Board 1: In the Business of Innovation: Development of a Canvas Tool to Promote and Sustain Pedagogical Risk Taking by Faculty

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In the Business of Innovation: Development of a Canvas Tool to Promote and Sustain a Culture of Faculty Innovation

Introduction

This paper reports on a Faculty Innovation Canvas tool being developed as part of a research project that is funded by the National Science Foundation “Revolutionizing Engineering and Computer Science Departments” (RED) program. The project’s overall aim is to support a culture of pedagogical risk-taking and realize an additive innovation mindset to promote faculty-teaching innovations at a large, southwestern public university. A specific research sub-goal of the project is to further understand how faculty development programs and initiatives can influence faculty-teaching practices. A modified version of the Business Model Canvas (BMC) [1] is employed to document the emergent activities of innovation driven, self-formed faculty groups over time. The Business Model Canvas is an organizational tool for capturing and communicating the critical elements of an evolving project’s ecosystem. Borrowed from entrepreneurship practices, it is used to identify the necessary infrastructure that would support a new venture, with a focus on specifying the value propositions for specific customer segments. The local RED project at [university], with an intention to study faculty-initiated innovation, piloted an intervention to facilitate the formation of affinity groups. The project has adapted the Business Model Canvas to determine and document components of an educational ecosystem that promote, assist, and engage faculty in pedagogical risk-taking. In our case, the customer segments are engineering faculty, and the value propositions emerged from their individual and shared stated goals and intent. Connecting the group’s internal local activities to the external global ecosystem, our adapted canvas documents motivations and inner workings of the group along with administrative policies, structures, and other resources that can make a sustained and scalable culture of faculty pedagogical risk-taking possible.

The local RED research team’s idea to document affinity group activities using an adapted version of the Business Model Canvas was informed by a retrospective analysis of a faculty intervention. At the intervention, faculty members were provided a forum to self-form working groups around areas of shared interests across the undergraduate engineering program here. For this specific work presented in this paper, faculty members from two of these affinity groups were interviewed about their reasons for participating and their experiences as members. An interview protocol based on the Business Model Canvas and contextualized in faculty change was used. Group accounts were constructed from the individual interviews and used to propose a Faculty Innovation Canvas. This paper reports on development and refinement of the canvas tool to promote and sustain teaching innovations initiated and led by faculty, and begins to answer the following two research questions: (1) How can the Business Model Canvas be adapted to initiate, iterate on, and document the faculty-initiated and faculty-driven teaching innovation process? And (2) What key elements do faculty members perceive as important to this process? The Faculty Innovation Canvas has been developed as a tool that can quickly capture the ecosystem of change in an academic setting. It is useful for the purposes of the local RED research project but can also be used more widely to capture, communicate, and share additional efforts across academia for faculty change.
**Background**

Supporting a culture of pedagogical risk-taking and realizing an additive innovation mindset to promote faculty-teaching innovations implies comprehending the problem at local as well as global levels. While studying local (within a team) collaborations, faculty development researchers have focused on group’s efforts in improving general pedagogical skills or motivation and tools for self-improvement [17]. Researchers have also studied and documented not only what facilitates faculty innovation but also what impedes pedagogical change. The most commonly cited barriers include lack of training, lack of time, and lack of incentives [18-20]. A comprehensive view of the educational ecosystem, with the implicit dependencies between the innovating team and needed resources, infrastructure, and outputs, has enabled the research team to conceptualize the problem, at what we call, a global level, and has facilitated the adaptation of the Business Model Canvas to the academic scenario.

The Business Model Canvas is an organizational tool developed by Osterwalder [1,2] for the purpose of identifying and documenting the critical elements of an entrepreneurial-focused ecosystem. It is used, through a process of iteration to identify the necessary infrastructure that would support a new venture [1]. The nine building blocks of the Business Model Canvas and their definitions are shown in Figure 1 and Table 1, respectively.

