

WIP: Reproducing or Resisting? Examining How Engineering Faculty's Doctoral Experiences Shape their Supervisory Practices

Dr. Gala Sofia Campos Oaxaca, Cornell University

Gala Campos Oaxaca is a Postdoctoral Research Associate in Chemical Engineering at Cornell University. Her research is at the intersection of engineering graduate education, supervision, and communication.

Joshua Wallace, University of Louisville

WIP: Reproducing or Resisting? Examining How Engineering Faculty's Doctoral Experiences Shape Their Supervisory Practices

Motivation and Framing

Faculty supervision plays a central role in engineering doctoral education. Supervisors shape students' research development, professional identity formation, well-being, and career aspirations [1]. However, doctoral supervision remains an understudied component in engineering education. As a result, many efforts to improve doctoral education focus on outcomes or student experiences without fully examining how faculty understand and enact their supervisory roles.

Despite the importance of supervision, most engineering faculty receive little to no formal preparation for this role. Instead, supervision is often learned informally, through experience, intuition, and by drawing on memories of one's own doctoral training [2], [3]. Prior research shows that supervisors' experiences as students strongly shape how they approach supervision later in their careers [2], [3], [4], [5]. While this process can lead to thoughtful and supportive mentoring, it can also unintentionally reproduce practices that are misaligned with students' needs or with the realities of contemporary doctoral education. In the absence of shared expectations or structured support, supervision often becomes a private practice, developed in isolation and rarely examined [6], [7].

While prior research has documented doctoral students' experiences and the outcomes of mentoring relationships, much less is known about how engineering faculty themselves understand and make sense of doctoral supervision. Without attending to faculty perspectives, efforts to improve doctoral education risk oversimplifying complex relationships or placing responsibility on individuals without acknowledging the constraints they face. In this work-in-progress paper, we examine how engineering faculty's prior supervision experiences shaped their current supervisory practices.

Doctoral Supervision in Engineering

In engineering, supervision takes place in a demanding, complex environment. Doctoral students must navigate competitive funding structures (e.g., applying for GRFP), high expectations for research productivity, rapidly evolving research tools, and career trajectories that shift over time [8], [9], [10]. Students often do so with limited guidance beyond their supervisors [11]. Thus, supervisors play a central role in helping students interpret institutional policies, access opportunities, and reflect on their academic and professional trajectories.

However, research in doctoral education shows that supervisors and trainees frequently hold different expectations about autonomy, mentoring, and professional development, leading to frustration and missed opportunities [12], [13]. These tensions are rarely the result of poor intentions. Instead, they reflect broader structural pressures and a lack of shared understanding about what supervision should involve. For students from marginalized backgrounds, these dynamics are especially consequential, as relationships with advisors strongly shape feelings of belonging and decisions about whether to remain in or leave academic pathways [1], [14].

Across graduate education and post and doctoral training, prior literature has emphasized three recurring dimensions of supervision: (1) professional and scholarly development, (2) accessibility and availability, and (3) work-life balance [11], [12].

First, a substantial body of work highlights how supervisees describe professional and scholarly development as an essential function of supervisory work [3], [15], [16]. For instance, Burt and colleagues' [15] work on Black men's advising experiences in doctoral engineering programs highlighted how supervisors who offer developmental and constructive feedback on scholarly work often enhance a student's motivation to persist and finish their program. In addition, qualitative work from González-Ocampo and Castelló [3] foregrounds supervisors' perspectives on being a supervisee and their influence on their supervisory approach. Namely, their work highlights how the development of research skills, such as feedback or shared learning, was crucial in their supervisee experience, thus they sought to implement research skill development into their supervisory practices.

Second, literature also highlights the impact of accessibility and availability of supervisors on their supervisees [17], [18]. Breen and colleagues' [17] document how advisor inaccessibility contributes to negative supervisory relationships, leaving doctoral students feeling unsupported and stalled in their progress. Similarly, Olson and Naya-Bhalerao's [18] work on faculty mentorship highlights the necessity for faculty who want to practice developmental mentoring must master being approachable and accessible to the students they mentor.

