



# Perceptions of shared experiences in mentoring relationships: a collaborative autoethnography

## Julie Martin

Julie P. Martin is a Fellow of ASEE and an associate professor of Engineering Education at The Ohio State University. Julie's professional mission is to create environments that elevate and expand the research community. She is the editor-in-chief of Journal of Women and Minorities in Science and Engineering, where her vision is to create a culture of constructive peer review in academic publishing. Julie is a former NSF program director for engineering education and frequently works with faculty to help them write proposals and navigate the proposal preparation and grant management processes. She was a 2009 NSF CAREER awardee for her work operationalizing social capital for engineering education. More recently, Julie has encouraged the engineering education research community to embrace methodological activism, a paradigm whereby researchers intentionally choose methods for the political purpose of empowering marginalized populations. Learn more about her research team, Elevate, at [juliepmartin.com](http://juliepmartin.com).

## Deepthi Suresh

I am a graduate student in biomedical engineering with a research focus in engineering education. I seek to improve the undergraduate experiences of other biomedical engineering students in ways such as better preparing them for industry positions or offering them new opportunities during their time as undergraduates.

## Paul Jensen

# Perceptions of shared experiences in mentoring relationships: A collaborative autoethnography

**Keywords:** autoethnography, mentoring, new faculty, graduate student, collaboration, NSF RIEF, research initiation

## Abstract

This research paper describes an autoethnographic study of three individuals: Julie, a tenured faculty member and experienced engineering education researcher, and two novice engineering education researchers, Paul, a more junior faculty member, and Deepthi, a graduate student. The tripartite mentoring relationship between us formed as part of a National Science Foundation Research Initiation in Engineering Formation (NSF RIEF) project. We grounded our work in the cognitive apprenticeship model of mentoring and theory of social capital, asking the question: How do mentors and mentees perceive shared experiences? Over the course of 16 months, we collected data in the form of reflective journal entries and transcripts from individual and joint interviews, combining these with other documentation such as emails and text messages. We analyzed these data by identifying three critical incidents over the course of the relationship to date and comparing each of our perceptions of these shared experiences. We found that our perceptions of the shared experiences differed greatly, providing multiple opportunities to improve our future communication. We also discovered that our initial mentoring model in which Julie mentored Paul and Paul mentored Deepthi did not withstand scrutiny. Because Paul was new to engineering education research, it was better for Julie to mentor both Paul and Deepthi than to expect Paul to teach Deepthi topics and methods that were new to him. We assert that other projects would benefit by this approach as well. Our findings offer broad implications for the efficacy of reflection and communication in mentoring relationships.

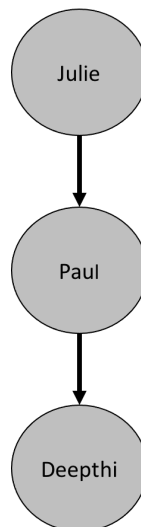
## Introduction

The National Science Foundation (NSF) Research Initiation in Engineering Formation (RIEF) provides funding for an engineering faculty member to partner with an established engineering education research (EER) mentor to complete a two-year project. The proposal requires a robust EER research plan and mentoring plan, and proposal reviewers are instructed to give equal weight to both. This research paper is a product of a collaborative autoethnographic study of a tripartite mentoring relationship.

Julie is an established member of the engineering education research (EER) community and is a tenured associate professor in the Department of Engineering Education at The Ohio State University (OSU). Paul is an assistant professor in the Department of Bioengineering at the University of Illinois at Urbana-Champaign (UIUC) whose research expertise is in artificial intelligence and automated science. He had no prior EER experience before being mentored by Julie. Paul and Julie's mentoring relationship began when Paul first contacted Julie for advice on writing a RIEF proposal. Unlike OSU, UIUC does not have a department of engineering education or a formal network of engineering education researchers so working across institutions was necessary for Paul. Deepthi, a graduate student who has worked in Paul's research lab since she was an undergraduate in bioengineering, also had no prior EER

experience. She is Paul's advisee and is currently completing an EER Master's thesis. She became the graduate research assistant for Paul and Julie's RIEF project.

Given the relative responsibility and expertise of each member of the team, and the fact that Paul had been mentoring Deepthi for years, the initial model of the tripartite mentoring relationship was conceived in line with Figure 1.



**Figure 1. Initial model of tripartite mentoring relationship**

Our study is unique in that it includes a mentoring triad and the perspective of both the mentor and mentee(s). Most often, mentoring is studied from the perspective of the mentee. Research including the perspective of the *mentor* as well the mentee is much rarer in the engineering education literature (e.g., Mondisa, 2020). In offering the perspective of all three members of the relationship, we seek to contribute knowledge that could help mentors and mentees in other contexts improve the functioning of their relationship, including peer-to-peer mentor training as well as hierarchical mentor training.

### **The Positionality and Goals of Each Author**

*Julie:* Formally and informally mentoring graduate students, postdocs, and early-career faculty is one of the greatest joys of my career. I joined Ohio State after a two-year rotation as the program director engineering education in the NSF Directorate for Engineering, where I managed the RIEF program, among others. Being a tenured faculty member, a former NSF program director, and the editor-in-chief of a journal has positioned me as an influential member in the EER community. In my NSF role, I set regular “office hours” in which I spent considerable time talking with faculty about their research ideas, providing feedback on their proposal ideas, and helping them navigate the NSF funding process. This position came with a certain amount of power, as I chose how to spend my allotted portfolio budget. I made the RIEF program a priority because of its commitment to expanding research capacity in the field. I ran peer review panels,

made funding decisions based on reviewers' recommendations, and supported the work of funded RIEF projects through ongoing communication with investigators. Serving as a mentor for a RIEF project is a natural next step for me now that I have returned to academia.

My goals for working with Paul and Deepthi on our RIEF project are as follows:

1. Improve and reflect on my mentoring.
2. Use our mentoring relationships and products from this project to contribute to the EER community's understanding of how to improve mentoring and therefore grow the field.
3. Learn about a technical engineering topic previously unknown to me from Paul and Deepthi.

*Paul:* I joined academia because I wanted to teach, but I never thought I would do formal EER. My wife—an established engineering education researcher—encouraged me to apply for a RIEF grant and introduced me to Julie. I am a computational bioengineer specializing in artificial intelligence with expertise in quantitative research.

I had completed about half of my junior faculty years at Illinois when I started the RIEF project. Because I am established in bioengineering with talented graduate students, staff engineers, external funding, and publications, I do not worry that my career will suffer if some of the senior faculty in my department dismiss the value of my RIEF project (I have heard both “it’s a fantastic addition” and “it doesn’t count.”) My security in bioengineering allows me to be open about my lack of engineering education expertise and be comfortable with my developmental level.

My goals for this RIEF project are as follows:

1. Learn to conduct independent EER work.
2. Uncover what motivates (and frightens) engineering students about changes in artificial intelligence.
3. Translate these discoveries into the classroom to increase engineering graduates' access to careers in artificial intelligence.

