends to support a highly collaborative approach to implementing change. Each of the authors who report on results (based on research) point to the importance of implementing change with collegial, collaborative teams of participants. Initially, these teams might be at the local (campus) level. However, they also note the importance of having connections outside the campus to lend support and expertise to the effort. Candidates for external partnerships included professional organizations or funding institutions, e.g., NSF program areas.

Networks were viewed as essential for bringing participants together and sharing ideas. Dempster et al. (2012), Kezar (2011), Kezar & Lester (2009), Kezar & Elrod (2012), and Plumb & Reis (2007) all discuss change within a regional or national initiative. The impact of networks and partnerships are discussed in detail. The process of how networks were built and nurtured were described less. Kezar and Elrod's examination of PKAL is particularly pertinent.

Beach et al. (2012), Froyd et al. (2008), and Steinart et al. (2007) discuss collaboration at the local, campus levels, pointing out how it is essential to build buy-in to the innovation.

The business literature (Kotter, 2007 and Sirkin et al., 2005) tends to describe these concepts using the vocabulary of "teamwork" and "leadership." In this perspective, more attention is given to notions of power, coercion, building support, training and education, and communication. All of these factors reflect the more bureaucratic nature of the business environment rather than the collegial nature of higher education. (Froyd et al., 2008, touch a bit on the notion of leadership and teamwork in their description of what change agents need in order to be successful.)

> **FINDING: Communicate early, often, and broadly to build support and buy-in and to reduce potential alienation of allies.**

Effective communication with all parties addresses the need for the change process to be viewed as open and welcoming of all participation. This is more clearly addressed in the business literature than that of change in higher education. Kotter & Schlesinger (2008) and Sirkin et al. (2005) clearly point to the need for effective communication and the role it has in building support for the change effort. Being more bureaucratic in nature, it suggests how communication might work in the higher education arena across regional/national initiatives and at the local campus levels.

Dempster et al. (2012) and Kezar & Elrod (2012) discuss effective communication methods and strategies for regional or national initiatives or coalitions. Kezar & Lester (2009) gives a brief overview of how social networking tools might be used. Steinert et al. (2007) describes in detail the different communication methods used in driving a significant change effort in a medical school.

> **FINDING: Facilitators are essential to managing group processes. An effective approach to creating a less stressful learning environment in situations that require faculty members to question their approaches is to engage a facilitator external to the institution.**

Sirkin et al. (2005) point out the need to select team leaders carefully. They note that having the passion for and commitment to making the change is not enough – leaders also need a specific skill set that applies to managing people and processes. Using facilitators external to an environment (i.e., campus) were recommended in both business and higher education literature. Dempster et al. (2012), Sirkin et al. (2005) and Steinert et al. (2007) describe the role of facilitators (internal and external) and why they were important to the success of their efforts. Froyd et al. (2008) in their discussion of change agents imply that they might take on a similar role to a facilitator, though change agents are more involved in the planning and leading of change efforts.

> **FINDING: During the change process it is important to show success in the short- and long-term to help keep participants and stakeholders motivated.**

While Sirkin et al. (2005) are the only set of authors who make this recommendation, this is included because it was an idea that 'rang true' in both McMartin and Holsted's experiences in working with and evaluating change efforts. We have found that often, people become mired in the change effort and grow discouraged subsequently forgetting to acknowledge and appreciate their accomplishments.

This finding also focuses on an important purpose of formative evaluation efforts and the role of integrating assessment or evaluation into the work of the change effort. Several authors identified the need for evaluation and provided useful models for approaching evaluation, they include: Beach et al. (2012), Connelly & Seymour (2008), Dempster et al. (2012), Kezar & Elrod (2012), Kotter (2007), Kotter & Schlesinger (2008), Plumb & Reis (2007), and Sirkin et al. (2005).

Annotated Bibliography

INTRODUCTION

Broad-based Knowledge conducted a literature review (June-August 2013) with the objective of identifying effective models and promising practices to guide the design and implementation of the model for an Epicenter/ NCI-IA faculty development intervention. The findings and recommendations above are drawn from articles that have been compiled into an annotated bibliography. The resources are divided by topic (faculty development; change), and within each section, the resources are listed alphabetically and are described by a citation, abstract from the paper, comments, and tags denoting the topic area(s) covered.

FACULTY DEVELOPMENT MODELS

Bergquist, W. H., & Phillips, S. R. (1975). Components of an effective faculty development program. *The Journal of Higher Education*, *46*(2), 177–211. doi:10.2307/1980880

Abstract: Since piecemeal efforts to improve college and university teaching have generally proven ineffective, we must turn to a comprehensive approach to faculty development, through which we can develop new methods of **Evaluation:** and diagnosis, find viable ways of introducing new technology and curricula, and explore new approaches to instructional improvement. Faculty development must give serious attention to the impact of change on the faculty member himself and on his institution. Organizational and personal development thus become essential to faculty development. It is only through such a comprehensive approach that efforts toward improvement can have lasting impact.

Comment: While dated, this article served as a foundation for decisions about designing a faculty development intervention (Reilly et al., 2012).

Tags: Faculty Development

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Birman, B. F., Desimone, L., Porter, A. C., & Garet, M. S. (2000). Designing professional development that works. *Educational Leadership*, *57*(8), 28–33.

Abstract: Evidence supporting the effectiveness of professional development is often anecdotal. A research-based study names six factors with great potential for achieving results.

Comment: This article provides a succinct summary and case study examples of the study findings that are analyzed in detail in (Garet, Porter, Desimone, Birman, & Yoon, 2001). Again, the context is teacher professional development, but the results have been applied in the context of faculty development in higher education settings.

Tags: Faculty Development; Teacher Professional Development

Borrego, M., Adams, R. S., Froyd, J., Lattuca, L. R., Terenzini, P. T., & Harper, B. (2007). Panel - emerging results: Were the engineering education coalitions an effective intervention? In *Proceedings of the 37th ASEE/IEEE Frontiers in Education Conference* (pp. F4F–1–F4F–6). Presented at the 37th ASEE/IEEE Frontiers in Education Conference, Milwaukee, WI: IEEE. doi:10.1109/FIE.2007.4418188

Abstract: At the time the decision was made to discontinue funding to the NSF Engineering Education Coalitions, data in support of the impact of the coalitions were unavailable. Since then, whether an institution was a member of a coalition has been an important variable in many engineering education studies. In this panel session and paper, we present the results of three such studies and invite the audience to assess the strength of the evidence. Guided audience discussion will focus on whether the results can be used to evaluate the coalitions intervention, related research directions, and implications for future funding.

Comment: The panel members' research, briefly described in the paper, includes: Adams' study of career trajectories in engineering education; the perceived impact of a variety of factors on engineering education reform by Lattuca, Terenzini, and Harper; and, Borrego's work to identify the activity, evolution, and potential impact of the Coalitions. Synthesizing this research, this short paper puts forward the idea that faculty development can promote change in engineering education, noting:

"There is another 'people' aspect of engineering education becoming increasingly important to change: development of faculty, administrators, and other engineering education researchers. In each of the three studies presented, the interests, activities, learning and perceptions of faculty and other personnel is highlighted as an outcome. As engineering education moves forward and considers research capacity (the personnel capable of conducting engineering education research) and results (how people learn engineering), success in innovation and systemic reform may depend as much on attention to faculty development and institutional change as on the results of rigorous engineering education research." (p. F4F-5)

Tags: Faculty Development; Fostering Change

Brent, R., & Felder, R. M. (2003). A model for engineering faculty development. *International Journal of Engineering Education*, *19* (2), 234–240.

Abstract: Since its inception in 1992, the NSF-sponsored Southeastern University and College Coalition for Engineering Education (SUCCEED) has successfully induced large numbers of engineering faculty members to participate in instructional development programs and to adopt proven but (in engineering) non-traditional instructional methods. This paper briefly reviews the events in engineering education that led to the formation of SUCCEED, outlines the coalition's faculty development program structure, summarizes the program assessment data, and discusses possible implications for reform of engineering education.

Comment: Like most articles on faculty development models, the goal of these efforts is to affect teaching practice. What is unique about this article is that the authors are more detailed than most about their lessons. The lessons here address how to structure and manage faculty development that has a workshop format, though the faculty development program itself had six components. These are divided into two categories: instructional

development training (via workshops) and support targeted towards faculty, new faculty, and graduate students; and, modifications within institutional structures to institutionalize the faculty development programs: embedding a faculty development coordinator in departments or colleges, forming links with existing campus faculty development programs, and creating institutional incentives to improve teaching.

Tags: Faculty Development

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Garet, M. S., Porter, A. C., Desimone, L., Birman, B. F., & Yoon, K. S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal*, *38* (4), 915–945.

Abstract: This study uses a national probability sample of 1,027 mathematics and science teachers to provide the first large-scale empirical comparison of effects of different characteristics of professional development on teachers' learning. Results, based on ordinary least squares regression, indicate three core features of professional development activities that have significant, positive effects on teachers' self-reported increases in knowledge and skills and changes in classroom practice: (a) focus on content knowledge; (b) opportunities for active learning; and (c) coherence with other learning activities. It is primarily through these core features that the following structural features significantly affect teacher learning: (a) the form of the activity (e.g., workshop vs. study group); (b) collective participation of teachers from the same school, grade, or subject; and (c) the duration of the activity.

Comment: The survey reported in this article was conducted and analyzed in the late 1990's, and the article has been cited 583 times since then. It's popularity is because Garet et al represents one of the few studies that is national in scope and that has been rigorously designed and analyzed. The authors were trying to dispel common assumptions about teacher professional development, so their goal was not to report on how many individuals 'did it good' in their respective environments (unlike the bulk of the articles on faculty or teacher professional development), but to report how individuals 'did it' and what was effective. The results might seem a little high level, but they are also not so specific as to be dated or useful only in contexts specific to teachers. Indeed, the more useful 'how I did it good' resources in this literature review that occur in higher education settings refer to Garet and to Birman (2000), which is the more digestible version of this article.

