Coaching and Feedback in a Faculty Professional Development Program that Integrates the Entrepreneurial Mindset and Pedagogical Best Practices into Capstone Design Courses

Dr. Lindy Hamilton Mayled, Arizona State University

Lindy Hamilton Mayled is the Director of Instructional Effectiveness for the Fulton Schools of Engineering at Arizona State University. She has a PhD in Psychology of Learning, Education, and Technology from Grand Canyon University. Her research and areas of interest are in improving educational outcomes for STEM students through the integration of active learning and technology-enabled frequent feedback. Prior to her role and Director of Instructional Effectiveness, she worked as the Education Project Manager for the NSF-funded JTFD Engineering faculty development program, as a high school math and science teacher, and as an Assistant Principal and Instructional & Curriculum Coach.

Lydia Ross, Arizona State University

Lydia Ross is a doctoral candidate and graduate research assistant at Arizona State University.nHer research interests focus on higher education equity and access, particularly within STEM.

Dr. James Collofello, Arizona State University

Associate Dean of Academic and Student Affairs Professor of Computer Science and Engineering School of Computing Informatics and Decision Systems Engineering Ira A. Fulton Schools of Engineering

Prof. Stephen J. Krause, Arizona State University

Stephen Krause is professor in the Materials Science Program in the Fulton School of Engineering at Arizona State University. He teaches in the areas of introductory materials engineering, polymers and composites, and capstone design. His research interests include evaluating conceptual knowledge, misconceptions and technologies to promote conceptual change. He has co-developed a Materials Concept Inventory and a Chemistry Concept Inventory for assessing conceptual knowledge and change for introductory materials science and chemistry classes. He is currently conducting research on NSF projects in two areas. One is studying how strategies of engagement and feedback with support from internet tools and resources affect conceptual change and associated impact on students' attitude, achievement, and persistence. The other is on the factors that promote persistence and success in retention of undergraduate students in engineering. He was a coauthor for best paper award in the Journal of Engineering Education in 2013.

Prof. Keith D. Hjelmstad, Arizona State University

Keith D. Hjelmstad is President's Professor of Civil Engineering in the School of Sustainable Engineering and the Built Environment at Arizona State University.

Dr. Brent James Sebold, Arizona State University

Brent Sebold is the Executive Director of the Entrepreneurship + Innovation Training and Development Network within Arizona State University's Office of Knowledge Enterprise Development. In this role, Brent leads a variety of enterprise-wide entrepreneurial training and development initiatives for student, faculty, and community-based innovators. Concurrently, Sebold serves as the Director of Entrepreneurship @ the Fulton Schools within ASU's Ira A. Fulton Schools of Engineering. Dr. Sebold is responsible for the organization and advancement of curricular and co-curricular entrepreneurship programs for all Fulton students and faculty. He also oversees the eSeed Challenge + Accelerator, which is the Schools' premier new venture funding and support initiative. Brent also co-directs the Fulton Generator Labs, which is a 6,500 square foot workspace for student enterprisers.

Sarah Hoyt, Arizona State University

Sarah Hoyt is currently the Education Project Manager for the NSF-funded JTFD Engineering faculty development program. Her educational background includes two Master's degrees from Grand Canyon University in Curriculum and Instruction and Education Administration. Her areas of interest are in student inclusion programs and creating faculty development that ultimately boost engagement and performance in students from lower SES backgrounds. Prior to her role as project manager, Sarah worked as the SEI Coordinator for a local high school and has also developed an inclusion program for Migrant and Immigrant students that utilized co-teaching and active learning as keystones of the program. She began her educational career as a high school teacher, teaching courses in English, math, and science.

