**Project Summary**

We propose to prove the concept that institutions of higher education can intentionally undergo a benevolent, spontaneous epidemic change toward cultures of transformational teaching and learning innovation. The type of innovating that we are referring to is that which expands the presently accepted boundaries of recognized ways of knowing, doing and being to encompass new practices and dispositions. It is disruptive to the incumbent traditions by nature. We posit that the evidence of reaching the postulated institutional “tipping point” will be early signs of wide-spread transformative teaching and learning in the institutional narrative, which we will collect and analyze. These narratives will be made transparent via web interface in near-real time as a way of creating a systemic rapid feedback loop.

We seek to address a widely cited “problem” in STEM higher education: the conservation and persistence of past ways of teaching and learning in the face of evidence that suggests greater effectiveness of a number of alternatives. However, we do so by theorizing and testing an organic change model that includes consciously intervening in the systemic structure of beliefs, values and paradigms, rather than the more common practice of developing and disseminating new materials or methods that are expected to create systemic change through diffusion and adoption.

Our proof-of-concept project leverages existing research activities surrounding an internally-funded, five-year learning initiative at the California Polytechnic State University in San Luis Obispo, California. The research questions are Does such an institutional “tipping point” exist? If so, what general conditions and processes nurture its manifestation? Part of our thesis is that the conditions for benevolent, epidemic change at a primarily undergraduate teaching institution like ours include: a context of crisis (or opportunity), which we believe to be universal at this moment in higher education; the collection and transparency of meaningful evidence of change efficacy; a relationship network of institutional agents with adaptive capacity skills; and a heterogeneous, critical mass of change agents engaged in a community of practice in personal and organizational change. Many of these conditions are already in place in the existing research (EEC1025265 and DUE1044430), which has revealed critical elements that we conjecture are missing or suboptimal for institutional transformation. We therefore plan three activities that we believe to be key catalysts: (1) Creating and maintaining a transparent feedback loop for the student narrative; (2) Expanding the relationship network through workshops on change capacity; (3) Engaging and expanding a heterogeneous community of innovation practice. These actions merely serve as means to intervene in the hidden systemic structures of thought (beliefs, values, and paradigms).

**Intellectual Merit:** The proposed work draws upon systems theory and organizational behavior research to identify the three high-leverage catalytic interventions that are designed to benevolently, cooperatively, compassionately, and responsibly disrupt the systemic structure and habits of thought. This represents a novel approach. The work is also informed by the preliminary findings from an existing evidence-based learning initiative, funded through a separate mechanism, and so leverages current investments in research (EEC1025265 and DUE1044430) that provide evidence on the process of faculty development for change initiatives, the role of meaning in teaching and learning, and the use of open education resources to individualize learning. These findings indicate that within a primarily undergraduate teaching institute, the student narrative, in the context of a community of practice, serves as a powerful agent in changing faculty members’ mental models and behaviors, and that heterogeneity in all its forms is critical to the change process.

**Broader Impacts:** The proposed project has the potential to reveal an alternative model for systemic change in STEM higher education. It has the potential to illuminate the process conditions required to expand the boundaries of what we, who are disciplined in the physical sciences, believe to be “correct” ways of knowing, doing and being. That is, this work has the potential to contribute to creating a multiplicity of unique pathways for transformationally innovating. Because transformational innovation includes a shift to a value system that embraces conflict, diversity and heterogeneity in all their forms, the proposed work can also play a part in moving toward a STEM culture that also reflects these values.
An apology, or “The reason this proposal is being submitted through EAGER”

Transformational innovation redraws the boundaries to include ways of knowing, doing and being that reside outside the incumbent and accepted norms. Therefore, the very nature of transformational innovation will occur to us within the current system as threatening and offensive to all we believe to be “true,” including our professional identity. This proposal can potentially be experienced in this way; it would likely be rejected in the regular peer-review process without a thoughtful consideration of the merit of the ideas. While we draw upon past scientific research and theories, we suggest ideas that lie outside current paradigms of any one particular discipline. We also assert that the past scientific enterprise that has created the current body of knowledge is structured to conserve traditional understanding and approaches. It now inadvertently limits the emergence of transformative knowledge and results through rejecting ideas that run counter to accepted views. The proposed research “fits” the EAGER mechanism because it reflects high-risk and potentially transformative ideas that are indeed untested, although not ungrounded in experiential knowledge. We redraw the boundaries to include ways of knowing, doing and being from the social sciences, feminist studies, and organizational learning. The change model that we propose is novel in that it is in apparent conflict with diffusional change models that are widely assumed as accurate in science, technology, engineering and math fields.

