

Stories of Influence: Understanding How Social and Experiential Factors Shape Engineering Faculty's Innovation-Oriented Teaching Beliefs

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Abstract

Engineering educators are increasingly expected to foster innovation-oriented habits of mind such as persistence, initiative, and comfort with uncertainty. While prior research has emphasized student outcomes and faculty attitudes toward innovation and entrepreneurial mindset, far less is known about how faculty develop the self-efficacy required to model these practices in the classroom. Guided by Social Cognitive Theory, this qualitative exploratory study examines how social and experiential influences shape engineering faculty members' confidence to enact innovation-oriented teaching. Narrative interviews were conducted with four engineering faculty members from diverse disciplinary and cultural contexts. Narrative analysis enabled an in-depth examination of faculty meaning-making despite the small sample size. Using thematic analysis, we examined how faculty made sense of formative experiences across their personal and professional lives. Three themes emerged: (1) early socializers—including family members and mentors—shaped foundational beliefs about agency, persistence, and problem solving; (2) professional validation from advisors, colleagues, and students reinforced or recalibrated faculty confidence to experiment with innovative teaching practices; and (3) narrative reflection enabled faculty to interpret social feedback, normalize challenges, and consolidate self-efficacy over time. Findings suggest that faculty self-efficacy for innovation is socially constructed and continually negotiated, rather than a static individual attribute. This study extends engineering education research by foregrounding the role of socializer influence and storytelling in faculty belief formation. Implications highlight the potential of story-centered faculty development approaches to strengthen confidence and sustain innovation-oriented teaching in engineering education.

Introduction and Background

To date, most research on innovation and EM in engineering education has focused on students, examining how instructional strategies, curricular designs, and experiential learning opportunities influence students' attitudes, intentions, and learning outcomes [1]–[3]. This body of work has generated valuable insights into how innovation-oriented thinking can be fostered among engineering students. However, it often implicitly assumes that faculty are already prepared and confident to model and teach these ways of thinking.

To examine how engineering faculty develop confidence and beliefs related to innovation-oriented teaching, this study draws on Social Cognitive Theory (SCT); [5]. SCT emphasizes that professional beliefs and behaviors are shaped through an interplay

of personal experiences, social influences, and contextual factors, with self-efficacy playing a central role. From this perspective, faculty confidence in modeling innovation is not solely an individual attribute but emerges through mastery experiences, vicarious learning from peers and mentors, and social persuasion within institutional and disciplinary contexts.

Far less attention has been paid to engineering faculty, despite their central role in shaping classroom environments, instructional practices, and students' professional identity development. To this end, the Kern Entrepreneurial Engineering Network (KEEN) developed a conceptual framework that characterizes the entrepreneurial mindset and provides extensive resources to help faculty cultivate learning environments that support its development in undergraduate engineering students. However, while prior work has documented frameworks and institutional strategies for promoting an entrepreneurial mindset, less is known about how faculty themselves come to interpret, internalize, and develop confidence to enact these principles in their teaching practice [4]. Faculty beliefs about innovation influence how they interpret, enact, and sustain innovation-oriented teaching practices. Faculty beliefs evolve and are shaped by diverse personal and professional experiences, including upbringing, educational pathways, industry experience, mentoring relationships, and institutional contexts [5]. Prior work on professional identity development in higher education emphasizes that beliefs, agency, and confidence emerge through sustained social participation and reflective meaning-making rather than discrete professional development events [15]. These experiences may affect how faculty define innovation-related concepts and how confident they feel in modeling them in the classroom.

This study addresses this gap by examining how social and experiential factors shape engineering faculty members' beliefs about innovation-oriented teaching. Using narrative analysis informed by Social Cognitive Theory, the study seeks to better understand how faculty beliefs about innovation are formed, how they evolve over time, and how social influences contribute to faculty members' confidence in modeling innovation-oriented practices.

Literature Review

A. Student-Focused Research on Innovation and Entrepreneurial Mindset

A substantial body of engineering education research has examined how students develop innovation-oriented thinking and entrepreneurial attributes. Prior studies have investigated project-based learning, design thinking, interdisciplinary coursework, and experiential learning as mechanisms for fostering curiosity, creativity, and value creation [1], [8]. Within the KEEN network, research has operationalized EM through frameworks

emphasizing curiosity, connections, and creating value, and has explored how these elements influence student learning and engagement [6], [9].

While this work has strengthened the understanding of student learning outcomes, it has largely treated faculty as implementers of innovation-focused pedagogy rather than as learners whose beliefs and experiences shape instructional enactment. As a result, the processes through which faculty develop beliefs about innovation remain largely underexplored.

B. Faculty Perspectives on Innovation and EM

A smaller but growing body of research has begun to examine faculty perspectives related to innovation and entrepreneurial mindset. Prior work has explored faculty engagement with entrepreneurial mindset initiatives and professional development [4], documented variability in how faculty interpret the value of entrepreneurship in engineering education [4], and identified differences between faculty and student conceptions of entrepreneurial mindset [6, 7]. These studies suggest that although many faculty recognize the importance of innovation-oriented thinking, they vary widely in how they interpret EM and in their confidence to teach or model it.

Prior work on instructional change in STEM shows that dissemination-focused and top-down strategies often fail to produce sustained pedagogical change, particularly when faculty beliefs and professional identities are not addressed [17].

C. Narrative Approaches and Faculty Belief Formation

Narrative inquiry has been used in engineering education research to examine identity development, professional transitions, and meaning-making [8]. Narrative approaches allow researchers to trace how individuals construct coherence across life experiences and how beliefs evolve through interaction with social and institutional contexts. [11]'s work on engineering faculty teaching journeys demonstrates how faculty narratives can reveal shifts in beliefs and teaching practices over time [11].

Despite the promise of narrative approaches, they have rarely been applied to study how engineering faculty's beliefs about innovation and EM are socially constructed. Moreover, storytelling has seldom been positioned not only as a research method but also as a potential tool for faculty development—one that can support reflection, confidence building, and self-efficacy.

D. Gap and Contribution of the Current Study

Taken together, the literature reveals three key gaps:

- A strong emphasis on student outcomes with limited attention to faculty belief formation.
- Insufficient examination of the social and experiential influences shaping faculty innovation-related beliefs; and
- Limited use of narrative approaches to examine and support faculty development related to innovation.

This study addresses these gaps by examining engineering faculty narratives to understand how social influences and lived experiences shape innovation-oriented teaching beliefs. The findings are expected to inform future faculty development interventions that leverage storytelling and story listening to strengthen faculty confidence and self-efficacy in modeling innovation in engineering classrooms.

Theoretical Framework

This study is grounded in Social Cognitive Theory (SCT) and narrative inquiry as complementary theoretical lenses for understanding how engineering faculty develop, interpret, and enact beliefs related to innovation-oriented teaching. Together, these frameworks allow for an examination of both the social processes through which beliefs are formed and the narrative sensemaking through which faculty articulate and internalize those beliefs over time.

Social Cognitive Theory posits that learning and belief formation occur through a dynamic interaction among personal factors, social influences, and environmental contexts [5]. Central to SCT is the concept of reciprocal determinism, which suggests that individuals both shape and are shaped by their social environments. From this perspective, faculty beliefs about innovation, creativity, and value creation are not developed in isolation but emerge through repeated interactions with influential others such as family members, mentors, colleagues, supervisors, and professional communities. Observational learning, modeling, feedback, and social reinforcement play critical roles in shaping how individuals come to view their own capabilities and professional roles.

A key construct within SCT, particularly relevant to this study, is self-efficacy, defined as individuals' beliefs in their ability to organize and execute actions required to achieve desired outcomes [5]. Faculty self-efficacy related to innovation-oriented teaching influences whether they feel confident modeling curiosity, initiative, persistence, and creative problem-solving in their classrooms. SCT suggests that self-efficacy develops through mastery experiences, vicarious experiences, social persuasion, and interpretation of affective states. In the context of engineering faculty, these sources of efficacy may include prior industry work, mentoring relationships, peer observation, student feedback, and institutional recognition. This study uses SCT to examine how such experiences—

both positive and negative—contribute to faculty confidence or hesitation in enacting innovation-oriented teaching practices.

While SCT provides a robust explanation of how beliefs are socially learned and internalized, narrative inquiry offers a complementary lens for understanding how individuals make meaning of those learning experiences. Narrative inquiry emphasizes that people construct understanding of their lives and professional identities through stories that link past experiences, present actions, and future aspirations [13]. Stories serve as a mechanism through which individuals organize experience, assign significance to events, and construct coherent identities. For faculty, narratives about upbringing, education, professional transitions, successes, failures, and influential relationships reveal how beliefs about innovation are constructed and sustained over time.

In engineering education research, narrative approaches have been used to explore faculty teaching identities, career transitions, and professional growth, demonstrating how storytelling can surface implicit beliefs and values that may not readily emerge through more structured approaches [11]. In this study, faculty stories are not treated merely as accounts of past events but as active meaning-making processes through which participants articulate how social influences have shaped their beliefs and sense of professional agency. Narrative inquiry thus enables the examination of how faculty interpret social experiences and integrate them into their teaching identities.