*Deepthi:* I have been in Paul's research group for four years, including three as a graduate student. Initially, I conducted research solely in the field of bioengineering, where Paul was very familiar with the lab work and systems that are involved. Because I began as an undergraduate in his established lab, I would characterize my initial relationship with Paul as a “student-teacher” relationship, where Paul considers my interests and then gives me research tasks and the information necessary to complete them. Having worked as a teaching assistant for the past three years, I understand this relationship well, from both perspectives. Neither Paul nor I expected me to offer research ideas, any more than my students would tell me what assignments I should give them in my classes. When I shifted my research into engineering education, Paul was making the same shift. Because I'm the graduate student working on the project with two faculty and am also Paul's advisee I have less power than he and Julie do. Yet I found I had more power than in my previous mentoring relationships; I had more confidence in my capabilities within EER, and having a three-person dynamic allowed me to voice my thoughts more freely since Paul and Julie often brainstormed in my presence.

My goals for working with Paul and Julie on this RIEF project are as follows:

1. Learn the research life cycle of qualitative engineering education projects.
2. Improve my mentoring relationships by better understanding the “mentor” side of mentor-mentee relationships.
3. Give voice to the student side of mentoring relationships, recognizing that many mentees do not have this opportunity.
4. Grow undergraduate interest in technical engineering careers by gaining insight into how students currently view the field.

## **Conceptual Frameworks: Mentoring and Social Capital**

### **1. Mentoring**

We are using two mentoring models to guide our study our relationship(s). The first is Eby et al.’s (2013) process-oriented model of mentoring, which includes: instrumental support behaviors related to the mentee achieving a goal; psychosocial support (e.g., encouragement) of the mentee; and relationship quality. This model also includes interaction frequency, relationship length, and social capital.

The second, Mirabelli et al.’s (2020) framework, is based on the cognitive apprenticeship model (Dennen & Burner, 2008). Cognitive apprenticeship describes learning through expert demonstration and guidance/coaching. Cognitive apprentices must be situated in an “authentic task” and have their participation guided by an expert mentor and a community of practice. Mirabelli and colleagues identified several factors that influence the success of RIEF mentoring relationships specifically, saying that “the unique structure of mentorship among RIEF grantees provides an opportunity to study the path from novice to expert [by] apprentices who already possess scaffolds [that will help them] to be expert researchers.” They point out that participation in the RIEF program requires a rather unique kind of mentoring relationship in that the mentee is already an established expert in an engineering discipline who is seeking to learn how to conduct EER (NSF, 2020) and suggest that considering these factors of RIEF mentoring relationships: the proximity of researchers (e.g. whether they are affiliated with the same institution), the style of mentorship the mentor and mentee prefer, mentees’ access to the EER community, the academic rank of the mentor and mentee, and the interpersonal relationships between RIEF grantee pairings (Mirabelli et al, 2020).

### **2. Social Capital**

Mondisa (2020) explores the use of social capital in studying mentoring relationships in STEM education. Her work is focused on the important mentoring relationships between African American STEM PhD mentors and their African American proteges and provides a foundation for understanding how mentors and mentees access information and resources and how they exchange social support (Mondisa 2020). Her model of social capital in mentoring considers three types of assets: (1) access to networks; (2) trust and support; and (3) empathy. She describes how these assets are related to the mentoring functions of career networking, psychosocial development, and role modeling (Mondisa 2020). We also borrow from Lin’s network theory of social capital, which describes social capital as the resources available in

relationships and includes two types of actions or support: “instrumental actions” or “instrumental support” to refer to tangible actions that help an individual achieve a specific goal and “expressive actions” or “expressive support,” which refer to emotional or moral support (Lin, 2001).

## **Research Question**

How do mentors and mentees perceive shared experiences?

## **Research Design**

1. Autoethnography: We used a collaborative autoethnographic research design (Chang, 2013; Ngunjiri, Hernandez, & Chang, 2010) to study our perceptions of shared experiences. Autoethnography and specifically collaborative autoethnography is growing in use in EER (e.g., Coso Strong et al, 2021; Sochacka, Guyotte, & Walther, 2016; Martin & Garza, 2020). Autoethnography is autobiographical in nature and thus, unlike ethnography, uses “self-awareness about and reporting of one’s own experiences and introspections as a primary source of data” (Patton, 2015, p.102). Whereas ethnography examines culture from the etic (outsider’s) perspective, autoethnography examines cultures, situations, and events from the emic (insider’s) perspective (Patton, 2015).

Researchers have described autoethnography as both a *process* and *product* (Ellis, Adams, Bochner, 2011). Our *process* is described in detail in the data collection section. Our *product* to date is this conference paper; we also have plans to write a collaborative autoethnographic journal article further investigating the evolution of our relationship.

2. Research Quality: We use Patton’s (2015) quality considerations for autoethnography: reflexivity, substantive contribution, aesthetic merit, impact, expression of a reality. In addition, we consider Hughes and Pennington’s (2016) relational ethics criterion for autoethnography. These criteria and applications to our study are summarized in Table 1.

**Table 1. Research quality**

Quality Criterion	Consideration/application in our study
Reflexivity	We included first-person positionality to explicate our current positions in the EER community and foreground the power differentials in our mentoring relationships. Our statements of goals provide additional perspective on the mentoring relationships.
Substantial contribution	We grounded the study in relevant frameworks and demonstrate alignment between theoretical constructs and our reality. We included the perspectives of both mentor and mentee in the mentoring triad.
Aesthetic merit	We use “aesthetic” and “evocative” thick descriptions of our shared experiences and our individual responses to them (Ellis, Adams, & Bochner, 2011, p. 277). We trimmed a long list of critical incidents (similar to the epiphanies described by Ellis, Adams, & Bochner 2011) to a digestible list of three critical incidents and one overarching theme. We summarized our perceptions of the incidents using a table for easy reference.
Impact	While impact is best judged post-publication, we anticipate that insights generated from our autoethnographic product may help mentors and mentees deepen their relationships through consideration of how the other perceives shared experiences and subsequent improved communication.
Expression of a reality	We present our findings via a narrative describing critical incidents that feel credible because we have included multiple (and sometimes conflicting) viewpoints, misunderstandings, and even awkward moments in our relationships.
Relational ethics	We were “cognizant of the promise and potential problems” (Hughes & Pennington, 2016, p. 24) of revealing sometimes conflicting viewpoints, misunderstandings, and awkward moments, and discussed our comfort level with these revelations multiple times during the data analysis (process) and writing phases (product) of the project. We intentionally omitted incidents from the paper that one or more of us felt violated privacy or that we were uncomfortable making public. We chose not to include proper nouns for people or academic units where their inclusion would be publicly unfavorable.

### 3. Data Collection:

Our autoethnographic study spans the first 16 months of the funded RIEF project that brought us together: September 2020 to January 2022. We used data from reflective journal entries, emails, video meetings, individual and joint interviews, text messages, and RIEF grant documents such as the proposal and annual report.

*3A. Reflections:* We each wrote periodic reflective journal entries guided by a set of questions that we designed using Mirabelli et al.'s (2020) and Eby et al.'s (2013) mentoring models. In particular, we wanted to elicit our own reflections on instrumental and expressive actions from social capital theory. A partial list of reflection questions is shown in Figure 2. We included questions that were designed to elicit self-introspection, as well as questions about the experience of the other in order to facilitate perspective sharing. While we wrote these reflections every couple of months, we did not actually share them with other until we began the data analysis for this paper.

