Using Faculty Communities to Drive Sustainable Reform: Learning from the Strategic Instructional Initiatives Program

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Abstract

In February 2012, the College of Engineering allocated an unprecedented level of funding to solicit proposals for the Strategic Instructional Initiatives Program (SIIP) – a new program targeting the improvement of undergraduate engineering education. Faculty proposed large-scale renovations of a specific undergraduate course or closely-related group of courses, with the goal of improving student engagement, learning outcomes, and faculty teaching experiences. While our faculty possess requisite expertise in their course content, they are less aware of effective teaching practices. This weakness was particularly detrimental to our large enrollment gateway courses, undermining student persistence and subsequent academic success. Consequently, in addition to providing funding, the SIIP initiative attempted to provide on the fly faculty and community development. In this paper, we will discuss our observations and reflections on successful and halted reforms and will describe modifications to our approach to administrating and leading this pedagogical change effort.

Introduction

In February 2012, the College of Engineering (COE) allocated an unprecedented level of funding to solicit proposals for the Strategic Instructional Initiatives Program (SIIP) – a new program targeting the improvement of undergraduate engineering education. Faculty proposed large-scale renovations of a specific undergraduate course or closely-related group of courses, with the goal of improving student engagement, learning outcomes, and faculty teaching experiences. Alternatively, faculty could propose to develop teaching technologies that would facilitate the implementation of evidence-based teaching practices. Priority in funding was given to projects that would impact large numbers of students or provide critical interventions early in students' learning careers.

"Live deep, not fast," is an admonition coined in the early 1900's by literature professor, critic, and editor Henry Seidel Canby [1]. Faculty participating in SIIP were invited to **think deep, not fast**, about what is core and what is periphery in our efforts to provide the best undergraduate engineering experience that we know how to provide. Rather than rely on solitary faculty champions to initiate reforms, SIIP participants were required to *form teams of faculty dedicated to creating and sustaining reforms*. Faculty were challenged to act as reflective practitioners engaged in collaborative efforts [2,3].

Like faculty at most institutions, our faculty possess expertise in their course content but are less aware of effective teaching practices [4,5]. This weakness was particularly detrimental to our large enrollment gateway courses, undermining student persistence and subsequent academic success. To complement the faculty commitment to reflectively and collaboratively develop reforms, the college committed resources to provide just-in-time faculty training and community development experiences for SIIP participants.

In this paper, we report on the reform efforts that are currently underway as well as the efforts to provide just-in-time faculty training and community development. We will discuss our observations and reflections on successful and halted reforms. Finally, based on an examination of the research literature and critical reflection, we will describe how we are adjusting the administration of SIIP to deepen the impact and success of SIIP.

Structure of SIIP

While the COE faculty are generally pleased with the technical content of our courses, the depth of student learning and level of student engagement vary substantially from course to course or even from semester to semester within a course. This variability is particularly concerning in the large undergraduate gateway courses that are pivotal to students' persistence and subsequent academic success. Target courses for the program were defined as those that 1) enroll large numbers of students, 2) enroll students from multiple departments, 3) are regarded as challenging teaching assignments, and/or 4) provide a foundation for subsequent courses. Accordingly, SIIP initially adopted three goals for improving these courses with the explicit expectation that these goals would be sustained beyond the life of SIIP funding.

1. Perform a large-scale renovation of a single course or tightly-related group of courses by making a coordinated set of changes in course pedagogy, organization and delivery methods.
2. Improve student engagement and learning outcomes for the selected courses.
3. Make the courses attractive and rewarding experiences for both instructors and students.

During the second year of SIIP, a fourth goal was added.

4. Develop innovative uses of information technology providing significant enhancement of the student experience or creating novel educational opportunities.