The integration of SCT and narrative inquiry allows this study to examine both the mechanisms and meanings of belief formation. SCT informs the identification of key social influences and learning processes—such as modeling, reinforcement, and efficacy development—while narrative inquiry provides insight into how faculty construct and communicate those experiences as stories of influence. By listening to faculty narratives through an SCT-informed lens, the study captures how social interactions are remembered, interpreted, and carried forward into classroom practice. Consistent with a communities-of-practice perspective, faculty confidence and teaching identity develop through participation in professional communities where meaning, legitimacy, and competence are socially negotiated [16].

This integrated framework is particularly well-suited to the study's focus on storytelling and story listening as both research methods and potential developmental tools. From an SCT perspective, hearing others' stories can serve as vicarious experiences that strengthen self-efficacy, while telling one's own story can help reframe past experiences as sources of competence and growth. From a narrative perspective, engaging with stories allows faculty to recognize patterns in their own belief formation and to situate themselves within broader professional communities. Together, these frameworks support the study's dual aims: understanding how faculty beliefs about innovation are

socially and experientially formed, and generating insights to inform future faculty development interventions grounded in storytelling.

Methodology

This study employs a qualitative research design grounded in narrative inquiry to examine how social and experiential factors shape engineering faculty members' beliefs about innovation-oriented teaching. A qualitative approach is appropriate given the study's focus on lived experience, meaning-making, and belief formation, which are best captured through rich, in-depth narratives rather than standardized measures. Narrative inquiry allows for the exploration of how participants construct and interpret their professional journeys and how influential people and experiences are woven into those stories over time.

Research Design

The study uses semi-structured, narrative-based interviews to elicit faculty stories related to the development and evolution of their innovation-oriented teaching beliefs. Narrative inquiry was selected to examine belief formation and meaning-making across lived experiences, consistent with established qualitative research design principles [19]. The interview protocol is informed by Social Cognitive Theory, with particular attention to social modeling, observational learning, and self-efficacy development. Following demographic questions to collect self-reported data, open-ended questions invited participants to reflect on formative experiences, influential relationships, and moments that shaped their confidence or hesitation in modeling innovation-related habits of mind in their teaching. Follow-up prompts encouraged elaboration and clarified meanings without directing participants toward predetermined interpretations.

Participants and Recruitment

Participants include engineering faculty members across ranks and career stages at a large southeastern research university in the United States. Faculty are eligible to participate regardless of prior involvement in entrepreneurship or innovation initiatives, thereby allowing a range of perspectives. Participants are recruited through email invitations distributed via departmental listservs. The recruitment message emphasizes voluntary participation and the study's focus on faculty experiences and perspectives rather than evaluation of teaching performance.

Participant Profiles (N=4)

Table 1: Participant Narrative Profiles*

Participant	Ethnicity/Gender	Status	Experience in Years
Faculty 1	White (Turkish)/Male	1st Gen Immigrant	12
Faculty 2	White (Caucasian)/Male	US-Born	11
Faculty 3	Hispanic/Latina/Female	1st Gen Immigrant	15
Faculty 4	Asian (Chinese)/Female	1st Gen Immigrant	5-6

*Note. Participants were full-time engineering faculty members at a large public southeastern university. All participants had experience teaching undergraduate engineering students and integrating innovation-oriented practices into their teaching. Demographic information was self-reported.

Data Collection

Data are collected through individual semi-structured interviews lasting approximately 90 minutes. Interviews are conducted via Zoom to accommodate participants' schedules and to enable participation across departments. At the beginning of each interview, participants provide verbal consent to be recorded. Demographic information, including race, ethnicity, sex, first-generation immigrant status, and years of teaching experience, is collected to provide contextual background for interpreting narratives.

Interviews begin with broad, open-ended questions inviting participants to share their professional journey into engineering education. Subsequent questions explore influential socializers such as family members, teachers, mentors, colleagues, and professional communities, as well as critical incidents related to teaching, industry experience, or institutional contexts. Participants are also invited to reflect on how their beliefs about innovation-oriented teaching have changed—or remained stable—over time, and on how confident they feel about modeling these practices in the classroom. Throughout the interview, participants are encouraged to share stories rather than brief responses, allowing for rich narrative data.

