The Role of Mentorship in Preparing Early-Career Engineering Faculty

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Introduction/Background

Doctoral education is integral to preparing future engineering faculty for academic careers [1] [2]. Within doctoral programs, students are expected to develop different competencies, such as research, teaching, and professional competencies needed for faculty roles [3], [4]. As a result, engineering doctoral training plays a crucial role in shaping their transition from graduate students to early-career faculty. However, prior research suggests that early-career engineering faculty still report challenges related to their preparedness for the multifaceted demands of academic roles [3], [5].

Mentorship has been identified as a core component of doctoral education [6], [7] and early-career faculty preparation [8]. Mentors influence doctoral students' learning experiences through advising, research supervision, informal and formal feedback. These influence plays a role in students' research productivity [9], career satisfaction, and persistence in academia [6]. However, these influences were typically described as broad support or administrative supervision; they were rarely examined in terms of how they function as an intentional learning process [10].

Past literature provides a limited understanding of how mentorship functions in preparing doctoral engineering students for the complex demands of academic careers. While past literature has documented the importance of mentoring relationships, there is a paucity on the specific learning mechanisms through which mentorship supports the development of competencies needed for faculty roles. Hence, this gap calls for research on how mentorship may serve as a learning process that prepares engineering doctoral students for the multifaceted demands of academic careers [10]. This literature gap also reinforces the need to adopt theoretical framework to research and gain better understanding of how mentorship provided by advisors and senior faculty members facilitate the early-career faculty preparation in engineering education [11].

This study examines how mentorship prepares early-career engineering faculty for academic roles through the lens of Cognitive Apprenticeship Theory. Cognitive Apprenticeship Theory emphasizes instructional methods such as modeling, coaching, scaffolding, articulation, reflection, and exploration as processes that support mentees' gradual movement toward independence. Guided by cognitive apprenticeship theory, this study adopts a theory-informed qualitative analysis to examine the experience of ten early-career engineering faculty as they describe the role of mentorship in shaping their preparation for academic careers. The study addresses the research question: *How do early-career engineering faculty describe the role of mentorship in shaping their preparation for academic careers?*

Literature Review

Mentorship in Engineering Doctoral Education

Research on engineering doctoral education consistently identifies mentorship as an important component of graduate training [3]. Mentorship is most often conceptualized in terms of advising structures, supervisory roles, and relational support provided by faculty advisors within advisor–advisee relationships in engineering programs [12]. Mentorship is commonly described as the functions mentors serve such as providing research direction, offering career guidance, or supporting students' physical well-being [12]. While these role-based descriptions clarify the importance of mentoring relationships, they tend to emphasize what mentors do rather than how doctoral students learn through mentoring interactions.

Outcome-Oriented Mentorship Research

Studies have linked mentorship to research productivity [9], degree completion [7], career satisfaction, and persistence in academia [6]. These outcome-oriented approaches have been valuable in demonstrating that mentorship contributes positively to doctoral success [7], [13]. However, by prioritizing end results, much of this work provides limited insight into the developmental processes through which mentoring supports preparation for academic careers. Consequently, the mechanisms by which doctoral students learn to perform faculty work remain underexplored.

Learning the Hidden Curriculum of Academic Work

Preparation for academic careers involves more than the acquisition of technical research skills [3]. Faculty work includes navigating tacit norms, informal practices, and unspoken expectations related to research, securing funding, mentoring students, and managing professional relationships. This "hidden curriculum" of academic work is rarely addressed explicitly in doctoral coursework and is often learned informally through interactions with mentors [3]. Although existing studies acknowledge the importance of informal learning in doctoral education, they seldom examine how mentoring interactions facilitate access to this hidden curriculum in systematic ways.

These gaps in mentorship for graduate students identified in past research underscores the need for research that seeks to explore mentorship as a learning process within engineering doctoral education. Hence, to address this gap, this present study adopts Cognitive Apprenticeship Theory to examine how mentoring interactions support learning through modeling, coaching, scaffolding, articulation, reflection, and exploration in engineering doctoral education. This framework provides a useful lens for examining how mentorship in engineering doctoral education functions as a learning process that prepares doctoral graduates for multifaceted academic careers.