An overarching concern for the sustainability of reform efforts guided both the selection of the aforementioned goals and the administration of SIIP. Inspired by the successful, sustained revisions and improvements to the introductory physics sequence by a cohort of physics professors and a recent collaboration between the COE and the math department to revise introductory calculus, SIIP focused on creating teams of faculty dedicated to executing reforms. To be eligible for funding, projects required the collaboration of at least three faculty members to increase the chance that reforms would extend beyond a single instructor. Similarly, while non-tenure track faculty were encouraged to participate in, or even lead, efforts, each team needed at least two tenure-track faculty as well as the endorsement of the department head so that the efforts would have the political cache to institutionalize changes and to raise the visibility and acceptance of reforms. Further, all funded teams were required to collaborate with a team of education evaluators to collect data about the success of reform efforts.

Finally, each funded team was expected to meet monthly with the other funded projects to build community, share successes and warnings, and receive just-in-time training. These monthly meetings have covered a range of topics, including backwards course (re)design, student motivation, promoting productive student group work, creating effective faculty communities for reform, flipping the classroom, and classroom technologies. Other supports for faculty included a

one-time pre-proposal workshop as well as program and course evaluation provided by an external unit.

Funded Projects

SIIP has funded 12 reform efforts to date. Table 1 lists the reform efforts and provides brief descriptions of the objectives of each effort.

Projects funded for 2012-2014	
Course/Technology	Description of Reform Effort
Systems Engineering and Engr Risk	Improve student engagement by integrating video lectures, classroom response systems, and mini-projects
Computer Engr Core	Reorganize curriculum to modernize course content and integrate more laboratory experiences and active learning experiences
Computer Science Core	Develop tools and mechanisms to identify at-risk students earlier and enable instructors to provide remediation
Engr Mechanics Core	Improve student engagement by using collaborative, context-rich problem solving sessions, online simulations, and faster feedback
Student Test Prep in Physics	Identify students with poor study habits and provide additional structure to help those students
Projects funded for 2013-2014	
Pedagogy-focused initiatives	
Civil Engr Projects	Create a project-based learning course that enables students to explore different areas of civil engineering
Building Information Modeling	Create alternate Building Information Modeling track for civil engineering students in Engr Design course, using flipped classroom
Systems Modeling and Control Systems	Create context-rich and visually-rich examples and simulations for students to learn fundamental concepts
Mechanical Design	Integrate project-based learning into mechanical design courses
Instructional-technology-focused initiatives	
Adaptive Learning	Create an adaptive learning platform based on machine learning algorithms
Engr Simulations	Create a cloud-based platform to host simulation tools based on industry software
Sketch-Based Homework System	Create a homework assignment platform that provides automated feedback on students' sketches of engineering diagrams

Observations on the First Year of SIIP

The first year of SIIP has led to a mixture of successful and halted reforms. Relying on a combination of evaluation results, critical reflection, and the research literature, we present some observations on what distinguishes the successful from halted reform efforts. During the first year of SIIP two teams made excellent progress toward creating sustainable pedagogical change while the other teams were busy attempting change, but demonstrated little evidence that the changes were effective or sustainable. Perhaps more troubling, some efforts were clearly not

sustained after even one semester and some revisions worsened students' experiences and ratings of the courses.

Contrary to the commonly cited barrier of disengaged faculty [4,6], our faculty, especially those involved with SIIP, care deeply about helping students learn and improving the quality of instruction. Similarly, all of the SIIP teams enjoyed excellent departmental and college support for their efforts. Every pedagogically focused team received funding and support from the Dean's office as well as additional funding and support from their departments. Departments supported efforts by providing summer salary, providing additional graduate teaching assistants, accommodating changes in teaching schedules, and funding the development of new laboratory space and equipment. Further, the department heads and associate heads were supportive of the vision of SIIP, with many attending review meetings, attending team meetings, and even pushing teams to venture further in their changes.

In this context, the common reasons for the slow adoption of evidence-based pedagogies (e.g., lack of incentives or support, lack of training, and indifference among the faculty) were inadequate to explain the relative successes and failures within SIIP. Teams with some of the strongest levels of support and incentives made the least progress in sustainably adopting evidence-based pedagogies while other teams with less support accomplished much more. Similarly, some teams that included faculty with established track records in engineering education research fared no better than teams with relative novices in implementing educational best practices.