Finally, work-life balance is a persistent theme in studies of doctoral supervision (e.g., [1], [17], [19]). Much of this literature describes the unhealthy imbalance between work and life for supervisors and how their imbalance can result in unhealthy expectations of work for their students. For instance, Griffin and colleagues [19] work on principal investigators' influence on students' wellness found that due to expectations from their supervisors, some students regularly practiced unhealthy habits such as missing dinner, limiting sleeping hours, and others would prioritize time with family or exercise. Similarly, research from Flemming and colleagues [1] noted how doctoral students who perceived and could identify ways that their supervisors and advisors were positively balancing work and life often viewed them as models for their future faculty roles.

While supervision is known to shape doctoral outcomes, little research examines how engineering faculty make sense of supervision or how their own experiences inform their practices. To address this gap, we analyze faculty reflections on their supervisory practices. In particular, we examine how some faculty replicate positive mentoring models, while others intentionally counter poor experiences by fostering a more caring environment. Moreover, we examine how these understandings can either sustain existing patterns or open space for more supportive and inclusive approaches to doctoral training in engineering.

Methods

Recruitment

We recruited faculty members who held the rank of associate or full professor and were currently advising doctoral students. We focused on faculty at these ranks to learn from individuals who had navigated the pre-tenure period and had greater institutional stability to advise doctoral students.

Participants were recruited through a convenience sampling strategy, including professional networks and direct email outreach based on academic background (e.g., department and rank). Our goal was to assemble a sample with variation across engineering disciplines and personal backgrounds. Participation was voluntary, and no compensation was provided. Thus, we consider this faculty to be personally invested in learning and discussing supervision.

Participants

Our sample consisted of 24 faculty members in various engineering departments at a large research-intensive university in the Northeastern United States. Half of the participants identified as female and half as male. Fifteen faculty members reported English as a second language. Faculty identified their race and ethnicity as White ($n = 14$), Hispanic ($n = 5$), Asian ($n = 2$), and Indigenous ($n = 1$). Two participants reported more than one racial or ethnic background ($n=2$).

Nine participants were full professors, and fifteen were associate professors. Participants represented a range of engineering departments, including Industrial ($n = 2$), Mechanical ($n = 4$), Aerospace ($n = 4$), Electrical ($n = 1$), Agricultural ($n = 2$), Civil and Environmental ($n = 3$), Biomedical ($n = 3$), Chemical ($n = 2$), and Engineering Science and Mechanics ($n = 3$). We report our demographic information collectively to protect our participants' confidentiality.

Interviews

Data were collected through semi-structured interviews as part of a larger project examining doctoral supervision in engineering. Interviews were done online or in person based on faculty's preferences. For this work-in-progress paper, we focus on faculty responses to the first two interview questions. The first question asked faculty to reflect on their experiences as doctoral students, particularly their experiences of being supervised. The second question asked how these experiences influenced their current approaches to supervising doctoral students. Interviews were semi-structured, allowing for follow-up questions and elaboration as conversations unfolded. Guiding questions included: 1) *Can you describe your academic background?* and 2) *How did your experiences as a Ph.D. student shape how you supervise doctoral students today?*

Data Analysis

Analysis of our data included multiple rounds of coding, categorizing and refining. Specifically, the authors began developing codebooks by open-coding the interview transcripts separately. After the first round of coding, the authors then met to discuss and compare initial codes until we identified codes that were cross-listed across our code books. Then, we developed a separate codebook focusing on the codes that cut across our initial codebooks. For instance, codes such as “countering negative advising experience of limited availability” or “confirming positive advising experience of accessibility” were collectively placed in the new codebook.

We then, collectively, began our second round of coding by categorizing and refining our codes. During this process, we regularly discussed the categories and specific criteria for inclusion of the codes into certain categories. For example, sub-categories such as “countering limited availability in advising experience” were placed within a broader category of Countering negative advising practices. Last, we collectively reviewed the categories and began combining the broader categories into larger themes of countering or confirming advising and of positive or poor experiences. To ensure analytic rigor, disagreements between coders were resolved through structured consensus-building discussions in which each coder articulated their rationale before arriving at a shared decision. We also maintained notes throughout the process to document evolving interpretations and trace decision-making across rounds of coding. These practices supported consistency and transparency in how themes were developed and refined.

Preliminary Findings

Our findings are organized around two themes: the types of supervisory experiences faculty described during their own doctoral training, and the mechanisms through which they translate these experiences into their current supervisory practices. Example quotes can be found in Appendix A. Importantly, these findings reflect faculty perspectives as they look back on their doctoral training from the vantage point of their current roles as supervisors. Unlike most prior literature, which centers students’ experiences in the moment, this study captures a temporal dimension: how faculty retrospectively interpret and make sense of the supervision they once received, and how that interpretation now shapes their own supervisory approaches. This temporal and retrospective quality is central to understanding not just what practices faculty replicate or resist, but why and how those experiences continue to carry meaning across career stages.