<table>
<thead>
<tr>
<th>Key Partners</th>
<th>Key Activities</th>
<th>Value Propositions</th>
<th>Customer Relationships</th>
<th>Customer Segments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key Resources</td>
<td></td>
<td></td>
<td>Channels</td>
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<table>
<thead>
<tr>
<th>Cost Structure</th>
<th>Revenue Streams</th>
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**Figure 1: Business Model Canvas [1]**
Table 1: Elements of the Business Model Canvas (BMC) and their definitions [1]

<table>
<thead>
<tr>
<th>BMC Element</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Customer segments</td>
<td>The different groups of people or organizations that an enterprise aims to reach and serve</td>
</tr>
<tr>
<td>Value propositions</td>
<td>The combination of products and services that create value for a specific Customer Segment</td>
</tr>
<tr>
<td>Channels</td>
<td>The ways in which a business communicates with and reaches its Customer Segments to deliver a Value Proposition</td>
</tr>
<tr>
<td>Customer relationships</td>
<td>The types of relationships that a business establishes with specific Customer Segments</td>
</tr>
<tr>
<td>Revenue streams</td>
<td>The cash flows that a business generates from each of its Customer Segments</td>
</tr>
<tr>
<td>Key resources</td>
<td>The most important assets required to make a business model work</td>
</tr>
<tr>
<td>Key activities</td>
<td>The most important things a business must do to make its business model work</td>
</tr>
<tr>
<td>Key partners</td>
<td>The network of suppliers and partners required to make a business model work</td>
</tr>
<tr>
<td>Cost structure</td>
<td>The costs incurred to enact the business model</td>
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</tbody>
</table>

Since its introduction in the entrepreneurial world, the Business Model Canvas has gained popularity as a visualization tool to enable constrained brainstorming about aspects of the entrepreneurial ecosystem. With an increased national focus on promoting innovation and entrepreneurship education across the U.S., the Business Model Canvas itself has also become more prevalent within educational settings [3]. Permutations on the Business Model Canvas have emerged for teaching entrepreneurial thinking in engineering programs and courses, including the Innovation Canvas [4], the Product Archaeology Canvas [5], and the Learning Through Service Program Model Blueprint [6]. The Business Model Canvas has also received more widespread attention from its adoption by high-profile NSF programs such as I-Corps [7] and Lean Launchpad [8].

In their own synthesis of canvases as applied to educational purposes, Tranquillo, Kline, and Hixson [9] generalize canvases as “one-page visual frameworks for modeling the critical elements of a real-world system [each of which are] deemed essential in order to design, add value, or make changes to a system out in the world” (p.1). Using this framework, an innovator can more easily identify the most important levers within a system, collect and synthesize information, discover where critical information is missing, gain a holistic understanding of the system, and make decisions [9]. Building on these principles, the study team has adapted the Business Model Canvas to propose a template for the Faculty Innovation Canvas (FIC) intended to help better understand the levers and system that can drive faculty pedagogical risk-taking and additive innovation in academia, within our local context of an engineering program. A main goal for applying the Business Model Canvas to faculty risk-taking and innovation is the identification of the value propositions (motivations) for specific customer segments (i.e. faculty). As a process then, once value propositions are identified, the policies, structures, and other resources needed to engage faculty in innovating teaching can be determined, as can other
aspects of the ecosystem needed to sustain the revolution such as key partners and costs. The study undertaken in support of these two goals is described next.

**Study Design**

*Situation in Larger RED project*

The local RED project has pursued a multi-pronged approach [10] grounded in theory [11] toward achieving the following three outcomes:

1. Establishing, cultivating, and promoting a culture of pedagogical risk-taking,
2. Providing mechanisms to develop, share, and disseminate interesting and effective teaching approaches, and
3. Focusing on the educational ecosystem to identify the administrative structures and processes that support sustained change.

The study described in this paper was undertaken in support of Priority 3 above. Specifically, a retrospective analysis of an intervention facilitated by the local RED team to encourage pedagogical risk-taking among faculty was conducted to help develop and refine a canvas tool for promoting and sustaining faculty-driven teaching innovation (the Faculty Innovation Canvas, or FIC). The intervention and subsequent study are described in the sections below. Previous publications have detailed the larger research project and goals more holistically [11-14].

**Faculty Affinity Groups**

As part of the goal to establish, cultivate, and promote a culture of pedagogical risk-taking (Priority 1), the research team previously developed a set of guiding principles for developing faculty interventions grounded in literature on educational change, faculty motivation, organizational studies, and STEM teaching practice [11-14]. These guidelines suggested that faculty interventions implemented by the local RED team should have the following characteristics-- be faculty-driven (versus administrative-driven), community-based (versus individual-focused), sustained in duration (versus singular or standalone), flexible for faculty to modify and adapt, inclusive of opportunities for feedback and evaluation, connected to known faculty motivations and values, and disruptive to current thinking and practices but simple to implement [11].

