

## **Facilitating Engineering Faculty Mentorship with a Focus on the Entrepreneurial Mindset**

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# **Facilitating engineering faculty mentorship with a focus on the entrepreneurial mindset**

## **Abstract**

This work-in-progress paper describes a large-scale, multi-university grant initiative aimed at facilitating engineering faculty mentorship with a focus on using the entrepreneurial mindset as a way to instigate, connect, and contribute impactful mentoring within engineering. Research in the fields of mentorship and faculty development demonstrate the need for formal and informal mentorship programs to ensure faculty success. This is particularly true for traditionally marginalized groups, for whom the formal mentorship model may be more beneficial. Faculty mentorship programs are nascent in most engineering programs across the country. Evaluation of mentorship models across higher education settings will inform the future development of evidence-based programs. This paper describes the structure of a strategic effort to facilitate engineering faculty mentorship and provides selected examples of mentorship programs that have been developed at individual universities as part of the larger project. We outline the benefits and barriers to the development of successful mentorship programs and identify the structures, supports, and key takeaways from the project to date. Insights provide emergent, strategic oversight and looks ahead to the support and resources that can be beneficial for universities to develop their own engineering faculty mentorship programs.

## **Introduction**

Engineering faculty undertake a variety of demanding roles, including serving as educators, researchers, mentors, and scholars. The multifaceted nature of the position requires individual faculty to become proficient in each role. The vast majority of faculty members report taking four to five years to become ‘productive’ in their teaching and research efforts [1]. Research shows that early professional experiences, including mentorship support (or lack thereof), follow individual faculty throughout their academic life cycle, impacting career performance, research, motivation, persistence, and mental health [3, 4]. Pre-tenure faculty and professional track faculty also report significant stress, a general lack of support, and an overall struggle with work-life harmony [2].

Mentorship for tenured faculty can also present a challenge as mentorship initiatives are often targeted to pre-tenure roles, leaving tenured faculty to navigate their mid and late-career periods with little guidance [5]. Compounding this

scenario is the fact that these same tenured faculty are often tasked with mentoring junior faculty and graduate students with little training on how to do so effectively. These dynamics underscore the importance of universities providing meaningful mentorship opportunities rooted in mentorship research and best practices throughout the faculty life cycle.

This paper describes the formation of the Mentorship 360 (M360) faculty mentorship initiative, which aims to address the challenges associated with faculty-to-faculty mentorship. M360 provides funding and support to launch or expand faculty mentorship programs across the country. This work-in-progress paper shares initial findings in the following areas: (1) breakdown of the project's creation and structure, (2) description of mentorship programs that have been developed at individual universities as part of the larger project, (3) initial challenges to the development of successful mentorship programs, and (4) key takeaways from these efforts.

## **Background**

Engineering faculty mentorship takes place in a variety of forms and varies greatly depending on the institutional goals and university setting in which it exists. Common mentorship practices include senior faculty providing informal or formal guidance to junior faculty, institutional or departmental onboarding workshops or instructional learning opportunities, and occasional external participation in disciplinary or topically-focused communities of practice. The M360 project adopts and is guided by the definition of mentorship provided by the National Academies (NAE) [6], which arrives at their definition based on synthesis of available research:

*Mentorship is a professional, working alliance in which individuals work together over time to support the personal and professional growth, development, and success of the relational partners through the provision of career and psychosocial support.*

This NAE report further underscores that an ideal mentorship experience is a two-way, action-oriented activity that is ongoing over a period of time, rather than an isolated event [6]. These experiences, regardless of form, can typically be subdivided into three categories: role modeling, psychosocial support, and career development [7, 8]. There is general consensus from the existing literature exploring faculty mentorship that such experiences are valuable in supporting faculty and improving research output and instructional effectiveness [9, 10]. Such

support results in enhanced collegial relationships, job satisfaction, and overall work-life well-being [11, 12]. Mentorship programs have been shown to be particularly helpful in supporting faculty members from traditionally marginalized groups, including women and women of color, who often face unique challenges when seeking meaningful mentorship within their home institution [13-15]. The limited number of mentorship programs that do exist are often structured to meet the needs of a ‘white, male, heteronormative’ mentee profile [6], which further exacerbates the mentorship gap.