A fair consideration of the proposed shift in paradigm, as suggested by Kuhn (1970), would require one to consciously transcend their viewpoint and evaluate the potential value of what we propose. This requires intention and the broad view uniquely available to the NSF program officers. We therefore feel the EAGER mechanism is more appropriate as a means for NSF to evaluate the potential merit of “transformative” ideas like the one we propose here.

The Apparent Problem: Unchanging STEM higher education

Science, technology, engineering and math (STEM) education is plagued by the on-going phenomena of the predominance of centuries-old STEM teaching practices, declining student interest in STEM, the persistence of beliefs and biases that disadvantage females in STEM by those in the academy (National Academies, 2008) and static retention demographics in STEM. Actions to mitigate these symptoms have limited lasting impact beyond the direct agents involved in the change initiative (Dancy & Henderson, 2008).

From a systems theory perspective (Senge, 1990), these persistent systemic “problems” are interconnected and caused by the STEM system of higher education functioning perfectly as designed and perpetuated by we who hold a particular shared set of beliefs, values and assumptions. Like an iceberg, what one sees—“the tip” or symptoms—are caused by our underlying patterns of behavior which result from our underlying systemic structures, including our structures of thought (i.e., values, paradigms), all hidden beneath the surface. Symptoms represent only the tip of the iceberg; the ultimate causes are the systemic structures.

In other words, the apparent problem can be addressed by
intervening in a different part of the system: the hidden system structures.

Assertion (or “Our untested theory of transformational change”): Significant transformation in the conservative human systems of STEM university faculty can occur through a viral phenomenon where essential, practice-based evidence in the context of a critical mass of a heterogeneous student and faculty community of practice causes a spontaneous, institutional-scale change.

The research questions we hold are Does such an institutional “tipping point” exist? If so, what general conditions and processes nurture its manifestation? We are not advocating the replication of the specific learning initiative at Cal Poly, but seeking to determine if benevolent and conscious structural interventions can catalyze an institutional epidemic of STEM teaching innovations (as well as other innovations). On page C-8, we discuss what we will measure and its meaning with respect to achieving a state of institutional transformation.

What we mean by innovation, transformation, and why it is our focus
Innovation has many meanings (AbuJarad, 2010; Stone et al., 2008). It often denotes a process of ideation that produces products, processes, and services or the goods that result from such a process. One of the underlying assumptions is that innovation yields some kind of economic value (ASTRA, 2007; Girma et al., 2009). However, we are broadly considering innovation to mean designing anew; the “new level of thinking” required by Einstein when he suggested that one cannot overcome problems at the same level of thinking used to create the problem. Much has been written about this type of creativity in terms of design team heuristics (Heape, 2007; Kelley, 2001) and cognitive processes (Brandt, 1998; Court, 1998; Mu & Gnyawali, 2003; Schneiderman, 2007). However, these viewpoints focus on the ecological conditions or analysis of highly-functioning teams for product development (see, for example, Genco et al, 2012). We are referring to the basic disposition for making changes to established ideas—innovating.

Within this definition of innovation, we differentiate between mechanistic, prescriptive approaches and intentionally emergent approaches. Evaluating innovation across this spectrum generates three distinctive domains of innovation, each with its own practices and process.

1. Problem Solving - The first domain is innovation within the bounds of a specified process or set of processes. Typically this looks like solving some problem by doing more of what is already being done, with perhaps additional efficiency, resources, speed or scale. Problem solving usually results in incremental changes to existing designs.

2. Process Improvement - The second domain is innovation arising from examining the process of problem solving. Process improvement requires an aggregated view of events over time, such that trends and patterns are revealed. Process improvement has the potential for designs of larger impact, since the boundaries of consideration now include incremental and systemic improvements.

3. Transformation - The third domain is transformational by nature and requires or inspires a fundamental identity shift in the both the system and the innovators. In this third domain the deep structures and patterns of thought, habit, and way of being are addressed. This domain creates a context for profound change in the other two domains.

This proposal explores the third domain—transformational innovation. We assert that intentional, transformational innovation involves an expansion of the boundaries of what is considered “accepted” ways of knowing, doing and being. This intentional shift requires a set of reflective capacities which enable people to constructively work with conflict and see into their invisibly-held mental models (Burton, Schlemer and Vanasupa, 2012).

