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[NSF RIEF] Faculty Agency for Socially Responsible Engineering Education Through a Professional Society–Situated Community of Practice

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[NSF RIEF] Faculty Agency for Socially Responsible Engineering Education Through a Professional Society–Situated Community of Practice

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Abstract

This poster presents findings from an NSF-funded Research Initiation in Engineering Formation (RIEF) project examining how a professional society–situated Community of Practice (CoP) supported chemical engineering faculty integrating ethics, equity, and social responsibility into their teaching. Drawing on Ecological Systems Theory (EST) and a Transformational Agency perspective, the study explores how two faculty members from diverse institutional settings navigated pedagogical tensions within their academic environments. The poster focuses on how the CoP functioned as relational infrastructure supporting faculty sensemaking, reducing isolation, and enabling context-responsive instructional change. Implications are discussed for NSF-supported faculty development initiatives and professional society–based learning environments.

1. Introduction & Project Motivation

Engineering education has increasingly emphasized the need to prepare students not only with technical competence, but also with social responsibility and the ability to engage with complex societal challenges. National reports and professional organizations have called for integrating social responsibility into core engineering curricula, rather than treating these considerations as peripheral or elective content [1], [2], [3], [4]. As a result, many engineering faculty are encouraged to adopt pedagogical approaches that foreground real-world contexts, social impact, and professional responsibility alongside disciplinary knowledge.

Despite these calls, sustained pedagogical change remains difficult to achieve in practice. Prior research has documented that faculty development efforts often emphasize individual skill acquisition or short-term instructional innovation, with less attention to the relational, organizational, and professional conditions that influence whether change efforts persist over time [5], [6], [7]. Faculty may express strong commitments to socially responsible teaching yet encounter misalignment with institutional reward structures, curricular constraints, workload pressures, or limited peer support. These challenges are particularly pronounced when pedagogical change involves risk-taking that is not clearly recognized or rewarded within local academic environments.

Communities of Practice (CoPs) have been proposed as a promising approach for supporting faculty learning through sustained interaction, shared meaning-making, and collective problem-solving [8], [9], [10]. When situated within professional societies, CoPs may also provide cross-institutional connections that expose faculty to broader norms of practice and alternative models of teaching and professional engagement. However, empirical work remains limited on how such communities support faculty agency in context, rather than assuming their effectiveness based on participation alone [11], [12].

This NSF-funded RIEF project was designed to explore how participation in a professional society–situated CoP supports faculty agency for socially responsible engineering education. Rather than focusing solely on instructional outcomes, the project examined how faculty interpret their environments, negotiate professional commitments, and decide when and how to

pursue pedagogical change over time. By centering faculty narratives within a structured CoP, this work contributes empirical insight into the relational conditions that enable or constrain sustained engagement in socially responsible teaching.

2. Project Overview & Theoretical Orientation

2.1 Project Design. This NSF RIEF project was designed as an exploratory qualitative investigation of faculty professional development within a structured Community of Practice (CoP). The CoP was formed through the American Institute of Chemical Engineers [13] and brought together chemical engineering faculty who shared an interest in integrating social responsibility into their teaching. Participation was voluntary and driven by faculty members' pedagogical commitments rather than by institutional mandates. The virtual CoP spanned eight months and included regularly scheduled synchronous sessions, guided discussions, and shared reflective activities. Sessions were designed to support dialogue around teaching challenges, curricular experimentation, and professional identity, while allowing flexibility for participants to surface concerns specific to their institutional contexts. Rather than functioning as a training program or curriculum delivery mechanism, the CoP emphasized peer interaction, reflection, and collaborative sensemaking around socially responsible engineering education [11]. Participants represented diverse institutional environments, including research-intensive and teaching-focused institutions, enabling cross-institutional exchange of perspectives and experiences. The CoP was intentionally designed to create relational space for faculty to discuss pedagogical risk-taking, negotiate tensions between disciplinary norms and social responsibility, and learn from peers navigating similar challenges in different organizational settings. This design supported examination of how professional society–connected communities may facilitate faculty engagement in pedagogical change beyond local institutional boundaries.