Theoretical Underpinnings

This study is grounded in cognitive apprenticeship theory, which explains how learners acquire complex professional knowledge and skills through guided participation with more experienced practitioners in authentic contexts [14]. The Cognitive Apprenticeship Theory emphasizes instructional methods that make expert thinking visible and support learners' gradual movement toward independent practice, including *modeling* (observing expert practices), *coaching* (receiving feedback and guidance), *scaffolding* (engaging in tasks with temporary support), *articulation* (explaining reasoning and decision-making), *reflection* (interpreting experiences and comparing performance to expectations), and *exploration* (independently applying learning in new contexts) [14]. Within engineering doctoral education, cognitive apprenticeship theory provides a useful lens for examining how mentorship functions as a learning process through which doctoral students develop the competencies and professional practices required for careers as academic faculty.

Methodology

This study employed a theory-informed qualitative analysis to examine how early-career engineering faculty describe the role of mentorship in shaping their preparation for academic careers. A qualitative approach was appropriate for capturing participants' detailed descriptions [15] of mentoring experiences and how those experiences supported learning and professional development. Cognitive Apprenticeship Theory was used as an analytic framework to guide the interpretation of participants' accounts, focusing on how mentoring experiences aligned with key instructional processes associated with learning in authentic academic contexts.

Methods

The study draws on the lived experiences of ten early-career engineering faculty who were recently recruited for tenure-track faculty positions across multiple U.S. institutions. Participants were within one to three years of completing their doctoral training. Participants reflected on their doctoral and postdoctoral experiences and described the ways in which their advisors and other senior faculty members guided, supported, and challenged them (implicitly or explicitly through mentorship) throughout their doctoral training. Data were collected through semi-structured interviews during spring and summer 2025 and analyzed using deductive coding guided by the principles of Cognitive Apprenticeship Theory.

Participants were recruited through a brief screening survey designed to determine eligibility for the study. A total of 19 individuals responded to the survey, from which 10 participants were selected based on predefined criteria, including identification as early-career engineering faculty and having assumed a tenure-track faculty position within one to three years of completing their doctoral training. These participants were invited to participate in semi-structured interviews. Participant demographics were self-reported and included four White women, two individuals who identified as Middle Eastern or North African, one Black or African American man, two

Asian men, and one Hispanic or Latino man. This range of racial and ethnic backgrounds provided diverse perspectives on mentoring experiences within engineering doctoral education. Some sample interview questions that were asked are:

- Can you describe some of the key mentoring experiences during your doctoral and/or post-doctoral studies that you feel helped you become more effective in your current academic role?
- In what ways have you applied what you learned from your mentoring experiences in your current role as a faculty member?
- Can you describe how your mentors supported your development in skills such as public speaking, grant writing, or team leadership? Can you provide specific examples?

Findings

This study was guided by the research question: *How do early-career engineering faculty describe the role of mentorship in shaping their preparation for academic careers?*. Using a theory-informed qualitative analysis guided by Cognitive Apprenticeship Theory, participants' accounts of mentoring experiences during doctoral training were examined, revealing six theory-informed analytic responses through which mentorship functioned as a learning process: modeling (learning through observation), coaching (learning through feedback), scaffolding (learning through participation), articulation (learning through explanation), reflection (learning through interpretation), and exploration (learning through application).

Modeling: Learning Through Observation

Modeling refers to the ways mentors made academic work visible to participants by demonstrating scholarly practices, faculty practices, and decision-making processes. Participants described observation as their initial entry point into understanding what faculty work entails, particularly when they entered graduate school with limited prior knowledge of research or academic careers. One participant expressed learning research expectations by observing their advisor's scholarly work:

"I had no idea what research is… I used to read papers by my professor and others, and I imagined I would never be able to write a paper as good as theirs. There are too many details, too much stuff to do, and I get lost. However, gradually my professor stood back and I was developing the ideas." (**Participant 1**)

This account illustrates modeling as a developmental process through which participants initially recognized the complexity of academic work and, over time, embedded research practices. By observing their advisor's approach to research, the participant learned about research writing techniques. With the advisor's gradual withdrawal, the participant developed greater independence in research idea generation and writing mastering.

