

WIP: Mapping Mentorship: Assessing and Advancing Engineering Faculty Mentoring Competencies

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Introduction and Motivation

Mentoring is widely recognized as a foundation of faculty success, professional growth, and retention within higher education [1]. In engineering, effective mentoring has been associated with improved research productivity, stronger teaching practices, enhanced leadership development, and a greater sense of belonging among faculty. Additionally, effective mentorship enhances a sense of belonging and confidence among early-career faculty and those from historically underrepresented communities [1]. However, mentoring in engineering is often treated as an informal expectation rather than a skillset that can be intentionally developed and assessed [2].

Many engineering faculty step into mentoring roles without formal preparation, relying instead on their own experiences as mentees or on departmental norms that vary widely in quality and consistency [3]. While national organizations and institutions increasingly emphasize the importance of mentorship, fewer efforts focus on systematically assessing mentoring competencies or embedding such assessment within faculty development programming. This gap limits the ability of colleges of engineering to evaluate mentoring effectiveness, identify faculty development needs, and cultivate shared mentoring cultures.

The EngEx Mentor Network program was developed to highlight this need by integrating mentoring competency development into a structured faculty learning experience. The main element of the program is the EngEx Mentoring Competency Assessment (MCA-EngEx), a self-assessment tool adapted from a validated instrument and contextualized for engineering faculty. This Work in Progress paper presents the design and implementation of the MCA-EngEx, its alignment with the EngEx Mentor Network program modules, and the study design used to examine changes in faculty mentoring competencies over time.

Background and Conceptual Framework

Mentoring in Engineering Faculty Development

Engineering faculty mentoring consists of a broad range of responsibilities, including research advising, teaching development, service navigation, leadership preparation, and professional socialization [4]. Prior research highlights the importance of mentoring for faculty satisfaction and retention, yet also documents disparities in access to effective mentoring, particularly for women and faculty from underrepresented backgrounds [5]. These disparities demonstrate the need for intentional, inclusive mentoring practices supported by structured faculty development initiatives.

Mentoring as a Competency-Based Practice

Current faculty development literature increasingly frames mentoring as a set of competencies that can be learned, practiced, and refined over time [6]. This perspective shifts mentoring from an assumed personal attribute to an evidence-based practice that benefits from assessment and reflection [7]. Self-assessment tools play a critical role in this process by supporting faculty awareness and guiding targeted development efforts.

The Mentoring Competency Assessment (MCA)

The Mentoring Competency Assessment (MCA), developed by Fleming et al., provides a validated framework for assessing mentoring competencies across six domains [2]. The MCA has demonstrated reliability and validity in research mentoring contexts and offers a solid foundation for adaptation to other disciplinary settings [2]. However, applying the MCA to engineering faculty development requires contextual modifications to reflect engineering-specific mentoring roles and environments.

Program Context: EngEx Mentor Network

The EngEx Mentor Network is a faculty development initiative designed to support mentoring, leadership, and professional growth among engineering faculty at a large public research university. The program emphasizes peer learning, reflective practice, and evidence-based development strategies tailored to the engineering context.

The program is structured around monthly thematic modules, each aligned with a specific mentoring competency domain. Modules incorporate brief instructional context, facilitated discussion, case-based scenarios, and reflective activities. By aligning program content with assessment domains, EngEx Mentor Network reinforces mentoring as an intentional, developable practice rather than an informal obligation.

Development of the EngEx Mentoring Competency Assessment (MCA-EngEx)

A central contribution of this Work in Progress paper is the development of the MCA-EngEx, a discipline-specific adaptation of the validated Mentoring Competency Assessment (MCA). The adaptation process focused on preserving the conceptual integrity of the original tool while revising language and framing to reflect engineering faculty mentoring contexts.

Engineering faculty mentoring often spans research supervision, teaching mentorship, and professional development across multiple career stages [8]. As such, MCA items were reviewed for relevance and clarity, with modifications emphasizing engineering research groups, teaching teams, and departmental structures. The resulting MCA-EngEx retains the six competency domains and uses a Likert-type scale to assess faculty confidence and perceived effectiveness in mentoring behaviors. A full version of the MCA-EngEx instrument, including all competency domains and items, is provided in the Appendix.