Tags: Faculty Development

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Gjerde, C. L., Kokotailo, P., Olson, C. A., & Hla, K. M. (2004). A weekend program model for faculty development with primary care physicians. *Family Medicine*, *36* (SUPPL.), S110–S114.

Abstract: <u>Background</u>: Medical teachers are expected to be proficient at teaching students and residents about the changing health care system. The University of Wisconsin established a faculty development fellowship program to better prepare clinical teachers in family medicine, general pediatrics, and general internal medicine. This paper describes our fellowship program, presents data on program accomplishments, and discusses what we have learned. <u>Methods</u>: We developed a yearlong series of five weekend workshops. A core group of faculty provided 2- to 4-hour sessions on topics including evidence-based medicine, physician leadership, advocacy, doctor-patient communication, quality, technology tools, and teaching skills. Evaluation data were used to shape the program, make improvements, and assess impact. Fellows self-assessed their ability to perform skills at the beginning and ending of the year; paired t tests were used to compare these changes. <u>Results</u>: Attendance and program completion rates were more than 94% for the 84 fellows taught over 6 years. Individual sessions and the overall program were well

rated by fellows. Participants reported improvements in targeted skills; statistical analyses confirmed many significant pre-post improvements. **Lessons Learned:** To obtain high ratings, faculty must apply adult learning and active learning principles; lectures were not well tolerated. Initial technology skills were often low; computer labs needed many helpers. Participants needed extensive faculty support on their projects. It facilitated coordination and learning to have a core group of fellowship faculty who did most of the teaching. Graduates have become enthusiastic recruiters for new fellows. Our 5-weekend program has proven to be an effective faculty development model.

Comment: While the context for this article concerns a faculty development program in the healthcare field (the Department of Family Medicine at the University of Wisconsin) to help clinician-educators, again, become more skillful teachers, the motivations driving the development of the program appear to be similar to the situation faced by Epicenter/NCIIA: to pass along the knowledge, skills, and attitudes around new or rapidly evolving topics (in this case, entrepreneurship education) to faculty who must then share this information with students. The article describes: how the program and topics/activities are structured (a seminar series over five weekends throughout the year); recruitment strategies (planning for diversity; conducting needs assessments) and incentives (funding for housing, meal, travel; no stipends); teaching approaches (group discussion; mentoring; role play; problem-based learning; unstructured, informal networking opportunities).

Tags: Faculty Development

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Johnson, T., Wisniewski, M. A., Kuhlemeyer, G., Isaacs, G., & Krzykowski, J. (2012). Technology adoption in higher education: Overcoming anxiety through faculty bootcamp. *Journal of Asynchronous Learning Network*, *16*(2), 63–72.

(This article was not summarized in the Findings.)

Abstract: The reluctance to design and teach online courses in higher education is often attributed to technology anxiety in faculty. This article documents a faculty development model that has successfully helped faculty overcome this obstacle. "Bootcamps," faculty development programs held at Carroll University in Waukesha, WI, were specifically and intentionally designed to be consistent with the principles of andragogy and transfer of learning to assist faculty in technology adoption for teaching and learning in an online environment. The faculty development "Bootcamps" can be easily adapted for implementation at other higher education institutions.

Comment: Again, another faculty development program to improve teaching aka modify faculty behavior. The context is Carroll University, a small liberal arts university located in Waukesha, WI, serving both undergraduate and graduate students, with approximately 112 full-time faculty. The Provost encouraged the development of "Bootcamps" to assist faculty in adopting technology for teaching and learning in an online environment using a course management system that was implemented in 2009.

This faculty development effort was developed around Malcolm Knowles' learning theory, andragogy, which focuses on the learning strategies of adults. The thesis of the authors is that "when faculty understand the principles of andragogy and integrate these into their teaching, they can more easily transfer this knowledge to enhancing the learning environment with technology and be successful" [in their teaching, one assumes].

Tags: Faculty Development

Judge, S., & O'Bannon, B. (2008). Faculty integration of technology in teacher preparation: Outcomes of a development model. *Technology, Pedagogy and Education*, 17(1), 17–28. doi:10.1080/14759390701847435

(This article was not summarized in the Findings.)

Abstract: This article reports on a faculty development model that uses a variety of approaches and strategies to help faculty restructure their curricula and effectively model technology integration for their students. A multifaceted model, funded in part by the Preparing Tomorrow's Teachers to Use Technology (PT3) initiative, was implemented at The University of Tennessee, Knoxville. The model included training, technical and collegial support, access, and incentives. Questionnaires and qualitative data indicated substantive changes in faculty expectations and assumptions regarding technology as well as increases in faculty and student technology skills and the degree to which faculty members integrate technology into their curricula. The model helped to facilitate the collaborative efforts of a cadre of faculty to model and integrate technology throughout their teacher preparation programs.

Comment: Again, getting teachers to integrate technology into the curriculum, in this instance, in a teacher education program.

"The Project ImPACT model was based on the ten essential conditions established by the International Society for Technology in Education (ISTE, 2002) – shared vision, access, skilled educators, training, technical assistance, content standards and curriculum resources, student-centered teaching, assessment, community support, and support policies – *with an emphasis on access, training, support, incentives and evaluation*."

The most salient lesson learned is that through mini-grant projects, 100% of the recipients revised their syllabi to reflect the inclusion of new technology-based learning activities.

Tags: Faculty Development

Laird, S. D., George, J., Sanford, S. M., & Coon, S. (2010). Development, implementation, and outcomes of an initiative to integrate evidence-based medicine into an osteopathic curriculum. *Journal of the American Osteopathic Association*, *110*(10), 593–601.

Abstract: <u>Context</u>: In response to the American Osteopathic Association's Commission on Osteopathic College Accreditation (COCA) standards set forth in 2008, osteopathic medical schools are restructuring curricula to demonstrate they are teaching the seven core competencies and integrating evidence- based medicine (EBM) throughout all 4 years of training. <u>Objective</u>: To describe and evaluate the efforts of a college of osteopathic medicine to integrate EBM concepts into its curriculum while maintaining existing course content and faculty contact hours. <u>Design</u>: One-group pre- and post-test study. <u>Setting</u>: Kirksville College of Osteopathic Medicine-A.T. Still University (KCOM) in Missouri. <u>Participants</u>: KCOM course directors in workshop series I (n=20) and KCOM faculty workshop series II (n=14). <u>Intervention</u>: A faculty development workshop series based on the diffusion of innovations model was instituted to facilitate cultural change, gain faculty support, and accelerate the implementation of EBM throughout KCOM's curriculum. <u>Outcome measures</u>: Faculty attitudes, confidence levels, and the number of courses that included instruction of EBM concepts were measured in August 2007 and May 2008. <u>Results</u>: Faculty attitudes about integrating EBM into the curriculum and confidence levels measured pre-

and post-workshop series found that 21 of 26 participants believed they improved their ability to locate primary EBM resources using the Internet; 21 of 28 improved their ability to teach EBM concepts to students. Fifteen of 16 faculty course directors agreed to find ways to incorporate EBM into their classes. Review of KCOM's course syllabi in April 2009 demonstrated a statistically significant difference (P<.001) in the number of faculty teaching EBM concepts after the faculty development workshop series concluded in March 2008 compared to before the series commenced in March 2006. An unexpected outcome was the implementation of a faculty-conceived, standalone EBM course in fall 2007. Conclusions: A workshop series based on the diffusion of innovations model is effective in garnering faculty support for the implementation of a change in curriculum that emphasizes EBM content without increasing faculty contact hours or eliminating existing curricular content. A faculty development model emphasizing a "bottom-to-top" approach is effective in achieving workplace culture changes and seamless curricular transitions. Results have shown that a consensus-building model is conducive to engaging faculty and garnering its support to effect curricular change, which, ultimately, ensures success.

Comment: The context for this article is that the Kirksville College of Osteopathic Medicine in Missouri, with its partner allopathic school, Penn State University College of Medicine, restructured its curricula to comply with new accreditation standards to integrate training for evidence-based medicine in its courses. The approach of this article on effecting curricular change is to make faculty aware of the value of the content and the need for it, so that faculty will more readily incorporate the content into their classes. The tone of the article is very chipper and no negative results are reported. Still, this seems like an on-target "how-I-did-it-good" article. Also useful is that the model is structured around Roger's diffusion of innovation theory, which might provide an opportunity to model knowledge and processes that are critical to entrepreneurship education. The article discusses the structure of the workshops plus assessment efforts and results to measure uptake of the curriculum. Some relevant statements:

- "People are more apt to adopt innovations when the advantages outweigh the risks, are compatible with adopters' needs, and are easily implemented." (p. 594)

- "…the training series was designed to encourage adoption of the curricular change, which could not take place until faculty arrived at consensus to revise the curriculum." (p. 594)

- "We opted to cultivate favorable attitudes among faculty by personally engaging them in the curriculum enhancement process and transferring cutting-edge knowledge about the relative benefits[8] of incorporating EBM concepts." (p. 596)

- "The findings from our project coalesce with research literature's findings and demonstrate that the quality of collegial relationships, methods of dispensing knowledge transfer, and how a call for action is communicated are salient factors that influence an innovation's rate of adoption or rejection." (p. 597)

Tags: Faculty Development, Fostering Change, Revising Curriculum

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Reilly, J. R., Vandenhouten, C., Gallagher-Lepak, S., & Ralston-Berg, P. (2012). Faculty development for e-learning: A multi-campus community of practice (COP) approach. *Journal of Asynchronous Learning Network*, 16(2), 99–110.

