



Intercollegiate Coaching in a Faculty Professional Development Program that Integrates Pedagogical Best Practices and the Entrepreneurial Mindset

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Abstract

This work-in-progress (WIP) paper reports on intercollegiate faculty coaching experiences in a large-scale engineering professional development program funded through the Kern Family Foundation. Research demonstrates that adding coaching and one-on-one targeted discussions to the traditional workshop professional development model effectively supports faculty with integration of pedagogical approaches, conceptualization of strategy application in their classes and content, and persistence through later phases of Diffusion of Innovation models including *confirmation* and *adoption*. Despite increased interest and offerings of higher education faculty development programs in recent years, coaching in higher education settings, particularly in the engineering disciplines, remains relatively rare. If coaching does take place, it typically occurs on a small-scale or in single discipline programs. Rarely, if ever, does intercollegiate coaching occur. This study reports on the effectiveness of a large-scale coaching effort, with 73 faculty participants from 15 engineering disciplines at more than 30 universities across the country.

Beginning in the summer of 2019, a diverse group of engineering faculty participated in the Innovating Curriculum with Entrepreneurial Mindset (ICE) faculty development workshop. This intensive three-day workshop introduced faculty to the framework of entrepreneurially minded learning (EML) centered on curiosity, connections, and creating value. The workshops promoted evidence-based pedagogical best practices and participants experienced different active learning techniques that can be applied to instill the entrepreneurial mindset in students at their home institution. Following the workshops, faculty were provided with ongoing coaching and support comprised of two individual coaching sessions and two small-group Community of Practice coaching sessions. Coaching sessions included in this study were led by a four-member, intercollegiate coaching team comprised of experts in engineering education, EML classroom integration, and instructional effectiveness.

This WIP paper reports on the first half of this ongoing project, including the summer workshops and summer and fall coaching sessions. This paper reports and reflects on coaching session notes and discussions with participants. Evaluation includes trend analysis to identify themes raised during coaching sessions, and assessment of the effectiveness of the coaching meetings. Future survey data will be used to measure the effectiveness of coaching sessions for implementation and accountability of project goals.

Introduction

Over the last two decades, the Kern Entrepreneurial Engineering Network (KEEN) with support from the Kern Family Foundation has actively supported, developed, and promoted programs to create a change in engineering education [1]. Specifically, KEEN has focused on the development of entrepreneurial mindset (EM) in students, centered on curiosity, connections, and creating value. To accomplish this change in engineering education, KEEN has embraced a multifaceted approach to faculty development. These elements include holding an annual conference to foster community networking and exchange of ideas, funding to support curricular changes, and running structured faculty development workshops.

In the last ten years, several faculty leaders have developed and deployed faculty development workshops entitled “Innovating Curriculum with Entrepreneurial Mindset (ICE)”. These intensive in-person three-day workshops introduce faculty participants from KEEN member institutions to the EML framework and evidence-based instructional practices (EBIPs). Faculty participants are immersed in active learning techniques that they can

adopt or adapt to instill an entrepreneurial mindset in their students. In 2019 the KEEN leadership implemented a change to the ICE workshops, namely, offering faculty participants one-year of coaching following the workshops to help ensure that the participants can successfully implement and assess a project, module, or activity at their home institutions.

Professional development in higher education often follows a group workshop model, in which faculty attend a single-day or multi-day workshop and then are left to implement newly learned instructional innovation on their own. Coaching, which has been used successfully at the K-12 level for decades [2], aims to provide a structured support system offering faculty the opportunity of guidance from peer or mentor ‘experts’ at regular intervals following the workshop. Coaching models are relatively new in engineering education, and are designed, in part, to assist faculty in progression through challenging phases of implementation. The Rogers’ Diffusion of Innovation model demonstrates that faculty are often successful in progression through the *awareness* and *interest* stages, falter in the *evaluation* and *decision* phases, and often fail to achieve the final stage of *confirmation* and *adoption* necessary to realize diffusion of the innovation or idea [3]. In promoting an entrepreneurial mindset in engineering education, faculty often grapple with the additional challenge of helping students with this complex instructional shift. Two research questions of interest here are:

1. Does intercollegiate coaching shift the entrepreneurial mindset of participating faculty, and, if so, how?
2. Does one year of intercollegiate coaching help faculty persist through change to adoption of new instructional practices?