- Tell me about your experience as a mentee/mentor since the last reflection.
- What specific instrumental actions has the mentor taken recently? What was helpful (or not) about these? What did the mentee learn? The mentor?
- What specific expressive actions (e.g., encouragement) has the mentor taken recently? What was helpful (or not) about these? What did the mentee learn? The mentor?
- What has the mentee learned or accomplished since the last reflection? What helped them learn or accomplish this?
- What are you learning about the mentoring relationship? How might you apply this to other mentoring relationships?
- What was not helpful or constructive? What adjustments might we need to make to the relationship?

**Figure 2. Sample reflection questions.**

*3B. Interviews:* We each participated in both individual and joint interviews performed by a fourth researcher during the first year of the RIEF project and again about a year later. Interviews lasted approximately one hour each. Similar to the reflection prompts, we designed the interview guides to elicit discussion on aspects of the mentoring models. Whereas the initial interviews formed a basis for capturing these aspects, the follow-up interviews focused on how our thinking on them had evolved over the year. The interviewer used the critical incident technique, which is a well-established technique increasingly used in EER (Flannagan, 1954; Grant & Trenor, 2010). In this technique, the interviewer draws out specific examples of significant events that occurred in a process, asking follow-up questions as needed to get to the specific moments in time that the interviewee associates with their more general response. Figure 3 includes selected interview questions. Like the reflections, we did not share the individual interview transcripts until we began data analysis.



- What are your goals for this mentoring relationship? Tell me about something that the mentor/mentee did that illustrates the goal or change in goal.
- What specific approach are you taking with this mentoring relationship? Tell me about a specific time when something was working or not working. What did you each do to adapt?
- Julie is at a different schools in a different state from Paul and Deepthi. How have you developed your relationship virtually? Tell me about a specific time when being virtual was a challenge or an advantage.
- Tell me about the relationship so far. What have your interactions been like? What is the significant thing your mentor/mentee has done to make the relationship a success? How did that play out?

**Figure 3. Sample interview questions**

*3C. Grant documents and messages:* Because our mentoring relationship was formed for the purpose of conducting a RIEF project, we consulted grant documents that documented aspects of our mentoring relationships. The proposal itself included the required plan for Julie’s mentoring of Paul, and reflective statements about our motivations for the mentoring relationship, goals, and mentoring approaches were an element of describing the plan. Once the RIEF project was funded, we cataloged email exchanges using the Basecamp project management program and exchanged occasional text messages.

*4. Data Analysis:* The critical incidents we each identified are a form of “epiphanies,” what Ellis, Adams, and Bochner define as “remembered moments perceived to have significantly impacted the trajectory of a person’s life ... after which life does not seem quite the same” (2011, p. 275). We defined critical incidents as an event or process to which we ascribed importance with respect to the RIEF project and the mentoring relationship, rather than our lives in general. We discussed our most salient critical incidents, initially identifying 11 incidents that focused on the evolution of the multilevel relationship. We each contributed to a collaborative document that summarized the most salient quotes or passages of reflection text related to each incident by identifying quotes or text from our own reflections and interviews. We then decided to scope this paper by focusing on the incidents where we had differing perceptions of the same event. We wrote a chronological narrative describing the critical incidents and our reaction to them. As part of the narrative, we included the most salient relevant raw data—that is, text from the reflections, interviews, messages, and grant documents—that illustrated the similarities and differences of perspectives.

## **5. Findings**

In this section we present our findings describing three incidents we all considered critical but that we perceived differently: (1) writing a new grant proposal to submit to the Department of Defense (DoD), (2) our three-way discussions of project pauses, and (3) training for and conducting research interviews. A timeline of the project and the critical incidents appears in Table 2. We present our perception of these incidents first in tabular form (Table 3), then in narrative form. The narratives use the third person for clarity; excerpts from reflections and interviews are presented in direct quotation with the sources in brackets. Following the critical events, we describe an overarching theme—the evolution of our mentoring tripartite relationship.

**Table 2. Project timeline.**

<b>Date</b>	<b>Event</b>
November 2019	Paul and Julie meet and begin writing proposal.
February 2020	Proposal submitted.
September 2020	Project begins and Deepthi joins the project team.
November 2020	Julie arranged practice interviews for Paul.
January-March 2021	Paul, Julie, and Deepthi write a DoD proposal.
June-August 2021	RIEF project paused for the summer. Paul and Deepthi conduct interviews for Deepthi's thesis project.
November-December 2021	Paul and Deepthi continue project while Julie is on medical leave.
December 2021	Interviews and reflections shared in preparation for this paper.

**Table 3. Critical incident from variable perception summary.**

<b>Critical Incident</b>	<b>Paul</b>	<b>Deepthi</b>	<b>Julie</b>
Writing DoD proposal	Hesitant to ask Julie to join, worried the project was outside scope of their relationship	Sense of importance and responsibility, highly conscious of Paul's faith in her capabilities	Excited to join, left comfort zone and gained new experience in searching for funding
Pausing for the summer.	Concern for project and Julie's reaction	Confusion about pause and concern for project's return	Concern for Paul and relief for pause
Not pausing for medical leave	Concern for Julie and her other mentees	Appreciation that Paul and Julie shared their doubts	Concern for project and inability to help
Training for/conducting research interviews	Gained confidence, appreciated practicing and receiving Julie's feedback	Worried she was unprepared but gained confidence due to Paul's guidance	Concerned that her style of support was not what Paul needed

### Critical Incident 1: *Writing the DoD proposal*

In early 2021, the DoD released its annual call for STEM Education grants. Paul wrote a white paper (pre-application) based on an outreach activity he had previously conceived (with input from Julie) for another proposal that was not funded. As the deadline was approaching, he asked Deepthi for comments on the white paper before submitting it, which Deepthi found a very positive experience:

The main thing I have learned in the past month about mentoring relationships is the importance for a mentee to be given responsibilities as well as acknowledgements of his/her success. I noted this as I was reviewing Paul's whitepaper submission, that giving someone a sense of importance bolsters their confidence and encourages them to work harder. [Deepthi's February 2021 reflection]

Deepthi also discussed the responsibility of reviewing the white paper in an interview.

I've just been more enthusiastic about this engineering education stuff [than I was about bioengineering research], so I've been offering or being willing to take on more responsibility. But I also have noticed that [Paul] has just asked me for advice on things more or my opinion, "can I review this for him?" And that was definitely not something I did two years ago. And honestly it shocks me even now when he asks, because I feel like, "Am I even ready for that responsibility?" [Deepthi's February 2021 interview]

Deepthi points to this event as an important moment where her confidence within the relationship grew immensely. Since it occurred just as she was beginning her work in engineering education, she feels it shaped how she shared ideas and suggestions throughout the rest of the project. Paul rarely asks his mentees to review grant applications, as he views applying for funding as "his job" as the adviser. Looking back, he's unsure why he asked for Deepthi help with the DoD whitepaper, saying that the short timeline may be a reason. He also says that the fact that he and Deepthi took up EER at the same time, and thus she has a similar level of experience in the field as Paul, which his other students do not, may have played a role in this violation of his usual practice. Here we have a mentor who does something he usually would not for reasons he doesn't recall and the mentee considers it a key factor in her later confidence. This may suggest that mentors should give mentees more responsibility than they believe the mentees are ready for; it also may be the case that Deepthi's confidence partly comes from the fact that she knew this wasn't Paul's usual practice.

Paul and Deepthi were invited to submit a full application, much to Paul's surprise since he "didn't think we had a chance" [Paul's April 2021 reflection]. Paul realized the grant's scope was larger than he could handle alone and he needed more educational expertise on the project team. Paul recalls being hesitant to ask Julie for help, since the project was outside the RIEF project and would be a large amount of work over a short time. He only asked Julie to join the project after she ask him if he wanted help. Paul viewed her joining the project as a favor to him:

Julie graciously joined the team, and a good part of a month was lost to grant writing.... Much of it was repurposed/expanded from [a previous proposal], which Julie also helped with [during the course of the mentoring relationship]. I would not have applied without Julie on the team, especially after [a director] in the college research office asked, “who is on your team?” [Paul’s April 2021 reflection]

As she wrote in her reflection journal later, “I’m really excited about it—both the idea he’s proposing and the potential for us to collaborate on a big project!” [Julie’s May 2021 reflection]. Based on her experience with the RIEF project, she knew that working on another of Paul’s ideas would be exciting. She also saw this as an opportunity because she was unfamiliar with the DoD proposal processes. She said in the interview:

[Paul] has helped me branch out in terms of the funding that I seek. I had never written a DoD proposal before the one with him. Now [the fact] that we’ve done it once has opened up a new area for me. . . . I’m imagining [a future DoD submission] could be with him in the future, or it could be with somebody else. But [writing] that was something that was for sure out of my comfort zone, because I know how to write a great NSF proposal. But another agency? I don’t know. [Julie’s January 2022 interview]

Here Paul assumed Julie would be reluctant to help with projects outside of the RIEF grant. He did not anticipate that Julie might feel being involved in the DoD proposal would also benefit her, and that she was interested in working with him on other ideas. He underestimated her commitment to his development and her recognition that mentoring might benefit her as a researcher. Mentors and mentees could avoid these errors in perception by openly communicating their support for each other and the individual benefits they receive from the mentoring relationship.

### Critical Incident 2: Project pauses

We paused the RIEF project twice in 2021. Paul requested the first pause for June to mid-August because the COVID-19 pandemic’s impact on his family’s childcare arrangements had created a significant backlog in his research tasks. He was certain that he needed this pause but he worried that Julie would react negatively to his request because, due to delays obtaining IRB approval, the project was already behind its planned timeline. Soon after he asked her and she accepted he wrote:

I had been worrying for a while about asking Julie to just put everything on hold. I don’t know why I was so worried. Julie has given me no indication that she’d be upset or the least bit unsupportive. . . . I don’t mind when students put things on hold to focus on other projects, so maybe I always assume Julie won’t react the way I would given our differences? [Paul’s June 2021 reflection]

Paul compares his relationship with Julie to the relationship he has with his students, suggesting that he views himself in part as a “student” of EER rather than a faculty researcher. Paul mentions differences between his and Julie’s management styles. Julie uses deadlines and progress reports to help her students structure projects, while Paul allows his students to set their

own schedules and organize their work as they see fit. In her reflections, Deepthi acknowledged the pros and cons of being mentored by these different management styles [Deepthi's January 2022 reflection].

Julie recalls being more concerned at the time about Paul's well-being than the project. As with her eagerness to work on the DoD project, this stemmed from her seeing the mentoring relationship as the primary goal and the RIEF research itself as secondary. She also felt the need for a pause herself. She said:

I was feeling really burned out from having been online for the past couple of semesters. And Paul was feeling really burnt out because of not only what was going on with his job, but the having to put so much energy into what was happening with his kids that I was thinking to myself... I need to really push myself to provide him with what he needs for us to start being able to collect data. [I was thinking] what is the information he needs? What are the resources, what is the mentoring? . . . How am I going to propose [a plan] that we can still get this done, despite all these things that have been happening? [Julie's January 2022 interview]

Both Paul and Julie felt the stress of balancing this project with other commitments during the pandemic; however, not sharing these feelings caused them to worry about asking each other for a break *that they both wanted*. Julie said, "I didn't even think about suggesting it because I didn't want to let him down" [Julie's January 2022 interview].

Paul was concerned that temporarily stopping the project would have long-term effects on the research. He wrote that he would know in the fall whether the pause had been "great (which I think it will be)" or "a disaster" due to the loss of momentum [Paul's June 2021 reflection]. Julie was far more optimistic, having recognized that the initial delay due to IRB approval had meant they were trying to collect data towards the end of the term and that this was difficult. She felt that seeking student responses in the summer would be even more difficult, likely impossible. When Paul finally asked Julie for the pause, she had been reassuring him that it would not be harmful for some time. She wrote in May:

I've been trying to convince Paul that if we don't get enough data now, we can relaunch the survey in the early fall semester and finish collecting data then. I've been saying that for about a month-plus now. Last week when we met, Paul said that he was getting used to the idea, so we had a good laugh about that. I'm used to talking people off a ledge (grad students). Ha! [Julie's May 4, 2021 reflection].

In September it was clear to both of them that the pause had been wise. Paul wrote, "For as much as I worried about shutting things down for a few months, it went by quickly and I don't think there will be any issues" [Paul's September 2021 reflection]. Julie wrote:

I was actually really relieved [when Paul asked for the pause] . . . because I [also] really needed a summer schedule that wasn't as hectic as the last academic year. He pointed out that things would get much easier for him when [his children] could go back to school,

and I was so glad that we were realistic about how the pandemic has affected the project and *us*. [Julie's September 2021 reflection]

The decision was also the occasion for an increase in honesty and support in the mentoring relationship. Julie called the critical incident “a turning point” [Julie's January 2022 interview] in their relationship and Paul described it as a “make-or-break” conversation, saying that if Julie had declined to pause the project it might have caused “irreparable damage to the relationship” [Paul's June 2021 reflection].

Paul and Julie were so focused on each other's reactions to pausing the project that they forgot to tell Deepthi about the decision. Paul continued to meet with Deepthi weekly about her other projects, but he never mentioned the RIEF project. Deepthi reflected privately on this:

I have mentioned [in this reflection journal] not feeling like I'm in the loop before, but more specifically, I would like some sort of status update when things are at a standstill like they are right now. I feel like the project came to a halt unexpectedly without me knowing why and now I have no idea when it will start back up again. [Deepthi's June 2021 reflection]

Normally overwork and tight deadlines make projects stressful. Deepthi's reflections show how an unexpected lack of work can also be stressful, because without clear communication she had no way to anticipate when the project would resume. She wrote:

I'm worried I'll be in the middle of other work and will be called back to the project and be required to do urgent work unexpectedly. I'm sure my mentors will be understanding if I say I need more time or something, but I still don't like that kind of sudden pressure. [Deepthi's June 2021 reflection]

Deepthi's perspective reminds us that good communication outlines what needs to be done as well as what does not need to be done. Projects can be paused and resumed so long as everyone is clear about their expectations.

After the project resumed, it soon appeared that a second pause would be necessary for Julie to take a medical leave. She wrote:

I'm really stressed about [the leave I need to take] for a number of reasons—I have no idea how long I'll be out. I also don't know when the surgery will be scheduled [yet], so between those two unknowns, I'm really anxious about how it's going to affect my work in general and this project in particular. Paul told me that he's confident that he and Deepthi can handle the data collection without me if needed, and I think that's significant because it shows how much confidence he's gained since this time last year! I have all kinds of feelings about the possibility that me being out for surgery will negatively affect him and the project—because I care about the work, and mostly because I don't want to let him down. We're in such an exciting place in the project and it stinks that I will have to miss some of it. I really don't want Paul and Deepthi to get stuck and me not be around to help/answer questions. [Julie's September 2021 reflection]

As the start of Julie's leave approached, Paul reflected:

Julie keeps asking what she can do before she goes on leave. I feel like I'm obviously supposed to decline all these offers. She has bigger issues to worry about than this project, and even if she wants to do something at work to prepare, that energy is better focused on the new students in her group. [Paul's October 2021 reflection]

The differences between Julie's reflections about the two pauses and Paul's reflections are instructive. When he needed a pause, Paul focused more on the impact on the project, while Julie focused primarily on the mentoring relationship. When her medical condition required leave, the project appeared more prominently in her reflection while Paul thought about her emotional state and her other mentoring relationships.

The team decided not to pause the project for Julie's leave in late 2021, and Deepthi was aware of the decision this time. Deepthi later wrote:

Julie was on medical leave for a month, so Paul and I were just chugging along without her and while I think the projects moved slowly, we also didn't encounter any huge issues. I think all three of us were more worried about handling Julie's absence than we needed to be. [Deepthi's January 2022 reflection].

Paul's concerns about functioning without Julie were visible to Deepthi. She reflected:

I also think Paul letting me see his own doubts and concerns really validates when I might feel concerned. ... I hope "higher ups" keep sharing their personal feelings about their work because I'm a very anxious person and without seeing them do it, I'm afraid to have doubts myself, [much less] act on them. [Deepthi's January 2022 reflection]

Pausing projects for any reason can affect both the project timeline and the relationships between researchers. While delays are often unavoidable, researchers can mitigate interpersonal effects through open and clear communication. Delays and setbacks affect all research projects, but few mentoring relationships can thrive unless team members communicate their expectations and willingness to support each other.

### Critical Incident 3: *Training for/conducting research interviews*

Paul had assumed he would use quantitative research methods when pursuing EER, but he recognized in his first meeting with Julie that qualitative methods were needed to answer his research questions, and through the RIEF project he began to develop a deep appreciation for qualitative work.

Thus when it was determined that interviews would be the primary method of data collection for the RIEF project, Julie made a plan to provide scaffolded training for Paul to learn to how to conduct interviews. She arranged for several graduate students from the OSU Engineering Education Department to let Paul interview them about their academic pathways. Partway through the training, Julie wrote:

We've conducted two [interviews] with me as the lead and Paul asking follow ups, then debriefing and discussing both the content of the interview and how it relates to [the theory], as well as pointers and discussion about asking follow-up questions that keep the interview on track. We're doing this verbally and by reading the transcripts and making some notes. Later this week we have two more and we are switching roles. Paul is going to lead and I'm going to ask follow-up questions, or as we joked in our last meeting, I'm going to bail him out. I shared a book chapter about interviewing techniques with him before we started. I didn't expect it to be extremely helpful because real ones are rarely "textbook" interviews; [it] was definitely the case [that the interviews we conducted were not textbook]. Yeah, what I should have told him is to throw the textbook out and hang on for a wild ride. [Julie's December 2020 reflection]

The practice interviews included unexpected moments for both Paul and Julie. Paul wrote:

[T]he interviews were surprising. I guess I expected them to be more difficult because of mechanical issues [e.g., asking questions clearly, or getting participants to talk]. They flowed pretty well, but I think that was because I was interviewing students who had themselves conducted interviews [because they are engineering education students themselves]. Now I'm concerned that other interviewees won't be so responsive/helpful, and there isn't much I can do about it. [Paul's January 2021 reflection]

Julie reflected on whether her feedback to Paul struck the right tone when she wrote, "A lot of my expressive support is done with humor (or at least I think it's humor). I'm interested to know if that makes him feel supported or I should change my tone" [Julie's December 2020 reflection]. Paul's reflections written a month later reveal that he felt Julie's feedback was appropriate and enjoyed her humor: "Julie was great during the interviews. She pushed me enough, and sort of dropped me in with a 'no turning back' attitude. I think she read me well" [Paul's January 2021 reflection]. Paul did not know that Julie had wondered about this, and Julie did not know that he found her feedback helpful until they each read the other's reflections almost a year later. They both agreed that it would have been useful to be more open with each other at the time.

Paul described the scaffolded interview training as "definitely constructive," saying, "The idea of practice interviews was great. I wouldn't have thought of it. We don't do practice experiments in the [bioengineering] lab" [Paul's January 2021 reflection]. On the other hand, he also wrote:

I guess I'm supposed to feel better having interviewed someone, but I'm more anxious. It was different than I thought, in part because it depends so much on the personality of the interviewee. Who knows how the real interviews are going to go. . . I still have no clue what to do with data *after the interviews*. [Paul's January 2021 reflection]

Looking back, Paul attributes his concerns about analyzing the interviews to his experience as a computational biologist. In his other projects, data analysis often takes far longer than data collection and requires an entirely different skillset. Paul was now prepared to conduct interviews but felt unprepared to take the next steps in the project.



Given his feelings that the practice interviews had been constructive, Paul later noted in his reflection that Deepthi should have the same opportunity [Paul's January 2021 reflection], but there were no practice sessions for Deepthi. She was anxious about conducting interviews, as she wrote before they started:

I am really nervous about beginning the interviews. I have signed on to four projects that are very interview and interview-analysis focused, but I have never even observed an interview, much less conducted one myself. I've mentioned this to Paul but he could be busy or may just not know how to remedy this until we have interviews for me to observe. Either way, I definitely look forward to being trained on this so that I don't feel as overwhelmed by the projects when we get to the interview stage. [Deepthi's March 2021 reflection]

When the time came Deepthi observed Paul doing "real" interviews and slowly took over the questioning. Despite not being trained in the same systematic manner as Paul, Deepthi actually learned from this process. She wrote:

Since the last reflection I have worked with participants to set up and conduct interviews, and will soon conduct my first solo interview. Paul's guidance and example has really helped me in this, and Paul has explained/relayed what he learned from Julie when she was teaching him how to do it. [Deepthi's June 2021 reflection]

Julie's reflections may suggest why Deepthi achieved the same results without the exercise of doing practice interviews and in spite of Deepthi's concerns. Julie wrote that having done interviews for years made it difficult to remember the experience of a first-time interviewer and that the practice sessions helped her as much as Paul to realize what kinds of instruction he needed:

The first [interview] kind of blew him away. . . Seeing [Paul's] reaction to that was amusing because he was expecting something totally different—this pointed out what I have trouble seeing because it's been so long since I first did an interview and I've done so many over the years that I feel like I've seen it all (participants crying, etc.). It's easy to forget what the experience can be like as a newcomer and I appreciate being able to see these aspects of research through his eyes. [Julie's December 2020 reflection]

As an established qualitative researcher, Julie had a wealth of experiences, tips, and suggestions to offer Paul when he was learning. Paul, on the other hand, had conducted only a handful of interviews before modeling one for Deepthi and was aware of his limited knowledge. Yet he knew the perspective of a novice, and thus was able to instruct Deepthi.