Abstract: Faculty development is a critical process, enabling instructors to remain abreast of new discipline specific content and innovations in the scholarship of teaching and learning. The explosion of online higher education and advances in technology provide examples and rationale for why faculty development for e-learning is needed. Literature on faculty development and e-learning is reviewed and a multi-campus faculty development program using distance technology and a community of practice model for nursing educators will be described. Successful strategies, barriers and an evaluation of the multi-campus faculty development model experience will be presented in a format that allows for replication across disciplines.

Comment: The context of the work is situated within a five-year grant-funded initiative among five University of Wisconsin campuses to infuse technology into nursing education and prepare nursing faculty to become online instructors. This article describes the details of planning and implementing one year of faculty development online using a virtual community of practice. The article is useful in that it defines faculty development and reviews the research on faculty development and elearning. The authors are informed by best practices that are detailed in (Birman, Desimone, Porter, & Garet, 2000; see below). This article is important because a) it's recent enough to leverage new technology and build on recent research and b) it's thorough in laying out the structure (and challenges) for a multi-campus endeavor. Also, provides a model for how to incorporate previous research that provides recommendations on best practices for faculty development.

The most salient paragraph from the article with details that can be adapted to NCIIA's needs is this:

> "*Characteristics of successful faculty development programs build on previous activities, offer opportunities to discuss classroom experiences with others, are aligned with state and national standards, and encourage ongoing professional communication of instructors with similar concerns [20]. A systematic review of faculty development studies designed to enhance medical education found programs to be most effective when they incorporated experiential learning, provided feedback, included effective peer and colleague relationships, applied effective teaching learning principles, and used diverse methods [21]. Diverse methods for faculty development include seminar series, short-courses, workshops, and webinars. Faculty can benefit from formal and informal consultations from off-campus "experts," mentors, fellowships, and learning communities [22, 23].*" (p. 101)

Tags: Faculty Development

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Steinert, Y., Mann, K., Centeno, A., Dolmans, D., Spencer, J., Gelula, M., & Prideaux, D. (2006). A systematic review of faculty development initiatives designed to improve teaching effectiveness in medical education: BEME Guide No. 8. *Medical Teacher*, *28*(6), 497–526. doi:10.1080/01421590600902976

Abstract: Background: Preparing healthcare professionals for teaching is regarded as essential to enhancing teaching effectiveness. Although many reports describe various faculty development interventions, there is a paucity of research demonstrating their effectiveness.

Objective: To synthesize the existing evidence that addresses the question: "What are the effects of faculty development interventions on the knowledge, attitudes and skills of teachers in medical education, and on the institutions in which they work?".

Methods: The search, covering the period 1980-2002, included three databases (Medline, ERIC and EMBASE) and used the keywords: staff development; in-service training; medical faculty; faculty training/ development; continuing medical education. Manual searches were also conducted. Articles with a focus on faculty development to improve teaching effectiveness, targeting basic and clinical scientists, were reviewed. All study designs that included outcome data beyond participant satisfaction were accepted. From an initial 2777 abstracts, 53 papers met the review criteria. Data were extracted by six coders, using the standardized BEME coding sheet, adapted for our use. Two reviewers coded each study and coding differences were resolved through discussion. Data were synthesized using Kirkpatrick's four levels of educational outcomes. Findings were grouped by type of intervention and described according to levels of outcome. In addition, 8 high-quality studies were analyzed in a 'focused picture'. Results: The majority of the interventions targeted practicing clinicians. All of the reports focused on teaching improvement and the interventions included workshops, seminar series, short courses, longitudinal programs and 'other interventions'. The study designs included 6 randomized controlled trials and 47 quasi-experimental studies, of which 31 used a pre-test-post-test design.

Key points: Despite methodological limitations, the faculty development literature tends to support the following outcomes:

- Overall satisfaction with faculty development programs was high. Participants consistently found programs acceptable, useful and relevant to their objectives.

- Participants reported positive changes in attitudes toward faculty development and teaching.

- Participants reported increased knowledge of educational principles and gains in teaching skills. Where formal tests of knowledge were used, significant gains were shown.

- Changes in teaching behavior were consistently reported by participants and were also detected by students.

- Changes in organizational practice and student learning were not frequently investigated. However, reported changes included greater educational involvement and establishment of collegiate networks.

- Key features of effective faculty development contributing to effectiveness included the use of experiential learning, provision of feedback, effective peer and colleague relationships, well-designed interventions following principles of teaching and learning, and the use of a diversity of educational methods within single interventions.

- Methodological issues: More rigorous designs and a greater use of qualitative and mixed methods are needed to capture the complexity of the interventions. Newer methods of performance-based assessment, utilizing diverse data sources, should be explored, and reliable and valid outcome measures should be developed. The maintenance of change over time should also be considered, as should process-oriented studies comparing different faculty development strategies.

Conclusions: Faculty development activities appear highly valued by participants, who also report changes in learning and behavior. Notwithstanding the methodological limitations in the literature, certain program characteristics appear to be consistently associated with effectiveness. Further research to explore these associations and document outcomes, at the individual and organizational level, is required.

Comments: This research study originated from the Best Evidence Medical Education (BEME) Collaboration (http://www.bemecollaboration.org/), whose goal is to provide medical teachers and administrators with the latest findings from scientifically grounded educational research.

The goal of this review is to determine the effect of faculty development activities on faculty members' teaching abilities and to assess the impact of these activities on the institutions in which these individuals work (p. 499).

Like Birman, Desimone, Porter, & Garet, 2000, both Steinert et al. (2000; 2006) are cited as sources for best practices in faculty development in contexts other than medical teaching. To situate their research study, the authors provide a round-up of definitions of faculty development and a discussion of previous reviews of the effectiveness of faculty development activities (p. 498). The authors conclude that previous reviews did not include a systematic review of the literature, did not follow a predetermined protocol, and that few reviews considered the impact of faculty development on the organizations/institutions in which individuals work (p. 498). Steinert, and other researchers in medical disciplines, often use Kirkpatrick's model of educational outcomes (1994) as a conceptual framework to classify the results of interventions, and Steinert includes a potentially useful diagram and short discussion (p. 500). In addition to the discussion of results, the end of the article provides a detailed discussion of methodological issues (see pp. 520-522) and may be most useful when starting the planning process for a faculty development program.

Tags: Faculty Development

CHANGE IN HIGHER EDUCATION

Beach, A. L., Henderson, C., & Finkelstein, N. (2012). Facilitating Change in Undergraduate STEM Education. *Change: The Magazine of Higher Learning*, *44*(6), 52–59. doi:10.1080/00091383.2012.728955

Abstract: Efforts to transform introductory course sequences in STEM have met with only modest success despite having significant knowledge of effective practices, along with curricular and pedagogical resources, While we may know what to do, we do not know how to enact and sustain these reforms at scale. What we need is a framework for understanding STEM instructional change. We propose such a framework to provide a tool for those engaged in educational transformation at the undergraduate level, particularly within STEM education. We summarize findings from an interdisciplinary literature review, introduce a typology of change strategies, and use these to make recommendations for mechanisms of change.

Comment: Building on previous research by these authors they lay out four categories of change strategies employed by STEM innovators based on their goals. Framework emerged from research. One axis of this model focuses on the aspect of the system to be changed: is it at the environmental or structural level or at the individual level. The other axis identifies the level to which the change is known in advance, that is, is it prescribed or emergent? They describe successful strategies within each category, summarized here: 1) individual/prescriptive: disseminating curriculum and pedagogy, 2) individual/emergent: developing reflective teachers, 3) environmental/prescribed: developing policy and 4) environmental/emergent: developing a shared vision. Argues for structural reform, not just at individual level. Builds on Froyd's 2008 article and research on SUCCEED. Makes specific recommendations for action by Change Agents and how to organize the change.

Tags: Fostering Change, Revising Curriculum

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Clark, M. C., Froyd, J., Merton, P., & Richardson, J. (2004). The evolution of curricular change models within the foundation coalition. *Journal of Engineering Education*, *93*(1), 37–47.

Abstract: This paper examines one aspect of the curricular change process undertaken by the Foundation Coalition (FC); specifically, how understanding about curricular change held by the FC leaders evolved as they moved through the process of establishing a new curriculum at their institutions. The initial change model was similar to that used for product development and emphasized the role of a pilot program. However, as the curriculum moved beyond the pilot stage to adoption and full-scale implementation, and then into the final stage where sustaining the new curriculum was the focus, the change model became more complex. Those complexities reflect a parallel evolution in their understanding of what constitutes a curriculum, from their initial conceptualization of it as a product to be carefully designed towards an understanding of it as a dynamic entity whose growth must be sustained.

Comment: 8 case studies of campuses participating in the Foundation Engineering Coalition. Retrospective study that identifies the original coalition's change model and traces how it evolved as the participants became more experienced in terms of making sustainable curriculum change. Resulting model was still seen as insufficient to guarantee change. Issue seen and described through the lens of Roger's dissemination; reflects the thinking at the time. **Lessons Learned:** 1) change takes time, its messy, its not logical or rational. 2) Curriculum is not a machine (product) made up of various components; it is a dynamic process based on negotiation.

Tags: Fostering Change, Revising Curriculum

Connolly, M., & Seymour, E. (2008). *Why theories of change matter. Mobilizing STEM Education for a sustainable future*, viewed August 14, 202, http://mobilizingstem.wceruw.org/

Abstract: In the January meeting we will ask Critical Advisors to propose new or adapted theories of change that can accomplish our shared vision for higher education. It will be useful, therefore, to review some of the theories of change that have already been used in efforts to improve quality and access in STEM education and to consider why some STEM reform efforts based on particular theories of change (whether implicit or stated) may be more or less successful than others. To this end, the principal purpose of this paper is to argue that theories of change are powerful yet often unacknowledged guides for human action for change. We first explain what a theory of change is; then we present our findings from a modest preliminary study of theories of change in a small sample of projects that the National Science Foundation solicited and subsequently funded to improve STEM education. The paper concludes by discussing the implications of unarticulated theories of change for our efforts to mobilize STEM education for a sustainable future.