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Abstract

This evidence-based practice paper reports on the impact of individualized coaching as part of a broader professional development program for capstone engineering faculty. Research shows that coaching can help improve the ways that faculty conceptualize their classes, implement new ideas into their teaching, and facilitate incorporation of more diverse pedagogical approaches. An increased emphasis on pedagogical practices and effective teaching has resulted in the growth of professional development programs for faculty in higher education. However, coaching, or targeted one-on-one discussions about teaching strategies and practices, is still quite rare in post-secondary settings. This study examines the effect of individualized faculty coaching as part of a professional development program for engineering faculty teaching capstone courses across multiple disciplines at a large southwestern university. The project, funded by the Kern Family Foundation, began in fall of 2018 with the aim of institutionalizing the entrepreneurial mindset (EM), improving and expanding evidence-based pedagogical strategies in capstone courses, and creating a faculty Community of Practice to share resources and best classroom practices.

Sixteen capstone faculty from multiple engineering disciplines participated in three workshops and three coaching sessions in the fall semester. The workshops promoted the EM and evidence-based pedagogical best practice and covered topics including: (a) 'cultivating curiosity' for opportunity recognition, (b) writing measurable student learning objectives, (c) 'making connections' in the design process, (d) teamwork and cooperative and collaborative learning, (e) reflection on how and when these practices could be institutionalized in the capstone course. Faculty participated in monthly group workshops followed by individual coaching sessions with two members of the professional development leadership team. The two-member coaching team was comprised of two "experts" – one in the EM and the other in pedagogical practices. The coaching sessions included open-ended questions for faculty reflection on implementation of EM and instructional teaching strategies.

Coaching sessions were documented through a Google form, which captured coaching discussion details on the following: (i) pedagogy-related topics discussed during the coaching session, (ii) EM-related topics discussed during the coaching session, (iii) faculty requests for additional information/resources, and (iv) summary of the discussion and available faculty exemplars. This study focuses on both the quantitative and open-ended qualitative items to characterize common themes brought up during the coaching meetings, measure change across the semester on discussion and implementation of classroom strategies, and assessment of the effectiveness of the workshop and coaching meetings. This data is evaluated in conjunction with faculty interviews and end-of-semester faculty surveys to gauge the effectiveness of the workshop and coaching sessions for implementation and accountability of project goals. Initial analysis indicates that professional development, combined with coaching, is effective in supporting faculty with integration of both the entrepreneurial mindset and pedagogical best practices into their capstone design courses. The authors look forward to presenting these results through an interactive presentation using audience response/virtual vision board technology.

Introduction

This paper reports on the impact of individualized coaching as part of a broader professional development program for capstone engineering faculty. The project, funded by the Kern Family Foundation, provides professional development for faculty members across multiple engineering disciplines (Aerospace, Biomedical, Chemical, Civil, Computer, Construction, IT, Materials, and Mechanical) with the aim of institutionalizing the entrepreneurial mindset (EM), improving and expanding evidence-based pedagogical strategies in capstone courses, and creating a faculty Community of Practice. To effectively institutionalize the entrepreneurial mindset and expand evidence-based pedagogical practices in capstone courses, professional development was provided in conjunction with coaching sessions. This format aimed to provide accountability for faculty participants, offer opportunities to strategize how the innovation(s) would be implemented in a contextualized setting, and shift the attitudes and practices of the capstone faculty.

Rogers' Diffusion of Innovation (DOI) outlines an individual change model that describes the five stages individuals follow towards adoption of an innovation in fields, such as business or teaching [1]. The steps include awareness or knowledge, persuasion or interest, evaluation and decision, implementation and trial, and finally confirmation or adoption. This theory of change was used to develop a comprehensive faculty development program that included monthly group workshops promoting the EM and evidence-based pedagogical best practice and regular individualized coaching sessions with a peer team comprised of two "experts" – one in the EM and the other in pedagogical practices.

While professional development programs for faculty in higher education are relatively common, coaching, or targeted one-on-one discussions about teaching strategies and practices, is still quite rare. However, coaching has been identified as a critical component to ensure faculty progressed more completely through Rogers' DOI, confirming more thorough adoption and institutionalization of the innovation. This paper aims to fill in some of the gaps in literature surrounding coaching in engineering faculty development, professional development with the entrepreneurial mindset, and professional development specifically with capstone faculty members.

Data gathered during the coaching meetings and end-of-semester faculty surveys were used to gauge the effectiveness of the workshop and coaching sessions for implementation and accountability of project goals. This paper addresses the following research questions:

1) Could faculty development workshops paired with coaching provide effective training and support on both pedagogy and EM for capstone faculty?
2) Is the model of pairing coaching and faculty development workshops beneficial for implementation and institutionalization of instructional innovation?

Background and Relevant Literature

Student-Centered Instruction and Unique Features of the Capstone Course Design

Multiple studies have shown that students in STEM courses learn best when they actively engage in the course material [2], [3]. Best practices, such as constructivist-based active learning, help to facilitate a shift in centeredness: away from the teacher and toward the student to boost student achievement [3]. Constructivist active learning emphasizes the importance of students constructing their own learning through active participation rather than through passive lecture or rote memorization [4], [5]. Active learning also shifts the responsibility of knowledge acquisition, giving more ownership to the student through instructional techniques such as real-world problems, collaboration and discussion, and frequent formative feedback [6]. Positive results from active learning instructional methods have been reported throughout the STEM disciplines, and after completing the most comprehensive meta-analysis study to date, Freeman et al. [3] concluded STEM learners demonstrate higher examination scores and lower failure rates in courses using active learning over traditional lecture delivery.

Capstone courses, by design, are a natural fit with the pedagogical principles of active learning. In the critical time just before graduation, capstone courses provide engineering students with an opportunity to apply the analytical and technical knowledge learned throughout the undergraduate curriculum in the context of the actual practice of engineering [7]. In a survey of 444 ABET-accredited engineering institutions, capstone courses were typically one or two-semesters long, ran parallel class and project requirements, used extensive team-based activities, and culminated in a final project that often originated from industry or faculty research [8]. This design process offers a distinct learning opportunity for students by providing structured occasions to collaborate with each other, the instructors, and the client involved in the innovation [9]. Additionally, rather than focusing solely on the technical content that is prevalent in many other required engineering courses, capstone faculty reported the following top six content areas: Written communication (87%), Oral Communication (83%), Engineering Ethics (76%), Project Planning and Scheduling (72%), Decision-Making (68%), and Teambuilding (66%) [8].

Entrepreneurial Mindset in Engineering

The unique structure, design, and topics addressed in capstone courses provide ample opportunities for embedding innovative instructional best practices as well as complementary skill sets such as sustainability, soft skills, and the entrepreneurial mindset (EM). It has become increasingly evident that these skill sets, in particular entrepreneurially-minded education, are valuable in preparing undergraduate engineering students to join the complex, technology-enabled, global 21st-century workforce [10]. In addition to integration into classrooms by individual faculty members, programs like the NSF-funded I-Corps™ for Learning program (I-Corps™ L) have supported this shift in curriculum and aim to improve the scalability of educational innovations by leveraging the entrepreneurial mindset [10].

The Kern Entrepreneurial Engineering Network (KEEN) values EM for its potential to graduate engineering students who go on to “create personal, economic, and societal value through a

lifetime of meaningful work" [10]. The EM is often discussed in terms of the Three Cs (curiosity, connections, and creating value) and aims, in part, to encourage students towards inquisitiveness, increased empathy and understanding of customer needs, and improved skills of innovative and entrepreneurially-minded thought in the engineering disciplines. Despite the growing acceptance of EM in engineering, a common definition and set of standardized learning objectives surrounding EM remains somewhat fragmented, making uniformity of goals and outcomes more challenging and confusion with the more traditional ideas of *entrepreneurship* more frequent [11]. In spite of the challenges to create a consistent definition and shared set of student outcomes, a large number of universities have recognized the value of EM in their programs and moved forward with implementation into their broader curriculum.

Coaching as a Tool for Facilitating Change in Pedagogy and the Entrepreneurial Mindset

Considering the available research on active learning and promise of more well-rounded engineering graduates available through the introduction of EM, the need for quality faculty professional development on these topics is a natural next step. Professional development is a fundamental part of educational innovation as it allows faculty to learn about changes in pedagogy and receive instruction on implementing best practices into the classroom. Research shows that faculty respond to professional development in different ways, progressing at varied rates and requiring additional assistance to persist through difficult topics or challenges with implementation. Research by Rogers [1] examines how people react or process change when introduced to a new innovation. Called the Model of Diffusion of Innovation, Rogers' research focused on a five-stage model that describes how people adopt an innovation:

1. Awareness or knowledge - an individual is exposed to an innovation
2. Persuasion or Interest - interest in the subject grows and individuals seek out further information about the innovation
3. Evaluation and Decision - individual either adopts or rejects the innovation
4. Implementation and Trial - innovation is tested by an individual
5. Confirmation or Adoption - individual continues and sustains use of the innovation

Traditional professional development models are often successful in assisting faculty through the *awareness* and *interest* stages (see Figure 1), but faculty often falter in the third phase of *evaluation and decision*, and ultimately fail to move past the fourth phase of *implementation and trial* [12]. There are a number of contributing factors to the breakdown in implementation; however, evidence suggests that providing small-group support, such as coaching, can assist faculty in persisting to the final stages of *confirmation or adoption* [13]. Faculty report that when they are coached by colleagues who are familiar with their working environment and discipline, they are more responsive to the professional development opportunity, and thus better equipped to progress through the entire model of diffusion of innovation [15].

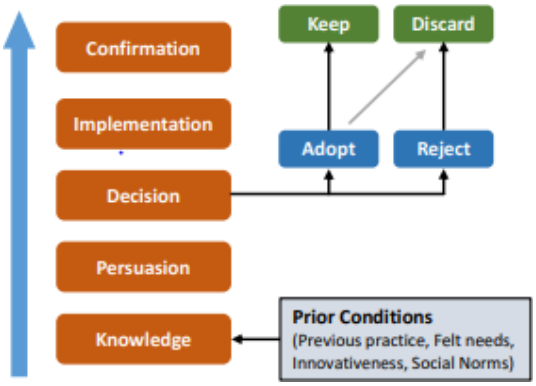

Figure 1. Innovation Stages in Roger's Model of Diffusion [1]

These insights, and other similar findings, have led to the growth of coaching as a professional development model in higher education. Coaching has been used at the secondary level for decades, and much of the available data on its effectiveness comes largely from research at the K-12 level. While traditional models of professional development often follow a workshop and survey format, coaching models focus on the exchange of information among professionals within similar disciplines using reflection and discussion as the platform [15]. Faculty who participate in coaching report a reduction in judgment perception, an increase in motivation through peer involvement and greater opportunity for collaboration and implementation of pedagogical skills [16]. Teachers who participated in workshops paired with coaching also showed significantly higher levels of positive change related to student-centered pedagogy [17]. Subsequently, coaching can bring about an increase in student achievement, reflective teaching, intrinsic values of teaching, and a positive professional climate [16].

As the concept of coaching is still relatively novel in higher education, the body of research surrounding how these models are best implemented for engineering faculty, specifically with faculty who teach capstone courses, is extremely limited. An extensive search of journal publications on 'professional development and capstone faculty', 'entrepreneurial mindset and professional development', and even 'coaching with engineering faculty' produced very few relevant results. As detailed above, the capstone course design is unique and presents specific challenges and opportunities due to the structure, breadth, and dynamics of this type of course. Literature on professional development specific to faculty instructing capstone courses is sparse and research specific to capstone courses and the entrepreneurial mindset is nearly non-existent. Instead, most available literature related to capstone courses understandably focuses on student activities and outcomes in the classroom rather than on development or growth of the faculty who lead them. Therefore, there is a need for further research to better understand faculty approaches to capstone classes, and the potential role of coaching and workshops in supporting the development of these courses.

Structure of Workshops & Coaching Sessions

Noting the lack of available research on coaching and professional development with engineering faculty, specifically with capstone and EM, the project team focused on applying

the best practices that could be gleaned from available publications on active learning best practices, EM-style approaches and course design, and successful professional and coaching models (primarily at the K-12 level). This information was used to create a professional development program that aimed to merge pedagogy, EM, and capstone design principles with professional development workshops and coaching sessions.

Sixteen capstone faculty from a variety of engineering disciplines (Aerospace, Biomedical, Chemical, Civil, Computer, Construction, IT, Materials, and Mechanical) participated in a series of three workshops and three coaching sessions during the fall semester of 2018. Attendance for the 16 faculty participants averaged 92% for the three workshops and 77% for the three coaching sessions. Participants were recruited into the professional development program through an email invitation from the engineering department leadership and personal referrals from members of the project team. The overall aims of the project included institutionalizing the entrepreneurial mindset (EM), improving and expanding evidence-based pedagogical strategies in capstone courses, and creating a faculty Community of Practice to share resources and classroom best practices.

The workshops consisted of monthly professional development sessions focused on different research-based topics related to pedagogy and the entrepreneurial mindset. The workshops covered topics including: (a) 'cultivating curiosity' for opportunity recognition, (b) writing measurable student learning objectives, (c) 'making connections' in the design process, (d) teamwork and cooperative and collaborative learning, (e) reflection on how and when these practices could be institutionalized in the capstone course. Workshops were designed to model instructional best practices and therefore included an introduction and mini-lecture followed by an activity and questions to stimulate discussion around the learning objectives. This activity was typically followed by a group report-out/discussion and post-workshop 'homework' summary to prepare faculty to participate in the coaching sessions the following week. The workshops were well attended, with 15/16 faculty attending the first workshop, 13/16 at the second, and all 16 at the third workshop.

The coaching sessions included open-ended questions for faculty reflection on implementation of EM and instructional strategies. Coaching sessions varied in length and typically lasted between 20-40 minutes. Each coaching session consisted of one faculty participant and two peer "experts"– one in the EM and the other in pedagogical practices. In addition to providing formative feedback to the faculty participant, the coaching sessions also provided the professional development team with insight into the needs of the faculty for future workshop sessions as well as an opportunity to discuss existing exemplar resources from faculty that could be shared with the larger group.

While the theory of Constructivism (described above) is traditionally applied to active learning with students, it was also leveraged in this program in the practice of coaching. Just as students are encouraged to construct their own learning in the classroom environment [18], faculty were encouraged to construct their understanding of the professional development material by answering reflective questions in the coaching sessions. There were opportunities for coaching leads to share relevant or helpful information with the faculty participants, but the majority of time in the coaching session was devoted to faculty reasoning through recently learned concepts

and conceptualizing how the ideas could be applied to their upcoming curriculum. This process allowed coaches to tailor the sessions to focus on the needs of the learner, required faculty to be active participants in the learning process, and incorporated elements of social interaction, both with peers and with a knowledgeable mentor, to complete the learning process [18- 20].

Project Evaluation & Data Sources

Program evaluation was comprised of workshop attendance and participation for the sixteen participating capstone faculty, quantitative themes brought up during the coaching meetings, measurement of change across the semester on discussion and implementation of classroom strategies, and assessment of the effectiveness of the workshop and coaching meetings. These data were evaluated in conjunction with end-of-semester faculty surveys to gauge the effectiveness of the workshop and coaching sessions for implementation and accountability of project goals. Data were collected through two primary methods. The first was through Google coaching forms which documented the coaching session discussions and the second was through self-reported surveys provided to faculty (at the conclusion of the fall semester workshops and coaching sessions).

Google Coaching Forms

As part of the project evaluation, coaching sessions were documented through Google forms. The Google forms captured coaching session details in the following areas: (i) pedagogy-related topics discussed during the coaching session, (ii) EM-related topics discussed during the coaching session, (iii) faculty requests for additional information/resources, and (iv) summary of the discussion and available faculty exemplars. The information gathered through these forms was used to track changes in coaching topics, gauge effectiveness of workshops from the previous week, evaluate faculty implementation of ideas through answers to reflective questions, and understand how helpful the coaching sessions were in supporting faculty through Rogers' DOI change model.

End-of-Semester Surveys

To assess effectiveness of faculty workshops and coaching sessions, workshop attendance, coaching participation, and self-reported surveys were reviewed. While faculty responses to self- reported surveys were, to an extent, subjective, they provided feedback on the degree to which faculty felt workshop material and coaching sessions were valuable and aligned to project objectives. The survey included eight Likert-scale quantitative questions on topics related to workshop material, coaching session usefulness, project workload, and the broader community of practice. The survey also queried faculty through five qualitative questions asking for feedback on changes in beliefs, relevance of workshop material, and suggestions for improving coaching sessions in the future. The data presented here focuses primarily on the quantitative feedback collected in the survey and was used, in part, to gauge how helpful workshops and coaching sessions were in progressing through Rogers' DOI from the faculty perspective.

Data Analysis & Results

Coaching Sessions

The Google forms contained coaching comments and were analyzed to determine the most common themes from the coaching sessions, while also assessing for change over the course of the semester. Due to the small sample size, this paper presents descriptive statistics related to the number of participants and topics discussed across each coaching call.

Table 1, below, provides an overview of the coaching sessions by number of participants and average number of topics covered related to pedagogy and entrepreneurial mindset. The number of participants was nearly identical between the first and second coaching sessions. However, due to end-of-semester scheduling for one of the coaching pairs, the number of participants decreased by for the last coaching session. The average number of pedagogy topics covered decreased from the first to last two sessions, as did the average number of entrepreneurial mindset topics discussed.

Table 1. Number of Participants and Topics Covered.

Coaching Session	Number of Participants (out of 16)	Average Number of Pedagogy Topics Covered	Average Number of EM Topics Covered
1	14	2.5	3.1
2	15	1.9	3.8
3	8	1.8	1.6

Next, specific pedagogy and entrepreneurial mindset topics were examined for trends across the three coaching sessions. Descriptive statistics for these sessions are presented in table 2. During each session, coaches recorded which pedagogy/entrepreneurial mindset topics were discussed and this information is summarized below. Some of the topics were covered more frequently across all three of the coaching sessions for both content areas, such as grading/assessment rubrics from the pedagogy related areas and EM assessment from the entrepreneurial mindset related topics. Whereas, other topics seemed to be very popular during only one of the coaching sessions, for example, measurable learning objectives from the pedagogy topics and customer discovery from the entrepreneurial mindset related topics. For instance, there was a notable decrease in the number of times the entrepreneurial mindset at Fulton Schools of Engineering performance indicators was discussed during the last coaching session (n=0) in comparison to the first two (n=5 for both sessions). Whereas, grading assessments/rubrics were consistently brought up across all three coaching sessions.

Table 2. *Individual Coaching Topics Covered in Coaching Sessions.*

Topics Covered	**Percentages of Coaching Sessions with Topic Covered**		
Pedagogy Related	**Session 1** (n= 14)	**Session 2** (n=15)	**Session 3** (n=8)
Problem-Based learning	14	7	25
Teamwork and cooperative grouping	14	7	25
Measurable learning objectives	64	67	25
Active learning	50	0	25
Lesson planning/activity design	21	0	25
Grading/assessment rubrics	43	40	25
Other	36	53	50
Entrepreneurial-Mindset Related			
3 C's	57	53	25
Customer discovery	93	7	50
Human-centered design	14	0	13
Business acumen	43	33	25
EM@FSE performance indicators	36	33	0
EM assessment	50	27	50
Other	21	33	0

End of Program Surveys/Evaluation

At the conclusion of the coaching/workshop series, a survey was administered to the faculty participants to gather feedback on the program. Table 3 shows the average scores on the post-survey assessment items.

In general, participants had positive feedback about the program. For instance, respondents reported that the workshops were worth the time and did not have an unreasonable workload. Furthermore, they indicated that the workshops made the participants feel part of a community of practice, and that they would recommend their colleagues participate in the workshops. When it came to the entrepreneurial mindset questions, participants also had positive feedback. In general, the respondents felt that they could confidently integrate the EM into the classrooms after participating in the workshops. Nearly all faculty indicated that they planned to integrate the EM performance indicators the next time they taught the capstone course; however, they also stressed a desire to have example lessons and assessments on how to integrate EM performance indicators.

Table 3. *Average scores on post-survey items (scale of 1-4), (n= 16).*

Item Topic	**Survey Item**	**Average Score**
Workshops & Coaching Sessions	The workshop sessions provided me with new strategies I can implement in my capstone course.	3.25
	Overall, the sessions were helpful to my teaching practice.	3.13
	The workshops have made me feel part of a Community of Practice	3.38
	Coaching sessions enhanced my ability to implement ideas presented in workshops.	3.33
	Coaching sessions increased my sense of accountability for participating in the project.	3.53
	Overall, the workload was reasonable.	3.25
	The Capstone Faculty Development workshops were worth the time.	3.40
	I would recommend participation in the program to colleagues.	3.38
Entrepreneurial-Mindset	I feel confident that I can teach EM@FSE Performance Indicators in my capstone course.	3.33
	I would feel more confident if I had examples of lessons that covered EM@FSE Performance Indicators.	3.07
	I feel confident that I can assess the EM@FSE Performance Indicators that I teach.	3.14
	I would feel more confident if I had examples of EM@FSE assessments.	3.23
	The EM@FSE Framework (Definition, Student Outcomes, Performance indicators) align with my understanding EM.	3.50
	I plan to integrate EM@FSE into my capstone course next time I teach it.	3.60

Support of Diffusion of Innovation Change Model

Assessment of elements of Rogers' DOI model were completed through coaching session documentation as well as end-of-semester surveys and were supported by the following data points:

1. *Knowledge and Awareness* was shown in the faculty surveys in which 100% of faculty agreed or strongly agreed that the 'workshops sessions provided me with new strategies I can implement in my capstone course'.
2. *Persuasion and Interest* was shown in the faculty surveys in which 93% of faculty agreed or strongly agreed that the 'sessions were helpful to my teaching practice'. The level of interest was also demonstrated by faculty attendance in workshops which averaged 92% for the three workshops over the course of the semester.
3. *Evaluation and Decision* was demonstrated by the variety of project-related topics (seven pedagogy-related and eight EM-related) covered during the coaching sessions as well as 93% of faculty agreeing that they 'would recommend participation in the

program to a colleague'.

4. *Implementation or Trial* was shown in the faculty surveys in which 93% of faculty agreed or strongly agreed that the 'coaching sessions enhanced my ability to implement ideas presented in the workshop'.
5. *Confirmation or Adoption* was supported by 93% of faculty stating that they 'plan to integrate EM in my capstone course next time I teach it'.

Summary and Discussion

Limitations of this research included a small sample size and reliance on primarily self-reported data. Data were analyzed to determine:

1) Could faculty development workshops paired with coaching provide effective training and support on both pedagogy and EM for capstone faculty?
2) Is the model of pairing coaching and faculty development workshops beneficial for implementation and institutionalization of instructional innovation?

Despite the limitations present in the research, the results indicate positive initial outcomes on the relationship between coaching and the diffusion of innovation of EM and pedagogy with the capstone faculty. With the acknowledgement that this is research is still early in exploration of findings and conclusions, there are still several implications that can be garnered from the data. First, in regards to research question one, faculty development can easily span across both pedagogy and EM and coaching sessions can be used to support both innovations. The analysis of topics covered across the three coaching sessions indicate that faculty participants were engaging with important pedagogy and entrepreneurial mindset topics throughout the semester. All of the pedagogy and entrepreneurial mindset topics were discussed at least once across the three coaching sessions and all were brought up throughout the workshop sessions.

Across the three coaching sessions, faculty participants discussed various topics related to pedagogy with the coaches. The workshop-related pedagogy topics discussed closely aligned with the workshop information and the coaching session discussions. The popularity of topics and discussions surrounding pedagogy and collaboration indicates faculty interest in creating diverse, interactive ways for students to work together, either in or out of the classroom, to engage with course material. This is particularly promising given the abundance of research that indicates that group learning and collaboration has a positive effect on student achievement [21].