Further, the practice interviews prompted Paul to offer Deepthi what he felt they had offered him: a "push out of the nest." Paul reflected as much about his practice interviews, writing, "I think I'm ready to do an interview on my own; I certainly could if there was no other option. I guess it's one of those things you just need to do" [Paul's January 2021 reflection]. By June Deepthi had gained a good deal of confidence:

Paul has been extremely encouraging and supportive about how I'm conducting the interviews. . . It has really pushed me to be more self-sufficient and take more initiative, which is both fun and scary. . . [Deepthi's June 2021 reflection]

Looking back at this critical incident as we analyzed data for this paper, we realized that our initial conceptualization of our mentoring relationship (Figure 1, where Julie mentored Paul and Paul mentored Deepthi) was not realistic. Paul, who is learning how to conduct engineering education research, does not yet have enough expertise to mentor or train Deepthi. He was able to model some techniques that he learned from Julie, but he could not fulfill the expert role required needed to develop mentees under the cognitive apprenticeship framework (Vygotsky, 1978).

### Overarching Theme: *Evolution of mentoring relationship*

One surprising finding of this work was how the mentoring relationship between three individuals evolved over time. When Deepthi was first added to the autoethnography, we all assumed that Julie would be Paul's mentor, and Paul would be Deepthi's mentor. Julie articulated it thus: "Paul had a great idea to include a tiered mentoring component in our autoethnography, which I think is brilliant. So now Deepthi is going to be reflecting on her experiences being mentored by Paul" [Julie's January 2021 reflection].

As time went on, however, it became increasingly clear that the nature of the relationship was much more complex. Paul felt that since he was only slightly more familiar with the new field than Deepthi, he was unsure how to be a mentor in EER. When Deepthi decided to join the RIEF project and work in engineering education, Paul wrote, "I think this will be great for her, but now I need to figure out how to mentor someone in engineering education. That's terrifying." [Paul's January 2021 reflection]. Around the same time, Deepthi noted:

I've also encountered more questions of my own that sometimes Paul doesn't know the answers to, which teaches me that even my own mentor may not know everything. When those questions come up, Paul directs me to [his wife, who is an EER researcher] and Julie, so it's a dynamic I'm not used to. [Deepthi's February 2021 reflection]

Deepthi did not have formal training in EER and needed to know where to go for help developing her skills. She found that when she and Paul were both "mentees" of Julie, the nature of their established teacher/student relationship changed. For instance, Deepthi noticed that she and Paul had different strengths in EER; Paul was quicker to pick up the nuances of qualitative work and the theories behind EER frameworks, and Deepthi was more effective at executing research tasks such as survey development and transcript coding. Deepthi and Paul needed to switch to a collaborative relationship to move the project forward.

Paul did not necessarily find the change easy. As Paul and Deepthi became more familiar with different components of engineering education research, Paul began to feel like he could not walk her through the project the way he used to with bioengineering lab work. Instead, he considered simply assigning Deepthi her own parts of the research. Paul said:

I think I need to give more of the project over to Deepthi, but that's hard to do. It seems like I'm just passing it off since I haven't done it myself. With my other research there's always a feeling of "yes, I could do this, but you need to learn how" when working with a student. Here, it's more of "neither of us know how to do this, and you should learn instead of me." That's an odd feeling, and I don't know how to resolve it. [Paul's June 2021 reflection]

During the time that Paul was having doubts about his own mentorship of Deepthi, Deepthi and Julie's relationship started shifting. Deepthi had initially talked about her interactions with Julie, saying, "I only see Julie during [her research team's] meetings so I feel like I don't gain as much of the mentoring experience from her" [Deepthi's March 2021 reflection]. However, just two months later, Deepthi wrote: "Julie has been a great help in finding me resources, advising me, and bringing [her research team] in to help me" [Deepthi's May 2021 reflection]. As Julie began to take a more prominent mentoring role with Deepthi, she spoke of the three-person dynamic:

I have also been helping Paul mentor Deepthi on her master's project. And so some of this time that we meet, we talk about the RIEF project, and some of the time we've talked about the master's project. And then there have been other times when it has been just Deepthi and I emailing or just Deepthi and I meeting. [Julie's January 2022 interview]

When Deepthi received interview transcripts for her master's project she felt very unsure how to handle them, as she had never coded interviews before. Paul had not learned how to code interviews either, so Julie immediately began coaching Deepthi through the steps. While Paul could not assist with this specifically, he gave constant encouragement and used his own social capital to help Deepthi. She described this new aspect of her relationships with both mentors, saying:

I met with Julie one-on-one to discuss interview coding which was very informative. She also has been helping me set deadlines so that I'm making more progress on my thesis. . . . Paul has been giving advice when I ask for it, as usual, but otherwise has let me be independent on my work. [One way Paul supports me is that] He gives nudges to people [like the transcriptionist] when they aren't responding to me, which is also helpful (although of course I wish they would just respond to me). [Deepthi's September 2021 reflection]

Paul, realizing the mentoring role Julie had taken with Deepthi, was worried that when Julie went on medical leave, Deepthi would feel at a loss for how to continue her research. He wrote just after Julie's return to work:

It would have been an easy out [for Julie] to say "let's put things on hold and pick it up when I get back", so it was helpful to let me run unsupervised for a while. I'm curious how Deepthi feels about this. I imagine her confidence could wane when Julie isn't around. [Paul's December 2021 reflection]

Deepthi's reflections suggest otherwise, however:

Julie was on medical leave for a month, so Paul and I were just chugging along without her and while I think the projects moved slowly, we also didn't encounter any huge issues. I think all three of us were more worried about handling Julie's absence than we needed to be. . . . I've learned a lot these last few months. With Julie's help I've learned to code transcripts, and across the seven transcripts I coded, I can tell my confidence grew. [Deepthi's January 2022 reflection]

Because Julie took on a greater role in mentoring Deepthi than any of them expected, there were some moments of careful consideration about who should play what role in Deepthi's mentoring. In an interview, Julie was asked whether she had conversations with Paul about their respective mentoring roles with Deepthi. Julie recalled:

There have been times where I think we've just had to talk about it because otherwise it could get tricky, because he is her advisor. . . . There have been times when I've said to Deepthi, "This is what I think you should do. But if Paul says differently, you got to listen to Paul because he's your advisor." But Paul is telling Deepthi, "Do what Julie does, because I don't know what I'm talking about." There have been a couple times that we've had to come together and say, "this is what I'm telling Deepthi, what are you telling her?" Because . . . the last thing that we want to do is confuse somebody. [Julie's January 2022 interview]

Julie noted how the relationship evolved from what they initially imagined when she spoke about the delineation of her role as Deepthi's mentor in discussions with Paul:

[Paul and I have] established. . . I'm not going to give [Deepthi] advice specific to their [bioengineering] program requirements or things like that, but I am going to give her advice specific to the field [of EER] . . . It's not like we sat down and outlined it from the beginning, but there have been things that have come up that we've discussed like that. [Julie's January 2022 interview]

This contrasted greatly with Julie's earlier reflection where she explicitly referred to Paul as Deepthi's mentor, and herself as Paul's mentor. By the time we began this paper, Julie had begun to make statements that show she now feels like a mentor to both Paul and Deepthi. In one of many examples, Julie wrote, "I told Paul and Deepthi what a great job they did with the interviews and pointed out how much they have learned in a short amount of time. I hope Deepthi knows how invested I feel in her success" [Julie's January 2022 reflection].