Table 1. Alignment of MCA-EngEx Competency Domains with EngEx Mentor Network Program Modules

MCA-EngEx Competency Domain	Description	Corresponding EngEx Module Focus
Maintaining Effective Communication	Providing feedback and fostering open dialogue	Communication & Feedback in Engineering Mentorship
Aligning Expectations	Establishing shared goals and roles	Setting Expectations & Mentoring Agreements
Assessing Understanding	Gauging mentee comprehension and progress	Reflective Mentoring & Check-ins
Addressing Well-being	Supporting mentees' well-being and inclusive environments	Intentional and Equitable Mentoring Practices
Fostering Independence	Supporting autonomy and leadership development	Developing Independent Engineers
Promoting Professional Development	Guiding career planning and growth	Career Pathways & Professional Growth

Methods: Work in Progress Study Design

This ongoing study employs a pre-post design to examine changes in faculty self-reported mentoring competencies over the course of the EngEx Mentor Network program. Faculty participants complete the MCA-EngEx at program entry and again at program completion. Participation is voluntary, and the university's Institutional Review Board approved all procedures.

Baseline (pre-program) MCA-EngEx data have been collected, and post-program data collection is ongoing. Descriptive statistics have been generated for baseline responses, and paired comparisons will be conducted following completion of post-program data collection. Qualitative data from reflective prompts are being analyzed using an inductive thematic analysis approach. At this stage, an initial round of open coding has been conducted on a subset of responses to identify emergent patterns.

Preliminary qualitative reflections from early modules have been reviewed; however, full systematic analysis across all participants and timepoints is still in progress. Findings presented here should therefore be interpreted as preliminary and illustrative rather than conclusive.

Preliminary Qualitative Findings: Faculty Reflections on Mentoring Practice

In addition to the MCA-EngEx self-assessment, faculty participants were asked to provide brief written reflections throughout the virtual modules related to their mentoring practices and areas for growth. While systematic qualitative analysis is ongoing, early reflections offer insight into how faculty are making sense of mentoring as a competency-based, intentional practice within the EngEx Mentor Network program.

Several participants described increased self-awareness around mentoring expectations and communication. One faculty member reflected:

“This module has helped me to be more self-reflective about what sorts of expectations I bring to my mentoring ‘table’ with some food for thought about setting and revisiting expectations with my mentees rather than assuming they can read my mind” (Faculty Participant).

This reflection highlights how structured engagement with the aligning expectations competency prompted faculty to critically examine implicit assumptions within mentoring relationships. This excerpt illustrates an emerging shift from implicit to explicit expectation-setting, suggesting that competency-based modules may begin to support more intentional mentoring practices.

Additional reflections further highlight this theme of intentionality. Another participant noted:

“This module has influenced me to be more intentional and proactive about setting and revisiting expectations with mentees, rather than assuming they will naturally become clear over time” (Faculty Participant).

Beyond individual mentoring relationships, participants also reflected on how mentoring competencies could be modeled within broader departmental and research group contexts. One faculty member described a concrete strategy for assessing understanding:

“I would proactively confirm shared understanding during our group meeting, especially with the co-advisor. I would ensure that everyone gets the same takeaways from the meetings, by summarizing them at the end verbally and in writing per email a bit later” (Faculty Participant).

Anticipated Outcomes & Contributions

Preliminary qualitative insights from faculty reflections suggest that engagement with the MCA-EngEx and aligned program modules is associated with increased intentionality in mentoring practices. Faculty responses indicate emerging shifts in how participants approach expectation-setting, communication, and reflective engagement within mentoring relationships. These early patterns, while not yet generalizable, provide initial evidence that competency-based framing may support faculty in moving from implicit to more explicit and structured mentoring practices.

Building on these preliminary findings, this work contributes a discipline-specific adaptation of the validated Mentoring Competency Assessment (MCA) for engineering faculty development. The MCA-EngEx extends prior work by contextualizing mentoring competencies within the multifaceted roles of engineering faculty, including research supervision, teaching mentorship, and professional development. Additionally, the intentional alignment between assessment domains and programmatic learning modules offers a structured model for integrating self-assessment, guided learning, and reflective practice within faculty development initiatives.

As data collection and analysis continue, this study will examine whether observed qualitative shifts in mentoring intentionality correspond with measurable changes in faculty self-reported

competencies across domains. Future work will also explore longitudinal patterns across program cohorts and incorporate additional data sources, such as mentee or peer feedback, to strengthen the validity of findings. Collectively, this research aims to inform scalable approaches to mentoring development in engineering by positioning mentoring as a measurable, teachable, and continuously evolving faculty competency.

Limitations & Future Work

This study has several limitations. The MCA-EngEx relies on faculty self-reported perceptions of mentoring competencies, which may reflect increased awareness rather than changes in mentoring behavior. Additionally, data are drawn from a single college of engineering at a large public institution, and participation in the EngEx Mentor Network is voluntary, which may limit generalizability and introduce self-selection bias.