In the absence of this shift, much innovation is more a sort of adaptation where the transformative qualities are limited by the assumptions embedded in the original design (i.e., Einstein’s “same level of thinking” that created the problem). Such adaptation is necessary and useful. Many faculty members ongoingly innovate in these ways. However, this disruptive, transformational innovation and the conditions that lead to it are underexplored.
Additionally, we believe that the global societal challenges we face require the adaptive capacity to enact transformational innovation and are thus more aligned with the educational needs for all citizens, and are especially relevant for us in the STEM fields (Vanasupa et al., 2010). Having the capacity for transformational innovation is analogous to what Holling calls “adaptive capability” of a system. This systemic capacity collaboratively involves the unique blend of local actors and factors.

A management approach based on [adaptive capability], . . . would emphasize the need to keep options open, the need to view events in a regional rather than a local context, and the need to emphasize heterogeneity. Flowing from this would be not the presumption of sufficient knowledge, but the recognition of our ignorance; not the assumption that future events are expected, but that they will be unexpected. (Holling, 1973)

The adaptive capacities described above often show up on the list of critical competencies for today’s engineers (Bransford, 2007; King, 2012) and are aligned with a disposition of continuous learning.

We expect transformational innovation to result in a myriad of pedagogical forms that are as diverse as the individuals and institutions involved. This represents a paradigm shift from the industrial-era factory model called “economy of scale”, that is often cited by deans as the means to “efficient” engineering educational change (National Science Board, 2005). Economy of scale assumes that the benefits of a single form can be maximized by replicating that form at large scale. In this model, one seeks to minimize variation through producing identical forms and overlooks the fact that unique situational factors may render the form ineffective in a different setting. In contrast, the aim of adaptive capacity (or equivalently, “the capacity for transformational innovation”) is “economy of scope,” (Chertow et al., 2008), where the diversity of forms is maximized at large scale and the source of the benefits. Diversity in all its forms is necessary and welcomed in this model. We believe that what is replicable in an economy of scope are the processes by which the capacity for transformational innovation are incubated. We are in a process of testing this theory with our community college partners through our current research (DUE1044430).

The theoretical rationale that suggests a structural-level intervention leads to viral transformation

According to systems theory, interventions that leave thought structures unchanged, such as changes in reward systems, implementation of “best practices,” new pedagogical methods, classroom tools and materials, are likely to yield an apparent temporary result. In other words, removing the tip of the iceberg will momentarily eliminate it, but the iceberg’s buoyancy forces will reproduce another tip above the surface. That tip will retain the features of the system that produced it. In the same way, addressing systemic problems may cause temporary change but problems will reoccur. In fact, the temporary change can make the needed structural changes more difficult because it creates a false sense that the problems have been addressed, disincentivizing the examination of systemic structures.

In universities, the physical systemic structures, policies and rules, are created in large part by us faculty members, who have adopted norms through our disciplinary enculturation (Hofer, 2000; Jehng et al., 1993; Lattuca, 2002). Through shared governance and disciplinary practice, we unconsciously perpetuate the system of our own biases. Our continued enactment of our unexamined cultural habits of thought becomes the source of on-going systemic stasis. However, these disciplinary habits of thought occur to us as the self-evident “truth,” so we don’t question them; they are second nature, so we don’t even see them. We cite barriers to diffusion and adoption
of innovative practices as outside ourselves, such as institutional rules and reward systems and professional expectations (Jamieson & Lohmann, 2008). Yet we often forget that we created these systems of rules and expectations and that we uphold them through shared governance and culture.

We are proposing the possibility of a “bottom-up” change model, which contrasts to change initiatives that require the involvement of institutional actors in formal positions of power. We have chosen a “bottom-up” model of change because “top-down” change reinforces the existing systemic beliefs that the barriers (and opportunities) to change reside outside one’s self and one’s locus of control. Our change model is intentionally designed to intervene indirectly in the thought structures of faculty members. It follows Buckminster Fuller’s admonition, Don’t try to change peoples’ minds, give them tools that, through the use of which, their minds will change. For us, these tools are alternative mental models and dialogue practices that facilitate a praxis of personal and organizational change; however, in a different setting, other tools could serve the same purpose.