Participants also described modeling as extending beyond mastering research writing to include learning mentoring practices through observation. One participant reflected:

"For mentoring? I was not trained in mentoring, but I observed it closely. I really enjoyed my time in the lab, and I think the experience was very valuable. I also admired the philosophy of how my lab operated and wanted to replicate it. Although I was not formally trained in mentoring, I learned what good mentoring looks like through observation and was able to imitate it." (**Participant 7**)

This account demonstrates how modeling enabled participants to learn tacit aspects of faculty work, particularly mentoring and interrelational practices, through sustained observation rather than formal instruction. The participant's ability to replicate these practices as a faculty member reflects the transfer of learning from doctoral training to early-career practice.

In addition, participants' description of modeling included professional judgment and strategic thinking. Participant 4 described learning how faculty align research agendas with broader institutional and funding priorities:

"He's very strategic in thinking about what types of topics should I focus on… not just what I think is cool, but what NSF is investing in, what the university is investing in." (**Participant 4**)

This account illustrates that through observing strategic decision-making, participants learned how faculty navigate academic systems and make informed choices that sustain academic careers.

In addressing the research question, modeling functioned as a major way in which mentorship shaped early-career engineering faculty preparation for academic careers by making the expectations, thinking processes, and professional practices of faculty work visible. Through sustained observation, participants developed an early understanding of how faculty think and operate, laying a foundation for what they do or the practices they adopt in early-career faculty roles.

Coaching: Learning Through Feedback

Coaching refers to mentoring practices through which advisors provided ongoing feedback, encouragement, and guidance to participants as participants actively engaged in scholarly and instructional work. Participants described coaching as central to their preparation for academic careers, particularly in learning how to improve their work, make informed decisions, and develop confidence through regular feedback.

One participant emphasized that coaching involved learning how to engage productively with feedback as part of scholarly leadership:

"*I understand that mentorship is essential if you want to succeed, but I think it is mainly about developing the mindset that when you are leading a paper, you can submit all these drafts and have someone else take the initiative to identify issues and help you improve*." (**Participant 6**)

This account highlights coaching as a learning process that shaped participants' mindset toward feedback. Rather than viewing feedback as evaluative, the participant appreciated it as a developmental tool that fostered growth and improvement as they learned various scholarly competencies for succeeding as a faculty.

Participants also described coaching as helping them learn how to provide feedback and make pedagogical decisions. One participant reflected:

"I think gaining that experience in graduate school was beneficial for that. Again, it is valuable to get a sense of how you function as an instructor in a classroom and also to learn how to provide feedback effectively… Sometimes, it is not about whether they made the right decision; it is about highlighting feedback related to various choices they could make and understanding the decision-making process behind choosing one option over another." (**Participant 4**)

This account illustrates coaching as preparation for instructional roles, where mentors helped participants learn how feedback supports learning beyond highlighting accuracy in students' work . Through these experiences, participants developed effective feedback skills and professional judgment about how to guide students' thinking, another important competency for faculty work.

In relation to the research question, coaching shaped participants' preparation for academic faculty careers by helping them learn how to engage students through effective feedback mechanism, thus developing professional judgment to support students' learning. Through sustained coaching interactions, mentorship prepared participants not only to improve their own scholarly work, but also to enact effective mentoring and instructional practices in their faculty roles.

Scaffolding: Learning Through Participation

Scaffolding refers to mentoring practices through which advisors structured opportunities for participants to engage in authentic faculty work with guidance and support. Participants described scaffolding as learning through participation, where they were invited into complex academic tasks before feeling fully prepared, allowing them to develop competence gradually.

Participant 10 described intentionally seeking scaffolded exposure to grant writing by contributing to an advisor-led proposal:

"I asked my advisor, next time you're working on a grant, can I help out to understand more about how that works? So I contributed a little bit to an NSF grant that he submitted." (**Participant 10**)

This account illustrates scaffolding as participation in high-stakes academic work with limited responsibility. By contributing to projects under the advisor's guidance, the participant learned grant-writing processes in a supported environment.