Data Analysis

Interviews are transcribed verbatim and analyzed using thematic narrative analysis. Analysis proceeds in multiple iterative phases. First, transcripts are read holistically to preserve narrative coherence and identify overarching storylines. Second, narrative segments are coded for key elements aligned with Social Cognitive Theory, including

social influences, observational learning experiences, sources of self-efficacy, and contextual factors that supported or constrained belief development. Third, cross-case analysis is conducted to identify patterns and variations in how faculty describe the formation and evolution of their innovation-oriented teaching beliefs.

Throughout the analysis, attention is paid not only to what participants describe but also to how they tell their stories, including the sequencing of events, the emphasis placed on particular influences, and moments of reflection or reinterpretation. Artificial intelligence tools were used as analytic support rather than as primary decision-makers in the coding process. After initial open coding conducted by the researcher, AI tools were used to assist with organizing coded segments, identifying potential thematic groupings, and suggesting relevant literature for contextualization. All coding decisions, theme development, and interpretive judgments remained under the direct control of the researcher. This approach allowed AI to function similarly to a research assistant supporting pattern identification and text organization while preserving researcher oversight and interpretive rigor.

Given the exploratory and narrative nature of the study, the small sample size was appropriate for enabling an in-depth examination of participants' lived experiences and belief-formation processes. Qualitative narrative inquiry prioritizes depth of meaning over breadth of coverage, allowing researchers to trace how individuals construct coherence across life events and social influences. Prior methodological research suggests that small samples in qualitative studies can yield rich analytic insight when the focus is on meaning-making and thematic depth rather than statistical generalization [19], [21]. The goal of the present study was therefore not representativeness but analytic insight into how social influences shape faculty members' self-efficacy for innovation-oriented teaching.

Trustworthiness and Ethical Considerations

Several strategies are employed to enhance trustworthiness, including prolonged engagement with the data, careful attention to narrative context, and transparent documentation of analytic processes. Participant confidentiality is maintained by removing identifying information from transcripts and using pseudonyms in reporting. All study procedures are reviewed and approved by the institution's Institutional Review Board. Participation is voluntary, and participants may withdraw from the study at any time without penalty.

Findings

Analysis of the four faculty narratives revealed three interrelated themes that explain how social and experiential influences shape engineering faculty members' confidence and self-efficacy in modeling innovation-oriented habits of mind. Across participants, self-

efficacy emerged not as an individual trait, but as a belief system developed and reinforced through social interaction and narrative sensemaking over time.

Theme 1: Early Socializers as Foundations of Innovation-Related Self-Efficacy

Faculty consistently traced their confidence in problem-solving, initiative-taking, and persistence to early socializers, such as family members and formative mentors. These experiences established durable beliefs about agency and capability that later supported professional confidence.

Faculty 4 described teaching her grandmother to read and write during childhood as a formative mastery experience that shaped her belief in her ability to make a difference through teaching:

“Every day after my primary school, I just go back home, and I taught her what I learned from school... I feel like that gave me a lot of sense of achievement.”

Similarly, Faculty 2 reflected on his father’s approach to problem solving, emphasizing persistence and self-directed learning rather than avoidance:

“He wouldn’t let not knowing something slow him down or stop him from achieving it.”

Faculty 1 and Faculty 3 shared parallel narratives in which early encouragement, hands-on problem solving, and family expectations normalized experimentation and effort. Despite differences in background and career trajectory, these accounts converged in illustrating how early socializers shaped beliefs about which challenges were worth engaging and one’s confidence in engaging them.

Theme 2: Professional Validation from Mentors, Leaders, and Students as Catalysts for Confidence

While early experiences laid the foundation, professional validation was critical to strengthening faculty confidence in academic settings. Mentors, supervisors, colleagues, and students functioned as powerful socializers through encouragement, trust, and recognition.

Faculty 2 described how supervisors who combined autonomy with guidance reinforced his confidence:

“He gave me the tools and the support and guidance that I needed... he knew that my personality could manage to successfully progress through that situation.”

For Faculty 4, her PhD advisor's validation—particularly amid linguistic and cultural challenges—helped reframe perceived limitations as manageable rather than deficit-based:

“She gave me a lot of courage to pursue my academic career... she focused more on whether I was passionate about the research and teaching.”

Across participants, **students also emerged as influential sources of efficacy**. Faculty described student engagement, questions, and requests for mentorship as shaping how they interpreted their own instructional effectiveness. Faculty 2 recalled a moment when student recognition and request to be mentored prompted an explicit shift in self-perception:

“When a student asks you to do that, then I have to see it in myself.”

Faculty 1 described using students' questions as a way to gauge both students' understanding and instructional effectiveness:

“I still ask... to see, you know, the students' understanding through their questions.”

Faculty 3 emphasized responsiveness to students as evidence of competence rather than failure:

“I cannot keep teaching the class the same way, because it won't work for the students.”