2.2 Conceptual Framing. The project was guided by a Transformational Agency perspective, which frames faculty agency as the capacity to reflect on professional commitments, take intentional pedagogical action, and persist in change efforts over time, particularly under conditions of uncertainty or constraint [14]. In this study, agency was understood as a process that unfolds through faculty sensemaking and engagement with their professional environments, rather than as a fixed individual trait. The study was also informed by Ecological Systems Theory (EST), which conceptualizes human development and professional action as shaped by interacting layers of individual, relational, and institutional contexts [15]. EST sensitized the analysis to how faculty experiences within the CoP intersected with broader professional and organizational environments, without serving as a formal analytic framework or assessment model. These perspectives supported a focus on documenting how faculty navigated professional learning over time and how relational and contextual conditions influenced their capacity to pursue socially responsible pedagogical change. Consistent with the exploratory goals of an NSF RIEF project, the emphasis remained on understanding processes and experiences rather than testing theoretical propositions.

3. Methods

This project employed a qualitative research design to examine how faculty experiences and sensemaking evolved over time through participation in a professional society–situated CoP. A qualitative approach was appropriate given the project's focus on understanding faculty perspectives, interpretations, and decision-making related to pedagogical change within complex academic environments [16], [17].

Participants included two chemical engineering faculty members from research-intensive and teaching-focused institutions, respectively. Both held contingent, non-tenure-track teaching-focused appointments and ranged from five to twelve years of teaching experience. All participants were voluntary members of the professional society–connected CoP and engaged across the full eight-month virtual series. Rather than seeking statistical generalization, this qualitative study explores the phenomenon of transformational agency in depth, generating conceptual insights that may inform understanding of faculty development within comparable disciplinary and institutional contexts.

3.1 Data Sources. Multiple qualitative data sources were collected to support a contextualized account of faculty engagement in the CoP. Primary data consisted of three sequential semi-structured interviews of approximately 90 minutes each, conducted with each participating faculty member near the beginning, midpoint, and conclusion of the CoP. Interviews elicited reflections on teaching practices, professional identity, experiences within the CoP, and perceptions of how institutional and professional contexts influenced pedagogical decision-making over time. Additional data sources included reflective artifacts generated during CoP activities, such as written reflections and shared discussion materials, and session observations documented through facilitator field notes. These materials captured group interactions, emergent topics, and moments of collective sensemaking that complemented individual interview narratives. Together, these data sources supported exploration of the phenomenon across individual, relational, and contextual dimensions of faculty experience [18].

3.2 Data Analysis. Data analysis followed a reflexive, interpretive qualitative approach focused on identifying patterns in how faculty described their experiences, interpretations, and actions across time and context [18], [19], [20]. Interview transcripts and supporting artifacts were examined iteratively to surface recurring themes related to sensemaking, professional learning, and engagement with pedagogical change. Rather than applying a predetermined coding scheme or testing theoretical propositions, the analysis emphasized participants' perspectives and how meanings and commitments developed through interaction within the CoP and participants' broader academic environments. Consistent with the exploratory goals of an NSF RIEF project, analytic attention centered on understanding processes and conditions shaping faculty engagement rather than producing generalizable claims or evaluative judgments about program effectiveness.

4. Key Findings: The Role of the CoP as Relational Infrastructure

Across participants' narratives, a consistent finding was that the CoP served as a relational infrastructure supporting faculty agency. Rather than operating as a site of content transmission or prescriptive training, the CoP created sustained relational conditions that enabled faculty to interpret their professional environments, legitimate pedagogical concerns, and pursue instructional change despite institutional constraints. The findings highlight three interrelated ways in which this relational infrastructure supported faculty agency.

4.1 Sensemaking and Validation. Faculty participants described persistent tensions between dominant disciplinary norms (e.g., content coverage, technical rigor, and efficiency) and their commitments to integrating social responsibility into engineering instruction. The CoP provided a structured space for faculty to articulate these tensions and examine how their values aligned or conflicted with expectations within their departments and institutions. Through collective dialogue, challenges that were often experienced privately or framed locally as individual issues became shared professional concerns. Engagement with peers from other institutions enabled faculty to situate their experiences within broader disciplinary conversations, reframing uncertainty and

hesitation as common features of socially responsible teaching rather than personal shortcomings. This collective sensemaking process validated participants' pedagogical commitments and affirmed the professional legitimacy of integrating social responsibility into technical curricula. By developing shared language and mutual recognition, the CoP supported continued engagement rather than withdrawal from pedagogical change efforts.