Types of Supervisory Experiences

Faculty described three dimensions of positive experiences: communication, support, and professional development. Positive communication involved clear expectations, accessible channels for interaction, and constructive, dialogic feedback that allowed students to explore ideas and ask questions. Supportive supervision extended beyond research guidance to include funding stability, help navigating institutional processes, and recognition of students as whole people. Professional development focused on preparing students for future careers by making implicit academic norms explicit, encouraging participation in conferences and job searches, and fostering professional networks and autonomy.

In contrast, faculty described poor supervisory experiences across four dimensions: poor communication, lack of availability, well-being, and gatekeeping. Poor communication involved unclear or implicit expectations that left students uncertain about responsibilities and progress. Limited availability reflected supervisors who were difficult to reach or perceived as unapproachable, discouraging students from seeking guidance. Concerns related to well-being included dismissive or hostile interactions and the normalization of unhealthy work habits, while gatekeeping involved territorial control over research directions or resistance to interdisciplinary work, restricting students’ intellectual and professional autonomy.

Mechanisms of Translation

Faculty described two primary mechanisms through which past supervisory experiences shaped their current practices: replicating positive experiences and countering negative ones. Replication mechanisms included sustained engagement in students' professional development, commitment to securing and maintaining funding, and flexibility in supervisory style to accommodate students' individual needs and stages of development. Faculty emphasized making the hidden curriculum of graduate education visible and adapting mentoring approaches based on students' goals, including both academic and industry pathways.

Countering mechanisms reflected faculty members' efforts to avoid reproducing negative experiences they had encountered as students. These included establishing intentional structures such as regular meetings and clear expectations, adopting flexible approaches tailored to students' backgrounds and needs, and prioritizing caring practices that supported students' comfort, well-being, and sense of belonging. Together, these mechanisms illustrate how faculty actively reflect on prior experiences to shape more supportive supervisory environments. Notably, structural factors such as competitive funding environments, disciplinary norms around productivity, and career-stage pressures all shaped the extent to which faculty could enact the supervisory practices they valued.

Next steps

Next steps include further refining the themes and more clearly describing how these mechanisms operate across different cases. We also plan to better connect these findings to the context of engineering doctoral education. Specifically, the next phase of analysis will explore patterns across career stages to examine whether supervisory philosophies evolve as faculty gain experience.

Implications of the Study

Our work suggests a few potential implications. First, as an implication for practice, our work tentatively suggests the value of more developmental supervisory approaches. Specifically, departments across graduate education might consider developing guidelines or pilot programs to support training for doctoral and post-doctoral supervision. While further investigation is needed to identify the most effective forms of such support, these preliminary findings point to training and professional development as a promising avenue for improving the consistency and quality of supervision.

In addition, this work suggests implications for research. In particular, as our work investigates the reproduction or resistance of supervision, a productive direction for future research would be to examine what specific tools and practices supervisors across various developmental stages draw on to aid in their supervisory role. Exploring this question could potentially inform faculty and staff across departments and disciplines on *how* faculty can take up developmental supervision.