Formal mentorship programs within engineering departments across the country are largely underdeveloped and underutilized [16, 17], which may be due in part to a lack of clarity on what constitutes a well-structured program, overreliance on informal mentorship relationships, and a lack of funding and resources to support ongoing mentorship efforts [17]. Research on engineering faculty mentorship demonstrates an overwhelming positive sentiment around mentorship, but there remains a need for additional evaluation of mentorship models in various university settings to inform the future development of evidence-based programs.

## **Mentorship 360**

M360 was created to address some of the gaps that exist in our understanding of engineering faculty mentorship programs, specifically focusing on the creation of programs, research, frameworks, and resources to foster meaningful mentoring for all engineering faculty. The project integrates an entrepreneurial mindset (EM)-based approach, rooted in the Kern Entrepreneurial Engineering Network (KEEN) framework of curiosity, connections, and creating value (3Cs). KEEN, which is currently comprised of over 50 partner institutions across the country, encourages adoption of EM/3Cs to ensure engineering graduates can “create value for their organizations and communities in successful and rewarding engineering careers” [18].

An entrepreneurial mindset approach has also been leveraged to support other Engineering Education-related programs. For example, Innovation Corps for Learning (I-Corps<sup>TM</sup> L), an offshoot of the NSF-funded I-Corps<sup>TM</sup> program designed to support scientists and engineers in commercializing their innovations, aims to foster ‘an entrepreneurial mindset within the engineering community in order to impact sustainability and scalability of educational innovations’ [19]. Continued evolution of an EM definition and research implementation is still emerging [20] and thoughtful consideration has been given to how the EM tenants could support the M360 project as well as subaward project sustainability.

EM for M360 was eventually operationalized through the following overarching goals: (1) instigating broad interest in and awareness of EM-based engineering faculty mentorship and development (Curiosity), (2) connecting engineering faculty to build and share resources and mentorship professional development opportunities (Connections), and (3) contributing to the knowledge base around effective engineering faculty mentorship (Creating Value).

The approach taken by M360 was to support teams nationwide via subawards through a call for action around mentorship. Proposals received fit into two categories: 1) research and development, or 2) scaling and adaptation. A total of 19 EM-based mentorship projects were funded during two cycles between 2019 and 2021 (see Table 1). The PI team reviewed all proposals and later provided regular support to the funded projects through the sharing of resources, ideation and guidance around mentorship program creation, and a facilitated community of practice.

Table 1. Funded Projects and Area of Focus

<b>Funding Cycle</b>	<b>Institute Affiliation [Redacted]</b>	<b>Focus of Project</b>
2019	Project #1	Enhancing Entrepreneurial Mindset for Women in Engineering Education Leadership
2019	Project #2	Faculty Learning Communities (FLCs) for improving mentoring skills in faculty across all departments in the College of Engineering (COE)
2019	Project #3	Develop conceptual framework and perform qualitative and quantitative research to investigate the links between mentorship and faculty productivity
2019	Project #4	Collection of 10-15 stories from faculty who employed Entrepreneurial Mindset (EM) to achieve tenure and life balance while pursuing their intellectual passions
2019	Project #5	Entrepreneurial Mindset for Innovative Teaching (EMIT)
2019	Project #6	Introduce an Entrepreneurial Mindset to faculty-student teams to facilitate innovation in teaching and research of mid-career Engineering faculty
2019	Project #7	Develop instrument to quantify the Entrepreneurial Mindset of engineering faculty
2019, 2021	Project #8	Create formal mechanism for faculty within small engineering colleges or departments to find a qualified, motivated, and prepared mentor from another school within the KEEN network
2019, 2021	Project #9	Identification of gaps between mentors' and mentees' perceptions of effective mentorship, and (ultimately) connecting these to mentee outcomes
2021	Project #10	Cohort-based professional development for engineering faculty around the Scholarship of Teaching and Learning (SOTL)
2021	Project #11	Research study on engineering faculty beliefs about abilities to further faculty development and mentor initiatives