Participants also described scaffolded participation in professional service and leadership. Participant 8 recalled being asked to represent his advisor in meetings early in his doctoral training:

"He sent me as his representative… I was like, what do I know? How can I sit together with those professors?" (**Participant 8**)

Although initially intimidating, this experience positioned the participant within professional academic spaces with senior faculty members under the advisor's support. Such scaffolded exposure allowed participants to observe norms, engage in professional dialogue, and build confidence without bearing full responsibility.

With respect to the research question, scaffolding shaped participants' preparation for academic careers by enabling gradual engagement in faculty work through supported participation. Mentorship functioned as a learning process that allowed participants to build competence, confidence, and professional identity over time, preparing them to assume independent faculty roles.

Articulation: Learning Through Explanation

Articulation refers to mentoring practices that required participants to explain, justify, or communicate their thinking in academic contexts in response to tasks provided by their advisors. Participants described articulation as learning through explanation, often occurring when advisors prompted them to verbalize their reasoning before they felt fully confident in their understanding.

Participant 8 described how being placed in professional settings compelled him to articulate his thinking despite uncertainty:

"I didn't fully understand what they were talking about… so many jargon, long acronyms. I didn't know what I was supposed to say." (**Participant 8**)

This experience illustrates articulation as a challenging but formative learning process. Being expected to contribute to academic conversations encouraged the participant to engage with technical language and learn other vocabulary expectations, shaping the development of their academic voice over time.

Similarly, Participant 9 described how her advisor intentionally structured opportunities that required articulation through direct interaction with faculty:

"She would say, here's a template send this to your committee member, now go have a 30-minute meeting with them. Terrifying. But that's how I learned." (**Participant 9**)

This account highlights articulation as an intentional practice facilitated by mentors to create situations that required participants to explain their ideas and navigate professional conversations. Although intimidating, these experiences helped participants clarify their thinking and gain confidence in communicating with senior academics.

In addressing the research question, articulation shaped participants' preparation for academic careers by supporting the development of academic voice and professional communication skills. Through mentorship that required explanation and justification, participants transitioned from passive learners to active contributors, better preparing them for faculty roles that demand clear articulation of ideas in research, teaching, and service contexts.

Reflection: Learning Through Interpretation

Reflection refers to mentoring experiences that helped participants make sense of challenges, uncertainty, and professional growth during their preparation for academic careers. Participants described reflection as occurring through conversations with mentors and personal sensemaking that reframed difficult experiences as part of the academic development process.

Participant 9 described how mentoring support helped her reinterpret uncertainty and rebuild confidence:

"I had to learn to trust myself and my work being quality…. My advisor helped me see that not knowing is okay, as long as you have a plan." (**Participant 9**)

This reflection illustrates that mentorship supported participants in interpreting uncertainty as a manageable and expected aspect of academic work, rather than as a personal shortcoming.

Participants also reflected on impostor syndrome as an ongoing experience rather than something to be resolved quickly. Participant 6 noted:

"I don't think I fully overcame it. I think I'm still working on it. Even as a new faculty, I still struggle with the imposter syndrome of mentoring new graduate students" (**Participant 6**)

This account highlights reflection as a continuous process through which participants adjusted their expectations of confidence and growth over time.

Another participant reflected on learning to reinterpret conflict through mentoring feedback:

"I avoid conflict… I get reality checks from supervisors and supportive people… conflict equals growth, but it is still hard." (**Participant 4**)

This account reflects how mentorship encouraged participants to evaluate their approach to navigating conflict and interpersonal challenges, viewing it as opportunities for professional growth.

In relation to the research question, reflection fostered participants' preparation for faculty roles by encouraging sensemaking around uncertainty, self-doubt, and conflict. Through mentoring

interactions, participants developed greater self-awareness needed to navigate the interpersonal and emotional demands of early-career faculty roles.

Exploration: Learning Through Application

Exploration refers to participants' ability to apply what they learned through mentorship independently as they transitioned into faculty roles. Participants described exploration as learning through application, as prior mentoring experiences informed how they taught, advised students, managed research groups, and navigated institutional responsibilities with increasing autonomy.