Based on these guidelines, the research team previously facilitated an intervention at an annual engineering program faculty retreat in fall 2016 by providing a forum for the faculty to self-sort around areas of shared interests or pain points related to the undergraduate engineering curriculum. Following the retreat intervention, groups met and worked throughout the 2016-2017, and in some cases, the 2017-2018 academic year, with support provided by the RED project in the form of funding recognition, and time during faculty meetings to share updates and work in their teams. A graduate research assistant also helped to coordinate the logistics for group meetings. Additional information about the formation and support of the faculty affinity groups can be found in the prior publication [11]. Four groups emerged from the faculty retreat activity focused on, respectively: 1) rethinking how technical writing is taught within
engineering, 2) revolutionizing content-heavy courses through flipping, 3) enhancing student learning in math-intensive courses, and 4) aligning student outcomes across the program’s design project spine. The technical writing and flipped classroom groups dissolved within the first two semesters of forming for reasons including lack of consensus about approach and perceived lack of time by faculty to make changes in their classes. By contrast, the math-intensive course and project spine affinity groups each had sustained activity for three or more semesters. To maximize the richness of our findings, the current study focuses only on these last two groups, briefly described below.

**Math-Intensive Course Affinity Group:** This group connected around shared interest and experience in teaching undergraduate engineering courses that rely heavily on mathematics. The aim of the group was to improve students’ understanding of, and ability to apply complex mathematical concepts. The shared issue was to try to engage students more in the context and applications of math in an array of engineering fundamentals courses. The group’s primary activities during the 2016-2017 and 2017-2018 academic years included identifying specific conceptual difficulties observed in students and brainstorming solutions that could be implemented across courses. The group’s five members were all tenure-line assistant professors within the engineering program.

**Project Spine Affinity Group:** The primary goal of this group was to better align the course content of sequentially offered project-based courses forming the ‘design spine’ of the program. To this end, the group met regularly during the 2016-2017 and 2017-2018 academic year to discuss activities and share materials and learning goals from their respective project courses. Group membership included four tenure-line assistant professors, one associate professor, and two lecturers, with all four years of the design spine (first-year to senior) covered among them.

**Interview Protocol Development**

To understand the experiences and motivations of the affinity group members, and to identify key elements of the faculty teaching innovation process, the research team conducted interviews with members of the math-intensive course and project spine affinity groups. With a goal of leveraging the functionality of the Business Model Canvas, the team began by adapting elements within the Business Model Canvas in a faculty innovation context. Elements from the BMC were retained, eliminated, and modified according to their suitability to faculty initiated and driven innovation. Terms such as Key Activities, Key Partners, and Key Resources were retained, while terms like Revenue Streams and Customer Relationships were eliminated, as they seemed incompatible with an academic setting. Other terms were updated to remove jargon or add specificity. Elements--Value Propositions and Channels, were renamed to--Faculty Motivations and Dissemination Channels, respectively. Term ‘Cost Structure’ was modified to include both costs and roadblocks or constraints that the groups might have experienced. Customer Segments were re-conceptualized as both the users and the beneficiaries of the groups’ output and activities. Lastly, interview questions were developed to probe participants’ thoughts and perspectives as they related to each of the proposed FIC elements. The original Business Model Canvas elements, proposed FIC elements, and corresponding interview questions are shown in Tables 2 and 3.
Table 2: Mapping of Business Model Canvas and proposed Faculty Innovation Canvas elements