As this work is ongoing, post-program data collection and full qualitative analysis have not yet been completed. Future phases of the study will include longitudinal analysis across cohorts and the incorporation of additional data sources, such as mentee or peer feedback, to triangulate findings and strengthen validity.

References

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Appendix

MCA-EngEx Self-Assessment Tool

Start of Block:

MCA-EngEx Self-Assessment Tool: The MCA-EngEx Self-Assessment Tool helps you reflect on your mentoring competencies by rating your skills in key areas; review each item and select the response that best represents your current level of confidence or ability. Each competency area, such as maintaining effective communication or fostering independence, is scored based on your responses, allowing you to identify your strengths and areas for growth. These scores can help guide your professional development as a mentor or mentee and inform future training or goal setting.

MCA Competency: Maintaining Effective Communication: The "Maintaining Effective Communication" competency in the MCA focuses on a mentor's ability to foster open, honest, and respectful dialogue with their mentee. This includes actively listening, providing constructive feedback, asking thoughtful questions, and adapting communication styles to meet the needs of the mentee. Effective communication builds trust, clarifies expectations, and supports mutual understanding throughout the mentoring relationship. Strong communication skills also help mentors navigate difficult conversations, address misunderstandings, and ensure that both parties feel heard and valued.

	Not at all skilled (1) (1)	(2) (2)	Moderately skilled (3) (3)	(4) (4)	Extremely skilled (5) (5)
Active Listening (1)	☐	☐	☐	☐	☐
Providing constructive feedback (2)	☐	☐	☐	☐	☐
Establishing a relationship based on trust (3)	☐	☐	☐	☐	☐
Identifying and accommodating different communication styles (4)	☐	☐	☐	☐	☐
Employing strategies to improve communication with mentees (5)	☐	☐	☐	☐	☐
Coordinating effectively with your mentees' other mentors (6)	☐	☐	☐	☐	☐

MCA Competency: Aligning Expectations: The "Aligning Expectations" competency in the MCA emphasizes a mentor's ability to establish and maintain shared goals, roles, and responsibilities within the mentoring relationship. This involves setting realistic expectations from the outset, revisiting, and adjusting them as needed, and ensuring both mentor and mentee are on the same page regarding progress, timelines, and outcomes. By proactively aligning expectations, mentors help create a structured and supportive environment that minimizes confusion, fosters accountability, and promotes a productive and mutually beneficial experience.

	Not at all skilled (1) (1)	(2) (2)	Moderately skilled (3) (3)	(4) (4)	Extremely skilled (5) (5)
Working with mentees to set clear expectations for the mentoring relationship (1)	☐	☐	☐	☐	☐
Aligning your expectations with your mentees' (2)	☐	☐	☐	☐	☐
Considering how personal and professional differences may impact expectations (3)	☐	☐	☐	☐	☐
Working with mentees to set research goals (4)	☐	☐	☐	☐	☐
Helping mentees develop strategies to meet goals (5)	☐	☐	☐	☐	☐

MCA Competency: Assessing Understanding: The "Assessing Understanding" competency in the MCA focuses on a mentor's ability to gauge how well their mentee comprehends key concepts, tasks, or feedback discussed during their interactions. This involves using strategies such as asking clarifying questions, encouraging reflection, inviting the mentee to summarize ideas, and checking for misconceptions in a respectful and supportive manner. By regularly assessing understanding, mentors can identify gaps in knowledge, tailor their guidance more effectively, and promote deeper learning and development. This competency is essential for ensuring that mentoring conversations lead to meaningful growth and progress.

	Not at all skilled (1) (1)	(2) (2)	Moderately skilled (3) (3)	(4) (4)	Extremely skilled (5) (5)
Accurately estimating your mentees' level of scientific knowledge (1)	☐	☐	☐	☐	☐
Accurately estimating your mentees' ability to conduct research (2)	☐	☐	☐	☐	☐
Employing strategies to enhance your mentees' knowledge and abilities (3)	☐	☐	☐	☐	☐

MCA Competency: Addressing Well-Being: The "Addressing Well-Being" competency in the MCA highlights a mentor's role in recognizing and supporting the overall well-being of their mentee, including emotional, mental, and physical health. This competency involves creating a safe and intentional space where mentees feel comfortable discussing challenges, showing empathy, being attentive to signs of burnout or stress, and connecting mentees with appropriate resources when needed. By acknowledging the whole person beyond academic or professional

performance, mentors can foster a more supportive, sustainable, and human-centered mentoring relationship.

