

## **Navigating Challenges: Women teaching faculty members' experience in the teaching-focused communities of practice in engineering**

**Dr. Yonghee Lee, University of Illinois at Urbana-Champaign**

Teaching and Learning Specialist Center for Innovation in Teaching and Learning University of Illinois at Urbana-Champaign

**Dr. Jay Mann, University of Illinois Urbana-Champaign**

Jay Mann is Director of the Academy for Excellence in Engineering Education (AE3) in the Grainger College of Engineering at the University of Illinois Urbana-Champaign. Dr. Mann is a twenty-five-year veteran educator with previous experience as a high school classroom teacher, school administrator, and teacher educator. He is a three-time graduate of the University of Illinois (A.B. in History; M.Ed. in Educational Organization and Leadership; Ph.D. in Curriculum and Instruction).

**Chris Migotsky, University of Illinois at Urbana - Champaign**

Chris Migotsky is the Senior Coordinator of Faculty Teaching Programs within the College of Engineering at the University of Illinois. He also has college-level academic advising duties with undergraduate students from all departments.

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Yonghee Lee, University of Illinois at Urbana-Champaign  
Jay Mann, University of Illinois at Urbana-Champaign  
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## **Background**

Women have long been underrepresented in engineering education, and while considerable efforts have been made to improve their enrollment and retention as women students in engineering, the experiences and contributions of women faculty remain insufficiently explored. Women faculty play a critical role in shaping teaching practices, mentoring students, and fostering educational innovation. Like many non-tenure track teaching faculty, they face institutional challenges in research-intensive universities where research is valued more than teaching. However, women teaching faculty also navigate gender-specific barriers, including persistent underrepresentation and male-dominated academic cultures, which often lead to limited recognition for teaching contributions. Non-tenure track teaching faculty now outnumber tenure-line faculty in engineering departments [1], particularly in research-intensive university settings. Yet, the roles and experiences of these women teaching faculty remain underexplored from the perspective of teaching faculty.

According to Wenger, communities of practice (CoPs) are groups of people who share a common interest for their practices and develop them through regular collaboration [2]. Faculty communities of practice provide a promising pathway for addressing these systemic issues by creating collaborative spaces where educators can share practices, develop innovative teaching strategies, and reflect on their professional growth. Unlike short-term professional development programs, CoPs foster sustained, peer-driven collaboration that empowers faculty to align their teaching practices with their values, overcome institutional challenges, and contribute to inclusive learning environments. Research highlights the transformative potential of CoPs in fostering long-term change, particularly by focusing on faculty beliefs, values, and institutional cultures rather than short-term interventions [3]. For example, CoPs can help redefine professional identities and foster people to adopt and adapt collaborative teaching practices in traditionally competitive environments [4].

Although our primary theoretical framing focuses on communities of practice, our analysis is also informed by literature on gendered organizational cultures in STEM [5]. This lens helps us interpret how institutional norms, such as undervaluing teaching or emotional labor, influence women faculty's participation in CoPs and their approaches to teaching innovation.

The competitive and individualistic culture of engineering presents additional challenges for women faculty. Although many faculty members bring collaborative and student-centered approaches to their teaching, these values often conflict with dominant norms, resulting in resistance from colleagues and students [6]. The women faculty members in this study exemplify how participation in CoPs can support them to overcome these challenges. Through

their engagement in CoPs, these participants reflected on their teaching practices, aligned them with their values, and explored pathways to foster innovation within their contexts. Their experiences offer insights into how CoPs can support women faculty in negotiating their roles and contributing to systemic change in engineering education.

We investigate the experiences of three women engineering teaching faculty members who participated in CoPs aimed at fostering teaching innovation in a research-intensive university. By using CoPs framework, we examine how these faculty members reflect on and adapt their teaching practices within supportive communities. We also explore how personal, departmental, and institutional factors, if any, affect their participation and career paths. This leads us to examine the following research question: How do women engineering teaching faculty experience and perceive their participation in communities of practice?

## **Methods**

The Faculty Innovation Initiative (FII) is a program that supports innovation in undergraduate engineering education at a large research-intensive Midwestern U.S. university. For over a decade, it has been supported by the College of Engineering and encourages faculty collaboration through communities of practice. Faculty teams work together to design and implement innovative teaching strategies aimed at enhancing student engagement, integrating new technologies, and addressing discipline-specific teaching challenges. FII provides a structured environment for collaboration, experimentation, and dissemination of innovative teaching practices.

