# Engineering Capabilities for Ethical Development: Bridging Philosophy, Pedagogy, and Professional Practice

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# Work in Progress | Engineering Capabilities for Ethical Practice: Bridging Philosophy, Pedagogy, and Professional Development

## I. Introduction

Since the ABET EC 2000 criteria took effect at the turn of the century, engineering ethics education has largely treated unethical behavior as a knowledge problem. The implicit theory is that misconduct stems from a lack of awareness, a disregard for professional standards, or underdeveloped reasoning skills, and that better cases, better codes, and better frameworks will close the loop. From the perspective of Rest's [1], [7] influential four-component model of moral functioning, this is a curriculum that has scaled awareness and judgment far more successfully than intent and action. Conflating knowledge transfer with behavior change is a costly mistake [2]. Bairaktarova and Woodcock [3] put it plainly:

> *Development of ethical behavior skills in future engineers is a key competency for engineering schools as ethical behavior is a part of the professional identity and practice of engineers. While engineering educators have somewhat established instructional methods to teach engineering ethics, they still rely heavily on teaching ethical awareness and pay little attention to how well ethical awareness predicts ethical behavior (p. 1130).*

The same tension shows up in industry, where ethics divisions and annual training modules coexist with systemic harm [2]. If we want to influence professional practice, ethical intent and implementation must become objectives in their own right. Recent reviews of engineering ethics interventions reach similar conclusions. The field's standard tools (codes, cases, debates) catalyze awareness and reasoning but rarely produce the confidence and commitment values-driven practice requires [4], [5]. As long as professional standards are taught as rules to apply, students learn to manage compliance without developing the moral identity, character, or motivation that consistent ethical practice demands [6].

The gap is empirically well-documented. Across meta-analytic and narrative reviews, measures of moral judgment have explained roughly 10 to 15 percent of the variance in observed moral behavior [31]. Reviewers across professions reach the same conclusion: judgment is a real but moderate predictor of action, and any account that expects awareness and reasoning to translate cleanly into behavior is empirically out of step. The reason-action gap is not an artifact of weak curricula. It is a structural feature of moral functioning that no purely cognitive intervention can close on its own.

Rest's four-component model (Figure 1) names the developmental outcomes professional ethics education should enable. Acting morally requires the joint operation of (1) ethical sensitivity, (2) prescriptive reasoning, (3) ethical motivation, and (4) ethical behavior [1], [7], [8]. We use these accessible labels in place of Rest's original moral terminology because they read more naturally for engineering audiences without altering his distinctions. Engineering curricula have made real headway on the first two components but typically stop short of the latter two. The unfinished work is not only pedagogical, it is structural. The “meritocracy of difficulty” [10] narrows emotional bandwidth and drains the cognitive resources that self-reflection and prosocial motivation depend on [13], [14], [29]. On the job, those academic stressors recede, only to be replaced by organizational cultures that prefer compliance to capability [11], [12].

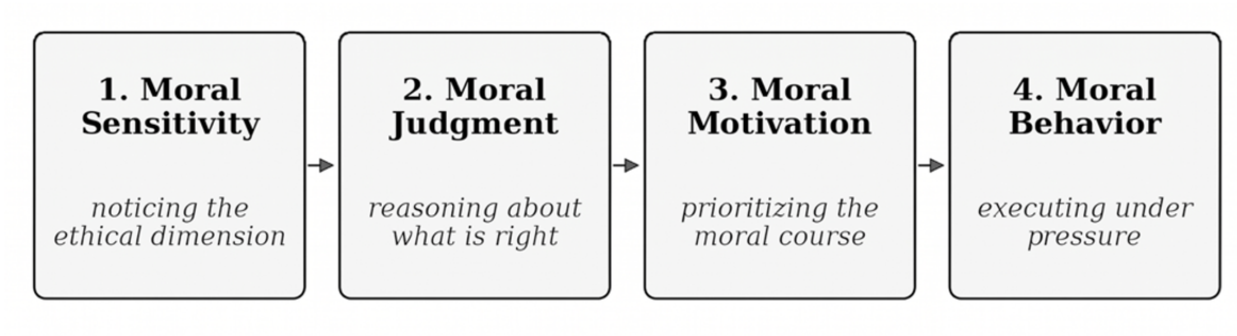


*Figure 1. Rest's Four Component Model of moral functioning. Adapted from [7].*

The Capabilities Approach to Professional Ethical Readiness (CAPER) is designed to address that unfinished work. It draws on Sen's [17] formulation, in which attention shifts from what people should do to what they can actually do in context, with conversion factors deciding whether resources translate into realized functionings, and on Nussbaum's [15] further development, in which education is the engine that converts internal skill into combined capability when external conditions cooperate. CAPER operationalizes ethical practice as a combined capability of this kind: it depends on individual resources (skills, habits, identity commitments) and on situational supports (norms, channels, protections, action pathways). Each of its four components is strategically aligned with one element from Rest’s model of moral functioning and one of Nussbaum’s central capabilities. Next, we lay out a theoretical foundations, defines the four components, and reports formative outcomes from an ongoing course-based study.

This Work in Progress paper has three aims: (1) to locate the gap in the conversion factors that allow moral knowledge to function in context rather than in individual moral failure; (2) to operationalize a framework that treats ethical readiness as a set of combined capabilities developed by individuals and institutions together; and (3) to report formative evidence on whether targeted instruction can influence proximal indicators of ethical intent and implementation.

We implemented the Capabilities Approach to Professional Ethical Readiness (CAPER) across three sections of a required undergraduate engineering ethics course (n = 84) and evaluated its effects using pre-post measures of ethical voice self-efficacy, perceived utility value, behavioral intention, and scenario-based behavioral performance. These measures capture proximal indicators of ethical action rather than behavior in professional settings; the study tests tractability, not transfer. Pre-post results show consistent gains across all four indicators, suggesting that ethical intent and implementation are tractable instructional targets when ethics education is designed around conditions of action rather than transmission of content

## II. A capabilities approach to ethical development

Mainstream engineering ethics education aligns well with Rest's first two components, awareness and reasoning, and counts on students to continue a linear progression to action. Bairaktarova and Woodcock [3] take a representative step toward closing the awareness-behavior gap by applying the Theory of Planned Behavior, predicting ethical action from attitude, perceived behavioral control, and subjective norms. The logic is sound for neutral environments. It is less robust when professional environments are not neutral.

A student's perceived behavioral control inside the classroom bears little resemblance to expressing oneself authentically inside a corporate hierarchy. Current pedagogy sensitizes students to social pressure in theory without equipping them to resist it in practice. The missing piece is not motivation alone but the capability to function as a moral agent in morally hostile contexts. Expecting compliance with the subjective norms embedded in (arguably hyperbolic) codes of ethics is particularly risky: organizational cultures often prize efficiency and hierarchy over deliberation, and the catalysts of ethical lapses tend to be situational rather than dispositional [28]. Bounded ethicality compounds the problem; even well-intentioned engineers fail to recognize the ethical features of routine decisions because attention, not motivation, is the binding constraint [29]. When a software team adopts a patch-and-ship mentality in place of long-term public safety, local norms prevail at the expense of personal values.

The Capabilities Approach (CA) reframes the question. Where virtue ethics asks whether a student possesses the relevant character traits, CA asks whether they can exercise them. Sen [17] introduces conversion factors, the conditions that decide whether a resource becomes a functioning, and Robeyns [16] divides these into personal, social, and environmental categories. A bicycle is a resource, but it produces no mobility for someone who cannot ride (personal), in a community that forbids cycling (social), or on impassable roads (environmental). The resource exists; the capability does not. Nussbaum [15] separates internal capabilities (trained skills and dispositions) from combined capabilities (internal capabilities plus the external conditions that allow their use). The educator's job, on this view, is not to transfer knowledge but to cultivate combined capabilities.

### Integrating Rest and Nussbaum

Rest's model of moral functioning and Nussbaum's Capability Approach are complementary in specific and important ways. Rest [7] insists that the four components are processes in the production of a moral act, not virtues a person has or lacks, and that competence in one area does not guarantee competence in another. None of the four is purely cognitive or purely affective; each involves a different kind of cognitive-affective interconnection. The implication is consequential: teaching awareness and reasoning will not, by itself, produce motivation and action. Each component requires its own developmental and affective work. Rest and his colleagues made this explicit when they extended the model into the professions, drawing data from nursing, dentistry, medicine, accounting, journalism, and other fields, and finding that programs which confine themselves to awareness and judgment regularly stall on intent and action [30].

Nussbaum [15], [22] supplies the language for that work at institutional and individual levels. Her list of central capabilities includes emotions ("not having one's emotional development blighted by fear and anxiety"), practical reason (forming a conception of the good and revising one's life by it), and affiliation (living with and toward others, with the social bases of self-respect intact). Wolff and de-Shalit [9] add two concepts that Nussbaum endorses [15]: fertile functionings, capabilities whose presence supports many others, and corrosive disadvantages, deprivations that pull many others down. The convergence matters here. Rest's claim that affect and cognition are entangled in every component, and Nussbaum's that emotions are themselves a central capability, both indicate that "moral failure" is often a predictable failure of combined capability under load, not a personal failing. Engineering education has been slow to internalize this. We teach students to think clearly about ethics in conditions that are unlike the conditions in which they will need to act, and we then ask why the transfer is poor.

**Antagonistic environments and conversion factors**

Robeyns's [16] three categories of conversion factors give the diagnosis traction in professional contexts.

*Personal conversion factors* include physical and mental health, skills, identity, and emotional regulation. The culture of engineering education shapes these directly. Chronic stress and sleep deprivation degrade the cognitive resources required for critical reflection [14] and a prosocial mindset [13]. The packed curriculum that produces this state is itself an environmental factor; the student and their environment are interconnected.

*Social conversion factors* include norms, hierarchies, and peer relations. Engineering programs, with their competitive structure and finite supply of internships, often position peers as rivals and erode the social scaffolding that ethical calibration requires. In organizations, silence is more often a calculated assessment of the cost of speaking than a product of cowardice or bad judgment [11], [12]. When costs are high and self-efficacy is low, silence and compliance are rational choices. Cultural norms and social dynamics are stronger predictors of (un)ethical behavior than individual values [11].

*Environmental conversion factors* include structural, situational, and temporal constraints. Cech [19] argues that the functional structure of engineering education works against ethical development by decoupling technical work from social responsibility. Once that decoupling is naturalized, the technical work feels ethically neutral and the ethical work feels optional.

These factors reframe how we should interpret unethical behavior in junior engineers. Ethical silence under hierarchical pressure is best understood not as a failure of courage but as a rational response to a capability-suppressing environment. Asking students for exceptional courage without addressing the personal, social, and environmental conditions of action is a kind of pedagogical fantasy. If we expect engineers to contribute ethically to the public good, the institutions that train and employ them have an obligation to provide the conditions that make such contribution possible [20].

**The four components of CAPER**

Nussbaum treats education as the principal engine that converts internal capability into combined capability, and the workplace as the environment in which combined capabilities flourish or fail. The central capabilities most relevant to the engineering classroom and workplace include practical reason, affiliation, emotions, and the social bases of self-respect [15], [22]. Walker and McLean [18] adapt this list for professional higher education, with autonomy, affiliation, emotion, and practical reason at the core of a public-good account of professional formation.

CAPER operationalizes ethical readiness through four components that align with Rest's and with the Central Capabilities highlighted by Walker and McLean (Figure 2). Affiliation supports ethical sensitivity by extending what one notices through trusted peer relationships, a check on the bounded ethicality that compromises individual judgment in isolation [29]. Practical Reason supports prescriptive reasoning by giving students an integrated narrative identity that holds technical and ethical considerations together under pressure. Emotional Bandwidth supports ethical motivation by protecting the affective resources that sustain commitment when disengagement is the easier path. Voice supports ethical behavior by providing the agency through which motivation becomes observable action. Each pairing is primary rather than exclusive: Rest [7], [30] is clear that the components interact, and our four components are fertile in the Wolff and de-Shalit sense [9], so strengthening any one produces gains in the others.

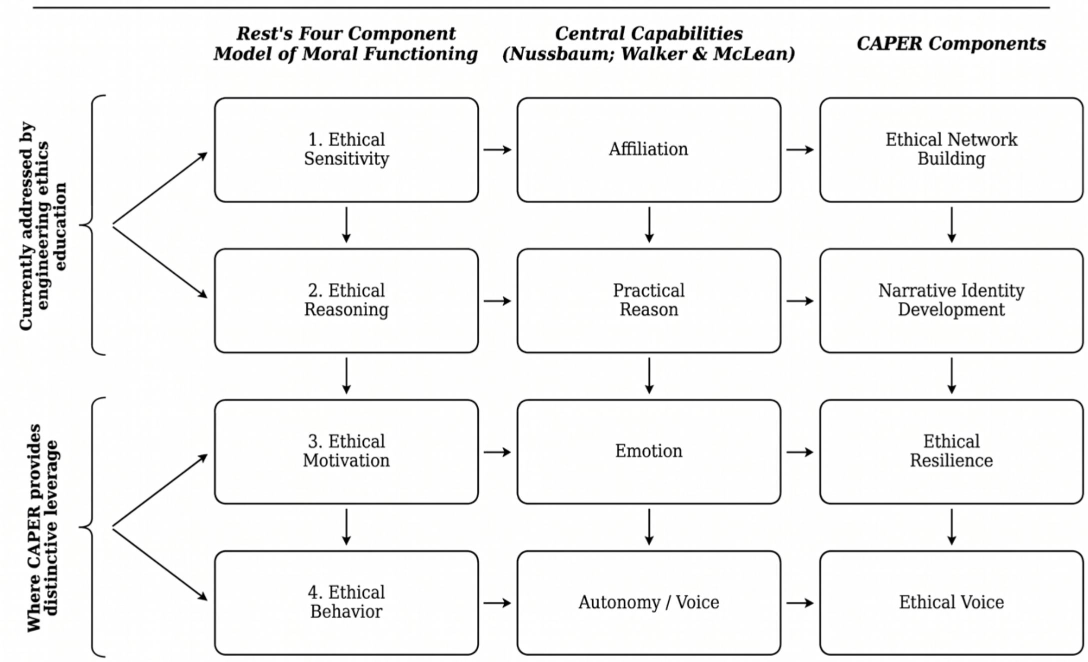


*Figure 2. Alignment of Rest's Four Component Model with Central Capabilities and CAPER components. Each CAPER component primarily engages one Rest component while contributing to the others.*

*Figure 2. Alignment of Rest's Four Component Model with four of Nussbaum's Central Capabilities and the four components of CAPER.*

**1. Affiliation as ethical network building**

The first CAPER component pairs with Rest's first: affiliation supports ethical sensitivity. The competitive, sink-or-swim culture of engineering education frequently leaves students without trusted peers to pressure-test their moral intuitions, and isolated individuals are reliably prone to the bounded ethicality Chugh, Banaji, and Bazerman describe [29]. Trusted peers are how attention gets distributed across the social field of a problem; they raise concerns the individual would have missed. Nussbaum [22] places affiliation among the central capabilities, and Walker and McLean [18] argue that a sense of belonging is essential to professional identity formation. To build this capability, our course cultivates durable learning teams that persist across multiple assignments. Unlike one-off group projects, sustained collaboration permits psychological safety to develop, and the team becomes a low-stakes proving ground for higher-stakes professional challenges. The aim is to shift students' perception of their peers from competitors for scarce rewards to resources for shared value creation. Done well, the durable team format produces affiliative capability in the present while building the habits that protect ethical agency in the professional future [11], [12].

**2. Practical reason as narrative identity development**

The second CAPER component pairs with Rest's second: practical reason supports prescriptive reasoning. Engineering students often experience their education as a series of disconnected technical hurdles, lacking what Walker and McLean [18] call practical reason, the capacity to form a coherent life plan. When a curriculum treats technical excellence and ethical sensitivity as separate domains, it undermines the student's ability to reason about ethical dilemmas without fragmenting under competing role demands. We address this with two bookend assignments: a backward-looking ethical autobiography and a forward-looking ethical vision statement. Nussbaum [22] defines practical reason as the capacity for critical reflection on the planning of one's life; by constructing narratives that connect who they have been with who they aspire to become, students develop an integrated self-concept rather than a compartmentalized one. The narrative work draws on Wilson's [23] story-editing research, which shows that small interventions targeting how people interpret their own experiences can redirect identity and behavior trajectories. This is a meaningful departure from the neo-Aristotelian reliance on a lifetime of habituated practice. Alongside these self-generated accounts, we present evidence-based narratives that clarify the shared value proposition of ethical practice, giving students access to the empirical case that integrity and professional effectiveness are more often complementary than conflicting.

**3. Emotional bandwidth as ethical resilience**

The third CAPER component pairs with Rest's third: emotional bandwidth supports ethical motivation. Sustained moral motivation is an affective achievement, not a purely cognitive one. Chronic stress depletes the resources ethical reasoning requires, and the engineering curriculum's heavy load propels many students into a scarcity mindset [14] that prioritizes immediate survival over the prefrontal (System II) deliberation ethical reflection requires. Two recent systematic reviews confirm that emotional regulation is a critical and underexamined component of ethical capability in engineering education [24], [25]. Rest and Nussbaum converge here. Rest [7] insists that no component of moral functioning is purely cognitive; emotion is internal to each. Nussbaum [15], [22] identifies emotional health as a central capability, and fear and anxiety as conditions that inhibit the development of all others. Fredrickson's [13] broaden-and-build research adds the empirical observation that positive emotional states expand the action repertoire while threat states contract it. To cultivate this capability, we draw on Nussbaum's argument that emotions are essential to practical judgment and on Walker and McLean's [18] treatment of social and emotional security as a precondition for capability formation. Following Klotz's [26] subtractive design principles, we ask first what can be removed to create reflective space rather than starting from what to add. In class narratives reframe anxiety as a legitimate signal rather than a personal weakness. The goal is to help students recognize when they are in threat mode and to reclaim the emotional bandwidth ethical motivation requires.

### 4. Agency as ethical voice

The fourth CAPER component pairs with Rest's fourth: voice is the agency channel through which motivation becomes ethical behavior. In engineering workplaces, implicit hierarchies push entry-level employees toward self-censorship. The problem is rarely that they do not know what they should say; it is that they do not know how to say it without putting themselves in jeopardy. CAPER frames voice as an essential ethical capability, building on Sen's [20] argument that universities should develop public reasoning, the ability to participate materially in collective deliberation. Faculty operationalize voice through Gentile's [21] Giving Voice to Values (GVV) approach. GVV starts from a different question than the conventional case study. It assumes the student already knows the right thing to do but does not know how to get it done. Through scripting, rehearsal, and peer coaching, students build confidence and learn to anticipate the rationalizations that derail ethical action. The pedagogical shift is to treat moral courage less as a virtue waiting to be summoned and more as a learnable professional competency. This has direct precedent in Duckett and Ryden's [32] application of Rest's framework to nursing education, where they argued that the four components do not exhaust moral functioning and proposed a fifth: interpersonal implementation skills, the capacity to execute a moral decision with the warmth and tactical care that makes it likely to land. Voice work in the GVV tradition is essentially training that fifth component. By targeting the social conversion factors that make speaking up feel risky, it converts ethical motivation into ethical behavior.

## III. Methods

Formative evaluation tested feasibility, refined instruction, and piloted measurement approaches for ethical motivation and the capabilities for action. The intervention was implemented across three sections of a required undergraduate engineering ethics course using a mixed-methods design. Data sources included (a) participation and completion logs, (b) repeated-measures intent and self-efficacy scales, (c) performance on scenario-based behavioral tasks scored with a behaviorally anchored rubric, and (d) self-reflective artifacts coded for intent- and implementation-relevant features.

Measurement constructs were derived from CAPER's four-component architecture, with each measure aligned primarily with the Rest component its parent CAPER component is designed to engage. Voice self-efficacy is the closest proxy for ethical behavior, capturing confidence in raising concerns through interpersonal and formal channels. Perceived utility value of ethical action is the closest proxy for ethical motivation, since it measures how much weight students place on ethical action relative to competing professional values. Rest himself flagged Component 3 (moral motivation) as the least empirically developed of the four components, because measurement traditions in moral psychology had concentrated on judgment [30]; our utility-value measure contributes to that thin literature. Behavioral intention to act bridges all four components by measuring students' reported likelihood of engaging in ethically courageous behavior under constraint, which presumes affiliation, narrative identity, emotional bandwidth, and voice working together. Scenario-based behavioral tasks are the most direct combined-capability measure, requiring students to demonstrate moral reasoning in collaborative contexts and execute under simulated pressure.

### Participants and setting

Participants were 84 undergraduate engineering students enrolled in three sections of a required engineering ethics course taught by the same faculty member during the same semester. All three sections met on the same two days of the week and followed the same syllabus to reduce variability across the sample. Data were drawn from in-class activities that are part of the existing course curriculum, immediately de-identified, and analyzed in aggregate.

### Measures

Ethical intent was operationalized using three proximal indicators of ethical action under pressure: (1) voice self-efficacy, the confidence to raise ethical concerns through interpersonal and formal channels; (2) utility value of ethical practice, the perceived value to self, organization, and others of maintaining high ethical standards; and (3) intention to act ethically, the expressed likelihood of speaking up, escalating, or pausing work under specific scenarios. Items used a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree). Scale reliability was assessed with Cronbach's alpha ($\alpha$), and short-form factor structure was assessed via exploratory factor analysis when sample size permitted. Reflective student artifacts (e.g., ethical action plans) were coded for actionable intent signals (explicit commitment language, concrete next steps, anticipation of social friction) and for behavioral realism (recognition of constraints, escalation sequencing).

### Analysis

Feasibility metrics were summarized descriptively (completion rates, time-on-task). For pre-post outcomes, paired-samples t-tests assessed within-subject change, and effect sizes were reported as Cohen's d with 95% confidence intervals. Because the primary purpose was formative, emphasis was placed on effect sizes, confidence intervals, and measurement reliability rather than p-values alone.

## IV. Results

*Self-reported measures of ethical intent.* Students showed pre-post gains across all three intent measures. Ethical voice self-efficacy increased from $M = 4.18$ ($SD = 0.96$) to $M = 5.36$ ($SD = 0.88$), $t(83) = 7.12$, $p < .001$, $d = 0.78$. This was the largest observed effect and the one most directly targeted by GVV-informed scripting and rehearsal, consistent with the framework's prediction that the voice component, paired with ethical behavior, would be most responsive to scripted practice. Utility value increased from $M = 4.91$ ($SD = 1.02$) to $M = 5.62$ ($SD = 0.97$),

$t(83) = 4.25$, $p < .001$, $d = 0.46$. Behavioral intention to speak up increased from $M = 4.02$ ($SD = 1.11$) to $M = 5.01$ ($SD = 1.03$), $t(83) = 5.63$, $p < .001$, $d = 0.61$. Scale reliabilities were acceptable for short forms (voice self-efficacy $\alpha = .86$; utility value $\alpha = .79$; intention $\alpha = .82$).