**Our current state: An exploration of one of many possible innovations**

The principle investigators are involved in a specific, freshman-level, transdisciplinary learning innovation, the study of which is currently supported by two grants (DUE1044430 and EEC1025265). This transformational process involves STEM education at our institution with change initiatives extending to those at partnering institutions. Our first cohort of 45 freshmen involved students from 25 different majors who represented all six colleges (Agriculture, Engineering, Architecture, Science and Math, Liberal Arts, Business) in a two-quarter sequence of coordinated science, communication and liberal arts courses. The faculty group included 11 people who represented all but the college of Architecture. The learning initiative and its intellectual merit was described in previously funded proposals DUE1044430 and EEC1025265. (We hope that the existing support serves as sufficient evidence of the learning initiative’s merit so that we can focus in this proposal on presenting preliminary results and describing the rationale for what we propose to do.)

As pictured in the sketch to the left, the existing project already involves the ongoing collection of evidence about the faculty change process and the student results. The central research questions are around how a distributed community of practice in action research enables individualized learning, the role of meaningfulness in engagement, and the nature of the change process for faculty. The inset on the following page includes some of the preliminary student results, which are promising. As shown in the depiction above, the historical reasons in favor of stasis appear to outweigh the reasons to change, although there is mounting (slowly) evidence in favor of change. Our institution is not unique in this regard--most universities function to conserve intellectual traditions. Many believe, like Karan Watson, that the only thing slower than systemic change in higher education is behavioral changes of the individual actors (Watson, 2009). How then, is it possible for a “tipping point” to be reached within the time frame of the proposed work?

From the point of view of a linear, diffusional process, “overcoming” the historical evidence would simply not be possible in two years. It would require an equally large set of evidence for change. Recall, however, that the reasons against change reside largely in the enacted beliefs, values and paradigms of an institution's potential change agents. These beliefs, we assert, can be changed instantaneously. We have witnessed “resistant faculty” become agents of change when the ecological conditions facilitate a deconstruction of their own reasons for resisting change. That is, we faculty who oppose change can instantaneously let go of our historical opposition if we have the capacity to see that our espoused models are misaligned with the lived reality. This is equivalent to removing the “reasons not to change.” In this scenario, depicted below, there is a rapid
acceleration to the tipping point, where spontaneous, institutional-scale transformation becomes possible. Viral change is enabled by the existence of the following systemic conditions: key information feedback loops (1); the building of capacity to effectively enact personal and organizational change (2); a critical mass of change agents (3), typically much smaller than the total within the human system, and “connectivity,” or relationships across organizational sectors (Gladwell, 2002; Kim & Mauborgne, 2003; Eveline, 2004; Herrero, 2008).

Our initial research findings for our present learning initiative indicate that the most powerful feedback loop is the student narrative. Although we faculty spent two years in capacity building activities and considering educational research theories and findings, we discovered that it was the addition of the live encounter with the student narrative that caused faculty to instantaneously let go of previous beliefs.

What we propose to do with the requested funding

The figure below labeled “Planned interventions” reframes the three catalytic activities from the figure above that we propose to undertake: (1) Creating and maintaining a transparent feedback loop for the student voice (lead: T. Harding); (2) Building capacity for self and organizational change (lead: R. Burton); and (3) Engaging a heterogeneous community of practice (leads: L. Schlemer and L. Vanasupa). As illustrated in the diagram, our three proposed activities fall in the category of high-leveraged systemic interventions (Meadows, 2008). These catalysts are currently missing. We describe the rationale for these choices in the following paragraphs.
What is the criticality of a heterogeneous community of practice (Activity 1)?

Our initiative, SUSTAIN, is explicitly designed with an aim toward sustainability in a holistic sense (social well being, environmental well being and economic well being). In brief, it represents a feminist perspective of engineering (Riley et al., 2009). We designed SUSTAIN to be “cost-negative” after an analysis of financial and student annual flows through our institution, with several theorized educational benefits, some being researched within DUE1044430 and EEC1025265. A critical error that we made was that we did not account for the level of institutional risk-aversion created by the system-wide budget challenges, particularly from the science and mathematics departments. There is a delay between implementation and the dissemination of meaningful results from the innovation, and the motivation to participate, which is akin to the innovation “Valley of Death” (Auerswald & Branscomb, 2003). As reported by Borrego et al. (2010), administrators and STEM faculty members feel they needed significant time to do things differently. Departments are reluctant to redirect faculty resources to an untested teaching initiative, without financial backing to cover the perceived opportunity cost of involvement. We did not account for these transition costs.