This study employed a qualitative case study approach to investigate how three women engineering teaching faculty members with mid-career teaching experience engaged with teaching-focused CoPs within the context of FII. The case study method was chosen to provide a deeper understanding of how they engaged in CoPs to pursue shared interests, professional growth, and connection with peers. This approach enables an in-depth exploration of participants' experiences within their institutional context, offering rich insights into their professional journeys [7], [8].

We purposefully selected three women engineering teaching faculty members for this study. They had 5-10 years of teaching experience. Each participant had participated in FII projects for 4-7 years and demonstrated a commitment to leveraging CoPs to improve teaching practices and address persistent challenges in a research-focused academic culture. Their departmental affiliations and career paths provided diverse perspectives on how CoPs support mid-career faculty innovation and collaboration.

Data were collected through semi-structured interviews, which served as the primary data source, supplemented by artifacts related to participants' involvement in FII. Each participant engaged in a one-hour interview conducted via online video conferencing. The interview protocol focused on their motivations, challenges, and strategies for engaging in CoPs, as well as the impact of these collaborations on their teaching practices and career development. Semi-structured interviews allowed participants to provide detailed accounts of their experiences while ensuring key topics were addressed consistently.

Artifacts such as teaching materials, project proposals, and FII-related documents were collected to contextualize participants' engagement in CoPs. These artifacts offered additional insights into participants' approaches to collaborative teaching and their contributions to FII projects. Collecting multiple data sources aligns with case study methodology, enhancing the credibility and depth of the findings [7].

Narrative analysis was used to reconstruct participants' individual stories, focusing on key themes such as motivations, lived experiences, impacts on teaching and career development, and barriers encountered in their work. The analysis aimed to preserve the sequence and context of each participant's narrative while identifying commonalities and differences across their experiences. Interview transcripts were carefully reviewed and coded inductively to develop themes, which were then refined through iterative comparison. Artifacts were analyzed alongside interview data to triangulate findings and ensure consistency across data sources [8].

To ensure the trustworthiness of the study, data triangulation was employed by integrating multiple data sources, including interviews and artifacts. Reflective memos were maintained throughout the research process to document researcher perspectives and minimize potential biases. The use of this systematic research process, which included examining our own subjectivity, further supported the trustworthiness of the study [9].

## **Mia's Journey: From Hesitation to Advocacy**

### ***Pedagogical Change and Internal Conflict***

Mia vividly recalls her initial exposure to the FII initiative, a moment steeped in skepticism and resistance. As a newly hired lecturer co-teaching with her former advisor, she was confident in her teaching methods. Reflecting on this pivotal moment, Mia shared, *"I knew that class like the back of my hand, and I thought, 'Why are these people coming here asking me to change how I teach? I'm doing fine.'"* This resistance was deeply rooted in her familiarity with traditional methods and a reluctance to disrupt her established routine. She adds, *I didn't think group work was a good thing. I didn't know anything about it and didn't think it would be best for my students."* Her words illustrate the internal conflict many educators face when asked to adapt to unfamiliar pedagogies, balancing professional pride with uncertainty.

The shift in her perspective began when she started working with Jennifer Lane (pseudonym), an expert in collaborative learning. Mia described this partnership as transformative:

I started working with Jennifer, and she's enthusiastic and knowledgeable about collaborative learning. We worked together for almost three years, revamping worksheets and redesigning the course.

This long-term collaboration not only introduced her to new teaching methods but also changed how she viewed herself as an instructor.

Mia's narrative demonstrates how change is often uncomfortable at first. She admitted, *"I was resistant... It wasn't intrinsic in me, this innovative mind. It grew; it really grew."* This honest

reflection shows how initial resistance to pedagogical change is a common experience among instructors engaging in new teaching practices. Her growth was not her individual effort alone but was influenced by mentorship and a supportive community.

One of the most critical impacts of FII on Mia's career was the sense of mentorship and networking it fostered. She speaks about these connections with gratitude, saying, *"FII gave me mentorship opportunities and networking. I met amazing mentors like James Miller (pseudonym), who shaped where I am today."* Beyond personal growth, these relationships became pivotal in shaping her career paths.

In one compelling story, Mia reveals how FII directly influenced her career move into computer science. She said, *"I wouldn't be in this department if it weren't for FII and the connections I made. FII helped me meet Amy, who pushed me to apply for my current position."* Amy's encouragement and belief in Mia's potential illustrate the importance of having champions within academic communities. Mia's story shows how participation in faculty CoPs can lead to new career opportunities.