Rather than these traditionally cited barriers, **ineffective models of collaboration served as the distinguishing characteristic of the less effective teams**. Each of the teams was composed of a loosely associated group of faculty who would all be responsible for teaching one of the targeted SIIP courses at some point. The ineffective teams did not meet regularly, apart from those who had regular staff meetings to deliver a specific course. Critically, faculty who were not currently teaching a course did not participate in these staff meetings. At the end of each semester, these instructors would hand a packet or website of course materials to the next instructor. These new instructors would then work independently, selecting or rejecting any or all of the previous instructors' materials. The hand-off of course materials from one instructor to the next resulted in a low fidelity of content, course design, policies, and pedagogies from semester to semester. Ideas like the importance of respecting each other's academic freedom were commonly expressed among these teams' project review meetings.

In contrast, the two teams that made the most progress over the semester developed a common vision for the priorities and end goal of reform efforts. They also met weekly, and collaboratively developed interventions and pedagogies. Notably, these teams transcended simply establishing a team, but rather established a community of invested faculty. Faculty who were not responsible for teaching a course during a specific semester still attended the weekly meeting, acting as advisors or mentors for the development and delivery of interventions and pedagogies. These teams developed a collaborative joint ownership of the targeted SIIP courses. Members of these reform communities agreed explicitly to use communally developed teaching materials. Perhaps more importantly, because these teaching materials were developed communally, the participating faculty developed implicit agreement to use, and enthusiasm for, the materials.

Having just completed the mid-year review of projects funded for 2013-2014, we are observing similar trends in groups' successes or frustrations in making progress toward creating sustainable, evidence-based reform. Groups that meet regularly and form communities are performing well, while groups that have failed to see the benefit in meeting regularly have made little progress or have had unsustained progress.

Discussion

The past 15 years have created a surge in research documenting how instructors' implicit epistemologies, beliefs, and commitments drive decision making during instruction and cause resistance to productive changes toward evidence-based pedagogies [7-13]. Unfortunately, the standard methods of dissemination in academia (e.g., articles, workshops, seminars, etc.) are ineffective at changing these belief systems, because these methods are appropriate for *technical change* efforts rather than *adaptive change* efforts [14-17]. Transformational Learning Theory tells us that technical changes simply require the acquisition of new skills or knowledge to effect change, while adaptive changes inherently challenge core beliefs or epistemologies of the individuals or institutions who are adopting the change [15,17]. Adaptive changes may be technically simple (e.g., asking more questions in class), but they are difficult to achieve because challenging core beliefs activates a psychological "immune system" that resists change (e.g., asking more questions challenges a primary identity of "instructor as knowledge disseminator") [4,17].

Through our administration of SIIP, we have discovered that the common faculty identity centered on "academic freedom" stands as a major barrier to the sustainable and wide-spread adoption of evidence-based teaching practices. Our teaching culture has a fierce independence. Faculty are hired for their expertise in content knowledge and then asked to teach with the implicit assumption that their expertise makes them uniquely qualified to teach disciplinary courses. Even when multiple faculty teach the same course during the same term, they often teach with different syllabi, content, and pedagogies. This implicit acceptance of academic freedom as applied to teaching, is further revealed through faculty's discussion of teaching as they discuss teaching "my course" rather than "our course."

We believe that this implicit belief in the centrality of academic freedom during teaching is in many ways responsible for faculty's reluctance to form communities of practice focused on implementing pedagogical reform. To work collaboratively with other faculty, faculty must sacrifice part of their academic freedom. This sacrifice activates their "immune systems" and leads them to adopt transmission models of dissemination. Unfortunately, just as transmittal of information through lecturing leads to poor learning and retention, these transmission models of reform led to frustrated adoption of evidence-based pedagogies.