<table>
<thead>
<tr>
<th>BMC: A tool for a company or entrepreneur with a vision/mission for a new venture</th>
<th>Proposed FIC: A tool for an individual or group of faculty member(s) with a vision/mission for a change / innovation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value propositions: What the company brings to its customers in the form of a product / service</td>
<td>Motivation: What attracted the faculty to the affinity group</td>
</tr>
<tr>
<td>Key activities: Design, manufacture, and deliver</td>
<td>Key activities: Share ideas, collaborate, create procedures and processes, and implement ideas to bring the change or innovation into existence</td>
</tr>
<tr>
<td>Key partners: Investors, manufacturers, and marketers</td>
<td>Key partners: Other faculty members, department chairs, upper administration</td>
</tr>
<tr>
<td>Key resources: Materials and human resources</td>
<td>Key resources: School infrastructure, money for implementing the solutions, time made available to faculty in the form of funded summers/reduced teaching load, graduate teaching and research assistants</td>
</tr>
<tr>
<td>Cost structure: Cost of materials, cost of human resources, etc.</td>
<td>Costs: Faculty member time</td>
</tr>
<tr>
<td>Constraints / roadblocks: Efforts to get alignment / buy-in from all partners</td>
<td></td>
</tr>
<tr>
<td>Customer segments: Individuals who buy the product</td>
<td>Beneficiaries: Faculty associated with the innovation, department faculty, school faculty, university faculty</td>
</tr>
<tr>
<td>Users: Other schools and universities as the innovation is scaled up</td>
<td></td>
</tr>
<tr>
<td>Channels: All channels to reach the customer</td>
<td>Dissemination channels: Workshops, seminars, conferences, publications</td>
</tr>
<tr>
<td>Revenue streams: $ provided by the customers in exchange for the value/product/service</td>
<td>Removed since it did not directly seem to pertain to the academic setting.</td>
</tr>
<tr>
<td>Customer relationships: Efforts put in by the company to convince the customer of the product’s value</td>
<td>Removed since it did not directly seem to pertain to the academic setting.</td>
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</tbody>
</table>
Table 3: Mapping of proposed Faculty Innovation Canvas elements, with corresponding interview questions

<table>
<thead>
<tr>
<th>Proposed FIC Element</th>
<th>Interview Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value proposition</td>
<td>What attracted you to the [math intensive course / project spine] affinity group? How did you get involved?</td>
</tr>
<tr>
<td>Key activities</td>
<td>What have been some of the group’s key activities since you started two years ago?</td>
</tr>
<tr>
<td>Key partners</td>
<td>Who have been key partners in the work you are doing? How have you engaged with them?</td>
</tr>
<tr>
<td>Key resources</td>
<td>What resources have you used to implement your activities?</td>
</tr>
<tr>
<td>Costs</td>
<td>Have there been any costs associated with them [the resources]?</td>
</tr>
<tr>
<td>Constraints / roadblocks</td>
<td>What parts of this work have been hard, such as times when you ran into constraints or roadblocks?</td>
</tr>
<tr>
<td>Beneficiaries</td>
<td>Who do you think can or will benefit from your work, and what do you think those benefits will be?</td>
</tr>
<tr>
<td>Users</td>
<td>Who do you think will use the results / outputs of your work, and why do you think they will find the results useful?</td>
</tr>
<tr>
<td>Dissemination channels</td>
<td>Have you thought about sharing your findings? Do you have any specific avenues in mind?</td>
</tr>
</tbody>
</table>

Data Collection and Analysis

The research team collected interviews from five math-intensive course affinity group members and five project-spine affinity group members in fall 2018. Each interview was approximately 45 minutes long, conducted in-person, recorded, and transcribed. The interview transcripts were thematically analyzed by the first author using a combination of using a priori codes (based on the proposed Faculty Innovation Canvas elements) and emergent codes (meant to capture participants’ own ways of describing the element) [15-16]. Replication of this process by another researcher with the larger RED project showed a high level of consensus between the two researchers. The emergent codes were then used to finalize the terminology and definitions for each element in the Faculty Innovation Canvas.

Preliminary Findings

The elements of the Faculty Innovation Canvas, their definitions, and supporting emergent codes from the interviews with faculty affinity group members are shown in Table 4.
<table>
<thead>
<tr>
<th>FIC Element</th>
<th>Definition</th>
<th>Supporting Emergent Codes</th>
</tr>
</thead>
</table>
| Value Propositions          | The motivation(s) or interest(s) that a faculty has for pursuing a teaching innovation | • Driving force behind wanting to get involved  
• Interest in being a part  
• Desire to make a change / impact  
• Fact-finding mission  
• Goal / motivation / reason for joining |
| Key activities               | Tasks and events that contribute toward accomplishing the goal / innovation   | • Main / key activities  
• Major undertakings  
• Information sharing  
• Collaboration |
| Key partners                 | Individuals or groups that help with making the goal / innovation a reality  | • Faculty involved with the activity  
• Person that I interacted most with  
• Other members of the group  
• Action takers / change makers  
• Collaborators / partners |
| Key resources                | Administrative policies, structures, and other resources (e.g., financial, human) to support the activities for accomplishing the goal / innovation | • Funding / budget / monetary resources  
• Time dedicated to innovation activities  
• Faculty training  
• Expertise in teaching innovation  
• Person in charge / champion |
| Group / Community Building activity | Efforts taken by the members / champion to reach consensus, get a buy-in form other members | • Efforts to build the activity  
• Bring the participants to an agreement |
| Costs / Constraints          | Commodities that the faculty member has to spend. Potential or existing challenges / difficulties experienced by the faculty member in pursuit of the goal or innovation | • Time  
• Strain  
• Lack of champion / designated lead  
• Lack of direction / consensus  
• Lack of communication  
• Cause of the rift / strain  
• Things that are difficult / hard to do |
Table 4 (Continued): Elements of the Faculty Innovation Canvas (FIC), their definitions, and supporting emergent codes from the faculty interviews