4.2 Relational Support for Experimentation. Beyond sensemaking, the CoP provided relational support that reduced isolation and encouraged pedagogical experimentation. Regular interaction with peers who shared similar commitments fostered trust and accountability, making it easier for faculty to consider instructional changes that involved uncertainty or perceived risk. In contrast to local environments where innovation was often constrained by workload, reward structures, or curricular rigidity, the CoP functioned as a low-stakes space for exploring ideas and receiving feedback. Peer dialogue normalized experimentation and reframed unsuccessful attempts as part of an iterative learning process. This relational support was particularly important for faculty working in contexts where socially responsible teaching was not explicitly rewarded. The CoP thus operated as an external source of encouragement and legitimacy, enabling faculty to persist in change efforts even when local reinforcement was limited.

4.3 From Reflection to Enactment. Participation in the CoP supported faculty in translating reflective dialogue into enacted pedagogical and professional practices directly related to ethics, equity, and social responsibility in engineering. Participants described incorporating real-world and socially relevant contexts into chemical engineering course content, adjusting assignments to foreground the societal dimensions of engineering problems, and creating explicit opportunities for students to engage with questions of professional responsibility and impact. For example, faculty described introducing case studies involving environmental justice, supply chain ethics, and community impact into technically dense courses where such content had previously been absent or treated as peripheral. Others noted changes in how they approached mentoring conversations with students around professional identity and ethical responsibility, as well as how they engaged in departmental discussions about curriculum and accreditation-related outcomes such as ABET student outcomes related to professional and ethical responsibility.

These enactments were not uniform or linear. Instead, faculty emphasized that the CoP helped them identify feasible entry points for integrating ethics, equity, and social responsibility within their specific institutional and curricular constraints. Exposure to peers navigating different organizational environments expanded participants' understanding of how socially responsible pedagogy could take multiple forms, supporting adaptation rather than replication of practices. These findings suggest that the primary contribution of the CoP was not the production of specific instructional techniques but the creation of relational conditions that supported faculty agency, helping faculty move from reflective intention to enacted practice in ways directly responsive to their professional contexts and disciplinary responsibilities.

5. Implications for Faculty Development & NSF Projects

In engineering specifically, faculty operate within tightly sequenced curricula, accreditation-driven learning outcomes (e.g., ABET), and disciplinary norms that prioritize technical rigor and content coverage. Participants described how these structural features shaped both their hesitations and strategies when integrating ethics, equity, and social responsibility into core chemical engineering courses. The professional society–situated CoP functioned not as a generic development space, but as a discipline-attuned environment where engineering faculty could

collectively negotiate what socially responsive engineering looks like within technically dense curricula.

Findings from this NSF RIEF project point to several practical implications for the design of faculty development initiatives in engineering education, particularly those supported through NSF funding. Rather than treating professional development as short-term training or content delivery, the results underscore the importance of designing environments that support sustained faculty engagement with socially responsible pedagogy. Key implications include:

- **Prioritize relational spaces in faculty development**. Structured opportunities for dialogue, reflection, and peer validation supported collective sensemaking and helped faculty persist in pedagogical change, particularly when local institutional norms were misaligned with their values.
- **Design for cross-institutional engagement.** Bringing together faculty from diverse institutional contexts enabled participants to share strategies for navigating workload, reward structures, and curricular constraints. Cross-institutional interaction supported adaptation of practices rather than replication.
- **Leverage professional societies as enabling contexts.** Situating the Community of Practice within a professional society provided access to broader disciplinary networks, shared norms, and professional legitimacy. For NSF-funded projects, professional societies can complement institutional efforts and support continuity across organizational boundaries.
- **Support sustained engagement rather than one-time interventions.** Ongoing interaction and shared meaning-making over time were more supportive of faculty agency than isolated workshops or short-term instructional initiatives.

These implications offer guidance for NSF-supported faculty development projects seeking to create professional learning environments that are responsive to the contexts in which engineering faculty work.

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