Background

Creating a culture that supports change in faculty mindset is challenging. Prior efforts have studied the process of both institutional change and individual instructor change [3–5]. Coaching and mentoring in faculty development efforts have also been studied. Knight provides an overview of the process and suggests best practices for developing a coaching program [6]. Others have studied ways that coaching might improve instructional practices, as summarized in Table 1.

Table 1. Summary of prior work on instructional coaching.

Author	Year	Discipline	Coaching Context	Development Goals
Skinner and Welch [7]	1996	All	Instructional development	Evidence Based Practices
McLeod and Steinert [8]	2009	Medical Faculty	Instructional development	Evidence Based Practices
Pembridge [9]	2017	Engineering	Video annotation	Evidence Based Practices
Sherick [10]	2018	Engineering	Career Development	Promotion to Professor
Hamilton et al. [11]	2019	Engineering	Capstone/senior design	Entrepreneurial mindset
Current Work	2020	Engineering	All courses	Entrepreneurial mindset

Although coaching in engineering professional development has happened, to our knowledge there have been no cross-university and inter-disciplinary coaching programs.

Coaching Project Structure

Approximately 30 faculty participants registered and attended each of three workshops held in the summer of 2019, representing three cohorts of faculty participants. The cohorts were distinguished based on the month – June, July, August – the training occurred. Workshop participants were recruited from schools in the KEEN network or potential member schools resulting in a diverse group of faculty participants from approximately 30 schools. Aside from travel and lodging support for the duration of the workshop, no other financial incentives were provided to participants.

Experienced engineering faculty serve as facilitators who plan, coordinate, and deliver the workshops and other experienced engineering faculty serve as coaches who engage with participants at and after the workshop for one year. Coaches may attend all or part of a workshop or join virtually, most typically at the end of the workshop to learn participant plans for their project, module, and/or activity.

In each workshop, scheduled for three days, the faculty participants were trained on both evidence-based pedagogical tools and methods to cultivate the entrepreneurial mindset in students. During each workshop faculty participants proposed, planned, and started developing a project, module, and/or activity for enhancement of a course. The morning of the last day was reserved for faculty reporting and sharing the module idea they planned to implement with an opportunity to get feedback from the facilitators and faculty participants. In the year following the workshop, faculty participants complete development of their module, deploy it with students, and assess its effectiveness. The description of the module and all results of implementation and assessment are then published on engineeringunleashed.com as “cards” that are shared with the wider KEEN community.

The goals of the coaching program are to:

1. Support faculty participants in planning and assessing their modules initially planned and partially developed at the workshops.
2. Encourage faculty participants to take risks in exploring new pedagogical tools and practices, with an emphasis on mindset growth for students.

The ICE coaching structure was based on the “roadmap” shown in Figure 1. For each workshop, two coaches were assigned. The coaches selected were faculty that had experience in implementing EML in the classroom and were also trained in evidence-based instructional practices (EBIPs). Although the coaches were invited to participate in the workshops to get to know the faculty participants, due to travel conflicts only one coach per cohort attended each workshop. In two of the workshops, the coaches also participated as workshop facilitators.

At the conclusion of each workshop, the coaching team met and discussed the best personality and skill match for each participant and coaches were assigned to individual faculty participants. For the July cohort, an alternative model was used, where no specific coach was assigned, but all participants were coached by both coaches. This model offered the participant feedback from two different perspectives and had logistical advantages for the coaches, although it may have increased the challenge of tracking progress.

After the coaches were assigned, meetings with faculty participants were scheduled. Individual meetings (the first and third meetings) occurred with one coach and one faculty participant and lasted approximately 30 minutes.