<table>
<thead>
<tr>
<th>FIC Element</th>
<th>Definition</th>
<th>Supporting Emergent Codes</th>
</tr>
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</table>
| Fulfillment / Recognition | Goal Accomplishment, reduction of pain points.                          | • Long-term interest  
• Desire to help  
• Wanting to be a resource for junior faculty  
• Participation in innovation |
| Dissemination channels | Channels through which outcomes and activities resulting from the innovation can be shared with relevant groups. | • Sharing within the group  
• Sharing back to the community  
• Journals / book chapters  
• Seminars / workshops / conferences |
| Beneficiaries         | Individuals or groups that benefit from the activities undertaken in pursuit of the goal / innovation; can be direct or indirect, immediate or in the future. | • Faculty (within the group, at other similar institutions etc.  
• Students  
• Creating institutional memory |

Overall, the research team observed good alignment between how the team was conceptualizing each of the Faculty Innovation Canvas elements and how the participants interpreted them, as evidenced by the language that participants used in response to the interview questions (see emergent codes above in Table 4 for examples). Going forward, although further validation is required, it is expected that the elements within the Faculty Innovation Canvas will be easily understood and recognized by faculty and administrators using the canvas tool to plan or document their own innovation.

The participants’ responses also helped further contextualize some Faculty Innovation Canvas elements within the everyday realities of faculty members’ experiences, particularly those related to Key Resources and Costs / Constraints, and Fulfillment / Recognition. Participants generally seemed unconcerned about the availability of funding, perhaps because they did not perceive a great need for, or shortage of it. By contrast, and in line with prior literature [12-14], the concept of shortage of time repeated throughout the interviews. A participant reflects on the lack of time issue:

* "I would say that the largest cost has been our individual time, the faculty members' individual time. Because it takes some time to think about your course syllabus in a different way, thinking about ... Because in the curriculum plan, it shows you ... or there's indications of what courses might be prerequisites. But then we had to go back and think about what topics within that course are the most relevant.*

Another participant recounts what resources could make more time possible:

* "I think that there's probably something as a carrot and a stick to get faculty together to do such a thing. I think in previous attempts to kind of align the learning objectives for the Project Spine it's like, "Oh, here's funding over the summer. Here's a specific task to..."*
evaluate and select a specific textbook around engineering design that we could maybe ask students to use from across the project courses." I think that there's something about motivating faculty, although I think that there's a number of faculty for whom they're invested in these courses or for whom, you know, socializing with their colleagues on this level of teaching is useful.

Faculty members expressed not being able to dedicate more time to their affinity groups due to competing work and life responsibilities, and had several ideas for how the program could alleviate some of their time demands and better support their endeavors (e.g., course releases, summer salary, faculty training, outside expertise in planning and evaluation, etc.)

The element of Fulfillment / Recognition (which takes the place of Revenue Stream from the BMC) is the farthest removed from the BMC as it drives the FIC away from financial gains into the realm of personal accomplishments and fulfillment. We had eliminated this element initially but decided to include it from what we learned from our participant’s motivations, and from the literature. Literature shows that faculty are not typically rewarded for instructional innovations [21-23]. Also, from the interviews, it was evident that the faculty were attracted to their respective affinity groups to fulfill their personal interests, to be a resource for other younger faculty members, and to make a difference. As one faculty member recounts,

What attracted me to it was ... there was a couple of things. One, my personal interest and ... I'm personally interested in experiences, particularly learning experiences, in courses that a lot of students take. I'm really interested in foundational courses and the experiences that students have in foundational courses, 'cause I think that they have ... those experiences have long term implications. By experiences I mean what they learn, how they begin to see themselves as engineers, etc.