	Not skilled at all (1) (1)	(2) (2)	Moderately skilled (3) (3)	(4) (4)	Extremely skilled (5) (5)
Reflecting on the perspectives and assumptions you bring into the mentoring relationship (1)	☐	☐	☐	☐	☐
Working effectively with mentees whose personal background is different from your own (2)	☐	☐	☐	☐	☐

MCA Competency: Promoting Professional Development: The "Promoting Professional Development" competency in the MCA focuses on a mentor's ability to actively support their mentee's career growth by identifying opportunities, setting goals, and providing guidance aligned with the mentee's aspirations. This includes helping the mentee build skills, expand their network, explore career paths, and navigate transitions or challenges in their professional journey. Effective mentors encourage reflection, celebrate progress, and offer constructive feedback to foster confidence and momentum. By prioritizing professional development, mentors empower mentees to take ownership of their careers and reach their full potential.

	Not at all skilled (1) (1)	(2) (2)	Moderately skilled (3) (3)	(4) (4)	Extremely skilled (5) (5)
Helping your mentees network effectively (1)	☐	☐	☐	☐	☐
Helping your mentees set career goals (2)	☐	☐	☐	☐	☐
Helping mentees balance work with their personal life (3)	☐	☐	☐	☐	☐
Understanding your impact as a role model (4)	☐	☐	☐	☐	☐
Helping your mentees acquire resources (e.g., grants) (5)	☐	☐	☐	☐	☐

MCA Competency: Fostering Independence: The "Fostering Independence" competency in the MCA emphasizes a mentor's role in gradually guiding their mentee toward greater autonomy and self-confidence in their work and decision-making. This involves encouraging critical thinking, supporting problem-solving, and allowing space for the mentee to take initiative and learn from

experience. Effective mentors strike a balance between providing support and stepping back, adjusting their level of involvement as the mentee grows. By fostering independence, mentors help mentees build the skills and confidence needed to thrive as self-directed professionals in their chosen fields.

	Not at all skilled (1) (1)	(2) (2)	Moderately skilled (3) (3)	(4) (4)	Extremely skilled (5) (5)
Motivating your mentees (1)	☐	☐	☐	☐	☐
Building mentees' confidence (2)	☐	☐	☐	☐	☐
Stimulating your mentees' creativity (3)	☐	☐	☐	☐	☐
Acknowledging your mentees' professional contributions (4)	☐	☐	☐	☐	☐
Negotiating a path to professional independence with your mentees (5)	☐	☐	☐	☐	☐

Demographics: Which of the following describes you? Check all that apply.

- ☐ Nonbinary (1)
 - ☐ Man (2)
 - ☐ Woman (3)
 - ☐ Gender not listed (please specify) (4)
-
- ☐ Prefer not to report (5)

Demographics: Which categories describe you? Check all that apply.

- ☐ White (1)
 - ☐ Hispanic (2)
 - ☐ Black or African American (3)
 - ☐ Asian (4)
 - ☐ American Indian or Alaska Native (5)
 - ☐ Middle Eastern or North African (6)
 - ☐ Native Hawaiian or Other Pacific Islander (7)
 - ☐ Other race, ethnicity, or origin (please specify) (8)
-

Demographics: What department describes your discipline? Check all that apply.

- ☐ Biomedical Engineering (1)
 - ☐ Chemical and Biomolecular Engineering (2)
 - ☐ Civil, Construction, and Environmental Engineering (3)
 - ☐ Computer Science (4)
 - ☐ Electrical and Computer Engineering (5)
 - ☐ Industrial and systems Engineering (6)
 - ☐ Materials Science and Engineering (7)
 - ☐ Mechanical and Aerospace Engineering (8)
 - ☐ Nuclear Engineering (9)
-

Demographics: Which of the following titles apply to you? Check all that apply.

- ☐ Administrator (e.g., dean, chair, director) (1)
 - ☐ Professor (2)
 - ☐ Associate Professor (3)
 - ☐ Assistant Professor (4)
 - ☐ Non-tenure or research faculty (5)
 - ☐ Researcher (6)
 - ☐ Training Program Director (7)
 - ☐ Instructor (8)
 - ☐ Postdoc (9)
 - ☐ Clinical Fellow (10)
 - ☐ Research staff (e.g., research coordinator, program manager) (11)
 - ☐ Doctoral graduate student (12)
 - ☐ Master's student (13)
 - ☐ Undergraduate student (14)
 - ☐ Other (please specify) (15)
-

End of Block:
