Engineering education and The State: Teaching tolerance for ambiguity as an act of resistance

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WIP: Engineering Education and The State: Teaching tolerance for ambiguity as an act of resistance

Abstract

Recent state-level legislative mandates restricting diversity, equity, and inclusion (DEI) initiatives have introduced significant constraints on higher education, particularly within public institutions. While often framed as administrative or budgetary adjustments, these policies directly impact the pedagogical frameworks used to develop essential engineering competencies. This Work in Progress (WIP) paper explores the intersection of political interference and the development of "tolerance for ambiguity"—a cognitive capacity foundational to navigating uncertainty, incomplete information, and competing stakeholder interests in professional engineering practice.

The study utilizes an anonymous survey distributed to engineering faculty across 74 institutions in 24 states to assess how shifting political climates influence teaching practices, research agendas, and professional autonomy. Grounded in the understanding that DEI-related educational practices foster cognitive complexity and perspective-taking, the research examines whether the restriction of these practices constitutes a threat to engineering formation and accreditation standards.

Preliminary findings indicate a significant consensus (87%) among respondents regarding the critical importance of tolerance for ambiguity in engineering. However, data also reveal a pedagogical gap, with 14% of faculty reporting that this skill is not explicitly taught in their programs. Furthermore, early qualitative and quantitative analysis highlights that political pressures are manifesting most acutely through material and infrastructural disruptions, including the interruption of research funding and the dissolution of established support systems. This paper concludes by discussing the emerging tensions between state mandates and the professional obligation to prepare engineers for sociotechnical complexity, positioning the intentional teaching of ambiguity as a necessary act of professional and pedagogical resilience.

Prologue (by First Author)

The ASEE Annual Conference & Exposition serves as a site of expression, idea sharing, and connection for many engineering education scholars. The conference can also serve as a site of inquiry and inspiration, feeding our curiosity and driving us toward research, innovation, and growth well after the conference has ended. The spark for this project originated during a group discussion at ASEE 2025, when discussing the political attacks on education in Florida (FL). I (Dr. Joanna Burchfield, University of South Florida) noted that FL Governor Ron DeSantis wants to control the means of knowledge production by restricting – and in some cases ending – programs in the arts and humanities, and tightly controlling the content of STEM education. Dr. Tomás Estrada (Elizabethtown College) said simply, "I wonder why that is?" and the conversation moved along. But when I left the next day, that question went with me.

The simple answer was/is "Power." But the deeper question persisted: to what end, and through what means? DeSantis's public rhetoric shapes social perspectives on education – especially perspectives on teachers and professors, curricula, and programs that encourage inclusion, diversity, and equity – with the result that enough distrust has been sown among enough people that the governor's education restructuring tactics may be understood as "fixing a problem," thus dampening public opposition. While DeSantis is orchestrating his "anti-woke" education restructuring campaign from a well-established conservative platform that has been eroding public education and academic freedom for decades [1], [2], [3], [4], [5], [6], DeSantis is the current governor of Florida, and I am subject to the chaos he creates, so that was where I started: What "problem" is DeSantis trying to "solve" through his restrictive legislation and the hostile takeover of FL's state university system (SUS)? And why does he seem especially hung up on unilaterally dictating the prerogatives of K - Postsecondary STEM education?

When I got home, I read the AAUP's "Report of a Special Committee: Political Interference and Academic Freedom in Florida's Public Higher Education System" [7], then moved on to news articles reporting on DeSantis's rhetoric, proposals, and legislation (e.g., [8], [9], [10], [11]), as well as the legislation itself.

In communication, one of the core principles we teach to, through all levels and across fields, both implicitly and explicitly, is tolerance for ambiguity, as outlined by Frenkle-Brunswick's 1949 foundational work [12], wherein ambiguity tolerance "generalizes to the entire emotional and cognitive functioning of the individual, characterizing cognitive style, belief and attitude systems, interpersonal and social functioning, and problem solving behavior." As I read, it struck me that DeSantis's rhetoric and legislation broadly takes aim at disciplines, topics, and mechanisms that teach or enhance students' tolerance for ambiguity, including by (1) reducing tolerance for ambiguity among the public by framing pluralistic inquiry as suspect [13], [14], (2) diminishing educator autonomy [15], [16], [17], [18], (3) restricting educators' ability to teach specific areas of content and parts of history that help students develop tolerance for ambiguity [15], [16], [19], (4) reducing opportunities for students across all levels of education to develop tolerance for ambiguity by restricting topics, books, etc. that teach tolerance of ambiguity through discussions of difference, history, and multiple perspectives [20], [21], [22], and (5) by restricting programs, spaces, or access to spaces where students implicitly learn to tolerate ambiguity through participation and experience [16], [23], [24]. The "problem" DeSantis seeks to solve, it seems, is educator autonomy and elevated tolerance of ambiguity among students and the public, which fits with more recently enacted federal mandates, restrictions, and restructuring regarding education.

From there, I wanted to more clearly understand the "problem" as related to STEM education, specifically, and found works by Gambatta & Hertog [25] and Smith et al [26], which led me to Graham [27], Mody [28], and Katz [29]. I read about the historical precedents set by previous authoritarian governments – Nazi Germany, Stalin's Soviet Union, Mao Zedong's Cultural Revolution – as well as existing contemporary models – Putin's Russia, Xi Jinping's China, Orbán's Hungary, Erdoğan's Turkey – all of which aimed not to suppress or eliminate STEM and STEM education, but instead to elicit ideological conformity by controlling the means and orientation of education and research, persecuting professors and scientists, and creating politically convenient narratives that served the authoritarian mission [30], [31], [32], including the narrative that engineering is a value neutral, apolitical enterprise [26], [28], [29], [33].

The idea I thought might be an interesting paper – that DeSantis's broad attack on "woke," especially DEI initiatives, is at its core attempting to eliminate mechanisms within higher education that help students develop ambiguity tolerance– began to feel too big for me to tackle alone, and I felt multiple perspectives were required to do the topic justice. I reached out to Tomás, and we started brainstorming. We reached out to our colleagues, Dr. Shannon Clancy (Elizabethtown College) and Dr. Juliane Mora (Gonzaga) and invited them into the project.

On the phone one day, just before the start of the Fall 2025 semester, Tomás said that the project would help keep his morale up. I asked why, and he noted that there is a tendency among engineering educators to choose to believe that engineering and engineering education are separate from political and social realms, and thus engineers, engineering students, and engineering programs should just keep their mouths shut and heads down in the face of upheaval and adversity. I asked how widespread he thought that sentiment was. Ever curious, we started developing a survey intended to measure the temperature of engineering educators.

Our project, starting with this paper, and the survey, grew from a place of observation, curiosity, care, and a deep concern for the future of engineering and engineering education in the United States. The ideas and topics were not developed linearly, nor is how they are operationalized in the world neatly organized, easily pinpointed, or clearly defined, as so much engineering education research is delivered to us in publications. But we hope that our discussion here, right now, may be a catalyst for others' curiosity, discussion, idea development, research, and action. We have been uplifted and driven by Smith et al's [26] statement, "If we want our critical participation to have a chance of making a difference, we must maintain hope, even as we watch the things we have built crash down around us," because we, too, believe "Hope dies last."

Background

Professional Obligation of the Engineer

Engineering is often framed as a technical profession concerned primarily with efficiency, optimization, and problem solving [34], [35], [36], [37]. This framing frequently carries the assumption that engineering work exists outside of social and political contexts, and that engineers themselves can and should remain neutral actors whose responsibility ends at technical correctness [38], [39], [40], [41], [42], [43]. However, the view of engineering work as separate from sociopolitical contexts is incomplete and inaccurate, particularly as ethical training in engineering has differed widely across education and practice [44]. The apolitical, capitalist nature of engineering work creates a false dichotomy of social and technical work being separate [45], [46]. This leaves ethics education, when taught, to be primarily a lens of microethics, or individual accountability [47], [48], using few case studies removed from larger social contexts focused on financial or reputational risk and harm caused in one off situations rather than training engineers to questioning systems perpetuated by the work and systems they are involved in and connected to, such as the military industrial complex [49], [50] or intersectional historically oppressed communities [51], [52], [53], [54].

Professional engineering organizations have long articulated ethical obligations that extend beyond technical competence [55], [56], [57], [58], [59]. Many engineering programs, for example, participate in ceremonies associated with the Order of the Engineer, in which graduating students recite an obligation emphasizing integrity, fairness, tolerance, respect, and service to humanity [58]. While participation in the Order of the Engineer is not universal across U.S. institutions, the language of the obligation reflects a widely shared professional ethos. It explicitly recognizes that engineering skill carries responsibility, including an obligation to serve the public good and to consider broader human and environmental consequences [58]. These commitments are reinforced by the Code of Ethics of the National Society of Professional Engineers (NSPE), which states that engineers shall hold paramount the safety, health, and welfare of the public and conduct themselves honorably, responsibly, and ethically [59]. Together, such ethical frameworks make clear that engineering is not an extra-social endeavor. Engineering decisions are embedded in social systems and necessarily involve value-laden judgments about risk, equity, and responsibility [38], [45], [47], [60], [61], [62].

In their 2025 editorial, Smith et al highlights that the notion of the "apolitical engineer" is a myth. Citing Cyrus Mody [28], they remind readers "The idea that the engineer is a rational and apolitical figure, naturally quietist toward or even supportive of authoritarianism, is itself a political view with a contingent history. The history of engineering offers plenty of exceptions to that rule." Smith et al [26] continues:

> [...] the 1950s Engineers' Creed (Bekenntnis des Ingenieurs) guides engineers to "work with respect for the dignity of human life and in the service of his neighbor, without distinction of origin, social status and world view." It describes the engineer not as someone who prioritizes loyalty above ethics, but as someone who "does not bow to those who disregard human rights."

Engineering projects are shaped by political priorities, funding structures, and regulatory environments, while engineers' work, in turn, influences communities and public life. Acknowledging this embeddedness does not require partisan engagement; rather, it recognizes that engineering practice routinely involves navigating ambiguity, uncertainty, and competing values.

This professional context has direct implications for engineering education. If engineers are expected to act with integrity and responsibility to the public, then engineering curricula must prepare students to operate within complex social and institutional landscapes. Tolerance for ambiguity and uncertainty, as defined holistically in the prologue, is therefore central to engineering education, enabling future engineers to make informed and ethical decisions across contexts. Efforts within engineering education research have sought to more closely align with these long-held principles and more deeply entrench these ethical standards in engineering curriculums, pedagogy, and classrooms, with the goal that new engineering graduates will leave their academic institutions equipped with the technical and non-technical tools they will need to fulfill the obligations of their value-laden, socially focused, environmentally conscious, public-serving profession [39], [40], [49], [63], [64], [65], [66], [67], [68], [69].

Legislating Education in Florida

In December, 2023, the AAUP published its final report on a year-long inquiry into what the Association described as an "apparent pattern of politically, racially, and ideologically motivated attacks on public higher education" in Florida. The report concluded that "'academic freedom, tenure, and shared governance in Florida's public colleges and universities currently face a politically and ideologically driven assault unparalleled in US history,' which, 'if sustained, threatens the very survival of meaningful higher education in the state, with the direst implications for the entire country'" [7]. The final report provides a detailed timeline of the hostile takeover of Florida's higher education system through a series of policy changes and state legislation that defunded offices and programs dedicated to promoting and enhancing diversity, inclusion, and equity; effectively eliminated tenure; weakened educator unions; imposed content constraints on instruction and training; increased centralization of power in boards of trustees and the Board of Governors (all primarily appointed by the governor); and the installment of political insiders to university boards of trustees and presidential appointments alike. As intended, the legislation, firings, and expulsions in Florida have had a chilling effect, with a faculty member from Florida Atlantic University noting "We've become a machine of complicity" [7].

Since the publication of the AAUP's "Report of a Special Committee" in 2023 [7], DeSantis and Florida's republican supermajority have continued to escalate their ideologically driven takeover of Florida's institutions of higher education. States that have followed in Florida's footsteps include Alabama, Arkansas, Idaho, Indiana, Iowa, Kansas, Kentucky, North Carolina, North Dakota, Ohio, South Dakota, Tennessee, Texas, Utah, and Wyoming.

From a structural and systemic standpoint, we can see why extreme right leaning politicians like DeSantis target public education. Education—and by extension professional formation— is consistently targeted by authoritarian movements because education is the institutional site where ethics, judgement, pluralism, and civic responsibility are cultivated [30]. DeSantis, like Hungary's Prime Minister Viktor Orbán and Turkey's President Recep Tayyip Erdoğan, has worked to consolidate control of public education by reshaping curricula, constraining institutional autonomy, narrowing permissible inquiry, and populating governing boards and university leadership with political appointees. Such movements seek not merely to control content, but to recalibrate the developmental conditions that produce citizens capable of critical thinking, critique, and collective action [30], [31], [32].

Although the statues and political rhetoric do not invoke the language of “tolerance for ambiguity,” they collectively constrain interpretive plurality, instructional autonomy, and access to educational spaces that facilitate multi-perspective learning—conditions widely associated with the development of cognitive complexity and openness to ambiguity.

Official rhetoric surrounding these policies characterizes certain scholarly frameworks—particularly those addressing systemic racism, gender identity, and structural inequality—as “indoctrination” or “woke activism,” positioning pluralistic inquiry as suspect [13], [23]. Legislatively, the Individual Freedom Act (HB 7) restricts instruction that “espouses, promotes, advances, inculcates, or compels” specified concepts related to race and sex [70]. A federal court partially enjoined its application to higher education, finding it likely unconstitutional as viewpoint-based regulation of faculty speech [18]. The Parental Rights in Education Act (HB 1557) restricts classroom discussion of sexual orientation and gender identity and establishes enforcement mechanisms that expose educators and districts to complaints and potential litigation [15], contributing to documented uncertainty and self-censorship [23]. SB 266 further prohibits public funding for diversity, inclusion, and equity programs in state universities and mandates review of certain academic programs [16], resulting in the closure or restructuring of multicultural engagement centers and related programming [23], [24]. Parallel legislation governing instructional materials, including HB 1069, expands procedures for challenging and removing books and requires temporary removal during review [20], with substantial increases in removals reported statewide [21], [71].

From the perspective of engineering education, these developments extend beyond cultural or political controversy. Professional engineering practice requires sustained engagement with uncertainty, incomplete information, competing stakeholder values, and socially embedded technical decisions. Tolerance of ambiguity—conceptualized as an individual’s capacity to function effectively amid uncertainty and conflicting interpretations—has long been theorized as a broad cognitive–affective disposition shaping problem solving, belief systems, and interpersonal functioning [12], [72]. Educational environments that present students with plural perspectives, contested histories, and structured intercultural engagement are linked to increases in cognitive complexity and perspective-taking [73], [74].

When curricular scope narrows, professional discretion is constrained, access to contested texts is reduced, and diversity-oriented spaces are dismantled, students encounter fewer structured opportunities to grapple with difference, uncertainty, and competing interpretations. For engineering programs—where ambiguity tolerance is foundational to ethical reasoning, design under constraint, and public accountability—such constraints raise consequential questions about the broader conditions under which professional formation occurs.

Diversity, Inclusion, Equity

Scholars, journalists, and administrators alike have illustrated how politicians like Ron DeSantis and other conservative leaders have propagandized and weaponized the acronym *“DEI”* in efforts to shift public opinion against initiatives aimed at lessening the impacts of racism, sexism, classism, and other forms of bigotry in the pursuit of more equitable systems [75], [76], [77], [78]. Research on the political backlash to DEI highlights how critiques of diversity, equity, and inclusion have become central to broader cultural campaigns framed around opposition to “woke ideology" and related concepts [79], [80]. Many have watched in dismay as these efforts have taken root among political supporters, with segments of the general public — including some colleagues and students — adopting buzzwords such as "woke ideology" and expressing opposition to *DEI*, frequently without clear understanding of what the acronym originally referred to [77], [81].

While it is reasonable to criticize how some institutions have implemented or navigated DEI training and programs, to call out misuse or abuse, and to demand that public institutions uphold their moral and civic responsibilities to students, faculty, staff, and communities, the notion that diversity, equity, and inclusion are unworthy or even damning goals that educational institutions should cease striving toward is preposterous.

Scholars and advocates have watched as the term *"DEI"* has been co-opted and weaponized against education systems, and they have documented how the political rhetoric around diversity, equity, and inclusion has shifted the focus away from the original educational goals of DEI [75], [79], [82], [83]. This backlash has been characterized as part of a broader ideologically driven campaign to redefine DEI as divisive or discriminatory, fueling legislative and policy actions that curtail institutional equity efforts [76], [83]. Because the acronym *"DEI"* no longer always refers to the values of diversity, equity, and inclusion, and because the term has been politicized, stigmatized, and instrumentalized in contentious political debates, we avoid using the acronym for the rest of this paper.

> From Merriam-Webster Dictionary:
> **Diversity:** 1a: the quality or condition of having or being composed of differing elements (such as forms, types, or ideas); 1b: a group or collection of differing elements; 2: the state or practice of including people of different races, cultures, etc. in a group or organization
> **Inclusion:** 1: the act of including : the state of being included; 2: something that is included; 3: the act or practice of including students with disabilities with the general student population; 4: the act or practice of including and accommodating people who have historically been excluded (as because of their race, gender, sexuality, or ability)
> **Equity:** 1a: fairness or justice in the way people are treated; 1b: something that is equitable

It is well known that educational efforts around diversity, equity, and inclusion have consistently produced positive and measurable learning, developmental, and institutional outcomes for K-12 and higher-education students alike. The positive outcomes associated with diversity-, inclusion-, and equity-focused initiatives extend beyond attitudinal change to include cognitive, behavioral, and professional competencies that align with goals of higher education [61], [84], [85], [86], [87], [88], [89]

Diversity-, inclusion-, and equity-focused initiatives have been shown to enhance critical thinking, cognitive complexity, and perspective-taking [73], [74], [90], support communication competence and collaborative capacity [91], [92], increase students' sense of belonging, engagement, and academic persistence, especially for students from historically marginalized or underrepresented groups [93], [94], contribute to the development of ethical reasoning and social responsibility [95], [96], reduce prejudice and improve intergroup relations [97], [98], and improve learning climates, curricular relevance, and innovation, [99], [100].

Among engineering students specifically, we know that diversity-, inclusion-, and equity-focused initiatives enhance engineering problem-solving and design effectiveness [38], [101], support effective teamwork and professional communication in engineering practice [91], [102], improve retention and persistence, particularly among students historically underrepresented in engineering [103], [104], strengthen ethical reasoning and professional responsibility in engineering decision-making [105], [106], encourage human-centered and socially responsive engineering design [107], [108], and contribute to innovation, critical thinking, and creative problem solving within engineering education [99].

As diversity-, inclusion-, and equity initiatives have increasingly become more restricted, it has become more difficult to study and support these mechanisms directly. At the same time, engineering education is operating in an environment characterized by rapid policy change, shifting institutional priorities, and heightened uncertainty. Framing ambiguity tolerance as a core educational outcome provides a constructive bridge between these domains, capturing a set of cognitive and professional capacities long associated with diversity-oriented education while remaining grounded in widely recognized engineering competencies.

Conceptual Clarifications: Ambiguity, Uncertainty, and Tolerance for Ambiguity

Engineering education research has long recognized that contemporary engineering problems are increasingly complex, ill-structured, and situated in contexts where information may be incomplete, conflicting, or open to multiple interpretations. In this study, we distinguish among uncertainty, ambiguity, and tolerance for ambiguity, drawing on established scholarship while situating these concepts within engineering education.

Uncertainty refers to conditions in which relevant information is incomplete, probabilistic, or evolving. In engineering, uncertainty is inherent in contexts such as data quality, modeling assumptions, environmental variability, amongst others. While uncertainty is often framed as a technical challenge to be reduced through analysis or improved data, it remains a persistent feature of authentic engineering work, particularly in design, systems, and data-intensive domains.

Ambiguity refers to situations in which multiple interpretations, frames, or solution pathways are simultaneously plausible, even when information is available. As prior work has noted, engineers increasingly confront problems situated in conceptual rather than purely physical contexts, where no single interpretation or outcome can be definitive [101], [109], [110]. However, most engineering education research in ambiguity has involved only the problem solving lens of ambiguity, such as textbook characterization [34] and open-ended problems with varying degrees of information [111], [112], [113], [114], that may or may not explicitly include social, political, environmental, institutional, and cultural factors. Ambiguity is particularly relevant in open-ended problems, interdisciplinary collaboration, and contexts involving social, ethical, or stakeholder considerations. Therefore, as stated by Frenkle-Brunswick (1949), we holistically view ambiguity in a similar lens with problem solving, the sociocultural context of the individual's cognitive and value systems, and the way they engage with others and making decisions given these factors.

Tolerance for ambiguity is a stable, multi-dimensional disposition by which an individual perceives, appraises, and responds to situations that lack clear structure, single meanings, or definitive outcomes. Drawing on Frenkel-Brunswik (1949) [12], it generalizes across emotional and cognitive functioning—shaping cognitive style, belief and attitude systems, interpersonal and social functioning, and problem-solving behavior. Subsequent scholarship emphasized individuals' willingness to accept multiple interpretations or outcomes [115], whether ambiguity is appraised as desirable or threatening [72], and the range of reactions elicited by unfamiliar, complex, or dynamically uncertain stimuli [116], [117]. Together, these perspectives underscore a distinction between defensive responses to ambiguity and more open, adaptive engagement.

Empirically, individual differences in attitudes toward ambiguous uncertainty predict real-world social outcomes: Vives & Friedman-Hall [118] report that such attitudes constitute a robust, stable predictor of prosocial behavior, suggesting a cognitive phenotype that partly underlies motivation to engage others. Because prosocial behavior comprises cooperating, helping, comforting, sharing, and giving—"acts where people willingly and deliberately behave in a way that provides help to others" [119] (Kakulte & Shaikh, 2023)—tolerance for ambiguity can be understood as a capacity that supports socially oriented, ethical action under uncertainty by enabling open, flexible interpretation of competing perspectives and a readiness to act for others despite incomplete information.

As such, we can both theoretically follow and empirically understand how educational objectives that centralize diversity, inclusion, and equity – objectives that prioritize pluralistic thinking, cooperation, perspective-taking, multiple ways of knowing and being, and acceptance of uncertainty and incomplete information – help students develop ambiguity tolerance traits. Similarly, intentionally teaching students ambiguity tolerance traits can help them become more accepting of diverse viewpoints, more inclusive problem solvers, and more ethical and equitable decision-makers.

This study builds on existing work on ambiguity tolerance in engineering education by examining how engineering faculty conceptualize and engage ambiguity and uncertainty in their teaching and research, particularly in a moment when political and institutional pressures introduce additional layers of ambiguity into engineering education itself.

Survey and Methods

Design and Rationale

This study used a cross-sectional survey design to examine how engineering faculty perceive and engage the constructs of (1) tolerance for ambiguity and uncertainty, (2) collaboration and cross-disciplinary teamwork, and (3) the impacts of rapidly shifting political and policy environments on engineering teaching and research. The survey was intentionally designed to capture both prevalence (e.g., whether ambiguity tolerance or cross-disciplinary teamwork is explicitly taught) and meaning-making (e.g., how faculty interpret the social and political dimensions of engineering education). This approach aligns with our theoretical perspective that engineering is an inherently social endeavor and that ambiguity tolerance is not solely an individual trait but a capacity shaped by institutional norms, professional expectations, and broader sociopolitical contexts.

The rationale for using a survey was twofold. First, the current higher education landscape is shaped by rapid policy changes and well-documented chilling effects, creating forms of uncertainty that are often diffuse and difficult to observe directly. Thus, a survey allowed us to reach faculty across a wide range of institutions and geographic regions and to identify patterns that cut across local contexts. Second, because this project is oriented toward informing practical approaches in engineering education, faculty perspectives on what is taught, what is valued, and what pressures are being felt provide an important source of insight.

A PDF copy of the survey can be found using this URL: https://bit.ly/49dutE5.

Survey Design

The instrument was developed by a cross-disciplinary, multi-institutional research team spanning engineering and communication. The survey was developed iteratively, guided by the project's central premise that tolerance for ambiguity and cross-disciplinary collaboration are essential competencies in engineering practice, and that political and policy pressures have become increasingly influential in shaping engineering education.

The final survey instrument was organized into four sections. The first section focused on tolerance for ambiguity and uncertainty. To support a shared understanding of the concepts, the survey included a brief definitional framing drawn from classic ambiguity-tolerance scholarship. The second section examined faculty perceptions of the importance of collaboration within engineering and across non-engineering disciplines (such as the social sciences, humanities, business, and policy). It also asked whether students are explicitly taught concepts and practices that support effective cross-disciplinary collaboration. The third section explored how political or policy decisions affect faculty teaching and research, whether engineering and engineering education are socially and politically situated, and the extent to which respondents feel supported by their institutions. The last section asked information about respondents' appointments, institutions, and included a prompt inviting additional reflections or recommendations. A table organizing the questions by section can be found in Appendix A.

Measures

Key measures examined faculty perspectives across several areas. Institutional investment in ambiguity tolerance was assessed using an agreement item asking whether respondents perceived their department or college as invested in helping students develop flexible thinking and navigate ambiguous situations. To identify where these skills are addressed, respondents selected all applicable curricular contexts in which students are taught to navigate uncertainty and multiple interpretations, including first-year seminars, introductory engineering courses, design courses, general education, and non-engineering courses. Faculty instructional engagement was measured through an agreement item asking whether respondents attempt to teach ambiguity-related skills, with an optional elaboration prompt.

The survey also assessed the perceived importance of tolerance for ambiguity in professional practice and research. Collaboration and cross-disciplinary work were examined through agreement items addressing the importance of collaborating within engineering and with non-engineering disciplines, as well as whether students are explicitly taught practices that support cross-disciplinary teamwork. Additional items examined the impacts of political and policy decisions on faculty work, perceptions of institutional support, confidence in coping with external pressures, departmental strategies, and the resilience of the broader engineering education community. Finally, beliefs about the social and political context of engineering and engineering education were assessed using agreement items probing whether these domains are socially and politically embedded or insulated from external influence, with optional opportunities to elaborate.

Recruitment and Sampling

The survey was hosted in Qualtrics and distributed nationally to engineering faculty through a multi-pronged recruitment strategy. First, the research team targeted engineering faculty across 74 institutions in 24 states, ensuring at least two institutions per state in the sampling frame to support anonymity for geographically identifiable responses. Second, the survey was shared through four ASEE listservs to broaden reach and further protect respondent anonymity by increasing the size and heterogeneity of the respondent pool.

Because the study asks faculty to comment on politically sensitive dynamics, such as institutional and policy pressures, the survey design prioritized anonymity and data protection. The Qualtrics survey was configured using anonymous settings, including anonymous links and anonymized responses, such that IP addresses, embedded location data, and contact information were not collected or accessible to the research team. Respondents also had the option to contact the research team via a dedicated email address, preserving separation between survey responses and identifying information.

Analysis Approach

In this paper, we present initial findings and salient themes emerging from the dataset, with an emphasis on patterns that are especially relevant for engineering education theory and practice in the current moment. A subsequent paper will report more extensive question-by-question quantitative analyses and deeper qualitative analysis of faculty narratives and rhetorical positioning.

This study employs a mixed-methods analytic approach combining descriptive quantitative analysis with qualitative thematic analysis. Likert-scale and multiple-selection items were analyzed using descriptive statistics and qualitative analysis to characterize patterns in faculty perceptions across ambiguity tolerance, collaboration, and sociopolitical impacts. These analyses were used to identify salient alignments and tensions (e.g., high endorsement of ambiguity tolerance paired with lower reports of explicit instruction). Open-ended responses were analyzed using iterative qualitative coding to surface recurring themes, rationales, and interpretive frames, including how faculty describe implicit pedagogy, institutional constraints, political pressures, and coping strategies.

Results

Data were collected between October, 2025 and January, 2026. At the time of submission of this WIP, analysis of the full dataset is ongoing. The results presented here are preliminary, and highlight initial patterns and salient themes emerging from the data that are most relevant to the study's conceptual framing. Respondents represented 32 US states/territories. The survey distribution yielded 520 completed survey responses, and 821 total open-ended text entries (not including responses to optional Q25 "What is the name of your institution?").

Importance and prevalence of teaching tolerance for ambiguity (Section 1 questions)

Most respondents agreed that tolerance for ambiguity is an important skill for both professional engineering practice and research. In both contexts, ~87% of respondents rated tolerance for ambiguity as *important* or *extremely important*, with over half selecting the highest possible importance rating in each case. Very few respondents (<3%) characterized it as unimportant or unnecessary.

The parallel distributions for professional practice and research suggest that respondents conceptualize tolerance for ambiguity as a broadly applicable competency intrinsic to engineering work across fields. This alignment reinforces the interpretation of tolerance for ambiguity and uncertainty as a central tenant of engineering practice. The responses to these two questions indicate consensus among respondents that navigating uncertainty, inexactness, and multiple interpretations is fundamental to engineering practice and research.

However, while respondents largely agreed on the importance of tolerance for ambiguity and uncertainty and reported personal efforts to teach this competency (Q4), examination of the Likert and text entry responses to Q3 (Table 1, multiple selections) indicate that this area of instruction tends to be localized, implicit, and unevenly distributed across the curriculum, and that ambiguity-related learning is frequently understood as incidental rather than intentional. Respondents identified engineering design courses as the most prevalent instructional context (66%) for how engineering students learn tolerance of ambiguity and uncertainty.

Table 1
Q3 (multiple selections) – Where in the curriculum are students taught to accept and navigate uncertainty, inexactness, and multiple interpretations? (choose all that apply)
516 Responses

Field	**Choice Count**
First-year engineering seminar	80
Introductory engineering courses	145
Engineering design courses	342
General education courses	71
Non-engineering courses	68
Unsure	44
Other	89
To my knowledge, this skill is not explicitly taught in our program	74
Total	**913**

Notably, over 14% of respondents indicated that, to their knowledge, tolerance for ambiguity is *not explicitly taught* in their program, and 8% reported uncertainty about where such instruction occurs. This may indicate a misalignment between faculty intent and curricular visibility.

Although many respondents reported incorporating ambiguity-related elements into their own teaching, respondents also tended to frame ambiguity and uncertainty as "inherent in" and "part of" design courses, as well as "embedded in capstone" and "learned through open ended problems." This suggests that students may encounter these skills without recognizing them as learning outcomes, and that the broad institutional expectation is that engineering students will learn tolerance for ambiguity incidentally rather than through direct, intentional instruction of concepts, theories, and methods that contribute to students' development of that competency.

Ongoing analysis will allow for more granular examination of relationships among constructs and deeper exploration of faculty narratives. These extended analyses will be incorporated into a subsequent, expanded version of this work.

Importance and prevalence of teaching collaboration and teamwork (Section 2 questions)

Perceived Importance of Cross-Disciplinary Collaboration. Faculty respondents reported strong endorsement of cross-disciplinary collaboration. 93% agreed or strongly agreed that collaborating with other engineering disciplines is important for their work. Collaboration with non-engineering disciplines was also widely considered important (81.9% agreement).

Perceptions were strongest regarding students. Fully 95.4% agreed or strongly agreed that learning to navigate cross-disciplinary collaboration is essential for students' future professional success, including 55.0% who selected *Strongly agree*.

Explicit Instruction. Reported levels of explicit instruction were lower than endorsement levels. While 72.3% agreed or strongly agreed that students are explicitly taught concepts and practices that improve cross-disciplinary teamwork, only 20.6% selected *Strongly agree*. In contrast, 55.0% strongly agreed that such learning is essential for students. This represents a 23-point gap between perceived essentiality (95.4%) and reported instructional implementation (72.3%), and a 34-point drop in strong endorsement between belief and practice.

Nature of Reported Instruction. Open-ended responses indicate that collaboration instruction is most often embedded in project-based and design-centered contexts (e.g., capstone, team design projects). References to structured teamwork training, communication frameworks, peer assessment mechanisms, or formal scaffolding were comparatively infrequent.

Cross-referencing showed that respondents who selected *Strongly agree* were more likely to describe structured instructional elements (e.g., communication training, articulated expectations, assessment practices) than those selecting *Somewhat agree*. Linguistic comparison further suggested qualitative differences: Strongly Agree responses used pedagogically oriented language (e.g., "training," "assignments," "expected"), whereas Somewhat Agree responses more often referenced course context (e.g., “freshman,” “introductory,” “design”). Mean response length did not differ, indicating conceptual rather than rhetorical differences.

These responses suggest that collaboration is widely present in engineering curricula but often implemented experientially rather than through formalized instructional scaffolding.

Political, Social, & Policy (Section 3 questions)

Q14. Of 520 respondents, 311 (59.8%) reported that their work had been impacted by political or policy decisions. Thematic analysis of these 311 responses revealed that impacts were predominantly material and infrastructural (Table 1).

The most prevalent theme was direct funding disruption (68.8%, n = 214), including grant cancellations, delays, and funding freezes. Nearly half of respondents reported research interruption (47.3%, n = 147), such as stalled projects or altered research scope. Graduate student impact was identified in 38.9% of responses (n = 121), reflecting assistantship instability and recruitment challenges. A broader climate of uncertainty was described by 24.4% (n = 76). Additional themes included international student or mobility constraints (20.3%), hiring or staffing freezes (18.6%), administrative burden (16.7%), curricular impacts (15.8%), and topic self-censorship (10.9%).

Co-occurrence patterns (Table 2) indicate a cascading structure. Funding disruption most frequently co-occurred with research interruption (42.1%) and graduate student impact (31.5%). Research interruption and student impact co-occurred in 26.0% of responses. In contrast, funding disruption and self-censorship co-occurred in only 7.1% of responses. Overall, reported impacts clustered around funding instability and its downstream effects rather than primarily ideological or curricular concerns.

Table 2

Prevalence of Impact Themes Among Engineering Faculty Reporting Policy Effects (n = 311)

Theme	**Count**	**% of “Yes” Responses**
Direct Funding Disruption	214	68.8%
Research Interruption	147	47.3%
Graduate Student Impact	121	38.9%
Climate of Uncertainty	76	24.4%
International Student / Mobility Constraints	63	20.3%
Hiring / Staffing Constraints	58	18.6%
Administrative / Compliance Burden	52	16.7%
Curricular / Teaching Impact	49	15.8%
Topic Self-Censorship	34	10.9%

Themes are not mutually exclusive; totals exceed 100%

Table 3
Major Theme Co-Occurrence Patterns (n = 311)

Theme Pair	Count	% of "Yes" Responses
Funding + Research Interruption	131	42.1%
Funding + Graduate Student Impact	98	31.5%
Research Interruption + Student Impact	81	26%
Funding + Climate Uncertainty	73	23.5%
Funding + Self-Censorship	22	7.1%

Q19-22. Across four questions assessing whether engineering and engineering education exist outside social or political systems, respondents broadly rejected insulation narratives. Between 72% and 79% disagreed or strongly disagreed that engineering exists outside the social realm, outside the political realm, that engineering education is unrelated to social systems, or that engineering education is insulated from political climate. "Strongly disagree" was the modal response for each item, indicating widespread recognition that engineering and engineering education are socially and politically embedded.

Examination of responses across section 3. Differences emerged when responses were examined by reported impact in Q14. For the item "Engineering education is insulated from the political climate," approximately 89% of faculty reporting impact in Q14 rejected the insulation claim (strongly disagree/disagree), compared to 63% among those reporting no impact. Endorsement of insulation (agree/strongly agree) was higher among those reporting no disruption (~17%) than among those reporting disruption (~3–4%). Similar directional patterns were observed across the remaining items, with faculty who reported disruption in Q14 consistently expressing stronger rejection of insulation claims.

Open-text responses further clarified these differences. Faculty reporting disruption in Q14 frequently used structural and institutional language, referencing state actors ("state," "law," "board," "mandate"), institutional mechanisms ("policy," "administration," "restrictions"), and professional consequences ("funding," "research," "curriculum," "hiring," "graduate students"). Climate-related terms such as "chilling effect," "self-censorship," and "uncertainty" were also common. Disruption was described as affecting research agendas, graduate training, and instructional decisions.

In contrast, faculty reporting no impact more often employed boundary-drawing language, including "hasn't affected me," "not in my area," and "my work is technical." References to legislative actors or institutional processes were limited. Political developments were framed as external to disciplinary work or selectively avoidable.

These responses indicate that lived exposure to policy disruption corresponds with stronger rejection of insulation narratives and with a shift toward structural framing in faculty discourse about engineering education.

Discussion

Findings reveal a consistent tension: faculty overwhelmingly endorse tolerance for ambiguity and cross-disciplinary collaboration as central to professional engineering practice, yet both competencies are most often developed implicitly rather than through intentional, scaffolded pedagogy. Simultaneously, faculty report increasing structural instability driven by political and policy disruption.

Additionally, survey responses indicate that engineering faculty and engineering programs tend to conceptualize and treat tolerance of ambiguity narrowly as a problem-solving mechanism, segregated from its initial context wherein ambiguity tolerance "generalizes to the entire emotional and cognitive functioning of the individual, characterizing cognitive style, belief and attitude systems, interpersonal and social functioning, and problem solving behavior." [12] This narrow conceptualization often leads to programs treating students' development of their thresholds for tolerance of ambiguity as an implicit byproduct of problem structures in specific courses (usually design).

- "In senior design we work on meeting multiple goals/expectations & growth mindsets."
- "Why we make systems and how we design them to solve problems (and the problems they ultimately solve) are highly influenced by societal processes."
- "We are a design oriented program. Design is about navigating uncertainty, so it is throughout the curriculum."
- "Not *explicit* or at least that isn't an intentional learning objective. That said, it comes up in many/most of our design courses, I think."
- "The best manner one could incorporate ambiguity is by having a strong foundation in heuristics. One has to recognize the uncertainty associated with codes or computer models."
- "Students learn to deal with ambiguity in lab settings by taking data that is ambiguous."
- "I find our students' discomfort with ambiguity problematic. Not only is it important for their understanding of machine learning to think there isn't necessarily a definite and unique answer to many questions in this field..."
- "I work with the natural environment, so being comfortable with uncertainty (weather, natural/living materials) and adapting designs for that uncertainty is critical for our students."

At the same time, there are also many engineering faculty who conceptualize tolerance of ambiguity in its fuller context:

- "In this moment in time, systems thinking, prosocial equity and justice, and preparing ALL engineering students for the ambiguity of life's challenges is our objective."
- "Engineering does not occur in a vacuum... Divorcing engineering from social and political issues results in only marginally useful outputs."
- "My general feeling about ambiguity, social issues, and politics is that they are integral to all human activity, including engineering."
- "While I have learned to enjoy ambiguity or work with it, this reminds me I need to teach my students... how uncertainty, societal needs, and policy priorities influence the problems they will ultimately be asked to solve."

Unfortunately, some respondents also voiced concern and pessimism regarding various structural, attitudinal, and social impediments to teaching engineering students how to navigate ambiguity and uncertainty:

- "Students these days have very little tolerance for uncertainty. They demand predictability and resent attempts to expose them to uncertainty. They are highly grade-focused and with grades as their highest priority, any ambiguity is seen by them as a threat to their goals for high grades. I have tried to teach students how to deal with ambiguity and uncertainty but it's almost hopeless so long as our institutions see student ratings as the only metric for quality education."
- "Many of them want a very detailed rubric because they are only interested in a grade."
- "If the university bureaucracy won't tolerate any possibility of ambiguity or uncertainty in academic operations, how can we expect our students to learn how to deal with it?"
- Syllabi have become longer and longer each year with more and more required 'boilerplate' text. Allowable practices for course design and student evaluation have become more and more constrained with requirements for faculty to prove that ambiguity will not exist. These developments are mostly coming from a well-meaning place of wanting students to know what they must do to be successful, but there's also a significant amount of 'CYA' thinking to avoid complaints. However, these trends impair the ability of faculty to teach dynamically in response to student performance and to exercise discretion.

Additionally, some noted that they believe that tolerance for ambiguity either must be learned prior to college or cannot be taught at all:

- "One cannot teach this topic. Students must learn to navigate this earlier in life. Trying to teach fundamental life skills in an engineering curriculum detracts from the course content."
- "I think that dealing with ambiguity is a skill necessary for every human being navigating life."
- "This should be a skill acquired prior to entering a college education. This should be considered preparation from high school and home environments. Freshmen who are not mature enough to engage in 'uncertainty' are more likely to fail."

Importantly, it is possible to teach tolerance of ambiguity, and some survey respondents expressed a desire to improve teaching to ambiguity tolerance outcomes.

- "I had never thought explicitly about training students to tolerate and even thrive on ambiguity. Taking this survey made me realize there was a big disconnect between my values and my and our department's teaching on this topic. I think we have addressed it on an individual student and faculty basis quite implicitly, but by not making it explicit, I suspect some students struggle rather than getting the training they need in this regard. I would like to learn more about how institutions and individual faculty provide this type of training both in independent learning classes and more traditional classes."
- "I do but its implicit and I'd like to figure out how to do it more explicitly."

- "Very interesting survey. It reminds me of how my job as an engineering educator and researcher does not occur in a vacuum, but is shaped by social, political, and economic contexts. While I have learned to enjoy ambiguity or work with it, this reminds me I need to teach my students, both in class and personally mentored in the lab, how uncertainty, societal needs, and policy priorities influence the problems they will ultimately be asked to solve."
- "After retiring and reflecting on my teaching and research career, I wish I could reinforce the importance of uncertainty."
- "Agree. BUT I want to do this better! Help?"

Operationalizing tolerance for ambiguity as a teachable curricular outcome requires aligning the traits of ambiguity tolerance into observable learning objectives, instructional activities, and assessment practices that address cognitive, affective, interpersonal, and behavioral domains. Although structural changes may be needed across engineering programs to affect meaningful, long-term, system-wide advancements in how dynamic and layered personal-professional traits such as tolerance of ambiguity are taught in engineering programs, it is also possible to start intentionally teaching students to develop tolerance for ambiguity in your classroom right now through small but impactful classroom activities that encourage students to engage in perspective taking, to think creatively and imaginatively, and, importantly, to get out of their comfort zones. There are many classroom-based activities whose outcomes align with developing tolerance of ambiguity. For example, Dr. Mora uses an activity called "Lost on the Moon" to teach creative, flexible, analytical thinking to her engineering students. This in-class activity is described below.

Lost on The Moon: An In-Class Activity

Group activity: 4-5 students per group
Time: ~20 minutes

The premise for this activity is that students are a group of astronauts who have crash landed on the moon some distance from where they intended and now have to make their way to their intended destination. Students are given a list with an assortment of materials available to them that they need to sort based on potential usefulness to this journey. The list includes things like oxygen tanks, matches, a compass, water, a radio, a life raft, etc. The instructions for the activity require the students to first rank the items individually from most to least useful. Once they have done this individually, they then compare their list with the rest of their team and make a combined ranking (most to least useful) taking advantage of their combined intelligence to hopefully produce the most accurate and helpful ranking. Only after they have completed the individual and team rankings is the correct (according to NASA) ranking for these objects revealed, and students compare their ranking with NASA's.

As one can imagine, there is wide variation between and amongst the individual and team rankings, as well as across teams. Several things happen in the course of this activity that are important for teaching tolerance of ambiguity and making students more flexible thinkers and problem solvers.

First, there are often several individual students whose rankings are more correct than the ones their teams produced when working together, which does not initially make sense given the adage that “three heads are better than one,” which underlies most group work activities. However, when working with engineering students who have been trained to solve problems and answer with certainty, a different dynamic appears: Students who are less tolerant of ambiguity and feel confident that they have the right answer are less likely to engage in discussion about the “what if’s” of the fictional situation, to consider alternatives, to speculate or even imagine elements of the scenario outside of what is presented to them on paper. This often results in rigid assumptions and reliance on (sometimes faulty) logic. For example, many of the teams list the compass as a highly valuable object for navigation because they could not expand their thinking outside of their current frame of reference to consider that a compass will not work on the moon.

The debrief and discussion of this activity is where these students’ resistance to ambiguity and low tolerance of “maybes” and possibilities that are not guaranteed begins to surface. When individual students are asked why they did not assert their rankings as more correct than their peers – especially those that realize the compass won’t work – they often shrug and say it wasn’t worth it to go against the group.

This is curious because it appears to go against engineering students’ training to find the “right” answers. However, further probing questions asking *why* it wasn’t worth it to go against the group reveal that because the activity “wasn’t real” that it “didn’t matter.” The troublesome placement of thought experiments into the category of “not real” and therefore not important enough to engage in fully is one of the reasons teaching tolerance for ambiguity is so important for these students. The real situations that they will find themselves in are likely to have more in common with this fictional scenario than with the types of problems prevalent in textbooks and course work.

At many universities, engineering students spend their senior year engaged in a design project, typically with an industry stakeholder who gives them a task to provide an engineering solution for. In our experience, student teams often struggle to get started because there are multiple approaches they might take and they have to make decisions for which approach they will commit their time and energy towards completing. In Dr. Mora’s experience, this is usually the moment when the “real” problem brings her students back to the “not real” problem the students encountered in her “Lost on the Moon” activity, because they are forced to grapple with ambiguity and “what if’s” and to try several ways of solving the problem before they decide which solution to pursue.

Conclusion

This study highlights a critical tension in contemporary engineering education: while faculty overwhelmingly recognize that navigating ambiguity and cross-disciplinary collaboration are essential for professional success, these competencies remain largely marginalized or implicit in the formal curriculum. This curricular gap is exacerbated by an increasingly restrictive political climate that characterizes the very educational practices known to foster ambiguity tolerance—such as critical inquiry into social, historical, and ethical contexts—as "indoctrination".

Our findings suggest that current legislative efforts to narrow the scope of public education do more than just restrict specific topics; they actively undermine the developmental conditions required to produce engineers capable of ethical judgment and resilient action under uncertainty. By treating engineering as a value-neutral, technical silo, these policies threaten to produce a workforce that is technically proficient but ill-equipped to handle the complex, value-laden socio-technical challenges of the 21st century.

However, the survey also reveals a resilient community of educators who are eager to bridge the gap between their professional values and their classroom practices. Transitioning from implicit to explicit instruction of ambiguity tolerance is no longer just a pedagogical improvement—it is an act of professional resistance. By intentionally designing learning environments that require students to grapple with pluralistic perspectives and incomplete information, educators can safeguard the ethical core of the profession.

Moving forward, the engineering education community must move beyond defensive postures against external political pressures. We must instead double down on our professional obligation to "hold paramount the safety, health, and welfare of the public" by ensuring that future engineers are trained not just to solve equations, but to navigate the ambiguous, multi-dimensional human systems those equations serve. Hope for the future of the field persists in these intentional, everyday classroom practices, reinforcing the belief that even in times of upheaval, "hope dies last".