Comment: Seymour is well-known for promoting theories of change in the service of planned change and evaluation. Paper examines three NSF programs that sought to improve STEM education: the Math-Science Partnerships (MSP), Course, Curriculum, and Laboratory Improvement (CCLI), and the Chemistry Curriculum Initiatives (CCI). Article shows common pit falls in change attempts based on no theory or unarticulated theory – main message: if you can't explain what you want to do and why you think change will occur, how can you possibly determine if you accomplished what you hoped? Focus of study at both the NSF program level as well as the individual project level; individual projects examined as examples of how theories of change, whether implicit or stated was enacted. MSP & CCI are and were large multi-campus initiatives. CCLI analysis focused mainly at the Type I level that is at an individual campus.

Tags: Fostering Change

Dempster, J. A., Benfield, G., & Francis, R. (2012). An academic development model for fostering innovation and sharing in curriculum design. *Innovations in Education and Teaching International*, *49*(2), 135–147. doi: 10.1080/14703297.2012.677595

Abstract: This paper outlines an academic development process based around a two- or three-day workshop program called a Course Design Intensive (CDI). The CDI process aims to foster collaboration and peer support in curriculum development and bring about pedagogic innovation and positive experiences for both tutors and learners. Bringing participants together in multi-disciplinary teams enables critical review and cross-fertilisation of ideas within and across teams. The paper draws on an in-depth evaluation undertaken over a five-year period. Data were analyzed from reports, workshop feedback and in-depth interviews with nine CDI participants from six program teams. The CDI approach appears to legitimize and support time out for staff to work collaboratively and reflectively on new modes of delivery, such as e-learning for blended and distance courses. Its success, however, is contingent on a variety of factors, especially the agency of key staff members. We critique the workshop model and discuss the benefits, limitations and critical success factors.

Comment: UK-based effort focusing on 'professional knowledge' akin somewhat to tradition of PCK-pedagogical content knowledge efforts in US. Faculty development program based on well documented efforts of other CDI projects revised to meet their own campus needs. Other models are cited in the article. Evaluation based on five years of project data (reports, workshop feedback, images from workshops and representations of designs.) Results

tend to support some of the business literature on what it takes to make organizational change. See Appendix A for recommendations and lessons learned. While not a part of a larger regional or national initiative, the project seems to have emerged from within a context of support for CDI an based on effective models.

Tags: Fostering Change, Faculty Development

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Froyd, J., Beach, A., Henderson, C., & Finkelstein, N. (2008). Improving educational change agents' efficacy in science, engineering, and mathematics education. In H. Hartman (Ed.), *Integrating the Sciences and Society: Challenges, Practices, and Potentials* (Vol. 16, pp. 227–255). Bradford, GBR: Emerald Group Publishing Limited. Retrieved from doi: 10.1016/S0196-1152(08)16009-4

Abstract: Although recent decades have seen increasing calls for fundamental change in the teaching of Science, Engineering, and Mathematics (SEM), efforts to more broadly propagate proven innovations have met with only modest success despite (i) numerous national reports calling for changes, (ii) considerable funding that has been invested in SEM education improvements, and (iii) the growing body of literature on the superior efficacy of many curricular innovations. This chapter suggests that SEM innovators, while expert in their fields, may need to thoughtfully consider research and literature on change, both within higher education and including broader work on organizational change. From a review of the literature on change in higher education, two particular challenges are identified: goal ambiguity and narrow focus of change initiatives. To address these challenges, the authors offer a conceptual framework for decisions that SEM educational change agents make as they design and implement their change initiatives. Within this framework, they offer options and combinations of options that change agents might consider. Given the breadth and complexity of the literature and challenges of change, SEM educational change agents might consider forming collaborations to which they would contribute their disciplinary expertise in one of the three research communities. They might team with individuals who bring requisite expertise from other research communities or with respect to individual and organizational change. Such partnerships might develop approaches that would concurrently address multiple foci. Collaborations that included expertise in individual and organizational change would also be better prepared to navigate complexities of institutional change.

Comment: Covers in more depth much of the content from other papers. The most salient, actionable point that sets this paper apart is the call for collaboration amongst SEM (why eliminate technology?) educational researchers, faculty development researchers and higher education researchers to look at change. Extensive literature review in these three areas, with suggestions for literature on change in organizations from the traditions of: social science, political science, economics and business.

Tags: Fostering Change, Faculty Development, Revising Curriculum

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Froyd, J., Henderson, C., Layne, J., Finkelstein, N., Beach, A., & Larson, R. S. (2008). More than good curricula: A guide for curricular change agents. In *ASEE Annual Conference and Exposition, Conference Proceedings* (p. 14). Presented at the 2008 ASEE Annual Conference and Exposition, Pittsburgh, Pennsylvania: American Society for Engineering Education.

Abstract: Each year, many engineering faculty members undertake curricular innovation projects, often with a long-term goal of the innovation becoming mainstream in their department, college, or institution. While the

literature on curricular and pedagogical innovation is very large, the knowledge base on which engineering faculty members, who could be viewed as the essential curricular change agents, is smaller and scattered across different disciplines. This paper will synthesize research and practice on curricular change to offer an accessible knowledge base and guidance for curricular change agents. After the introduction, the paper will be organized in the following sections: (1) goals for change, (2) barriers to change, (3) foci for change, and (4) strategies for change.

Comment: Basically a summary of longer 2008 book chapter. The paper takes as its audience a change agent interested in making reform at the campus level. Interestingly, they never discuss what a change agent is, characteristics, role, etc. – rather a critical point in organizational development/change literature. They end with four things Change Agents need to know (see Appendix A) This is a good review of the literature on research on change in higher education, particularly in relation to STEM and engineering. Breaking the types of change efforts reported in the literature into the three foci for change: curriculum, faculty development and organizational structures and policies. They claim that they found no articles that looked at combinations of these foci – I question that claim – they give no description for their criteria in selecting articles for review. While it might not entail empirical studies, people do write about it and this has been the guiding principle of several organizations, most namely PKAL.

Tags: Fostering Change, Faculty Development, Revising Curriculum

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Kezar, A. (2009). Change in higher education: not enough, or too much? *Change: The Magazine of Higher Learning*, *41*(6), 18–23. doi:10.1080/00091380903270110

Abstract: Argues that the notion that change is not of interest to higher education is a myth that prevents needed progress. It is not a lack of interest in change but the large number of stakeholders and multiple initiatives that are constantly being introduced into higher education destroy the capacity to implement meaningful change. Draws on research conducted over the last 15 years on leadership and change and her experience as a change agent in a variety of initiatives locally, regionally, and nationally. This is largely a conceptual argument. This article describes a variety of conditions that lead to initiative overload, including too many stakeholders, a lack of synergy among similar efforts, an inability to prioritize, turnovers in leadership, and institutional isomorphism. There are not too many simultaneous change initiatives are the only obstacle to change, rather, resistance, lack of vision, poor implementation strategies, lack of long-term planning, ineffective communication, poor or non-existent succession planning, bureaucratic structures, and weak leadership impede deep change. Also, a lack of understanding about the degree to which change is being promulgated—constantly, innumerably, and duplicatively—creates a host of problems that could be addressed with greater awareness on the part of stakeholders, leaders, and change agents.

Comment: Conceptual - useful at campus level to show problems associated with short term vision and leadership.

Tags: Fostering Change

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Kezar, A. (2011b). What is the best way to achieve broader reach of improved practices in higher education? *Innovative Higher Education*, *36*(4), 235–247. doi:10.1007/s10755-011-9174-z

Abstract: This article examines a common problem in higher education - how to create more widespread use of improved practices, often commonly referred to as innovations. I argue that policy models of scale-up are often advocated in higher education but that they have a dubious history in community development and K-12 educa-

tion and that higher education leaders should shirk policymakers' push to use a scale-up model of change. These thoughts are conceptual and are based upon a critical review of literature in community development and K-12, but I also draw upon empirical data in reviewing examples of widespread use of innovations in higher education.

Comment: Discusses Mutual Adaption and Social Change as two models that are particularly useful in terms of supporting adoption of innovation or change on a campus. This would lay a good theoretical basis for integrating entrepreneurship into the curriculum. While mainly a literature review, she also discusses how Service Learning scaled to reach over 3,000 campuses in 10 years. Could provide the project with a theoretical under-pinning for a number of the approaches they are undertaking, e.g., building networks, leaving room for contextualization and building ownership at individual campus level, leadership building.

Tags: Fostering Change

Kezar, A. & Elrod, S. (2012). Facilitating interdisciplinary learning: Lessons from Project Kaleidoscope. *Change: the Magazine of Higher Learning*, 44(1), 16-25. DOI:10.1080/00091383.2012.635999

Abstract: Project Kaleidoscope (PKAL) has been looking at systemic ways to create interdisciplinary teaching and learning environments. Like the National Academies report, PKAL thinks that campuses across the country have not created environments hospitable to interdisciplinarity. In this article, we highlight research conducted on one of the major projects facilitated by PKAL: Facilitating Interdisciplinary Learning (FIDL), funded by the W.M. Keck foundation (at http://www.aacu.org/pkal/interdisciplinarylearning/index.cfm). The central premise of the project's leaders was that higher education institutions will not create the innovative and complex thinkers of the future unless campuses reshape their processes and policies.

For three years (2007–2010) the FIDL initiative brought together teams from 28 institutions of diverse types in order to foster more intentional interdisciplinary learning; connect various interdisciplinary initiatives; and learn about successful strategies for planning, evaluating, and institutionalizing interdisciplinary programs. 250 faculty and campus leaders participated in four national meetings, including two roundtables focused on assessment and leadership. The campuses concentrated on the creation of integrative learners, faculty and students with the skills and confidence to work at the interfaces between disciplines to address both research questions and complex societal problems.

