WIP: Teaching Empathy, Leadership, and Ethics in Computing

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I. Introduction

Computer Science and Engineering (CSE) at the University of Michigan has long housed most undergraduate ethics instruction in a 2-credit course for seniors entitled "Professionalism," initially developed circa 2000. The department has determined that this course is outmoded and placed too late in the curriculum, creating an opportunity to design an ethics-focused course *de novo*. The course was offered in small "pilot" sections during AY 2025–26 and will be required of all CS-Engineering majors (roughly 300 students per term) starting in Fall 2026. Departmental review of the course is anticipated after 2027.[1]

The purpose of this article is to (1) describe the goals and activities of the course as well as the collaborative multidisciplinary nature of its development; (2) describe how the effectiveness of the course is evaluated; (3) explore some preliminary findings on course effectiveness in small pilot offerings and plans for revision; and (4) to seek feedback on plans to "scale up" the course to serve 300 students per term.

Co-author Dexter volunteered to lead development of this course, receiving a charge to focus the course on "social impacts of computing" and to "avoid preaching," with substantial autonomy to develop the course. Several other foundational assumptions/observations provide important context for the course: (1) today's world is obviously and thoroughly suffused by computation in the forms of social media and artificial intelligence—our students are viscerally aware of the social context of computing, which we take as the foundation for engagement in this course; (2) our CSE students aspire to be leaders, not simply professionals—indeed, one of our institution's slogans is "The Leaders and the Best"—and many academic units house leadership and entrepreneurship centers; (3) students respond well to *challenges* to their preconceived ideas about the role of technology; and (4) for students, thinking about *ethics* is closely connected to career *agency* and *power dynamics*. (These last two points are based on recent research by Padiyath [1], further discussed below). Mirroring the conceptualization of *Critically Conscious Computing* in [2], which emphasizes that ethical computing relies both on *critical reflection*, an awareness of sociotechnical issues, and on *critical agency*, the confidence and power to address sociotechnical issues, we further chose to emphasize both *reflection* and *skills* in this course.

Based on these principles, we designed a 2-credit discussion-intensive pragmatically-focused course with the intentions/outcomes that students will leave the course better able to

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[1] This paper reports on the experience of designing and delivering the pilot to about 20 students in each of the Fall 2025 and Winter 2026 semesters.

1. Communicate effectively and empathetically with clients, co-workers, and stakeholders;
2. Recognize and analyze power differences, both among peers and between technology creators and users.
3. Be and become empathetic and inclusive leaders;
4. Create and analyze inclusive artifacts (e.g. accessible, gender-inclusive).

Key elements of the course are three case studies, four empathy activities, and two mini-projects, discussed below. Table 1 summarizes the relationships among course learning outcomes and activities—details of these activities are provided in the "Course Design" section below.

Learning Outcomes	**Course Activities** (Chronological)								
	Empathy 1	**Case 1**	**Empathy 2**	**Project 1**	**Case 2**	**Empathy 3**	**Project 2**	**Case 3**	**Empathy 4**
1 Comm	*		*			*			*
2 Power		*			*	*	*	*	
3 Leaders	*	*	*		*	*		*	*
4 Artifacts		*		*			*		

Table 1. Alignment of course learning outcomes and course activities.

In the balance of this article, we briefly review several bodies of literature that inform our course design, describe the elements of the course and their interconnection, report on some quantitative assessment of the course's effectiveness, and close with some notes on the iterative refinement of the course.

II. Literature Review

Because this course is part of a computer science curriculum housed within a college of engineering, its design and delivery draw on principles and practices of both computer science ethics instruction and engineering ethics instruction. Specifically, our course design is based on contemporary practices in computer science ethics instruction but draws equally on broader engineering research on preparing students as leaders with sociotechnical competency. In this section, we briefly review the state of computer science ethics curriculum and pedagogy, then engage some larger engineering ethics education concerns, including preparing students for leadership, the pedagogy of case-based learning, and the significance of empathy in the engineering workplace and classroom.

1. Computer Science Curriculum

The 2018 *ACM Code of Ethics and Professional Conduct*[2] begins with the observation, “Computing professionals' actions change the world. To act responsibly, they should reflect upon the wider impacts of their work, consistently supporting the public good” [3]. Further, the computer science community recognizes that undergraduate education must include more than technical training. The *Computer Science Curricula 2023*, a global standard jointly developed and endorsed by three international professional bodies (including ACM), specifies that successful computer science graduates have three types of characteristics:

- Professional knowledge and skills demonstrating technical expertise
- Professional responsibilities toward society, ethics, and the profession
- Professional dispositions such as persistence and life-long learning [4, p. 55].

Of most relevance to this paper, the *Curricula 2023* specifies that a graduate “must be committed to the **whole solution**…, [demonstrate] knowledge of a code of ethics… [and] awareness of responsibilities beyond those captured in a professional code (e.g., global and cultural competence)... [and] work to maximize the benefits of computing for the society at large while preventing harm to individuals” [4, p. 55, emphasis in original].

2. Computer Ethics Pedagogy

Computer science as a discipline has been grappling with potential and actual harms arising from computation for at least 50 years. The computer scientist Joseph Weizenbaum’s 1976 *Computer Power and Human Reason: From Judgment to Calculation*, in which he warned, “the technologist can no longer avoid the responsibility for… the wounds he inflicts on [society]” is often cited as an early work in this area, [5, p. 272]; more recently Gebru and Torres observe that “the race to build AGI [Artificial General Intelligence] is proliferating products that harm the very same groups that were harmed by first-wave eugenicists” [6].

The discipline has also been grappling with how we prepare the next generation of computer scientists to recognize and reduce those harms. As Brown et al. note in their 2024 literature review [7], computer ethics pedagogy has been developing for at least forty years, with conversations about the role of ethics in the undergraduate curriculum ongoing for at least thirty [8]. To paraphrase Brown et al [7, p. 6:3] diverse ways of thinking about ethics and computing yield a diversity of goals of teaching ethics in computing, which are mirrored in the diverse pedagogies and curricular interventions employed (e.g. discussions, lectures, case studies, stories, speculative writing, and “dual” technical/ethics learning activities). Brown et al further observe (citing similar work in engineering ethics such as Hess and Fore’s 2018 review [9]) computing ethics and engineering ethics share similar structural and curriculum concerns,

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[2] The Association for Computing Machinery (ACM) is “the world’s largest computing society,” bringing together “computing professionals” of all kinds.

including the need to address both "micro-ethics" and "macro-ethics" conceptions. The *effectiveness* of ethics instruction in computing is a parallel subject of concern and study. The review in [1] is guided by the question: "How do ethical interventions in undergraduate programming courses become accepted (or resisted or otherwise), by which students, in what circumstances, and why?" [1, p. 22:2].

This is a critical question for us as course designers. While our curricular context is slightly different (a standalone course, rather than ethics material augmenting a technical programming course), we adapted some findings from this review, as we intend this course to be taken by students as a requirement simultaneously with intermediate programming courses.

3. Engineering Leadership and Sociocultural Skill

Given the task of replacing a more traditional course on computing ethics and professionalism, we decided early in the process to avoid a narrow focus on professional ethics and to situate the course instead as an intervention into undergraduates' identity formation as computer scientists and, within an engineering college, as engineers. This decision was motivated not only by the critical approaches to computing cited above, but also by scholarship emphasizing the position of engineers as experts working in complex sociotechnical systems and embedded in relations of power, privilege, and identity.

Engineering (including computer science) impacts people and their resources, risks, and opportunities. Scholars argue, therefore, that engineers must be prepared not only as technical problem-solvers but also as leaders who can define problems, navigate social contexts, and account for downstream impacts [10], [11]. This includes ethical responsibility at the micro, meso, and macro levels, from professional relationships to community impacts and broader societal consequences of technology [11]. In particular, recently developed frameworks, such as [12], [13], emphasize adaptive expertise: the ability to apply technical knowledge while accounting for stakeholders—especially those systematically excluded from decision-making—organizational dynamics, and cultural context, with the explicit goal of benefiting both organizations and society at large.