We learned that our initial conceptualization of the mentoring relationship was actually evolving into something quite different.

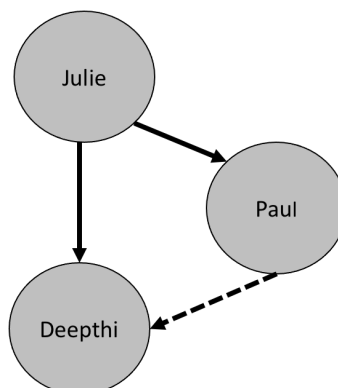
## Discussion

### *Revision of our initial mentoring model*

We originally viewed our tripartite research team as a mentoring hierarchy (Figure 1): Julie mentored Paul, and Paul mentored Deepthi. We used this model and sought to understand Paul's "dual role" as both a mentee and a mentor during initial stages of the RIEF project and the autoethnographic analysis of our relationship. However, our analysis soon revealed that we did not view ourselves in a hierarchy for three reasons:

1. Paul and Deepthi view their relationship as a shared experience of entering the EER field. They work together on data collection, analysis, and writing, but Paul has not conducted formal training sessions with Deepthi such as Julie conducted with Paul in the practice interviews.
2. Deepthi views Julie as a mentor or co-mentor. Deepthi arranges individual meetings with Julie to discuss her thesis research and participates in Julie's research team meetings at Ohio State. Julie trained Deepthi in interview coding and manuscript writing.
3. At this early stage in his EER development, Julie mentors Paul as a researcher, not as a mentor himself. This mentoring style is appropriate to Paul's developmental stage. For example, Paul needs to learn how to analyze primary data before he can be trained on EER grant writing or how to mentor his own EER students. This differs from other faculty mentoring programs that focus on funding, promotion/tenure, and group management but not the specifics of a faculty member's research area.

Our revised mentoring model appears in Figure 4, where Julie mentors both Paul and Deepthi. Paul serves as a co-mentor to Deepthi, but he could also be considered part of Deepthi's community of practice in that he provides mutual engagement and a common interest in engineering education research.



**Figure 4. Revised tripartite mentoring relationship**

Under the cognitive apprenticeship framework, mentors provide mentees with learning experiences within their zone of proximal development—the region just beyond the learner's

current ability level (Vygotsky, 1978). Julie conducting practice interviews with Paul prior to Paul doing actual data collection interviews is an example of providing learning experiences in the zone of proximal development. However, when Paul asked Deepthi to participate peripherally in the early data collection interviews for the project with no practice interviews first, doing so was outside her zone of proximal development. Had Paul been an expert in EER, he could have selected additional activities that were effective for Deepthi's developmental level.

As Mirabelli and colleagues (2020) explain, the RIEF project provides scaffolding for inculcating new members of the EER community. Our results suggest that RIEF mentees—including established engineering faculty—may not be prepared to mentor engineering education graduate students under the cognitive apprenticeship model. In our case, Paul relied heavily on Julie to mentor Deepthi in EER despite having graduated multiple Master's and Ph.D. students in bioengineering. Deepthi, as a mentee with co-mentors, benefits from access to social capital in two fields (bioengineering and engineering education) and from having a front-row seat as Paul finds his footing in a new field.

### *Benefits of autoethnography*

Our autoethnographic process revealed more than could be discerned from quantitative studies of mentoring or qualitative studies conducted with non-researcher participants. The reflective process sparked realizations that we do not believe would have happened if we had merely been participants in a mentoring study. For example, after years of experience interviewing participants, Julie's practice interviews with Paul helped her to view the experience of interviewing for the first time with a fresh perspective. But Paul is hardly the first mentee Julie has trained to interview. We attribute her fresh perspective to the autoethnographic process of writing and reflecting on the experience. Increased self-knowledge for the mentor is a known benefit of mentoring relationships (Astrove & Kraimer, 2021). In hindsight, Julie's self-realization was affirmed by Paul's reflections, but Julie did not receive this feedback until a year later when they exchanged reflections. Sharing reflections earlier would have benefited both the mentoring relationship and the individual researchers.

The periodic reflections and subsequent discussions among the three of us have helped us each to better understand our own needs for the relationship and those of the others involved. Having written about and verbalized our differing perspectives of shared events, we now clearly notice gaps in our past communication and the occasions where we failed to meet the needs of the other(s). For instance, Paul and Julie have redoubled efforts to communicate with Deepthi, such that she would know about a pause and plans for resuming a project. The autoethnographic process has helped us voice our individual needs and desired outcomes in a way we do not believe we could have done otherwise.

The autoethnographic process also inspired us to make adjustments not only in our tripartite mentoring relationship, but other mentoring relationships as well. For example, Julie has implemented a weekly reflection system in her research group where her graduate students provide her with written reflections prior to their periodic advising meetings. The reflection form

asks them to articulate what type of mentoring they need at that moment (e.g., working with a success, generating ideas, finding a solution, learning through failure).

### *Benefits to the mentor*

By including the mentor and mentee perspectives, our study revealed information about the positive effects of mentoring on the mentor that have been under-studied in the mentoring literature (Baugh, 2020). Early theories of mentoring (e.g., Feldman, 1976; Kram, 1983) did “not overtly acknowledge that benefits also can accrue to the mentor” (Malin & Hackman, 2016, p.174).

Julie described proximal and distal benefits of mentoring Paul and Deepthi (Allen, 2007). Eby and Lockwood (2005) also describe one of those benefits: mutual learning. For instance, Julie learned how to write a proposal for a new funding agency, which not only provided the short-term benefit of learning (which Julie enjoys) and perceived productivity in her faculty role, but also the longer-term benefit of experience and confidence to submit future proposals to that agency. Julie also demonstrated that she had experienced personal gratification when she described being proud of Paul and Deepthi’s progress learning to conduct social science research interviews (Eby & Lockwood, 2005).

We found one other collaborative autoethnographic study of a mentoring relationship that was conducted by Malin, a doctoral student, and Hackman, his faculty mentor (2016). These researchers noted “Mentoring should not be merely a one-way relationship, with only the protégé benefitting, and it is important to acknowledge the protégé possesses skills that can benefit the mentor.” They also found that their “experiences intensified and satisfaction deepened when we acknowledged mutual benefits” (2016, p.173). Julie finds this to be true of our tripartite mentoring relationship and aims to continue to reflect on these benefits and express the ways in which she benefits from the relationship to Paul and Deepthi.

### *Communication and reflection*

Reflecting for the past 16 months has provided us with a better understanding of how we view this mentoring relationship and how we want this relationship and other mentoring relationships to progress. One of the main takeaways from this experience was the striking difference between what our reflections say and what we tell each other in meetings. Our reflections contained more expressions of self-doubt, more expressions of encouragement for each other, and altogether more open communication than our in-person conversations. Perhaps some thoughts are easier to write down and share later than to share aloud immediately. This is likely a common discrepancy, as the power differentials between mentors and mentees could push mentors to hide feelings of doubt, and mentees to hide feelings of frustration.