Comment: PKAL has been extremely successful at fostering change via faculty development and systemic change. This is an evaluation of a program funded by the Keck consortium, which was multi-institutional. Useful model all around. Kazar uses own theories to evaluate the impact of the program and outlines what was initiated/supported by PKAL and what teams did at home campus. Some insight into what makes successful teams at campus level.

Tags: Fostering Change, Faculty Development

Kezar, A., & Lester, J. (2009). Promoting Grassroots Change in Higher Education: The Promise of Virtual Networks. *Change: The Magazine of Higher Learning*, 41(2), 44–51. doi:10.3200/CHNG.41.2.44-51

Abstract: There are many important innovations happening on campuses that are being championed by people who can be characterized as grassroots leaders. This article covers a study to document and better understand these kinds of changes and the leadership that initiates and sustains them. Hundreds of faculty and staff at liberal arts colleges, community colleges, universities, technical colleges, and regional public institutions, were interviewed

about asking past and current initiatives they have undertaken. The goal of the research was to help other potential leaders understand how to overcome obstacles, navigate power structures on campus, and maintain resilience in the process of instituting long-term change. The authors believed that most interviewees would talk primarily about campus-based resources (e.g., colleagues, centers for teaching and learning, campus networks, etc.) that supported their efforts. One of the findings to emerge in the study, however, was the importance of external networks and support groups in creating change on college campuses.

Comment: Discusses short case studies of change instituted on three campuses and how initiators used external networks. Part I is based on research, 2nd part of article is discussion of various online resources that people might use to create virtual networks. Provides support for creating an online network for the convenings.

Tags: Fostering Change

Kotter, J. P. (2007). Leading change: Why transformation efforts fail. *Harvard Business Review*, *85*(1), 96–103.

Abstract: Leaders who successfully transform businesses do eight things right (and they do them in the right order.

Comments: Business approach - 8 steps to accomplishing change - very pragmatic. Useful at the campus level or in terms of setting the curriculum; might be useful with regards to checklist or checking in on progress - rubric for study of change

Tags: Fostering Change

Kotter, J. P., & Schlesinger, L. A. (2008). Choosing strategies for change. *Harvard Business review*, *86*(7/8), 130–139 +162.

Abstract: Change initiatives often backfire because managers apply one-size-fits-all approaches. For example, they attempt to combat resistance to change by involving employees in the initiative's design even when employees don't have the information needed to provide useful input. To lead change, tailor your strategies to the types of resistance you'll encounter. For instance, with employees who fear change, provide skills training. Consider situational factors. For example, to avert an imminent crisis, change quickly – even if that intensifies resistance.

Comment: Re-issue and update of 1979 article on how to manage change using various political tactics. Focuses on resistance to change. While some strategies not applicable to higher education (e.g., firing staff is difficult) the description of how to analyze change situation, bring people into the process and negotiate with them to accomplish change is useful. Higher Ed change literature and management seems to take lessons for suggestions promoted by Kotter.

Tags: Fostering Change

Plumb, C., & Reis, R. M. (2007). Creating change in engineering education: A model for collaboration among institutions. *Change: The Magazine of Higher Learning*, *39*(3), 22–31. doi:10.3200/CHNG.39.3.22-31

Abstract: The United States, as well as the rest of the world, will face critical civil, environmental, energy, communication, manufacturing, and health-care challenges in the coming decades, and more scientists and engineers will be needed to address those problems. Instead of concentrating on analytical and problem-solving skills, engineering education needs to develop in American engineering students skills such as research creativity, entrepreneurial risk-taking, multidisciplinary thinking, and the strong interpersonal and language skills that will enable them to function as self-directed, collaborative learners long after they leave the classroom. In response to pressures and the need for reform in engineering education, in 2003 the William and Flora Hewlett Foundation initiated a comprehensive project, the Engineering Schools of the West Initiative (ESWI), to improve engineering education by means of the collective efforts of nine primarily bachelor's- and master's-granting institutions in the Western United States. After four years, the initiative already is having a significant impact at the schools involved, illustrating how collaboration and communication among the institutions have facilitated important changes in engineering education.
Comment: Specifically addresses program design that is multi-institutional and collaborative in nature. The funder (Hewlett) required collaboration to play. Describes how collaboration was designed and effective practices. Processes not particularly unique, e.g., face to face meetings, cross institutional committees, website, but they do draw useful lessons that were generalized to supporting change in general on campuses. See power point for lessons.

Tags: Fostering Change, Faculty Development

Sirkin, H. L., Keenan, P., & Jackson, A. (2005). The hard side of change management. *Harvard Business Review*, *83*(10), 108–118 +158.

Abstract: Little agreement on what factors most influence transformation initiatives. Companies must pay as much attention to the hard side of change management as they do to the soft aspects. By rigorously focusing on four critical elements - project duration, performance integrity, commitment, effort employees must make to make it stick – (DICE) they can stack the odds in favor of success.

Comment: not exactly 'hard' research by any means, but very practical suggestions; consistent with other business literature and some bleed into higher education literature. Based on research in various large companies. DICE assessment tool could be a useful tool for self assessment re: 'readiness for change'

Tags: Fostering Change

Steinert, Y., Cruess, R. L., Cruess, S. R., Boudreau, J. D., & Fuks, A. (2007). Faculty development as an instrument of change: A case study on teaching professionalism. *Academic Medicine*, *82*(11), 1057–1064.

Abstract: Faculty development includes those activities that are designed to renew or assist faculty in their different roles. As such, it encompasses a wide variety of interventions to help individual faculty members improve their

skills. However, it can also be used as a tool to engage faculty in the process of institutional change. The Faculty of Medicine at McGill University determined that such a change was necessary to effectively teach and evaluate professionalism at the undergraduate level, and a faculty development program on professionalism helped to bring about the desired curricular change. The authors describe that program to illustrate how faculty development can serve as a useful instrument in the process of change.

The ongoing program, established in 1997, consists of medical education rounds and "think tanks" to promote faculty consensus and buy-in, and diverse faculty-wide and departmental workshops to convey core content, examine teaching and evaluation strategies, and promote reflection and self-awareness. To analyze the approach used and the results achieved, the authors applied a well-known model by J.P. Kotter for implementing change that consists of the following phases: establishing a sense of urgency, forming a powerful guiding coalition, creating a vision, communicating the vision, empowering others to act on the vision, generating short-term wins, consolidating gains and producing more change, and anchoring new approaches in the culture. The authors hope that their school's experience will be useful to others who seek institutional change via faculty development.

Comment: Illustrates Kotter's theory in action - talks about how faculty development was implemented, less in workshops methods and more in terms of 'think tanks' and task forces - result: changed curriculum with method for evaluations

Tags: Fostering Change, Faculty Development, Revising Curriculum

Appendix A: Lessons Learned & Observations

Appendix A provides operational details from articles that are included in the Annotated Bibliography. The articles are grouped into the topic areas of faculty development and change management in higher education. To help synthesize and consistently present information from each article, we developed a framework that includes: article type; tags; context; theoretical model; lessons learned; recommendations; and, follow-up questions. For some articles, we included information on the program's structure under study, tools and/or activities associated with a program and any pertinent evaluation information such as measurement methods or tools.

LESSONS LEARNED FROM LITERATURE ON FACULTY DEVELOPMENT

What is Faculty Development?

Faculty development refers to planned activities designed to improve the knowledge, attitudes & skills essential to the performance of the instructor role.
(Reilly 2012.)

...the goal of faculty development [is] to "develop & support a dedicated, skilled (competent) & confident faculty to address the instructional needs of learners."
(McQuiggan & Ragan, 2009; from Reilly 2012)

Faculty development is also meant to improve practice & manage change by enhancing individual strengths & abilities as well as organizational capacities & culture.
(Bligh, 2005; from Steinert, 2006)

[faculty development] ... includes initiatives designed to improve the performance of faculty members in teaching, research & administration.
(Sheets & Schwenk, 1990; from Steinert, 2006)

In many ways, faculty development is a planned program to prepare institutions & faculty members for their academic roles, including teaching, research, administration, writing & career management.
(Bl& et al., 1990; from Steinert, 2006)

Faculty development has been defined as that broad range of activities that institutions use to renew or assist faculty in their roles.
(Centra, 1978; from Steinert, 2006)

Context for the role of faculty development within engineering education

Borrego et al. 2007. *Panel – Emerging results: Were the engineering education coalitions an effective intervention?*

Context: Panel presentation & discussion of research results around evaluating aspects of the NSF Engineering Education Coalitions, a program that had run for 15 years

Evaluation: None; evaluation related to separate the research efforts described did not address faculty development.

Lessons / Observations: *"success in innovation & systemic reform [of engineering education] may depend as much on attention to faculty development & institutional change as on the results of rigorous engineering education research."* (p. F4F-5)

Follow-up Questions: None

Article Type: Conference Paper

Tags: Faculty Development; Fostering Change

Examples of faculty development models from several disciplines

Brent & Felder. 2003. *A model for engineering faculty development.*

Context: In 1997, a coalition of eight R1 institutions designed & implemented a model for sustainable faculty development in engineering with the goal to improve teaching

Theoretical Model for Program: none

Program Structure:

- Support via (new) instructional development programs for: faculty; new faculty; graduate students
- Support leveraging organizational factors: designated FD coordinator embedded in engineering dept/college; links formed with existing campus programs; incentives created by institution to improve teaching
- Assessment: Local & across coalition

Local Evaluation: Participant satisfaction with FD program (written rating forms (most common) & interviews (uncommon); impact of FD on teaching practices (rarely done); impact on student learning (costly, difficult: never done)

Coalition-wide Evaluation: Impact on teaching practices (two email surveys to identify changes in teaching methods – frequency analysis)

Lessons Learned:

- Emphasize disciplinary relevance in FD programs. Perceived relevance is perhaps the single most important feature of faculty development programs that induces engineers to sign up for them & to take them seriously
- Keep it practical. The second most critical characteristic of successful engineering FD programs is their perceived practicality. Most engineers who attend teaching workshops are not seeking philosophical discussions about the nature of learning
- Include both disciplinary & pedagogical expertise on workshop facilitation teams.
- Cite the research. Workshop handouts should include summaries of relevant research results & references for those who wish to check the research for themselves.
- Avoid appearing prescriptive, dogmatic, or evangelical.
- Practice what you preach! Participants are acutely conscious of whether or not presenters do what they are recommending.