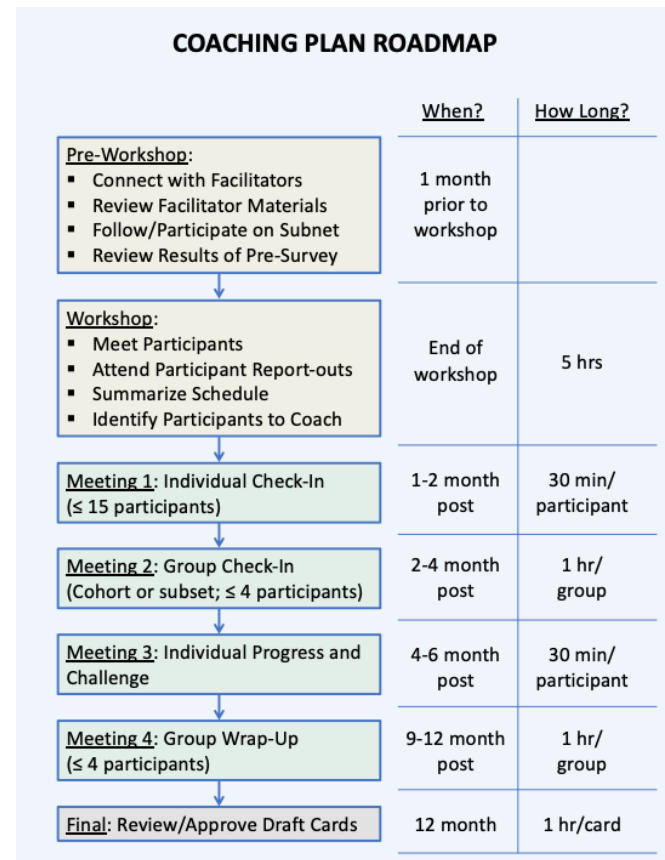


FIGURE 1. SUMMARY OF THE COACHING STRUCTURE DEVELOPED FOR THE KEEN ICE WORKSHOP PARTICIPANTS

Group meetings (the second and fourth meetings) occurred with one coach and three to four participants and typically lasted one hour.

Methods

The assessment methods for the coaching process focus on three elements. The first element is faculty participant satisfaction with the workshop and the coaching process. A survey was sent to the participants immediately after the workshop. The survey results provided feedback on the perception of participants of each segment of the workshop, the time allocated to each topic, and their assessment of the relevance of each topic to advancing their application of EM in the classroom. A second survey is planned to focus on the coaching process at the end of 2020 when the 2019 cohorts have completed their coaching plan. Throughout the year of coaching, informal feedback about the coaching process has been documented in notes and emails between coaches.

The second element of the assessment is the impact of the program on the teaching practices, knowledge, skills and attitudes of faculty. Discussions during the coaching meetings include: (i) pedagogy-related topics, (ii) EM-related topics, (iii) faculty requests for additional information/resources, (iv) educational research including IRB and publications opportunities, and (v) available exemplar KEEN cards. The coaching team has completed a preliminary trend analysis based on these themes to capture how practices and attitudes of faculty have shifted during this process.

The third element of assessment is the impact on student outcomes. To understand the student outcomes the published cards of faculty participants are/will be reviewed. Faculty participants are encouraged to include student artifacts (with names redacted) as part of their card.

Work in Progress Results

To help understand the effectiveness of the coaching process for faculty, the coaches reviewed notes for topics and trends. The topics include conversations initiated by either the participant or the coach, based on the module and pedagogical goals of each individual. Trends observed are summarized in Table 2.

Table 2. Summary of topic trends in the first year of coaching. Each percentage is the number of conversations on this topic.

<p>(i) pedagogy-related topics discussed during the coaching sessions</p> <ul style="list-style-type: none"> ● Jigsaws - 21% ● Scavenger hunts/photo essays - 12% ● Improving teamwork - 30% ● Active learning strategies - 30% ● Scaffolding /Progressive Disclosure - 7% 	<p>(ii) EM-related topics discussed during the coaching session</p> <ul style="list-style-type: none"> ● EM ties to economic analysis – 22% ● Mindset growth and character – 19% ● What is expected in a card for KEEN – 37%
<p>(iii) faculty requests for additional information/resources</p> <ul style="list-style-type: none"> ● Requests for rubric examples - 26% ● Research articles on active learning and teamwork – 22% ● Sample student learning indicators for EM – 21% 	<p>(iv) discussions around educational research and publications opportunities</p> <ul style="list-style-type: none"> ● What venues to publish/examples of abstracts for ASEE - 16% ● IRB questions/examples – 7%
<p>(v) summary of the discussion and available faculty exemplars/KEEN cards.</p> <ul style="list-style-type: none"> ● Exemplar KEEN cards – 25% 	

Participant Themes

The coaches observed that trends on questions and methods depended on the types of methods modeled and discussed in the ICE workshops. For example, in one workshop the jigsaw was discussed but not demonstrated and coaches noted that it was comparatively less popular for adoption and discussion by the faculty. Other trends were observed related to the expertise of the coach. For example, if one coach had extensive expertise in economic analysis, the participants were more likely to discuss this in coaching sessions.