References

- [1] G. C. Fleming, S. A. Cobb, and M. Borrego, "Professorial intentions of engineering PhDs from historically excluded groups: The influence of graduate school experiences," *J. Eng. Educ.*, vol. 113, no. 3, pp. 667–694, Jul. 2024, doi: 10.1002/jee.20607.
- [2] C. Halse, "'Becoming a supervisor': the impact of doctoral supervision on supervisors' learning," *Stud. High. Educ.*, vol. 36, no. 5, pp. 557–570, Aug. 2011, doi: 10.1080/03075079.2011.594593.
- [3] G. González-Ocampo and M. Castelló, "Writing in doctoral programs: examining supervisors' perspectives," *High. Educ.*, vol. 76, no. 3, pp. 387–401, 2018, doi: 10.1007/s10734-017-0214-1.
- [4] D. Jackson, T. Power, and K. Usher, "Learning to be a doctoral supervisor: Experiences and views of nurse supervisors of higher degree research students," *J. Clin. Nurs.*, vol. 30, no. 7–8, pp. 1060–1069, Apr. 2021, doi: 10.1111/jocn.15651.
- [5] M. Bahnson, C. Berdanier, and M. Ross, "Using Observational Learning Theory to Interpret How Engineering and Computer Science Faculty Learn to Mentor Postdoctoral Scholars," in *2022 ASEE Annual Conference & Exposition Proceedings*, Minneapolis, MN: ASEE Conferences, Aug. 2022, p. 40728. doi: 10.18260/1-2--40728.
- [6] L. Mcalpine, "Doctoral supervision: Not an individual but a collective institutional responsibility," *Infancia Aprendiz.*, vol. 36, no. 3, pp. 259–280, Jan. 2013, doi: 10.1174/021037013807533061.
- [7] E. Stracke and V. Kumar, "Encouraging Dialogue in Doctoral Supervision: The Development of the Feedback Expectation Tool," *Int. J. Dr. Stud.*, vol. 15, pp. 265–284, 2020, doi: 10.28945/4568.
- [8] D. Knight, T. Kinoshita, N. Choe, and M. Borrego, "Doctoral student funding portfolios across and within engineering, life sciences and physical sciences," *Stud. Grad. Postdr. Educ.*, vol. 9, no. 1, pp. 75–90, May 2018, doi: 10.1108/SGPE-D-17-00044.
- [9] M. Borrego, N. H. Choe, K. Nguyen, and D. B. Knight, "STEM doctoral student agency regarding funding," *Stud. High. Educ.*, vol. 46, no. 4, pp. 737–749, Apr. 2021, doi: 10.1080/03075079.2019.1650737.
- [10] J. B. Main, "Family formation and the career trajectories of women engineering PhDs," *Stud. Grad. Postdr. Educ.*, vol. 14, no. 1, pp. 26–46, Jan. 2023, doi: 10.1108/SGPE-05-2020-0026.
- [11] S. Rönkkönen, L. Tikkanen, V. Virtanen, and K. Pyhältö, "The impact of supervisor and research community support on PhD candidates' research engagement," *Eur. J. High. Educ.*, vol. 14, no. 4, pp. 536–553, Oct. 2024, doi: 10.1080/21568235.2023.2229565.
- [12] M. Bahnson, M. Ross, and C. G. P. Berdanier, "(Mis)alignments between postdoctoral and supervisors' perceptions of mentorship competencies in engineering and computer science," *J. Eng. Educ.*, vol. 113, no. 4, pp. 1115–1145, Oct. 2024, doi: 10.1002/jee.20611.
- [13] H. Anttila, K. Pyhältö, and L. Tikkanen, "Doctoral supervisors' and supervisees' perceptions on supervisory support and frequency of supervision – Do they match?," *Innov. Educ. Teach. Int.*, vol. 61, no. 2, pp. 288–302, Mar. 2024, doi: 10.1080/14703297.2023.2238673.
- [14] N. Bouhrira and J. M. Cruz, "System Factors Affecting Underrepresented Minorities in Doctoral Programs in Engineering: A Literature Review," in *2021 IEEE Frontiers in*

- Education Conference (FIE)*, Lincoln, NE, USA: IEEE, Oct. 2021, pp. 1–4. doi: 10.1109/FIE49875.2021.9637208.
- [15] B. A. Burt, C. M. McCallum, J. D. Wallace, J. J. Roberson, A. Bonanno, and E. Boerman, “Moving toward stronger advising practices: How Black males’ experiences at HPWIs advance a more caring and wholeness-promoting framework for graduate advising,” *Teach. Coll. Rec. Voice Scholarsh. Educ.*, vol. 123, no. 10, pp. 31–58, Oct. 2021, doi: 10.1177/01614681211059018.
 - [16] S. Carter and V. Kumar, “‘Ignoring me is part of learning’: Supervisory feedback on doctoral writing,” *Innov. Educ. Teach. Int.*, vol. 54, no. 1, pp. 68–75, Jan. 2017, doi: 10.1080/14703297.2015.1123104.
 - [17] S. M. Breen, J. McCain, and J. Roksa, “Breaking points: exploring how negative doctoral advisor relationships develop over time,” *High. Educ.*, vol. 88, no. 6, pp. 2319–2338, Dec. 2024, doi: 10.1007/s10734-024-01218-w.
 - [18] J. S. Olson and S. Nayar-Bhalerao, “STEM faculty members and their perceptions of mentoring: ‘I do not want to be a role model,’” *Int. J. Mentor. Coach. Educ.*, vol. 10, no. 1, pp. 67–83, Feb. 2021, doi: 10.1108/IJMCE-07-2020-0035.
 - [19] K. A. Griffin, J. Stone, D.-T. Dissassa, T. N. Hall, and A. Clarke, “Surviving or flourishing: how relationships with principal investigators influence science graduate students’ wellness,” *Stud. Grad. Postdr. Educ.*, vol. 14, no. 1, pp. 47–62, Jan. 2023, doi: 10.1108/SGPE-12-2021-0085.