Follow-up Questions: None

Article Type: How we did it good

Tags: Faculty Development

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Gjerde et al. 2004. *A Weekend Program Model for Faculty Development with Primary Care Physicians*

Context: a faculty development program in the healthcare field for clinician-educators Theoretical Model for the Program: none

Program Structure:

- Seminar series over five weekends throughout the year
- Incentives: funding for housing, meal, travel; no stipends
- Teaching approaches: group discussion; mentoring; role play; problem-based learning; unstructured, informal networking opportunities

Evaluation:
- Pre-planning: needs assessment (survey) to refine topics; intake assessments to address "housekeeping issues" (ID cards, computer configuration, food requirements)
- Formative: post-session assessments (survey) on satisfaction, used to refine ongoing program
- Summative: evaluate entire program (survey; large group exit interview); pre-post skills self-assessment (survey - skill indicators developed from the evolving general fellowship objectives & anticipated teaching emphasis)
- Caveats: "much of the data is self-report of short-term learning, & such data provide weak, though often valid, evidence"

Lessons Learned:
- The programs were appealing to community-based preceptors at all stages of their careers. CME credit is important for community- based physicians but not for university-based physicians.
- Teaching methods are important. Faculty needed to apply adult learning & active learning principles.
- Participants' initial technology skills were often low, & they needed help.
- Maintaining a sense of curriculum continuity during the year was a challenge, so it was better to have a core group do most of the teaching.
- Participants generally did not want take-home work when they returned to their day jobs.
- Participants needed extensive faculty support on their projects.

Follow-up Questions: None
Article Type: How we did it good
Tags: Faculty Development

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Laird et al. 2010. *Development, implementation, & outcomes of an initiative to integrate evidence-based medicine into an osteopathic curriculum.*

Context: Getting faculty to adopt & insert new / revised medical curriculum into their classes
Theoretical Model for Program: Diffusion of Innovation (Rogers)
Program Structure:
- Needs assessment, pre-intervention;
- Four workshops: an intro & three based on DoI themes (Knowledge, Persuasion, Implementation; NOT: Decision, Confirmation);
- Assessment, during & post-intervention

Evaluation:
- Needs assessment on attitudes & confidence teaching topic (survey, in appendix)
- Attitudes & beliefs assessment (pre-post survey, in appendix)
- Curriculum map to determine the extent of EBM content in each course
- Assessed student performance to evaluate the effectiveness of EBM instruction after it was institutionalized. (pre-post survey with students)

Tools / Activities: Workshop design emphasized activities that aligned with best practices to disseminate knowledge & facilitate behavioral change among faculty): 1) Consensus-building opportunities; 2) Educational outreach

visits by other faculty; 3) Recruitment of influential colleagues to champion curricular revision

Factors influencing adoption of innovations: 1) Collegial relationships; 2) Methods of dispensing knowledge transfer; 3) How a call for action is communicated

Follow-up Questions:

- Could you share or describe your curriculum mapping tool to track the diffusion of EBM content? Please reflect on its utility in the short- & long-term.

- Reflect on the results of using Rogers' Diffusion of Innovation model to guide the program development.

- Discuss the characteristics of participating institutions & individuals that contributed to successes or posed challenges to implementing your program.

- If you implemented this program again, what would you do differently or the same?

Article Type: How we did it good

Tags: Faculty Development, Fostering Change, Revising Curriculum

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Reilly et al. 2012. *Faculty development for e-learning: A multi-campus community of practice (COP) approach.*

Context: Five-year grant-funded initiative among five University of Wisconsin campuses to infuse technology into nursing education

Theoretical Model for Program: Selected from best practices in literature

- Build on previous activities; offer opportunities to discuss classroom experiences with others; align activities with state & national standards; encourage ongoing professional communication of instructors with similar concerns (Birman, 2000)

- [Specifically with regard to medical education programs]: incorporate experiential learning; provide feedback; include effective peer & colleague relationships; apply effective teaching learning principles; use diverse methods (Steinert, 2000)

- Use diverse methods for faculty development (seminar series, short-courses, workshops, & webinars); faculty can benefit from formal & informal consultations from off-campus "experts," mentors, fellowships, & learning communities Rubeck (1998); Steinert (2000)

- Select an organizing framework upon which to base the learning objectives, topics & presentations for the faculty development program Birman (2000) & Berquist (1975). For Reilly et al, this was the Flexible Framework for E-Learning by Badrul Khan

- Planning began two years prior to e-learning year via multi-disciplinary committee

Program Structure:

- Monthly video conferences among scholars;

- Annual face-to-face conferences (e.g., e-learning year of faculty development culminated in a two-day conference)

- Site leader on each campus (a compensated position): coordinated the campus budget & local faculty development activities;

- Participation in online Desire2Learn© (D2L) courses;

- Assignments that encouraged interaction & reflective discussion

- Participants were offered a chance to win incentives, if all of the monthly surveys were completed (in support of program evaluation)

- Self-reflection became an important tool for faculty as they processed their new role & paradigm shift (also part of evaluation)

Tools / Activities: participants received detailed handbook on content framework; calendar for video conferences; online course with readings, assignments, follow-up notes, discussion board; supporting resources

Evaluation:
- Assessment of e-learning knowledge & practice (pre-post survey around video conferences)
- Assessment of knowledge & application of knowledge skills, or attitudes (summative survey delivered post f2f conference)
- No details on how self-reflection results were incorporated into assessment activities

Lessons Learned:
- The campus site leader structure provided an informal & important source of feedback about how scholars experienced the faculty development year. Leaders discussed & addressed these concerns & achievements in monthly site leader teleconferences.
- Time & sustaining engagement in the year-long faculty development program were realities: critical that site leaders were creative & persistent in fostering continued excitement & engagement of scholars.
- Technology variability across participating sites was a challenge.
- Program success required administrative support from each participating campus, faculty willing to invest time & energy to improve their understanding & comfort with e-learning, & use of educational technologies.
- Best practices are key in faculty development design & impossible without financial & technology resources. To replicate model, be cognizant of the time required to plan & execute multi-campus virtual faculty development programs, best accomplished with a team approach.

Follow-up Questions: Discuss the decisions you made about which best practices to include or privilege when designing your intervention?

Research studies that provide lessons-learned on a large scale.

Garet et al. 2001. *What makes professional development effective? Results from a national sample of teachers.*

Context: data is drawn from a survey of a national probability sample of teachers who had attended Eisenhower-assisted activities from July 1 through December 31, 1997. Analysis focused on these features of professional development (PD):

- Structural features – the design of PD activities: 1) the <u>form</u> of the activity: a study group vs. a workshop or conference; 2) the <u>duration</u> of the activity, including contact hours & the span of time over which the activity takes place; 3) the degree of <u>collective participation</u> for participants from the same school, department, or grade level

- Core features – dimensions of the substance of the PD experience: 1) the degree to which the activity has a <u>content</u> focus; 2) the extent to which the activity offers opportunities for <u>active learning</u>; 3) the degree to which the activity promotes <u>coherence</u> by incorporating experiences that are consistent with teachers' goals & aligned with state standards & assessments; &, by encouraging continuing professional communication

- Results are empirical confirmation of the assumptions in the literature on "best practice" in professional development (PD): 1) PD that is sustained & intensive is more likely to have an impact than PD of shorter duration; 2) PD that focuses on academic subject matter (content), gives teachers opportunities for "hands-on" work (active learning), & is integrated into the daily life of the school (coherence), is more likely to produce enhanced knowledge & skills. 3) To improve PD, it is more important to focus on the duration, collective participation, & the core features (i.e., content, active learning, & coherence) of an intervention than the type of intervention (workshop, etc.)

- Changes in teaching practice result from: 1) Activities that are linked to teachers' other experiences, aligned with other reform efforts, & encouraging of professional communication among teachers; 2) The collective participation of groups of teachers from the same school, subject, or grade (which is also related both to coherence & active learning opportunities)

- Results give renewed emphasis to the profound importance of subject-matter focus in designing high-quality PD.
- A major challenge to providing high-quality professional development is cost.

Article Type: Research study

Tags: Faculty Development; Teacher Professional Development

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Birman et al. 2000. *Designing professional development that works.*

Context: Reports on survey of nationally representative probability sample of teachers & on 6 exploratory & 10 in-depth case studies. Note: lessons learned are reported below for the structural & core features defined above in the Garet et al. slides.

Lessons Learned (from Birman, Desimone, Porter, & Garet, 2000; pp 29-31):
- *Form*: Activities of the reform type [study group, teacher network, mentoring relationship, committee or task force, internship, individual research project, or teacher resource center] are more effective primarily because they are longer & thus have more content focus, active learning opportunities, & coherence. When traditional forms of activities, such as workshops or institutes, are longer, they, too, have better core features & are just as effective.
- *Duration*: Activities of longer duration have more subject-area content focus, more opportunities for active learning, & more coherence with teachers' other experiences than do shorter activities.
- *Collective Participation*: PD activities that include collective participation – that is, the participation of teachers from the same department, subject, or grade – are more likely to afford opportunities for active learning & are more likely to be coherent with teachers' other experiences.
- *Content*: The degree to which professional development focuses on content knowledge is directly related to teachers' reported increases in knowledge & skills. Teachers do not find generic professional development that focuses on teaching techniques without also emphasizing content to be effective.
- *Active Learning*: Teachers whose PD includes opportunities for active learning reported increased knowledge & skills & changed classroom practice. Active learning encourages teachers to become engaged in meaningful discussion, planning, & practice as part of the PD activity.
- *Coherence*: The coherence of PD with policies & other professional experiences is directly related to increased teacher learning & improved classroom practice. An activity is more likely to be effective in improving teachers' knowledge & skills if it forms a coherent part of a wider set of opportunities for teacher learning & development.