*Scenario-based behavioral performance.* Total rubric scores (0–20) increased from $M = 10.6$ ($SD = 2.7$) to $M = 13.8$ ($SD = 2.5$), $t(83) = 6.10$, $p < .001$, $d = 0.67$. The largest gains appeared in escalation sequencing and stakeholder framing. Smaller gains in tone calibration reflected ceiling effects concentrated among students with prior internship experience.

*Qualitative indicators.* The proportion of reflections containing at least one concrete escalation plan rose from 31% pre to 47% post, a 52% relative increase in students producing actionable rather than aspirational responses. A second shift was equally notable: post-intervention reflections increasingly named interpersonal friction, hierarchy, and peer dynamics as the relevant constraints, instead of describing ethical conflict in abstract terms of principle versus outcome. This movement toward behavioral realism, the capacity to anticipate social as well as technical risk, is one of the most educationally significant findings from this cycle.

*Interpretation.* The pattern of gains aligns with CAPER's architecture as laid out in Figure 2. The largest effect, on voice self-efficacy ($d = 0.78$), maps to the agency-as-voice component paired with ethical behavior, the capability most directly suppressed by hierarchy and fear of retribution. The moderate gain in utility value ($d = 0.46$) maps to the emotional bandwidth and practical reason components paired with motivation and reasoning, suggesting that students increasingly experienced ethical action as instrumentally compatible with professional identity rather than in tension with it. The behavioral intention gain ($d = 0.61$) bridges all four components. Scenario-based performance gains ($d = 0.67$) carry the most external validity, since rubric-scored tasks require behavior under simulated constraints rather than self-report alone. The smaller gains in tone calibration among students without prior internship experience suggest that emotional bandwidth under organizational pressure may be more sensitive to actual professional exposure than to instructional simulation.

## V. Formative revisions

Three revisions followed directly from the formative findings. First, early-semester rubric scores indicated that many students lacked an operational understanding of what ethical action looks like in practice; we now engage this theme earlier in the semester so students have clearer targets before being asked to perform. Second, workload constrained deliberate practice more than we had anticipated. Students were completing behavioral exercises in high-stakes clusters rather than through distributed repetition, so we restructured behavioral practice into shorter, more frequent activities to reduce cognitive load. Third, qualitative coding showed a persistent tendency toward aspirational but vague “do the right thing” responses, indicating that students were not yet working from a realistic repertoire of organizational action. Prompts were revised to require deliberate consideration of multiple strategic options such as information gathering, informal voice, structured dissent, and documentation.

## VI. Discussion

The formative outcomes suggest that CAPER interventions may be strengthening capabilities that support ethical intent and behavior across all four Rest components rather than only the latter two. The observed gains in voice self-efficacy, behavioral intention, and perceived value, while preliminary, are consistent with a meaningful shift in ethical agency. The qualitative changes in student reflections may be the most promising finding. Students increasingly placed ethics inside the interpersonal friction and organizational politics that define engineering work, moving beyond abstract catastrophe framing toward the situational savvy that aligns values and behavior.

If these findings persist across larger samples and longer timeframes, they have implications for how ethical readiness is operationally defined and taught. As Robeyns [16] argues, human development is ultimately a functional question, assessed by what people are able to do rather than what they can articulate. When an engineering graduate can identify a conflict of interest but lacks the tactical agency to navigate a safety concern in a meeting, the curriculum has failed them. Functional standards also implicate the external benchmarks that govern curricular design in U.S. engineering programs: the accreditation criteria that define what graduates must be able to demonstrate.

Accreditation criteria establish a floor rather than a ceiling for ethics education, and the current floor is keyed to recognition and judgment rather than to action. ABET organizes program assessment around seven Student Outcomes, and the ethics criterion is captured in Student Outcome 4, which requires that graduates demonstrate “an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments that consider global, economic, environmental, and societal contexts” [27]. This is significant progress over earlier benchmarks, but it addresses only the front end of the four-component model: sensitivity and reasoning. A more robust standard would assess the full architecture: affiliation that supports ethical sensitivity, practical reason that supports prescriptive reasoning, emotional bandwidth that sustains ethical motivation, and agency that converts motivation into ethical behavior. The CAPER framework remains provisional until more course data are analyzed and longitudinal studies track graduates into practice and examine behavior rather than intent alone.