Across cases, students influenced faculty confidence not through formal evaluation, but through everyday interactions that affirmed capability, legitimacy, and effectiveness.

Theme 3: Narrative Reflection and Storytelling as Mechanisms for Consolidating Self-Efficacy

Narrative reflection and storytelling helped faculty consolidate social experiences into coherent beliefs about their capability to model innovation-oriented habits of mind. Participants described gaining clarity and confidence through narrating experiences and listening to others' stories.

Faculty 4 reflected that teaching multiple sections helped her gain confidence by recognizing patterns in her development:

“I feel more confident and more clear about my career paths.”

Faculty 2 similarly noted that recounting experiences helped him recognize how early and professional socializers shaped his confidence:

“Those initial leaders really instill how you view that work environment moving forward.”

Faculty 1 and Faculty 3 described comparable sensemaking processes, reframing challenges as part of professional growth rather than evidence of inadequacy. Across cases, storytelling functioned as a mechanism for integrating social influence and sustaining confidence over time.

Summary of Findings

Faculty self-efficacy regarding innovation-oriented teaching emerged as a socially constructed, narratively reinforced belief. Early socializers established foundational confidence, professional validation—including from students—who strengthened and legitimized that confidence, and narrative reflection consolidated experiences into enduring self-beliefs. Together, these findings highlight the central role of social influence in shaping faculty confidence to model innovation in engineering classrooms.

Discussion

This study examined how engineering faculty develop confidence to model innovation-oriented habits of mind through social and experiential influences across their life and career trajectories. While confidence was the dominant trajectory, some faculty described early hesitation—often rooted in uncertainty about expectations or institutional norms—that diminished through subsequent social validation. Consistent with Social Cognitive Theory, faculty self-efficacy emerged as a dynamic belief system shaped by modeling, social persuasion, and the interpretation of experience rather than a fixed individual trait [5], [12].

Early socializers played a foundational role by establishing beliefs about agency, persistence, and the value of effort [13], [15]. These early mastery and modeling experiences continued to support faculty as they navigated uncertainty and risk in academic contexts. This finding extends faculty-focused innovation and entrepreneurial mindset literature by showing not only *what* beliefs faculty hold, but *how* those beliefs are formed over time.

Professional validation further strengthened faculty confidence, particularly when mentors and leaders expressed trust, provided autonomy, and recognized capability. Importantly, the findings also foreground students as **active socializers of faculty self-efficacy**. Student engagement, questions, and recognition served as forms of social persuasion and vicarious experience, prompting faculty to affirm or recalibrate their beliefs about their own effectiveness [5]. These reciprocal dynamics complicate unidirectional models of faculty development and suggest that faculty confidence is co-constructed through ongoing interaction with students [17].

Narrative reflection enabled faculty to consolidate these social experiences into a coherent professional self-belief. Storytelling helped faculty reframe challenges as expected components of growth and normalize uncertainty through shared experience [8], [11]. Integrating SCT with narrative inquiry thus provides insight not only into how efficacy develops but also into how it becomes durable.

Implications and Future Work

Implications for Faculty Development Practice

The findings suggest that faculty development initiatives should move beyond skill-based workshops to address the social and narrative dimensions of self-efficacy. Rather than treating confidence as an individual attribute to be cultivated through training alone, effective faculty development may benefit from engaging the relational and experiential contexts in which confidence is formed. In particular, faculty development efforts could:

- Recognize students as contributors to faculty confidence, not solely as recipients of instruction.
- Create structured opportunities for faculty reflection on moments when student engagement, feedback, or trust influenced their teaching beliefs.
- Leverage storytelling and story listening as mechanisms for social persuasion and vicarious learning among faculty.

To be specific, the findings suggest that faculty development initiatives designed to promote innovation-oriented teaching may benefit from incorporating structured story-listening and storytelling activities. Faculty workshops could invite participants to share formative experiences that shaped their confidence in experimentation, initiative, and problem-solving. Such reflective exchanges may provide vicarious learning opportunities that strengthen self-efficacy through social modeling and shared experience. Facilitated narrative reflection may therefore help faculty recognize existing strengths in their own professional journeys and translate those experiences into innovative teaching practices.

Implications for Research

This study contributes to engineering education research by positioning faculty belief formation as a socially constructed and narratively mediated process, and by identifying students as underrecognized socializers of faculty self-efficacy. Future research could examine these dynamics across institutional contexts, career stages, and teaching roles, and investigate storytelling-based faculty development interventions to assess their influence on instructional sustainability and long-term pedagogical change.

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