In response to these observations, we are adapting the administration of SIIP to focus on addressing faculty's reluctance to form communities of practice. The principle of "think deep, not fast" is critical both for our administration and our faculty. The "fast" solution of forcing faculty to work collaboratively is a poor solution precisely because it infringes on the faculty identity constructed on academic freedom. Similarly, the ineffectiveness of the "fast" solution of relying on independent, "academically free" faculty to create widespread reform has been well documented [4-6,18].

New Policies for SIIP and Future Work

Moving forward with the SIIP reform effort, we are adopting a long-term strategy focused on creating community and cultural change. Rather than focus on getting faculty to implement specific pedagogical reform, we need to focus on fostering environments from which adoption of evidence-based pedagogies will emerge. Creating this environment must rely on messaging and methods that help faculty feel that their academic freedom is still deeply valued within the context of community. Further, the messaging and methods must tap into other core faculty identities such as an identity of scholarship.

From organizational psychology, we know that creation of community relies on new members of the community being "invited in" by core members of that community (even if that community is currently only one person) [19]. Further, communities are formed around common passions and interests rather than common tasks [2,3]. To facilitate this invitation process and identification of common passions, we are restarting SIIP with a competitive renewal process. All proposals are required to participate in a pre-proposal period during which faculty can invite in their community and work on establishing common interests among the community without the time pressure goal of accomplishing a task (e.g., deliver a course or meet deliverable deadlines). This structure supports the "academic freedom" identity because faculty are given the freedom to invite the members of their community. Similarly, by creating community before executing a task, the team has a chance to find common interests and priorities so that faculty still feel academically free while they execute reforms. Finally, this process taps into the faculty "scholarly" identity as the proposal process reflects what faculty must commonly do when seeking funding for research grants. Faculty understand the importance of working alongside grant program officers, so the SIIP administration team will work alongside emerging communities to help them make competitive proposals and inform them of research literature that can inform their efforts and evaluation tools that can refine their efforts. Further, the hope is that this process will also help these faculty teams seek and procure external funding to extend their SIIP efforts.

In addition to focusing on creating faculty communities through this pre-proposal process, we plan to further tap into the "scholarly" identity of faculty by facilitating the adoption of implement-evaluate development cycles, beginning with a needs analysis. As faculty engage in the pre-proposal process, we can begin dialogues with them about what is going well and what is not as well as how they know. These conversations can lead to discussing what evidence they would accept as demonstrating the effectiveness of their reform efforts. Keeping the focus on what evidence faculty will accept further respects the "academic freedom" identity and increases the probability that faculty will accept and respond to collected evidence.

Finally, we are mandating weekly meetings for the faculty communities to ensure eligibility of future funding, but the messaging for this mandate builds on our faculty's own best practices for their research. Our faculty view weekly research group meetings as normative and maybe even critical for the success of their research programs. More importantly, faculty do not find these weekly meetings to infringe on their academic freedom, because these weekly meetings flow out of their common communal interest. By establishing faculty community first, these weekly meetings should align with the academic freedom of the faculty and build on their beliefs of what practices support good scholarship. We plan to have at least one member of the SIIP

administration team present at each of these meetings to provide just-in-time faculty training and to facilitate the agreed upon evaluation efforts of the faculty. Additionally, this constant presence will allow the administration team to better publicize and celebrate the efforts and successes of the faculty communities.

We believe that this new administrative structure for SIIP can create a new paradigm for faculty development and the sustainable adoption of evidence-based pedagogies. Rather than focusing on changing the practices and beliefs of individual faculty, the goal of faculty development will be to change the practices and beliefs of faculty communities. We believe that this new paradigm offers many advantages in terms of effectiveness by aligning with faculty identities and the principles of cooperative learning. This paradigm also promises greater sustainability as it fundamentally targets the creation of cultures and identities that will sustain engagement and practice beyond the life of the program. We expect that this program will lead to many new avenues for research on faculty development as well, opening doors to learn about how faculty learn through collaboration and for tracking how faculty beliefs about teaching and learning change over time.

Acknowledgments

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