Participant 2 described how mentoring practices observed during graduate school directly shaped her current faculty work:

"We did research group meetings, and my research group meetings now are informed by the way he did it. I tried to learn a lot from what he did." (**Participant 2**)

This account illustrates exploration as the transfer of mentoring practices into independent faculty work. Drawing on prior observation and participation, the participant applied their mentor's way of conducting and facilitating research meeting in their current what was learned research groups.

In addition, Participant 3 described how mentoring experiences minimized error when she acted independently performed familiar tasks:

"If I didn't have the prior experiences with my advisor, there would be a lot more error than trial." (**Participant 3**)

To address the research question, exploration of various faculty roles during doctoral training shaped participants' preparation for academic careers by enabling them to work independently by relying on prior knowledge to guide tasks execution with minimal errors in their early-career faculty responsibilities. Although participants did not describe fully being prepared, exploration reflected their growing autonomy and confidence to perform early-career faculty tasks.

Discussion

This study extends existing scholarship on doctoral mentorship by shifting attention from describing mentoring relationships to examining how mentoring experiences function as a learning process that supports preparation for faculty roles. While prior work has documented the value of mentorship for a range of academic outcomes [6], [9], [10], it has offered limited insight into the instructional processes through which mentoring contributes to readiness for the multifaceted demands of academic work [6]. The present findings address this gap by conceptualizing mentorship as a learning process embedded within doctoral training rather than solely as advising or support.

The findings of this study extend this body of work by demonstrating that mentorship supports preparation through sustained and interconnected learning experiences rather than isolated interactions. This perspective aligns with existing research suggesting that the transition into independent faculty roles is gradual and developmental rather than instantaneous [16], [17], [18]. However, while prior studies have emphasized early-career trajectories and cumulative advantage [5], they have offered limited insight into the specific learning processes that support this transition. By applying Cognitive Apprenticeship Theory, this study provides a mechanism-level explanation of how mentoring interactions facilitate gradual movement toward independence during doctoral training.

Importantly, these findings also help contextualize prior reports that early-career engineering faculty often feel underprepared for aspects of academic work beyond research [3]. Existing literature has documented gaps in preparedness related to teaching, service, professional judgment, and navigating institutional expectations [3], [19]. The present study suggests that these gaps may stem not from the absence of mentoring relationships, but from variability in how mentoring practices expose doctoral students to tacit norms and authentic faculty work. When mentoring functions as a learning process, (as described in this research) through observation, guided participation, feedback, reflection, and independent application, it enables access to aspects of academic practice that are rarely addressed through formal coursework or research supervision alone.

Finally, this study responds to calls for stronger theoretical grounding in research on doctoral mentorship [11]. By situating mentorship within Cognitive Apprenticeship Theory, the findings move beyond descriptive accounts of mentoring relationships and illustrate how learning theory can be used to examine doctoral preparation. This theoretical framing not only clarifies how mentoring contributes to faculty preparation but also provides a common language for future research seeking to examine mentoring practices across disciplines and institutional contexts. In this way, the study advances existing scholarship by reframing mentorship as an intentional learning process that supports the development of academic autonomy among early-career engineering faculty.

Implications and Recommendations

Based on these findings, several recommendations emerge for engineering doctoral programs and faculty mentors. First, mentors should recognize that how they model academic work matters, as doctoral students closely observe research practices, mentoring behaviors, and professional judgment. Making decision-making processes explicit can enhance learning through modeling and help doctoral students better understand the expectations of academic work. Second, programs should support intentional coaching practices, including structured feedback and encouragement that address both technical development and the affective dimensions of academic work, such as confidence and persistence. Third, departments should create opportunities for scaffolded participation in faculty-level responsibilities such as grant

development, professional service, and instructional leadership before students take up faculty roles.

Additionally, mentors can intentionally prompt articulation and reflection by encouraging engineering doctoral students to explain their reasoning, discuss challenges, and interpret experiences with guidance. Such practices can support the development of academic voice, resilience, and professional judgment. Finally, engineering doctoral programs should recognize that preparation for faculty roles continues beyond graduation; providing support during the early-career transition (such as mentoring based on observations from doctoral and post-doctoral mentoring) may further strengthen exploration and the independent application of learned practices.