### ***Navigating Student resistance***

Her current passion for collaborative learning stands in stark contrast to her initial resistance. Mia described her classroom experience with enthusiasm, *"Now I love collaborative learning. It's my caffeine. In the classroom with 200 students, working together and talking, I feel energized. It's hard to believe how much I've grown since 2012."* Her metaphor of caffeine reflects the energy she draws from engaging students through collaborative learning.

Mia openly reflected on the challenges she experienced, both from students and within herself. Early in her career, student resistance tested her resolve. She said, *"At first, students resisted. They'd say, 'We want to work alone.' It was hard, but I had to push through because I believed in it."* This persistence exemplifies the courage required to challenge entrenched norms in education, even when met with opposition.

One particularly challenging experience involved introducing Clickers to her computer science students. She shared:

I used Clickers for peer interactions in the classroom. Students in my previous department loved it, but in electrical engineering, they hated it. They said horrible things in my course evaluation. They'd come to me after class saying, 'Why are you making us buy this stupid device?'

Here, Mia was emotional when her students criticized her teaching practices. As she admitted, *"I wasn't strong enough to ignore students' voices... It hurt me personally."* Her vulnerability in sharing these moments highlights the emotional challenges involved in adopting and advocating for innovative practices.

Mia credits the pandemic as a turning point for making her students accepting her group work. She observed, *"The pandemic forced students into breakout rooms on Zoom. Once we came back*

*in person, group work became normal for them. The resistance disappeared.*” This shift shows how external events and broader environments can reshape perceptions and open opportunities among students and faculty in classroom environments for teaching innovation.

Mia’s reflections also extend to the broader implications of FII and its role in empowering teaching faculty. She emphasized the importance of structural support, saying, *“FII allows me to have one graduate student. All the papers, pretty much everything I’ve done so far, it’s because of FII funds.”* However, she also noted the limitations, particularly for teaching faculty who often lack access to resources like sabbaticals or adequate compensation for additional work. She argued:

If we want those people to actually commit to teach better, to innovate, why would they do it if there’s no incentive? Sometimes money does tell something.

Mia’s stories illustrate how sustained support and mentorship can lead to meaningful pedagogical shifts and professional growth. Her journey from resisting to championing collaborative learning shows the meaningful impact that communities of practice can have on educators. Her candid reflections remind us that growth often requires discomfort, and innovation thrives in supportive, well-resourced environments as well as individual faculty members’ interests, passions, and teaching practices.

### **Jane’s Journey: From Collaboration to Leadership**

Jane’s entry into FII was shaped by collaboration and a shared commitment to improving teaching practices. Reflecting on her initial involvement, she shared:

I joined this team... None of us were on the teaching profession track; we were all lecturers teaching big classes, interacting with a lot of TAs, and thinking about how to support their learning.

This acknowledgment underscores the importance of leveraging collective expertise and addressing practical challenges faced by instructors and teaching assistants.

Her passion for leadership became a cornerstone of her contributions to FII. *“So the idea comes up that I’m passionate about leadership. I’m like, ‘Why don’t we think about tagging that into leadership to make it more attractive to grad students?’”* This innovative approach not only enhanced the appeal of TA training but also highlighted the potential for leadership development to complement technical skills.

Jane’s philosophy of incremental change was evident in her work on her project. She described the project as starting small, *“We weren’t revamping entire courses but adding small things to make them more interesting.”* This approach allowed her team to introduce meaningful enhancements without overwhelming students or faculty. One significant innovation was offering extra-credit modules in the 100-level course.

We hired a PhD student to conduct a survey for students who either completed or

didn't complete the extra things we put in the 100-level course, and we found that offering these extra things as extra credit really helped. Students appreciated it, not just as extra learning, but it reduced their anxiety because now they had a buffer if they messed up some homework, a lab, or something else. This is something they could do to make up for those points.

This quote illustrates how even modest interventions can address both academic and emotional needs. By creating a safe environment, Jane's team not only encouraged participation but also reduced stress, fostering a more supportive learning environment for students. This finding highlights the importance of understanding student perspectives and designing interventions that resonate with their experiences.

While Jane's projects achieved notable successes, she acknowledged the difficulties of sustaining momentum. "*Once the momentum stops, it's hard to pick it up again,*" she observed, reflecting on her project. This insight highlights a common challenge in educational innovation, maintaining long-term engagement and securing resources for continuation.