Article Type: popular press version of Garet et al., 2001.

Tags: Faculty Development; Teacher Professional Development

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Steinert et al. 2006. *A systematic review of faculty development initiatives designed to improve teaching effectiveness in medical education.*

Context: faculty development interventions designed to improve teaching effectiveness in medicine

Caveats (p. 518):
- Many of the studies employed weak designs, making definitive statements about outcome difficult, <u>BUT</u> the literature suggests positive changes in teachers' knowledge, attitudes & skills following participation in a faculty development activity.

- The impact of faculty development on the organization is yet to be fully determined.
- Although many of the reported interventions were complex in nature (i.e. comprising different educational strategies & methods), few studies focused on teasing apart 'key features' of effective programs.

Lessons Learned re 'Key Features' of Faculty Development Programs
- Role of experiential learning: faculty members need to practice what they learn, & that immediate relevance & practicality is key
- Value of feedback: studies reported positive & negative results of feedback; more study required
- Importance of peers: peers are valuable as role models, for mutual exchange of information & ideas, & for the importance of collegial support to promote & maintain change
- Adherence to principles of teaching & learning: In terms of an organizing structure for FD programs, there appears to be a developing consensus that adherence to principles of adult learning (e.g. Knowles, 1988) & experiential learning (e.g. Kolb, 1984) promotes more effective learning & teaching. Principles of instructional design were also frequently cited.
- Use of multiple instructional methods to achieve objectives: programs recognized need to accommodate different learning styles & that different methods are required to meet diverse objectives
- Not included, but recognized by Steinert et al as important: 1) the need for systematic needs assessments at the outset of any program; 2) the value of reflection 'in action' & 'on action' (Schön, 1987); 3) the value of application to practice; & the need for follow-up or 'booster' sessions.

Lessons Learned from *Observations re faculty development interventions*
- Role of Context I: Although the results of these studies may not be generalizable, the principles of faculty development might be.
- Role of Context II: 4 conditions are necessary for change to occur (Kirkpatrick, 1994): 1. the desire to change; 2. knowledge of what to do & how to do it; 3. a supportive work environment; 4. rewards for changing. "*...the first two elements of change can potentially be achieved through faculty development activities; the last two cannot, & yet it is at this level that we expect change to occur. Consequently, the need to examine organizational characteristics, as well as the impact of faculty development on the organization, is critical.*" (Steinert, 2006; p. 519). [See Beach & Froyd(s)]
- Nature of Participation I: [wrt studies reviewed]: The majority of participants are volunteers. Perhaps it is time to move beyond 'volunteerism' to enhance teaching & learning.
- Nature of Participation II: "*It is our impression that facilitating a faculty development intervention requires a unique blend of skills & aptitudes that should be examined in greater depth.*" (p. 520).
- Where positive &/or lasting effects on teacher performance were found, they were often associated with interventions that involved active & experiential learning over time. "*This could be explained by the fact that repeated interventions over time allow for cumulative learning & practice; they also enable the development of a trusted network of colleagues & a community of teachers. These considerations are critical to faculty development program design.*" (Steinert, 2006; p. 521) [See Birman (2000); Garet (2001)]

Article Type: Research study
Tags: Faculty Development

Campus-based Change Initiatives

Dempster, Benfield & Francis (2012). *An academic development model for fostering innovation & sharing in curriculum design.*

Context: UK effort; faculty development based in CDI-course design intensive

Evaluation: useful framework for factors influencing perceptions of success

Model: Three principles of CDI: 1) working in extended teams (e.g., e-learning specialists & assessment experts); 2) challenging curriculum assumptions within a supportive collegial environment; 3) building & iteratively improving designs using peer review

Lessons Learned:

- Factors influencing CDI participation: 1) Management imperative: faculty member or department head decide to revise curriculum based on external pressure such as: modernization, new markets, changes in enrollment patterns. 2) Personal & professional aims: participants may have strong personal motivations to develop skills & knowledge; departmental imperative alone not enough

- Effective activities & outputs of CDI process: Allocating resources to curriculum planning: CDIs provided a clear way to allocate & prioritize time to focus, plan & organize – helped address workload issues

- CDI workshop design & facilitation: 1) Facilitators need to be able to simplify complex issues into pragmatic ideas. 2) Workshops need to be flexible as teams progress. 3) Participants highly value change to re-examine their own pedagogy.

- Factors contributing to success of CDIs: 1) Tangible deliverables; 2) Confidence & ownership (team & individual level); 3) Networks (among colleagues from different schools); 4) Conceptual change (experience is transformational)

- Challenges: 1) Sustainability of enthusiasm when time & resources for ongoing PD scarce; 2) Facilitators necessary to confront deeply held views about teaching & learning; 3) Requires sustained & open dialogue between host institution & 'experts' – host must take on project as their own

Article Type: journal article

Tags: Fostering Change; Faculty Development

"...the process of the CDI is not 'business as usual'. It needs commitment & resources, such as an institutional culture legitimizing innovation, high-level management support for freeing up course teams to work together for substantial periods, specialist facilitators/practitioners & a commitment to evidence-informed curriculum development founded on evaluation of the student experience." (p. 145)

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Steinert, et al (2007). *Faculty development as an instrument of change: A case study on teaching professionalism*

Context: medical schools

Model: Kotter's change model: 1) Establish a sense of urgency; 2) Form a powerful guiding coalition; 3) Create a vision; 4) Communicate the vision; 5) Empower others to act on the vision; 6) Generate short-term wins: 7) Consolidate gains; producing more change; 8) Anchor new approaches in the culture

Lessons Learned:

- Faculty development used at every step in model, from the initial workshops, which communicated the nature of professionalism to the faculty, to the sessions exploring methods of teaching and evaluation, the roles of the healer and the professional, and the concept of physicianship

- Faculty development trained fellows, focusing on roles as mentors and small-group facilitators, introducing them to the concept of portfolios, reflective practice, and narrative medicine

- Educational blueprint allowed for change and growth, additional activities need to be planned and implemented; unforeseen events will require adjustments

- Have a cadre of clinical teachers, small group leaders, and mentors, to teaching of professionalism in an incremental fashion throughout the faculty

Article Type: journal article

Tags: Fostering Change; Faculty Development; Revising Curriculum

Engineering Specific Change Initiatives

Clark et al (2004). *The evolution of curricular change models within the foundation coalition*

Context: change models in engineering education; retrospective research on Foundation Coalition

Model: Emergent. From simple (develop curriculum, pilot & assess leads to adoption) to more complex (develop curriculum, pilot & persuade colleagues to try it, implement in form that works for all students & faculty leads to structures & mechanisms to sustain its continuous growth)

Lessons Learned:

- Change takes time. It is messy, is not rational, or mechanistic.

- Change in Eng. Ed. Is not like product development; people do not easily adopt/adapt a prototype and sustain it. Assessment data alone is not persuasive.

- Curriculums need to accommodate all students and faculty

- Curriculums are 'living' and need to be supported by appropriate structures and mechanisms. Initial drafts are good starting places; end result rarely looks like the rational, carefully planned starting place

- Faculty members have to be involved in curriculum change 'up front' to find common ground re: expectations and processes for student learning and achievement

- Change is less about the curriculum and more about changes in beliefs about teaching & learning among faculty members.

Article Type: journal article

Tags: Fostering Change; Revising Curriculum

Change in National or Regional STEM-Related Initiatives

Beach, Henderson & Finkelstein (2012). *Facilitating Change in Undergraduate STEM Education*

Context: description of framework emerging from research on change in STEM education; mainly physics (PERS) & SUCCEED (engineering coalition)

Model:

	Prescribed	**Emergent**
Individual	**1. Disseminating: Curricula & Pedagogy** Goal: teach individuals about new teaching conception &/or practices	**2. Developing: Reflective Teachers** Goal: Encourage individuals to develop new teaching conceptions &/or practices
Environments & Structures	**3. Enacting: Policy** Goal: create environments & structures that require new teaching conceptions &/or practices	**4. Developing: shared vision** Goal: Empower stakeholders to collectively develop new environments & structures that support new teaching conceptions &/or practices

Lessons Learned: Whom to involve/where to act
- Work at the departmental level
- Engage both individuals & environments
- Align environments & structures
- Balance emergent & prescribed processes
- Create partnerships
- Involve professional societies & organizations

Lessons Learned: Organizing the change
- Plan to take time
- Build on prior work from disparate research communities
- Build in evaluation
- Be flexible & open to emergent outcomes
- Analyze institutional structures in advance

Article Type: journal article
Tags: Fostering Change

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Kezar & Elrod (2012). *Facilitating interdisciplinary learning: Lessons from Project Kaleidoscope*

Context: Large, multi-institutional effort funded by Keck Foundation to foster interdisciplinary learning
Evaluation: Based on research project currently being conducted
Model: Kezar's 3- stage model 1) Mobilization: the system is prepared for change; 2) Implementation: the change is introduced; 3) Institutionalization: the system is stabilized in its changed state
Lessons Learned:
- PKAL participation led to new language and ways to frame productive campus discussions
- PKAL network helped participants learn about change strategies, leadership approaches, barriers to avoid or surmount
- Characteristics of high functioning campus teams: 1) Regular interactions; 2) Documented progress; 3) Created an open & experimental mindset fostering innovation; 4) Had fluid & interdisciplinary membership