Beyond doctoral education, these findings also highlight the importance of mentoring during the early-career faculty stage. Participants' experiences suggest that preparation for faculty roles continues beyond graduation, particularly in areas such as grant writing, teaching, and navigating departmental expectations. Departments should consider implementing structured mentoring programs for early-career faculty that extend Cognitive Apprenticeship Theory practices, including continued modeling, coaching, and scaffolding. Such efforts may support smoother transitions into faculty roles and enhance long-term professional success.

Limitations and Future Work

This study has several limitations that should be considered when interpreting the findings. First, the analysis draws on retrospective accounts from a small sample of early-career engineering faculty, which may reflect participants' interpretations after transitioning into faculty roles. Second, although participants represented multiple institutional contexts, the findings are not intended to be generalizable across all engineering doctoral programs. Finally, the use of a theory-informed, deductive coding approach guided interpretation toward instructional processes associated with Cognitive Apprenticeship Theory, which may have constrained alternative interpretations of mentoring experiences. Despite these limitations, the study offers a theoretically grounded account of how mentorship supports preparation for academic careers in engineering.

However, future research can build on this study by examining how mentoring experiences are shaped by variations in advisor–advisee relationships, departmental cultures, and institutional contexts within engineering education. While this study focused on early-career faculty's retrospective accounts of doctoral mentoring, longitudinal research following doctoral students into faculty roles could provide deeper insight into how mentoring practices support preparation over time. Additionally, future work may explore how structured mentoring initiatives can be intentionally designed and evaluated using a range of learning, socialization, or professional development frameworks, including but not limited to Cognitive Apprenticeship Theory. Such efforts would further advance understanding of how mentorship can be leveraged to support

effective and equitable preparation for academic careers in engineering. It is important to also recognize that some engineering doctoral graduates pursue careers in industry, government, or other sectors. These pathways may involve different expectations, skill sets, and forms of professional socialization, including distinct hidden curricula. As such, the mentoring practices identified in this study may not fully capture the range of competencies or developmental experiences required for non-academic roles. Future work should examine how mentoring practices differ across career trajectories and how doctoral and/or post-doctoral programs can more intentionally support diverse professional pathways.

Conclusion

This study contributes to engineering education research by demonstrating how mentorship functions as a learning process that prepares doctoral students for academic careers. By examining new faculty experiences through cognitive apprenticeship theory, the findings illuminate specific mentoring practices that support preparation through observation, feedback, participation, sensemaking, and independent application. Rather than positioning mentorship as general support, this work highlights its role in shaping how future faculty learn to navigate the complex, tacit demands of academic work. These insights can inform more intentional mentoring practices within engineering doctoral education and support the development of new faculty preparations for the realities of academic roles.

References

[1] N. T. Buswell, "The Purpose of a PhD in Engineering: Where Does Teaching Fit In?," *Stud. Eng. Educ.*, vol. 1, no. 1, Jan. 2021, doi: 10.21061/see.8.

[2] I. E. Salami and L. A. Perry, "WIP: Engineering Doctoral Students' Perceptions of Transformative Experiences in Developing Non-Technical Competencies for Faculty Careers," in *2025 IEEE Frontiers in Education Conference (FIE)*, Nov. 2025, pp. 1–5. doi: 10.1109/FIE63693.2025.11328584.

[3] I. E. Salami, "Exploring Transformative Learning Experiences in Engineering Doctoral and Post-Doctoral Education: Developing Non-Technical Competencies for Early-Career Academic Roles," Ph.D., The University of Nebraska - Lincoln, United States -- Nebraska, 2025. Accessed: Jan. 14, 2026. [Online]. Available: https://www.proquest.com/docview/3280829424/abstract/57B2A88D4B2545DBPQ/1

[4] C. G. P. Berdanier, "Linking current and prospective engineering graduate students' writing attitudes with rhetorical writing patterns," *J. Eng. Educ.*, vol. 110, no. 1, pp. 207–229, 2021, doi: 10.1002/jee.20368.

[5] A. Coso Strong, C. Smith-Orr, C. Bodnar, W. Lee, E. McCave, and C. Faber, "Early Career Faculty Transitions: Negotiating Legitimacy and Seeking Support in Engineering Education," *Stud. Eng. Educ.*, vol. 1, no. 1, p. 97, Feb. 2021, doi: 10.21061/see.52.