Jane also emphasized the need for stronger institutional support:

I felt like that would work a lot better for the post-FII phase. Not every team will go through that, but if offered as an opportunity, a lot of successful teams can continue to pursue funding.

Her advocacy for a structured support after FII project aligns with broader discussions about sustaining innovations in her institution.

As a teaching faculty member, Jane approached innovation with pragmatism. "*I cherry-pick the ones that work for me. 'Ahhh, probably I don't need it right now' for some aspects.*" This selective adoption of practices reflects the balancing act educators perform in integrating new strategies while managing their existing responsibilities.

Jane also highlighted how FII contributed to her professional development:

It feeds directly into my research and service. As a result, you are working with multiple people. Especially for mid-career faculty, it's a good way to show leadership.

This observation underscores the dual benefits of FII that enhance teaching practices while providing opportunities for career advancement.

### **Shannon's Journey: From Connection to Community**

Shannon's journey into FII began even before she officially assumed her role, illustrating the program's capacity to foster early connections and collaboration. Reflecting on her introduction to FII, she shared:

It was actually the summer before I started, and it was really great because it introduced me to faculty from Aero and mechanical and then other people who were

just an amazing staff in the College of Engineering.

This early engagement was important for Shannon, as it allowed her to establish a professional network and develop a sense of belonging. She recalled the significance of this experience, “built my community from, you know, before the semester even began.” For Shannon, FII was more than a program; it was a foundation for her academic integration, offering a space where she could form meaningful relationships while contributing to shared goals.

A defining aspect of Shannon’s narrative is her commitment to maintaining FII’s culture of collaboration, even when confronted with institutional pressures. Early in her FII experience, she faced a challenge when her department head suggested using the program to secure funding for promotion purposes:

At the time, my Department Head said, ‘Oh, yeah, you’ll want to make sure you get funding. Use FII for that.’ And I remember thinking, ‘No, that’s not what FII is for.’

Shannon resisted this framing, emphasizing the program’s foundational purpose: “This is really meant to be truly collaborative, not just showing you’re bringing money.” This moment highlights her dedication to preserving FII’s mission of authentic collaboration, even in the face of conflicting institutional expectations. Her story underscores the tension between individual performance metrics and the collective goals of teaching-focused communities of practice.

One of Shannon’s most impactful contributions to FII was her work on a spatial visualization project. The project brought together diverse expertise, offering opportunities for cross-disciplinary collaboration that extended beyond the initial scope:

We had multiple RAs... doing the coding and development of the site, and then another set of students who were doing some of the analysis. The student support was really good.

This project exemplified how FII facilitates the integration of theory and practice. Shannon described how the project’s focus on growth mindset became a cornerstone of her teaching philosophy:

I make sure that I mentioned this explicitly... some people have an innate ability, and some of us work on it, and we get better. It’s something that you can get better at.

Her ability to embed these principles into her classroom underscores FII’s capacity to drive meaningful pedagogical innovation. By leveraging collaboration, Shannon and her team developed resources that continue to benefit students, illustrating the program’s ripple effect on education.

While Shannon celebrated the successes of FII, she also shared her pragmatic approach to navigating its challenges. Reflecting on a project with unclear goals, she explained her decision to step back:



It was weekly meetings that were kind of a seminar... I thought, 'Well, I don't know what we're investigating.'... I had a nice, graceful exit.

Her choice shows Shannon's ability to choose projects that matched her goals and values. Her story illustrates an important lesson for aligning collaborative work with clear goals and individual career paths. Shannon's intentional approach ensured that her contributions were purposeful and aligned with her professional values.

A recurring theme in Shannon's story is the importance of mentorship and support system within FII. She credited her project mentor with playing a crucial role in her early success:

Ross Geller (pseudonym) was a mentor on our project. And that was huge, and I noticed it first semester more than the money. Somebody who could help us answer questions and help connect us... I just haven't seen anything quite like that.

Beyond mentorship, Shannon emphasized the value of FII's structural elements, such as regular check-ins and events that honor excellent instructors. These supports created an environment of accountability and recognition, fostering continued engagement and community-building.

Shannon's reflections extend beyond her personal experiences to include a broader vision for FII's future. She emphasized the importance of maintaining the program's inclusivity:

The moment it becomes, 'Oh, this is for teaching faculty,' we'll lose too many of our faculty to be interested. So, I have a very keen eye to make sure that we really do everything we can to keep it as it started.

She also highlighted the need to amplify FII's visibility within the institution:

I think we could do a better job of showing within the college and within the university what we're doing... I think it's just the jewel.