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Appendix A
Table of survey questions

Questions			
Section 1	**Section 2**	**Section 3**	**Section 4**
Q2. My college/ department is invested in helping engineering students learn to develop flexible thinking that allows them to thoughtfully navigate ambiguous situations and stimuli	Q8. Collaborating with other engineering disciplines is important for my work Q9. Collaborating with non-engineering disciplines (e.g., social sciences, humanities, business, policy) is important for my work	Q13. Where is your institution located? Q14. My work has been impacted by political or policy decisions Q15. I feel adequately supported by my institution in navigating external pressures (political, financial, social, etc.) Q16. I feel confident in my individual ability to cope with these pressures.	Q23. What type of appointment/teaching role do you hold? (check all that apply) Q24. What department/ area do you primarily teach/work in at your college/university? (check all that apply)
Q3. Where in the curriculum are students taught to accept and navigate uncertainty, inexactness, and multiple interpretations?	Q10. Learning how to navigate and engage in cross-disciplinary collaboration is essential for my students' future professional success.	Q17. My department/team has effective strategies for moving forward in the current political/policy climate. Q18. The broader engineering education community is resilient in the face of external social and political challenges.	Q25. What is the name of your institution? (completely optional)
Q4. I attempt to teach these skills in my courses	Q11. My students are explicitly taught concepts and practices that improve their abilities to work on cross-disciplinary teams and projects	Q19. Engineering exists outside of the social realm; engineers do jobs that need to be done, but they do not influence nor are they influenced by social systems.	Q26. Is there anything you would like to expound on, add, share, or ask?
Q5. Tolerance for ambiguity is an important skill in the professional field(s) my students will enter post-grad Q6. How would you describe your own comfort with ambiguity and uncertainty? Q7. Tolerance for ambiguity and uncertainty is an important skill for researchers in my field	Q12. If you responded that your students are directly taught concepts and practices that improve their abilities to work on cross-disciplinary teams and projects, please briefly describe what methods you or your department/college/institution use to achieve this learning outcome.	Q20. Engineering exists outside of the political realm; engineering is an apolitical enterprise and is neither affected by the political climate nor are engineering projects politically associated. Q22. Engineering education is insulated from the political climate and is not affected by political decisions, mandates, or uncertainty.	

Appendix B
Recruitment Email

Dear Colleague,

We are seeking your participation in our research study (IRB #009355) on the current climate in engineering education. Would you please take the anonymous survey linked below? Most reviewers completed the survey in under 10 minutes.

- **Our team:** Joanna Burchfield (University of South Florida), Tomás Estrada (Elizabethtown College), Juliane Mora (Gonzaga University), Shannon Clancy (Elizabethtown College)
- **The research:** We are investigating the connections between post-graduate engineering students' capacity for ambiguity and uncertainty, adeptness at navigating teamwork and collaborative contexts, and tendencies toward prosocial behaviors and systems thinking. We are also interested in how rapid policy changes and the resulting uncertainty are impacting engineering education and how faculty approach teaching and research.
- **Your perspective is important to the success of this anonymous, voluntary study.** This online survey is completely anonymous and was sent to engineering faculty at 74 institutions across 24 US states, as well as via conference listservs. A diversity of perspectives from faculty at institutions across the US is key to the success of this project.
- **This survey is completely anonymous, and your responses are strictly confidential.** The information we used to contact you will not be shared outside of our research team and will not be reported in any results or publications from this study. All components of the survey are anonymized, which means responses cannot be traced back to individuals. As such, if you complete and submit this survey and later request your data be withdrawn, this will not be possible as the research team will be unable to extract anonymized data from the dataset. You may discontinue the survey at any time or choose not to answer certain questions.

Follow this link to the Survey (IRB #009355):
${l://SurveyLink?d=Take the survey}

Or copy and paste the URL below into your internet browser:
${l://SurveyURL}

Study Overview
We are a cross-disciplinary, multi-institutional research team investigating the connections between post-graduate engineering students' capacity for ambiguity and uncertainty, adeptness at navigating teamwork and collaborative contexts, and tendencies toward prosocial behaviors and systems thinking. We are also interested in how rapid policy changes and the resulting uncertainty are impacting engineering education and how faculty approach teaching and research.

As part of this research, we are conducting a survey (IRB #009355) to help us determine the prevalence of intentionally taught capacity for ambiguity/uncertainty and teamwork/collaboration among engineering undergraduate students, and the perceived importance of these capacities and skills among faculty in their respective fields. We also seek to develop a broad understanding regarding how faculty at US higher education institutions perceive the connections between engineering education and social/political realms, and the impacts of ongoing state and federally introduced ambiguity and uncertainty in education, research, and teaching.

If you have any questions, concerns or complaints about this study, please contact the research team at EngineeringAmbiguity@gmail.com. If you have questions about your rights, complaints, or issues as a person taking part in this study, call the USF IRB at (813) 974-5638 or contact the IRB by email at RSCH-IRB@usf.edu.

Who We Are:

- **Dr. Joanna Burchfield, Associate Professor of Communication Instruction, University of South Florida** Dr. Burchfield is a Communication professor in the College of Engineering at USF. She is guided by a philosophy founded on growth mindset and systems thinking, which is imbued in her approach to teaching, research, and service at USF. Dr. Burchfield’s current research focuses on STEM communication, student identity development, and cross-disciplinary communication.
- **Dr. Tomás Estrada, Associate Professor of Engineering, Elizabethtown College** Dr. Estrada firmly believes the faculty member needs to be a well-rounded teacher-scholar. He is deeply committed to fostering multi-disciplinary and holistic thinking in his students and to exemplifying it through his own scholarly work in engineering education. In his teaching, Dr. Estrada cultivates a spirit of mindful and continuous growth, encouraging attentiveness, adaptability, and effective communication.
- **Dr. Juliane Mora, Associate Professor of Communication Studies, Gonzaga University** Dr. Mora has taught communication across the curriculum in the humanities, sciences, engineering, and business for 20 years at five institutions, from California to Florida. Her research interests are in communication pedagogy at the college level, particularly the practices educators use to work for social justice through classroom instruction. She is passionate about creative approaches to teaching and strives to use innovative pedagogical practices in every class she teaches.
- **Dr. Shannon Clancy, Assistant Professor of Engineering, Elizabethtown College** Dr. Clancy is motivated by their passion for and experiences with equity-minded teaching and holistic mentorship of students as people and professionals, seeking to build a classroom grounded in care, joy, and cultivating students’ skills and interests. She particularly enjoys teaching intertwining engineering technical practices and social implications. Her research interests include sociotechnical thinking, creativity, and, queer engineering student experiences.

Thank you in advance for your response. Our Team values your participation and perspective and looks forward to analyzing the data. We hope to report our findings at ASEE 2026 in Charlotte, NC.

Thank you for your time,
Joanna, Tomás, Juliane, & Shannon