The participants also mentioned the need for a champion to drive the affinity group’s activities and help achieve consensus multiple times throughout the interviews. They attributed stalled progress and break-downs in communication within their groups to lack of such a leader. Although the literature on faculty change usually does not explicitly mention a champion, the presence of a champion is inherent in the form of a project sponsor [19, 24]. The comments by our participants suggest that the identification of a clear champion – with vision, passion, and ability to help continually make forward progress – to be critical to the success and sustainability of teaching innovation, and especially, those involving teamwork and collaboration among multiple faculty members. A participant speaks about this issue:

Actually, since [faculty member] [is] leaving, I don't even know how this kind of program will go in, you know what I mean? I don't know if we finish it, or we'll continue working on it? As I mentioned, I just explained what the status for this is, right? Somehow, we try to implement some kind of solution we proposed. Then that's it. We don't have time to make a conclusion or to summarize what we did.

Mention of the need for a champion and the champion’s perceived role made us rethink the elimination of the element ‘Customer Relations’ from our canvas adaptation process during the design phase of the study. Since we envisioned faculty members as customers the work done by
the champion to keep the group on the same page by eliminating disagreements, to establish seamless communication channels, and to keep the momentum constitutes ‘customer relation’ activities. In retrospect, we decided to include it as one of the elements of FIC and called it ‘Group /Community Building’ activity.

Taking these findings into consideration, a proposed template for the Faculty Innovation Canvas is shown in Figure 2. Notably, the Costs and Constraints boxes highlight potential pitfalls associated with lack of time and interpersonal conflict, while the central importance of identifying a champion to manage the process is specifically called out as an owner of the canvas or as a part of Key Resources. Throughout the canvas, suggested inputs, based on the interviews with faculty affinity group members, are provided to help envision how the tool might be used in the development and implementation of a new innovation. By using the canvas tool to envision the partners, activities, resources, anticipated outcomes, and possible problems, faculty members and administrators will be able to set both the expectations and infrastructure for their teaching innovation up front, making success of the innovation more likely.

Future Work and Implications

The local RED project team, in its fourth year, has taken up a study to understand how faculty development programs and initiatives can influence faculty-teaching practices using a modified
version of the Business Model Canvas (BMC). This project has led to the creation of a Faculty Innovation Canvas (FIC) that can be used to initiate, iterate, and document faculty-led teaching innovation. The canvas identifies nine elements that were identified prior to, and refined during the interviews with faculty affinity group members, as well as realized the importance of a presumed tenth element— the need for a Champion – identified as a result of the interviews. Looking ahead, a more in-depth comparison of the experiences of the two compared affinity groups is ongoing. The intent is to fully understand and get insights into how each team’s approach, dynamics, and leveraging of resources, influenced both the experiences of the faculty and the outcomes of the innovation effort itself. Although further validation of the FIC is needed to test its utility in planning and sustaining faculty innovation, we hope to use these test cases to both demonstrate its effectiveness to faculty and administrators as well as provide training on how to apply it in their own practice. Future work can also investigate faculty and administrators’ perceptions of the utility of the Faculty Innovation Canvas and its adaption for future teaching innovations. In particularly, its usefulness with or without a champion in the process. The authors expect that the Faculty Innovation Canvas can constructively support discussions about how an academic with limited resources such as time can navigate the innovation process. As noted above, such understanding could lead to realistic expectations and a clearer picture about the infrastructure required to support and sustain pedagogical risk-taking.

The Faculty Innovation Canvas also has unexamined potential beyond the engineering classroom. The local RED project team plans to use the Faculty Innovation Canvas as a way to take snapshots of the engineering program culture over time, to help evaluate progress toward its efforts of “establishing, cultivating, and promoting a culture of pedagogical risk-taking.” The team is also exploring dissemination of the canvas to RED projects at other institutions, to help facilitate the sharing of ideas between one another. Beyond RED, the Faculty Innovation Canvas could enable growth of more translational research within the field of engineering education more generally. As a visualization tool, the canvas provides an easy and intuitive means for faculty and administrators to document and share the things that they are trying in their classrooms and programs. The standardized language and framework also makes possible the identification of patterns, and thus, common pitfalls and best practices, across canvases, helping to further inform faculty change efforts. Thus, the local RED team sees opportunity for propagating a culture of pedagogical risk-taking and additive innovation within our school, beyond our school, and across engineering disciplines.

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References