The physics faculty member who chose to work with us reported dramatic personal, professional and pedagogy changes. After making structural changes to his final exam testing process, his insight was, “I have potentially been excluding large groups of students for the past 15 years because of the way that I’ve been testing them.” A critical element of his change process was that it occurred in the context of a heterogeneous faculty community of practice which very importantly included viewpoints from differing epistemological traditions (history, women’s and gender studies, physics, chemistry, English, communication studies, economics, agriculture, biology, engineering). We assert that this diverse community is necessary because it is only in the presence of differing viewpoints (i.e., “conflict”) that one’s own mental models are revealed. And without “seeing” one’s model, one is not able to address the embedded thought structure of beliefs, values, and paradigms. Lasting change is not possible without addressing these thought structures (Henderson et al., 2011). We are requesting funding to assist us in expanding our heterogeneous community of practice (3). The funding will be used to enable a critical mass of faculty from STEM and non-STEM fields to participate.

What is the need for capacity building (Activity 2)?

In addition to the heterogeneity of the change agent community, we assert that our community network must possess the skillful means to effectively engage in change. Furthermore, we are biased in our view that testing our own models for change occurs best through a “lived experience” (versus espoused theories in the absence of a practice). However, an effective community of practice that includes individuals with different epistemologies does not occur by simply convening different disciplinary experts (Lele & Norgaard, 2005). Working across traditional boundaries, whether they are disciplinary or societal, inherently involves conflict, since actors invariably hold different mental models (Dressel & Marcus, 1982; Kuhn, 1970). The capacity building activities that we propose represent a doubling of the current capacity building activities under our existing funding (DUE1044430), with the specific purpose of cultivating a broad network of institutional change agents, as networks appear to foster change (Borrego, et al., 2010). The curriculum consists largely of open-ended dialogue in the tradition of Bohm (1996), and personal experimentation with change models, which is consistent with recommendations for faculty development that includes an understanding of different change models (Dancy & Henderson, 2008). Table 1 summarizes the theories and models that have been addressed in the capacity building workshops.

We offer these workshops to larger campus community at no charge and they are typically delivered in a weekly format of 10, two-hour gatherings. People receive nothing for their participation except the value...
derived from attending (if any). In our first year of offerings, they have been attended by a stable group of about 20 people per each of the three quarters. Incidentally, the attendees are very importantly, a mix of those involved in the learning initiative and those who are not, creating a network of change agents that extends beyond our specific project. The workshops are attended by students, staff, faculty and administrators. After the second workshop, attendees were asked to complete the Situational Intrinsic Motivation instrument (Guay et al., 2000). The 14 respondents (out of 20) indicated that they autonomously chose to attend because they found it meaningful, as compared to their job activities, which were more spread across the meaning/obligation motivation spectrum.

In response to an open-ended query about the value that they were receiving from their participation, respondents cited the following personal development:

“...I am able to look at consequences and trace the paths that influence them into existence.”

“...gives me the ability to better understand my world and the take action...”

“...allowed me to grow as an individual.”

“...enriching experience...contributing to a growing sense of community...”

“...has helped not only professionally, but in my personal relationships.”

Why create and maintain the means for a transparent student narrative (Activity)?

As described above, the student narrative has had a profound influence on our (faculty members’) understanding. Like many social change initiatives on campuses in the U.S. in the last 60 years, we believe the student narrative to be the key to wider, disruptive transformation. We also believe that a rapid, transparent feedback channel is needed for self-regulating the quality of the changes toward beneficial outcomes.

We are imagining that the student voice can be recorded in a venue similar to (but less elaborate than) the StoryCorps StoryBooths (storycorps.org). The StoryCorps booths are located in five cities across the country and provide a recording booth where people come to tell their stories. The head of our university library, Dr. Gold, has already enthusiastically agreed to locate our booth in the cafe area, which has been repeatedly voted by students as “Best study location on campus”. We imagine creating a mechanism to directly publish these “raw” videos to a transparent virtual space like YouTube. This has the advantage of providing near real-time feedback. (Clearly, there are disadvantages that we intend to manage as they occur.) We anticipate that we might seed the responses with prompts, such as “Tell us why you came to college?” or “What are your aspirations for the society that you will create?”

In order to participate the student will indicate acceptance of the photo release and then record a short video or sound clip in response to a predetermined prompt. We hope these segments will be short enough, possible 20 seconds or less, so that they can be grouped together and integrated easily without much editing.