### Preliminary strategies for enhancing ethical capabilities

*Affiliation through team building.* Faculty might shift from one-off group projects to durable learning teams that treat student cohorts like a well-engineered system: consistent attention, productive tension, periodic tuning. Collaborative process can be evaluated alongside the technical artifacts. Teams that navigate challenges across an entire semester experience real interdependence and build the mutual trust that enables ethical practice. The wager: distributed attention across trusted peers improves ethical sensitivity.

*Practical reason through narrative identity.* The engineering curriculum can bridge the gap between technical and non-technical learning goals by helping students revise the "story of themselves" in productive, identity-relevant ways. Faculty might pair backward-looking and forward-looking reflective assignments with evidence-based narratives. Such story-editing strategies compel the functional integration of technical and professional development, helping students envision their career as part of a deliberately integrated life plan rather than a sequence of tasks. The wager: an integrated self gives students a stable platform from which to judge.

*Emotional bandwidth through resilience.* At the program level, we can serve students better by auditing and reducing unnecessary cognitive and emotional friction. Subtractive strategies streamline day-to-day demands and keep the scarcity mindset at bay. Framing anxiety as a diagnostic signal rather than a personal weakness, and cultivating psychologically safe classrooms, preserves the executive functioning that ethical engagement requires. The wager: protecting affective resources sustains motivation under load.

*Agency through voice.* Educators can recast moral courage as a technical competency rather than a spontaneous virtue and shift from historical post-mortems to pre-mortem strategies like value clarification and scripting. The classroom should be a safe environment where students pressure-test their responses to ethical dilemmas. By practicing pushback against simulated hierarchical pressure, students build the "moral muscle memory" [21] required to articulate their values in ways that minimize personal risk. The wager: practiced voice converts ethical motivation into observable behavior.

**Limitations and next steps**

As a formative study, these results prioritize feasibility, measurement readiness, and proximal change rather than causal claims about long-term professional behavior. The single-group pre-post design cannot rule out maturation, demand effects, or improved familiarity with what counts as a strong response. Scenario-based tasks, although more behaviorally grounded than conventional written analyses, remain classroom proxies for workplace conduct. Next steps include adding comparison conditions when feasible, tracking persistence of intent and behavior proxies after internships and capstone design experiences, and testing whether rubric scores align with external indicators such as ethical voice during placements. The most critical question is durability: will these gains hold up under real-world pressure?

## VII. Conclusion

The reason-action gap is a predictable result of instructional standards that treat ethics as a logic puzzle and underestimate the conversion factors that determine whether knowledge transfers to practice. To narrow the gap, the instructional burden must incorporate a broader conception of ethical readiness, one that surfaces and cultivates the conditions for ethical action. CAPER's contribution is to pair each of its four components with a specific Rest component and a specific Central Capability, so that the framework engages all four elements of moral functioning while concentrating its distinctive leverage on the third and fourth, where current pedagogy is weakest.

Five action items follow. First, recast accreditation standards by moving ABET assessment beyond theoretical application toward demonstrations of implementation capability under realistic pressure. Second, test students' ethical field strength: can they engage personal, social, and situational levers under realistic conditions? Third, supplement aspirational professional standards with concrete Ethical Blueprints that map specific tactics for consensus-building, strategic dissent, formal escalation, and documentation. Fourth, treat emotional resilience as a technical competency necessary for maintaining cognitive bandwidth under load. Fifth, distribute capability development across the engineering curriculum rather than concentrating it in a single course; Duckett and Ryden's Multi-Course Sequential Learning model [32] in nursing offers a tested precedent for this kind of distributed integration.

The remaining question is not whether the reason-action gap exists, but whether engineering education will commit to closing it. The field has spent decades teaching students how to think about doing the right thing. The next decade will be measured by whether it can also teach them how to do it.

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