[6] J. Mirabelli, A. Barlow, M. Ko, K. Cross, and K. Jensen, "Work in Progress: A Qualitative Study of Mentorship, Training Needs, and Community for New Engineering Education Researchers," in *2020 ASEE Virtual Annual Conference Content Access Proceedings*, Virtual On line: ASEE Conferences, Jun. 2020, p. 35601. doi: 10.18260/1-2--35601.

[7] M. Mastronardi, L. Contreras, and M. Borrego, "A Mentoring Program for First Year Engineering Graduate Students," *Adv. Eng. Educ.*, vol. 13, no. 1, pp. 2–23, 2025.

[8] M. V. Huerta *et al.*, "The Process of Conceptualizing and Creating the Engineering Faculty Impact Collaborative to Support Faculty Development and Mentorship," presented at the 2019 ASEE Annual Conference & Exposition, Jun. 2019. Accessed: Jan. 14, 2026. [Online]. Available: https://peer.asee.org/the-process-of-conceptualizing-and-creating-the-engineering-faculty-impact-collaborative-to-support-faculty-development-and-mentorship

[9] Á. Gutiérrez, L. R. Guerrero, H. E. McCreath, and S. P. Wallace, "Mentoring Experiences and Publication Productivity among Early Career Biomedical Investigators and Trainees," *Ethn. Dis.*, vol. 31, no. 2, pp. 273–282, doi: 10.18865/ed.31.2.273.

[10] Y. Zhang, J. Zhu, and W. Li, "Roles and functions of supervisors: Impact on the learning outcomes of professional engineering doctoral students," in *REES AAEE 2021 conference: Engineering Education Research Capability Development*, 2022, pp. 261–268. doi: 10.3316/informit.347387448574199.

[11] E. Crede and M. Borrego, "Application of Community of Practice Theory to the Preparation of Engineering Graduate Students for Faculty Careers," *Adv. Eng. Educ.*, 2010.

[12] G. C. Fleming, D. B. Knight, and M. Borrego, "Differential graduate student-advisor career mentorship for academic vs. non-academic careers," presented at the 2025 ASEE Annual Conference & Exposition, Jun. 2025. Accessed: Jan. 15, 2026. [Online]. Available: https://peer.asee.org/differential-graduate-student-advisor-career-mentorship-for-academic-vs-non-academic-careers

[13] J. G. Bagaka's, I. Bransteter, S. Rispinto, and N. Badillo, "Exploring Student Success in a Doctoral Program: The Power of Mentorship and Research Engagement," *Int. J. Dr. Stud.*, vol. 10, p. 323, 2015, doi: 10.28945/2291.

[14] A. Collins, J. S. Brown, and A. Holum, “Cognitive Apprenticeship: Making Thinking Visible,” *Am. Educ.*, vol. 15, no. 3, pp. 6–11, 1991.
[15] J. W. Creswell and T. C. Guetterman, *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research, 6th Edition*. Pearson, 2019.
[16] T. C. Dennehy and N. Dasgupta, “Female peer mentors early in college increase women’s positive academic experiences and retention in engineering,” *Proc. Natl. Acad. Sci.*, vol. 114, no. 23, pp. 5964–5969, Jun. 2017, doi: 10.1073/pnas.1613117114.
[17] A. E. Austin, “Preparing the Next Generation of Faculty: Graduate School as Socialization to the Academic Career,” *J. High. Educ.*, vol. 73, no. 1, pp. 94–122, Jan. 2002, doi: 10.1080/00221546.2002.11777132.
[18] S. K. Gardner, “‘What’s too much and what’s too little?’: The Process of Becoming an Independent Researcher in Doctoral Education,” *J. High. Educ.*, vol. 79, no. 3, pp. 326–350, May 2008, doi: 10.1080/00221546.2008.11772101.
[19] S. Cutler and A. C. Strong, “The Overlooked Impact of Faculty on Engineering Education,” in *International Handbook of Engineering Education Research*, 1st Edition., in 286. , New York: Routledge, 2023, pp. 286–311.