2021	Project #12	Entrepreneurially Minded Learning (EML) can be used as a central focus for creating cohort-spanning mentoring circles
2021	Project #13	Entrepreneurial Mindset and mentoring for graduate students, with focus on underrepresented communities
2021	Project #14	Strategic Instructional Innovations Program (SIIP) framework to support new faculty-led CoPs focused on the Entrepreneurial Mindset (EM)
2021	Project #15	Research and Development project aims to introduce engineering faculty to bioengineering and bio-inspired design as a way to increase the entrepreneurial mindset (EM)
2021	Project #16	Coaches and peer mentors to increase implementation of projects that develop students' EM through the makerspace
2021	Project #17	Develop and assess a new approach to connect faculty and establish a mentorship mechanism through sustainable entrepreneurial mindset (EM)-based curriculum
2021	Project #18	Study that aims to identify and characterize the advising practices faculty in Chemical Engineering believe to be effective when working with doctoral students

## Implementation Challenges and Preliminary Findings

The subaward projects faced varied and nuanced challenges depending on the project focus (e.g., mentorship of faculty as opposed to graduate students) as well as the university setting and pre-existing support for mentorship efforts prior to the award. Several themes have emerged as common challenges across the project portfolio despite the project variations. These include: (1) limited institutional funding and resources, (2) limited existence of scholarship and awareness around faculty mentorship, (3) lack of a community of practice around mentorship, and (4) difficulty finding and sharing mentorship-related content and materials. Subaward participants often voiced their desire for greater opportunities to collaborate with others engaging in mentorship efforts, specifically desiring a seamless mechanism to share resources with one another as they are identified or developed (visit Table 2 for a summary of select project assets developed by subawards).

Table 2. Selected Assets by Type and Funding Cycle

Funding Cycle Cohort	Conference papers, presentations, and posters	Survey Instruments, Conceptual Frameworks, and Interview Protocols	Workshop Presentations, workbooks, and activities	Total Useable Assets
2019	14	20	11	>50
2021	14	11	17	>50

The PI team has addressed the communication and resource challenges through the facilitation of virtual and in-person convenings that provide opportunities for

networking, idea-sharing, and community building. A portion of the developed assets are also available on the Engineering Unleashed website under the Engineering Unleashed Faculty Development (EUFD) dropdown [M360 tab](#) and on the [M360 Wakelet Learning Platform](#). The PI team continues to research ways to share these assets more broadly in the future, while the entire emergent community is working to address and overcome the challenges faced on individual campuses.

## **Discussion and Future Work**

The M360 project integrated an EM-based mentorship approach through the overarching goals of: (1) instigating broad interest in and awareness of EM-based engineering faculty mentorship and development, (2) connecting engineering faculty to build and share resources and mentorship professional development opportunities, and (3) contributing to the knowledge base around effective engineering faculty mentorship. Early metrics demonstrate that there has been significant progress in each of these three areas. The level of engagement from the community is high, as demonstrated by the participation in convenings and multiple ongoing collaborations between individuals and institutions. The number of publications, developed assets, and individuals pursuing other avenues of funding to continue this work are all trending in a positive direction. Awareness has also been positively impacted by conference publications and presentations as well as dissemination about M360 on the EUFD website.

There are many challenges to providing quality mentorship opportunities for engineering faculty across ranks and the spectrum of their careers. In addition to the common challenge of funding, the lack of clarity on what constitutes a well-structured program and the broader paucity of institutional and faculty member awareness of the scholarship on mentorship have emerged as common and persistent obstacles. This work outlines a successful grant funded approach aimed at overcoming these challenges through a combination of funding, support, professional development, and community building. The outlook of the project is positive and the team will continue to evaluate the impact of the program on mentorship opportunities and lessons learned. Future work will focus on evaluation of the mentorship efforts that were employed by the various subaward recipients and their institutions. The next phase of the project includes a focus on post-grant sustainability, resource sharing of created assets, and takeaways from subawards that can be transferred to other institutions. Additional findings will be reported at future events and publication outlets in the hope of providing greater insights to inform the development of evidence-based mentorship programs.



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