Follow-up Questions: What is their research method? Any preliminary findings?
Article Type: journal article
Tags: Fostering Change; Faculty Development

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Plumb & Reis (2007). *Creating change in engineering education: A model for collaboration among institutions*

Context: engineering education, Engineering Schools of the West Initiative – funded by Hewlett
Evaluation: collaboratively run by committee; no details in article
Model: multi-institutional collaboration; other institutions will adopt changes developed by collaborators because they are well respected institutions & innovations have been assessed. Hope.
Lessons Learned:
- Choose institutions based on: 1) Likelihood that changes at institution would stimulate changes at similar institutions; 2) Committed to rigorous assessment & ability to sustain the effort over the long term; 3) Willing to meaningfully collaborate with other institutions
- Use funding to support: 1) Face to face meetings to build & support collaboration; 2) Assessment staff or experts; 3) Annual meetings; 4) Committee meetings (e.g., assessment & sustainability); 5) Institution to institution exchange of resources; 6) Project website
- To increase probability of adoption, benefits to all participants must far exceed costs in terms of time, effort & money. Campus administrators need to: 1) Provide faculty with examples of collaborations that work; 2) Lower or eliminate barriers to collaboration by: providing funds for travel, meeting facilities, facilitators, documentation; 3) Collaboration must be an *explicit* part of funding criteria along with evidence of collaboration – it must be an explicit part of faculty member's professional responsibilities not an add on; 4) Assign a portion of faculty (& staff) salaries to grant; 5) Gather data to support case for continued funding from the beginning; assessment is key to making case for follow on funding

Follow-up Questions: What are the final evaluation findings? Is the collaboration still functioning? How? What has been the impact of change efforts?
Article Type: journal article
Tags: Fostering Change; Faculty Development

Organizational Change in Higher Education

Kezar & Lester (2009). *Promoting Grassroots Change in Higher Education: The Promise of Virtual Networks*

Context: higher education in general
Model: importance of external networks (e.g., AAHE, NSF) in making change locally
Lessons Learned: Create virtual communities of practice using social networking, blogs, and micro-lending as a model
Article Type: journal article
Tags: Fostering Change

Kezar (2009). *Change in Higher Education: Not Enough, or Too Much?*

Context: higher education – institutional level
Model: NA
Lessons Learned:

- Too many grassroots change efforts lead to chaos. Networks, informal groups, and collaboratives can secure more buy-in for ideas and make similar projects more viable by creating allies across campus to support them, synergies among them, and broader leadership for them.
- Leaders fear the difficulty of working in large groups or intergroup strife. Business has moved toward team-oriented reward structures; higher education needs to do so as well.
- Deep change typically takes 10-15 years; administrators turn over every 5-7 years. Presidents and other high-level campus administrators need to delegate authority to ensure someone carries the initiative forward, assuming successor will not.

Article Type: journal article
Tags: Fostering Change

Kezar (2011). *What is the best way to achieve broader reach of improved practices in higher education?*

Context: conceptual review of the literature of higher education; current notion of 'scaling up' is too narrow
Model:

- Redefine 'scale-up' based on Coburn's (2003) K-12 model. Getting a reform to multiple settings is a necessary but insufficient condition for scale. Instead:
  - *Depth*: innovations must reach deep and affect consequential change in classroom and school practice, impact the beliefs of teachers and underlying assumptions about the nature of teaching and learning
  - *Sustainability*: programs brought to scale must succeed overtime
  - *Spread*: impact more than activity structures; innovations must change underlying beliefs, norms, and principles
  - *Shift*: ownership moves away from external group until it is owned by the districts, schools, and teachers who sustained and deepened the reform
- A *mutual adaptation* change process is: 1) flexible; 2) negotiated between the developers and teachers; 3) its design reflects local needs but still holds true to the nature of the innovation (conditions that give rise to reform in the first place replicated, i.e., demand for innovation needs to be created)
- In a *social movement* change process people form networks, deliberate and discuss the innovation, work collectively, and create rewards and institutional structures to make it part of the system
- The model's *underlying assumptions* are that: 1) motivation is best achieved internally; 2) innovations developed or modified at the particular setting work best; 3) professionals are engaged in shaping and owning innovation

Lessons Learned:

- Modify reform efforts to fit the setting
- Create communities of practice to promote innovation
- Negotiate innovation among persons within the setting & in accord with changing circumstances
- Establish dedicated leadership
- Create or ensure there is strong interest and demand in target community
- Ensure sufficient funding
- Connect local settings to a network of other innovators

Article Type: journal article
Tags: Fostering Change

Organizational Change in Business

Kottar (2007). *Leading change: Why transformation efforts fail*

Context: business perspective on organizational change
Evaluation: 8 steps might be translated into evaluation rubric
Model: 1) The change process goes through a series of phases that usually require a considerable length of time. 2) Skipping steps creates only the illusion of speed & never produces a satisfying result. 3) A second very general lesson is that critical mistakes in any of the phases can have a devastating impact, slowing momentum & negating hard won gains.
Lessons Learned:

- Establish a sense of urgency
- Form a powerful guiding coalition
- Create a vision
- Communicate the vision
- Empower others to act on the vision
- Plan for creating short-term wins
- Consolidate improvements and produce still more change
- Institutionalize new approach

Article Type: journal article
Tags: Fostering Change

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Kotter & Schlesinger (2008). *Choosing strategies for change*

Context: business perspective on organizational change
Model: exchange theory – top down, power
Lessons Learned:

- Analyze Situational Factors: 1) Determine how much & what kind of resistance to expect; 2) Assess your power relative to resisters'; 3) Identify who has the most accurate information to design the change initiative; 4) Decide how urgently the company must change

- Determine optimal speed of change, proceed slowly if you: 1) Anticipate intense resistance, 2) Have less power than resisters, or 3) Need information from others to design & implement the change
- Manage Resistance: 1) Use education to communicate the reasons for the desired change if resistance stems for employees' lack of information. 2) Encourage participation in design or implementation if you want resisters to become more committed to the change. 3) Provide skills training and emotional support if people fear they can't make needed adjustments. 4) Negotiate: offer incentives for complying with the change if powerful people or groups resist because they'll lose out as a result of the change. 5) Use coercion if speed is essential. Threaten firing or transfer or loss of promotion opportunities.

Article Type: Journal article
Tags: Fostering Change

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Sirkin et al (2005). *The hard side of change management*

Context: business; based in research on organizational change
Evaluation: 4 factors could be indicators for success; impact design of evaluation
Model: 4 factors determine outcome of transformational initiatives (DICE)
- *Duration* of time necessary to complete change: if not short, then amount of time between reviews of milestones
- Project team *integrity*: its ability to complete initiative on time depends on member skills and traits relative to project requirements
- *Commitment* to change by top management and employees affected by change
- *Effort* necessary over & above usual work demanded to make the change

Lessons Learned:
- If long term project, review progress frequently. This is more effective than short-term project that is not reviewed. Make it formal occasion; review evaluation data and make decisions. Pay attention to team dynamics, changes in organization's perceptions of initiative and communications
- Free up best staff/faculty to participate; have clear roles, commitments and accountability. Team leader should have strong problem solving skills, be results oriented, methodological but tolerate ambiguity, be organizationally and politically savvy, and be willing to accept responsibility for actions but not crave the limelight
- Get visible backing from influential executives and people who must deal with new system. People won't change if they don't see top level buy-in
- Don't underestimate the need for communicating with all levels of organization about a change; communicating too late or inconsistently can alienate necessary allies
- Build support among staff; simple effort to reach out to them can convert them into champions for the change
- Calculate how much work employees will have to do beyond their existing responsibilities Ideally, go no more than 10%. Rid people of discretionary or nonessential responsibilities.

Article Type: journal article
Tags: Fostering Change

Organizational Change in STEM

Connolly, M., & Seymour, E. (2008). *Why theories of change matter*

Context: concerned with why innovations aren't adopted more in STEM; three large NSF programs: MSP, CCLI and Chem Curriculum Initiatives

Evaluation: good examples of how theory used in planning evaluation and interpreting data

Model: Definition: A theory of change is a predictive assumption about the relationship between desired changes and the actions that may produce those changes. Authors' thinking informed by evaluation theory and practice.

Lessons Learned:

- Articulating theory of change (TofC) will improved chances that project activities/program will succeed.

- TofC brings greater conceptual clarity to how a particular program will achieve its primary outcomes & why these means are equal to or better than other approaches to attaining the same aim.

- No articulation of TofC means participants may not support nor recognize *"the assumptions on which they are organized; this lack of insight may affect a project's ability to achieve the program's desired ends." (*p. 13)

Article Type: whitepaper
Tags: Fostering Change

Organizational Change in Engineering

Froyd et al (2008). *More than good curricula: A guide for curricular change agents*

Context: Engineering education. Change agent as audience, mainly conceptual with a literature review

Model: 1) Implies that Change Agents are important and change needs to be guided by theory but does not define change agent. 2) Makes no claims about which theory is best. 3) There are four issues associated with change: goals, barriers, foci, strategies. [See also Froyd, Beach, Henderson & Finkelstein, 2008]

Lessons Learned: To be successful, Change Agents need to strategize around four areas:

- Goals: involve stakeholders in construction of clear, widely supported goals for the change initiative

- Barriers: anticipate and be prepared to deal constructively with likely barriers that arise in the change process

- Foci: consider a wider set of options for the focus of the change initiative other than just the curriculum

- Strategies: build on other curriculum change initiatives to avoid pitfalls of previously implemented strategies. Recommends strategies that address a combination of change foci.

Article Type: ASEE conference preceding
Tags: Fostering Change; Revising Curriculum