Throughout this program, there was a strong emphasis on incorporating an entrepreneurial mindset into the classroom (in addition to more traditional faculty development topics of pedagogy described above). Across each coaching session, all faculty participants engaged in conversation around at least one of the entrepreneurial mindset topics. It is worth noting that faculty were equally interested in discussing EM-related topics as they were in discussing more established ideas of instruction and pedagogy. One of the program goals was to facilitate greater understanding around entrepreneurial mindset while also increasing awareness around how to integrate EM principles into the classroom environment. Faculty reported that the workshops contributed to increased confidence in their ability to integrate EM into the curriculum.

Based on the small shifts that did take place in the types of EM-related topics from one coaching session to the next, it is also evident that faculty used the coaching sessions to discuss EM topics that were presented in the workshops during the previous week. The coaching sessions allowed faculty to clarify their understanding of EM ideas presented in the previous week's workshop and discuss possible scenarios for implementation in upcoming phases of the capstone course. The high level of discussion surrounding EM was extremely promising, both from a project goal perspective as well as the potential that institutionalizing EM has for assisting engineering students in successfully transitioning to the 21-century workforce [10]. One area for future consideration of research and program development is that faculty requested more examples of lesson plans and grading/assessment rubrics around EM. Future professional development programs should consider dedicating more time to discussing lesson plans and grading around EM to improve faculty understanding and implementation.

The second major implication found in this research relates to research question two regarding the pairing of workshops and coaching for implementation and institutionalization of instructional innovation. This question was evaluated using Rogers' Diffusion of Innovation (DOI) individual change model. Coaching was identified as a critical component to ensure faculty progressed more completely through Rogers' DOI and ensure that comprehensive adoption and institutionalization of the innovation (EM and pedagogy) occurred. As discussed previously, faculty often progress successfully through the initial phases of Rogers' DOI (including *awareness* and *interest),* but fail to reach the final stages of *evaluation, implementation*, and *adoption*. In review of the initial data from the project, as they align with Rogers' model of diffusion and innovation, the preliminary results appear to support pairing workshops with coaching sessions to facilitate individual change and adoption of innovation. Combining workshops with coaching provided faculty with interaction, collaboration, accountability, and support that may otherwise not have taken place (through more traditional workshop formats) and faculty indicated that the coaching model helped guide them through the final phases of Rogers' DOI.

Participants overwhelmingly agreed that coaching sessions enhanced their ability to implement ideas presented in workshop and provided an increased sense of accountability for project participation. In addition to positive results surrounding workshops and coaching, faculty also reported that a community of practice developed through the workshop/coaching framework. This is a significant finding as previous research demonstrates that fostering environments where faculty can engage with one another regarding the proposed innovation is integral to implementation taking place in the future [22]. It is worth noting that there was an observed decline in faculty participation for the final coaching session, however, this decline was due to an unforeseen scheduling conflict with one of the faculty coaching pairs and not lack of interest on the part of the faculty. The perceived value of coaching in the larger professional development model remained strong throughout the program.

As we continue to evaluate the impact of the workshops and coaching sessions, we anticipate that data in support of a paired coaching and workshop model will continue to grow. At forthcoming ASEE conferences and through additional publications, we will report on the longitudinal effects of coaching and the entrepreneurial mindset in hopes of providing

additional insights into how to best enhance faculty development workshops and coaching sessions. Despite the limitations at this preliminary stage of evaluation, the available data is enough to support the conjecture that professional development, combined with coaching, effectively assists faculty with integration of both the entrepreneurial mindset and pedagogical best practices. Additional studies with larger sample sizes, research on the effect of coaching models on student achievement (grades and persistence), and evaluation of adoption by faculty in subsequent courses would be helpful. Further research will provide a more comprehensive picture of how the faculty development/coaching framework can deliver the accountability and support needed to achieve sustained implementation of innovation in engineering disciplines.

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