We want to continue to explore and overcome this communication barrier to optimize this and other mentoring relationships. Whether the changes we make are in the form of sharing written reflections as we write them, or simply making a more conscious effort to express our thoughts during meetings, we are planning for the relationship to continue evolving into an even stronger mentorship. We each gained much insight by reading each other’s reflections and the mentoring

relationship could strengthen faster and in new ways if that insight is consistently shared going forward.

We are also considering ways we can introduce more written reflections into our other mentoring relationships as a result of this project. For example, Julie now asks her graduate students to fill out reflection forms before they meet with her each week.

## **Conclusion and Implications**

Our study demonstrated that mentors and mentees can have widely differing perceptions of the shared experiences in the mentoring relationship. These findings have broad implications for mentoring relationships.

By recognizing their different perspectives, mentors and mentees could improve their relationship on both a personal and professional level. One way to accomplish this is to incorporate aspects of reflection into the relationship. The simple act of self-reflection followed by communication about the reflection can lead to breakthroughs that strength the relationship. The act of sharing written reflections has the potential to facilitate open communication about topics that may be difficult to share verbally. Additionally, having dedicated time spent on reflection could cause the mentors and mentees to express more encouragement for each other in writing than would naturally come up in conversation. Such encouragement in both directions of a mentoring relationship has the potential to strengthen the bond between mentor and mentee. While this reflection process could be done outside of an autoethnography, the use of an autoethnographic methodology provided the opportunity to analyze our mentoring relationship with the intention of understanding and improving it. This intention can and should be applied to regular reflections as well; and as we learned, sharing our reflections earlier could have provided much needed clarity to our communication.

We found limitations of the hierarchical mentoring relationship we originally planned for the RIEF project. We conclude that it is unrealistic to expect novice researchers to serve in both mentee and mentor roles while learning how to conduct research in a new field. Instead, we suggest that RIEF project teams use our evolved mentoring model depicted in Figure 4 where the established engineering education researcher has a direct line to the graduate student.

Finally, our findings contribute to the limited extant literature about the benefits of mentoring relationships to mentors. Our data illustrate ways in which mentoring is a two-way street. We conclude that reflection facilitates mentor realization of these benefits and has the potential to increase satisfaction and motivation to mentor.

## **Acknowledgments**

We thank Dr. Renee Desing of The Ohio State University for conducting the interviews.

This material is based upon work supported by the National Science Foundation under Grant Nos. 2024736 and 2025059. Any opinions, findings, and conclusions or recommendations



expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

## References

- Allen, T. D. (2007). Mentoring relationships from the perspective of the mentor. In B. R. Ragins, & K. Kram (Eds.), *The handbook of mentoring: Theory, research and practice*. Thousand Oaks: Sage. p.123-147.
- Allen, T. D., & Eby, L. T. (2008). Mentor commitment in formal mentoring relationships. *Journal of Vocational behavior*, 72(3), 309-316.
- Astrove, S. L., & Kraimer, M. L. (2021). What and how do mentors learn? The role of relationship quality and mentoring self-efficacy in mentor learning. *Personnel Psychology*.
- Baugh, S. G. (2021). Mentoring Research Through the Years: A Brief Review. *Oxford Research Encyclopedia of Business and Management*.
- Chang, H. (2013). Individual and collaborative autoethnography as method. *Handbook of autoethnography*, 107-122.
- Coso Strong, A., Smith-Orr, C., Bodnar, C., Lee, W., McCave, E., & Faber, C. (2021). Early Career Faculty Transitions: Negotiating Legitimacy and Seeking Support in Engineering Education. *Studies in Engineering Education*.
- Dennen, V. P., & Burner, K. J. (2008). The cognitive apprenticeship model in educational practice. *Handbook of research on educational communications and technology*, 3, 425-439.
- Eby, L. T. D. T., Allen, T. D., Hoffman, B. J., Baranik, L. E., Sauer, J. B., Baldwin, S., Morrison, M. A., Kinkade, K.M., Maher, C. P., Curtis, S., & Evans, S. C. (2013). An interdisciplinary meta-analysis of the potential antecedents, correlates, and consequences of protégé perceptions of mentoring. *Psychological bulletin*, 139(2), 441.
- Eby, L. T., & Lockwood, A. (2005). Protégés' and mentors' reactions to participating in formal mentoring programs: A qualitative investigation. *Journal of vocational behavior*, 67(3), 441-458.
- Ellis, C., Adams, T. E., & Bochner, A. P. (2011). Autoethnography: an overview. *Historical social research*, 273-290.
- Feldman, D. C. (1976). *A contingency theory of socialization*. Yale University.
- Flanagan, J. C. (1954). The critical incident technique. *Psychological bulletin*, 51(4), 327.
- Hughes, S. A., & Pennington, J. L. (2016). *Autoethnography: Process, product, and possibility for critical social research*. Sage Publications.
- Kram, K. E. (1983). Phases of the mentor relationship. *Academy of Management journal*, 26(4), 608-625.
- Grant, D. and Trenor, J.M (2010). Use of the critical incident technique for qualitative research in engineering education: An example from a grounded theory study. Proceeding of the 2010 ASEE Annual Conference and Exposition. Louisville, KY.

- Lin, N. (2001). *Social capital: A theory of social structure and action* (Vol. 19). Cambridge university press.
- Malin, J. R., & Hackmann, D. G. (2016). Mentoring as socialization for the educational leadership professoriate: A collaborative autoethnography. *Mentoring & Tutoring: Partnership in Learning*, 24(2), 158-178.
- Martin, J. P., & Garza, C. (2020). Centering the marginalized student's voice through autoethnography: Implications for engineering education research. *Studies in Engineering Education*, 1(1).
- Mirabelli, J., Barlow, A., Ko, M., Cross, K., & Jensen, K. (2020). Work in Progress: A Qualitative Study of Mentorship, Training Needs, and Community for New Engineering Education Researchers. *Work in Progress: A Qualitative Study of Mentorship, Training Needs, and Community for New Engineering Education Researchers*.
- Mondisa, J. L. (2018). Examining the mentoring approaches of African-American mentors. *Journal of African American Studies*, 22(4), 293-308.
- National Science Foundation (2020) PFE: Research Initiation in Engineering Formation (PFE: RIEF) , retrieved from [https://www.nsf.gov/publications/pub\\_summ.jsp?WT.z\\_pims\\_id=503603&ods\\_key=nsf20558](https://www.nsf.gov/publications/pub_summ.jsp?WT.z_pims_id=503603&ods_key=nsf20558)
- Ngunjiri, F. W., Hernandez, K. A. C., & Chang, H. (2010). Living autoethnography: Connecting life and research. *Journal of research practice*, 6(1), E1-E1.
- Sochacka, N. W., Guyotte, K. W., & Walther, J. (2016). Learning together: A collaborative autoethnographic exploration of STEAM (STEM+ the Arts) education. *Journal of Engineering Education*, 105(1), 15-42.
- Patton, M. Q. (2015). *Qualitative research & evaluation methods: Integrating theory and practice, Fourth Edition*. Sage publications.