Appendix A

Table A1. Examples of Positive Supervisory Experiences

Positive Experience	Example
Communication	We would sit and talk; he read my drafts; but I never felt the pressure many students here feel. The relationship was very conversational, he let me explore my arguments and why I thought one was better than another. In ethics, that let me explore a lot.
Supportive	So my PhD advisor style I really enjoyed and I am very thankful. So he pushes a lot to the students. But also once you are part of his team, you are on his team, meaning that I never had to worry about research assistantship. Once it's covered, he will figure things out to make sure I'm covered at those very end.
Professional Development	He was a very dedicated faculty. He really provided a lot of feedback, helped me understand academia. REALLY. He put a lot. Now going back when I think of everything that he did, he did a lot of work to help me and everyone, other people working with him understand actually academia writing and doing research.

Table A2. Examples of Poor Supervisory Experiences

Poor Experience	Example
Communication	My advisor never sat down with me to tell me what his responsibilities were and what his expectations of me were in the sense that the expectations of me were not spelled out as a list or as a bullet points. His expectations were rather loose.
Availability	I always felt a lot of stress about having to go down and knock on his door because what if he was busy or whatever.
Well-Being	He didn't have any social filters. I mean, today we cannot do that. But back in them, he just talked. You will say something that he considered stupid or silly. He will tell you - that is a very stupid thing. And then when you're a student, when you first arrive, especially in the first few years, I mean I was insecure. I was terrified [...]
Gate Keeping	I did not get along with my supervisor by the time I was close to graduation. So, I worked with the same mentor for both my master's and my PhD, and I would say my advisor was very territorial. And when I was working on an interdisciplinary project, that became problematic because he didn't seem to know how to work with people outside of his own comfort zone.

Table A3. Countering Mechanisms of Translation of Supervisory Practices

Countering Mechanism	Example
Intentional Structures	I decided to set weekly one-on-one meetings with all my students, and then also have our weekly lab meeting. And so that's kind of how I've gone because I can keep a kind of pulse on things, try to correct them when they're going way off topic or way off field earlier.
Flexibility	But I think as I worked for several years, I also have this perspective from advisors. So now it is more clear we can understand that students are different, so we can't just stick to one style mentoring student. You have to think about the student's background, the students' needs and how they evolve to be a more independent researcher.
Caring	think about in the end is research is really hard for all of the right reasons already. We shouldn't make it harder for the wrong reasons, and that can mean many things, but it mostly means making sure that the student is comfortable in their committee meetings, in all the research that they do, and then the culture that we provide for them in our departments and in our colleges .

Table A4. Examples of Confirming Mechanisms

Confirming Mechanism	Example
Professional Development	Excellent research is really about and how to really make sure that you can mentor folks to do very good work. A lot of my strategies, or a lot of the core of some of my mentoring philosophy really comes from him in terms of being able to support student investing in their development, to be able to meet with them regularly , to make sure that you bring the group together so you can discuss research problems, and then to give the freedom for the graduate mentees to provide their own ideas, to be able to explore some of their own directions, some of the partitioning
Commitment to Funding	One of the things that my graduate advisor did is he clearly delineated, he made a very clear line. Funding was his responsibility. It doesn't mean that you didn't help with proposals or things like that. It just meant that the pressure was, he took all the stress of how to make sure that there's enough resources [...]that's something that I took to heart. I thought it was really powerful and I've done as much as I could as a graduate advisor, is to create that division of responsibilities such that I see it as being my responsibility to be able to obtain the funding that's necessary to carry out the work and to support the students and not allow the students to necessarily worry about that.
Staying Flexible	All those experiences helped me balance things. Not every student benefit from a very relaxed supervisor; some need more accountability. I learned that for some, that laid-back style is best; for others, you need more hand-holding. Seeing lots of approaches made me more flexible.