Her advocacy reflects a commitment to ensuring FII's continued success and alignment with its core values. Shannon's vision underscores the importance of programs that focus on improving teaching as a way to build institutional support and inspire broader participation.

Shannon credited FII with fostering her professional development, particularly through its emphasis on collaboration. She described how the program allowed her to engage in meaningful cross-disciplinary partnerships:

This allowed us to investigate real questions. We are in the classroom in practical ways. We have our theoretical background, but this can be put into practice immediately and should have an impact in our college right away.

Her narrative reveals the dual benefits of FII, advancing teaching practices and providing opportunities for career growth. Shannon's reflections show how communities of practice can

support faculty development and teaching innovation in an institution.

## **Discussion**

This study highlights the unique experiences of three women engineering teaching faculty members, Mia, Jane, and Shannon, as they navigate the complexities of engaging in teaching innovation through participation in faculty communities of practice (CoPs). Their stories show how CoPs can support meaningful teaching, while revealing systemic challenges and institutional contexts that influence faculty engagement in educational change.

Mia, Jane, and Shannon's stories collectively demonstrate how CoPs enable instructors to overcome resistance to change, foster innovation, and build a sense of ownership over their work. Mia's journey through her linear algebra project, which she affectionately termed her "baby," reveals how collaboration across different disciplines and iterative design can drive sustainable change. Similarly, Jane's success with her project demonstrates the value of empathy and practicality in designing incremental innovation that address student needs. Shannon's spatial visualization project highlights the power of cross-disciplinary collaboration to connect theory with practices that improve student learning.

These examples suggest that CoPs can offer a solid foundation for educators to experiment, iterate, and innovate in ways that align with their passions and strengths. By fostering agency and providing structural support, CoPs can empower educators to take risks and develop new teaching practices that sustain impact. Existing literature supports this finding, emphasizing how CoPs support sustainable instructional change by encouraging collaboration and shared vision among faculty [10], [11].

The narratives of all three participants emphasize the critical role of mentorship, networking, and peer support in driving innovation. Mia's gratitude toward her mentors and her commitment to mentoring others highlight the relational cycle of support and growth within CoPs. Jane's leadership, both as a teaching strategy and a personal value, underscores the importance of aligning innovations with educators' identities. Shannon's reflections on the Educational Innovation Facilitator's role illustrate how dedicated mentorship and regular check-ins create an environment of accountability and recognition.

These relational dynamics suggest that building meaningful connections within CoPs is as important as providing resources or mentorship. Institutions seeking to replicate the success of teaching-focused initiatives must invest in the development of robust support systems that foster collaboration and mentorship.

Despite the benefits of CoPs, the participants' experiences reveal systemic challenges that must be addressed to sustain their impact. Mia's perseverance in the face of student resistance highlights the importance of contextual factors, such as timing and societal shifts, in shaping the adoption of new practices. Jane's call for stronger post-CoP support and structured funding pathways points to a broader need for support systems for faculty's long-term success. Shannon's resistance to reframing the CoP as a funding mechanism underscores the tension between institutional priorities and the culture of teaching innovation programs.

Further, the participants' experiences of mentorship and community-building reflect the findings of studies that emphasize the intersection of mentorship and inclusivity in faculty development [5]. This intersection highlights the need for institutional policies and practices that balance the demands of research-intensive environments with teaching-focused programs, reducing resistance to pedagogical innovations while fostering sustained engagement. Recent research suggests that faculty communities can play an important role in bridging these gaps by integrating mentorship, collaboration, and innovation [12].

Although the participants did not explicitly raise concerns about gender differences in faculty workloads in a research-intensive university, such disparities are widely documented in the literature on non-tenure track women faculty. A critical qualitative study of women in non-tenure-track roles at regional public universities found that these faculty members often take on additional work, manage the emotional demands of "mothering" in the classroom, and face institutional norms that reinforce gendered expectations regarding faculty labor and physical presence. The absence of these themes in participants' narratives may reflect how such inequities are normalized or possibly how they are reduced through the support of communities of practice (CoPs). However, it is important to consider how gendered expectations around teaching and mentoring continue to shape faculty experiences in research-intensive environments. Recognizing these dynamics helps us better understand the institutional context where teaching faculty work and highlights the importance of CoPs in creating spaces that may reduce persistent challenges.

These challenges raise important questions for future research: How can institutions balance the demands of research-intensive environments with the needs of teaching-focused programs? What policies or practices can reduce resistance to pedagogical innovations and foster sustained engagement?

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