In addition to the discussion topics, themes emerged for the value the faculty participants perceived in the coaching process. These included:

- **Accountability.** The structured coaching meant faculty participants were motivated to making progress in the planning, development, and possible deployment to be prepared for the following coaching meeting.
- **Example materials and resources.** Newer faculty members may not be familiar with the wide array of class and lab resources on the engineeringunleashed.com platform. They can be helped by coaches offering to send examples of cards on the platform.
- **Expert review of rubrics, lecture materials, activities, and worksheets.** This type of feedback and discussion was very relevant and valued by the participants.

Discussion and Preliminary Conclusions

Prior to 2019, faculty participants of ICE workshops did not work with coaches for follow-up reinforcement and help implementing workshop concepts. In addition, prior to 2019, participants were incentivized with monetary stipends and were expected to develop and implement 2 to 4 EM modules in their courses in the year after the workshop. Workshop facilitators encouraged participants to reach out during the year for feedback or if questions came up along the way, and a single 6-month optional check-in meeting was held in small groups. At the completion of their deliverables, participants gave a short presentation on what went well and what they would change. Anecdotally, facilitators reported few instances of participants reaching out to them during the year, and over half of the submitted documentation lacked some aspect of EM or evidence of EM impact.

To increase the experience for faculty participants and to develop stronger ties to EM, a more formal coaching model was implemented in 2019 for faculty development workshops. For the ICE workshops coaches have observed a significant increase in formative assessment and evidence-based pedagogical practices based on participant plans and deployment of their projects in classrooms. In particular, coaches reported that most faculty participants planned, developed, and in some cases already implemented modules that address EM in a way that will be helpful to students. These results indicate the goals of supporting faculty and encouraging them to take risks are benefiting from the coaching structure.

Coaches found that group coaching sessions, in which two coaches engage with faculty participants, offered additional benefits and provided more diversity of ideas in the exchange of workshop concepts and in discussions with participants. A significant challenge to the coaching process was the logistics of scheduling meetings with participants and coaches.

Early results indicated the coaching process has been beneficial for most participants. Approximately 90% of the faculty have participated in the coaching process through the first half of the year. By qualitative measures the coaches view the coaching opportunity for participants as leading to more effective and successful projects than developed under the prior model. In addition to providing more accountability, the result of the current coaching model is higher quality and enriching EM experiences for students. We plan to more formally survey the faculty participants for a quantitative follow-up to this work-in-progress paper.

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References

- [1] KEEN. KEEN - The Framework, <https://engineeringunleashed.com/mindset-matters/framework.aspx> (accessed 16 January 2020).
- [2] Scott V, Miner C. Peer coaching: Implication for teaching and program improvement. *Transform Dialogues Teach Learn J* 2008; 1: 1–11.
- [3] Rogers EM. A prospective and retrospective look at the diffusion model. *J Health Commun* 2004; 9: 13–19.
- [4] Weiman C, Gilbert S. The Teaching Practices Inventory: A New Tool for Characterizing College and University Teaching in Mathematics and Science. *CBE Life Sci Educ* 2014; 13: 552–569.
- [5] Weiman C. A Better Way to Evaluate Undergraduate Teaching. *Change: The Magazine of Higher Learning*, 2015, [http://www.changemag.org/Archives/Back Issues/2015/January-February 2015/better-way-full.html](http://www.changemag.org/Archives/Back%20Issues/2015/January-February%202015/better-way-full.html) (2015, accessed 27 May 2016).
- [6] Knight J. *Instructional Coaching: A Partnership Approach to Improving Instruction*. SAGE Publications, 2007.
- [7] Skinner ME, Welch FC. Peer Coaching for Better Teaching. *Coll Teach* 1996; 44: 153–156.
- [8] McLeod PJ, Steinert Y. Peer coaching as an approach to faculty development. *Medical Teacher* 2009; 31: 1043–1044.
- [9] Pembridge JJ. The Role of Instructional Coaching in Video-annotated Peer Review of Class-room Instruction. In: *American Society for Engineering Education*. 2017.
- [10] Sherick HM. Work in Progress: Coaching as a Midcareer Faculty Development Approach. In: *American Society for Engineering Education*. 2018.
- [11] Hamilton Mayled L, Ross L, Krause SJ, et al. Coaching and Feedback in a Faculty Professional Development Program that Integrates the Entrepreneurial Mindset and Pedagogical Best Practices into Capstone Design Courses. In: *American Society for Engineering Education*. 2019.