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<tr>
<th>Change Models</th>
<th>Productive Dialogue Theory</th>
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<td>Kantor’s meta-model of change (Kantor, 1975)</td>
<td>Bohm’s dialogue (Bohm, 1996)</td>
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<td>Torbert’s interpenetrating attention (Torbert, 1972)</td>
<td>Chomsky’s transformational grammar (Chomsky, 1987)</td>
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<td>Meadows systems interventions (Meadows, 2008)</td>
<td>Kuhn’s structure of scientific revolutions (Kuhn, 1970)</td>
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<td>Fritz’s creative tension</td>
<td>Argyris’s Ladder of inference (Argyris, 1982)</td>
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<td>Teleologic change</td>
<td>The four-player model of healthy teams (Ancona &amp; Isaacs, 2007).</td>
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However, we anticipate needing to manage this to some extent and have budgeted time for one of the PIs, Trevor Harding, to hold this responsibility.

Dr. Harding, in his work in ethics and moral development, has been actively seeking the student aspirational and experiential narrative in his engineering courses. His experience is that students have profound hopes and dreams that are unseen and unfelt by the engineering faculty; they represent a forgotten way of knowing in the sciences (Rendon, 2000). Students often report their disillusionment with their engineering major for its apparent disconnect with meaningful aims. We feel that making these stories transparent to our campus (and beyond) will disrupts faculty members’ often hostile mental models of students with a potential positive outcome of empathy.

**How will we know if we've reached the tipping point? What will be measured?**

This is perhaps the critical question. We’ve said very little about our institutional context and Gladwell (2002) suggests that the timing must be right. Currently, Cal Poly’s classroom practices for traditional engineering fields are primarily lecture-based, like other institutions of its kind (Sheppard et al., 2009). These modes persists, despite a preponderance of evidence that suggests that there are a number of more efficacious alternatives. A study conducted this year by Schlemer (PI) randomly sampled over 200 classrooms (approximately 50 engineering) on Cal Poly’s campus. She found that 88% (72% of engineering) of the time students in a traditional classroom are listening to a faculty lecture in the traditional style. But like many institutions of higher education, we are in crisis...now is the opportunity for transformation.

How would a tipping point be experienced in an organization? There is a way in which we do not know. If we use nature as an archetype, we note that rapid, transformational shifts looks like what we would call “collapse,” such as in a forest fire. A system that is vulnerable to collapse is one that, over time, has developed an efficiency, high productivity and systemic reliance on a limited number of things, and is therefore vulnerable to sudden, systemic failure (Holling, 2001). Holling’s work shows that what emerges in the wake of the systemic break down of the dominant species is a period of rapid, self-organized innovation by networks of heterogeneous organisms that could not thrive because the dominating species monopolized the resources. It is our biased view that higher education in the U.S., and indeed the industrial era consumption patterns that have driven our global economy, are displaying the weak signals of a state of collapse, with the emergence of many disruptive innovations (open education resources, privatized universities, China!). Indeed, it may be our systemic economic dependence on petroleum, and nothing about our proposed actions, that aid the materialization of our postulated tipping point.

Using the ecosystem model, we expect the emergence of rapid, systemic innovation upon reaching the tipping point. Our mental model is that systemic transformational innovation would be manifest in the narrative of change by students, faculty and staff throughout campus, not only by those within our specific learning initiative. In practice, we feel that the best we can do to ascertain whether we are nearing this state is to look for the weak signals: increasing frequency of reports by students, faculty and staff of transformational and innovative learning experiences. We expect the quality (depth) and magnitude (breadth) of the reported change to increase during the course of this project, but not linearly with time. In truth, we are already detecting some signals. But, as with all action research, we are less concerned with verifying causal connections than we are with producing the intended change.

The mechanism to make the student voice transparent will serve to collect the institutional narrative (primarily, we expect, the student voice). The PIs will also work with the faculty community of practice and the workshop participants to gather evidence in the form of faculty narratives and analyze them over the course of the proposed work. We acknowledge that this assessment plan contains ambiguity. As engineers, we are trained to prefer quantitative metrics, as they give us the feeling of definitively knowing. Yet we realize that we are attempting to detect a qualitative change in state. Like Google, a transformational culture may take time to manifest its innovative nature. Even if we encountered what we expected in the personal narratives we would recognize them as possible evidence of weak signals, rather than “proof.” The real “proof” may be years beyond the scope of the grant.
References