However, persistent framings of engineering as narrowly technical actively undermine this broader preparation. Engineering education and career pathways—certainly including computing professionals' pathways—often reward technical expertise while marginalizing social, ethical, and leadership work, reinforcing a technical/social divide that shapes engineers' identities and limits leadership development [14], [15], [16]. In the workplace and in education, engineers frequently experience leadership as incompatible with their professional self-concept, especially in cultures where technical roles are more valued than managerial or people-centered ones [17], [18]. Scholars have argued that effective engineering leadership emerges not by abandoning technical identity, but by recognizing that leadership is already embedded in technical decision-making itself [16], [19].

This body of work points directly to the need for ethics education that treats technical and social reasoning as inseparable, rather than as an add-on, and has implications for how to embed it into curricula. As course designers, we see our goals of (a) developing students' capacity for leadership and (b) developing students' critical reflection and agency as similarly inseparable.

4. Case-Based Learning

To make the inseparability of social and technical questions visible to students, we scaffolded the course around three case studies that ask students to engage in qualitative, open-ended analysis of real-world engineering problems and to reflect on engineers' power, position, identity, and agency. These cases guide students through three scenarios: the design of an adaptive controller for gamers with disabilities at Xbox; design and leadership decisions that inadvertently fostered, then attempted to mitigate, discrimination at Airbnb; and understanding the risks to stakeholders and social systems of implementing "emotion AI" in privately owned automobiles.

Case-based learning is commonly used in STEM education to support integration of societal context with technical content toward development of ethical decision-making skills [9], [20]. However, the content, format, and delivery modes of cases can vary considerably. Past research has, for example, explored the potential for case studies to engage with the intersection of technical and social issues on scales ranging from the individual to the societal level [21], [22]. From a student perspective, case-based approaches have the potential to increase engagement [23]. For example, students recognize the value of cases in preparing them for future careers by demonstrating real-world applications of course concepts, supporting connections between course topics, and providing opportunities to practice working through complex, authentic problems without clear answers [24]. At the same time, students may be challenged by modes of learning beyond traditional lecture [25]. Even when students enjoy case content and the novelty of a new modality, they may also question whether additional effort on their part is worthwhile and whether their time might be better spent on more traditional technical content [23]. From this perspective, course design choices in framing and scaffolding the integration of case content are critical.

Further, assessment of the success of case-based approaches has often focused primarily on self-reported data from students and faculty, which may not reflect actual learning [26]. This tension is particularly salient in the context of ethics education in which students can reflect hypothetically on how they might respond to a given scenario but are necessarily removed from the power dynamics of the real-world scenario in question.

5. *Empathy in Engineering and Leadership*

The design decisions made by computer scientists and software engineers, like those made by engineers of all kinds, impact a diversity of stakeholders, potentially in large numbers [27]. As the current ABET accreditation criteria state, we need to prepare students to "produce solutions that meet specified needs with consideration of… global, cultural, social, environmental, and economic factors" (Student Outcome 2) [28, p. 6]. But this preparation will not happen automatically, and is perhaps in tension with the overwhelming focus on analytical techniques in undergraduate engineering education. Citing research by Jack et al [29], showing that human brains cannot simultaneously analyze and empathize, and by Cech [30], showing that undergraduates' commitment to public welfare tends to decrease during their engineering studies, Walther et al assert, "students need explicit training in empathy to offset the analytic cognitive bias of undergraduate engineering degree programs. If we do not actively foster social reasoning and concern for public welfare, Cech argues that we risk limiting how engineering students will approach future problems" [31, p. 13]. We view empathy, therefore, as a skill of critical importance to software engineers.

From a psycho-social perspective, empathy is generally viewed is having an *affective* component (emotional responses to others' emotions and actions), a *cognitive* component (processing one's own responses and analyzing the perspective of others), and a *behavioral* component (acting on the basis of affective and cognitive processes) [32], [33]. While naturally arising, empathy can also be trained and developed as a set of skills supporting design and engineering (e.g. [34], [35], [36]). In this vein, Walther et al characterize empathy in engineering as "a skill, a practice orientation, and a professional way of being," with no hierarchy or trajectory explicitly relating the three dimensions. In particular, they emphasize that empathy is composed of "learnable and teachable" skills: "affective sharing, Self and Other awareness, perspective taking,… emotion regulation, [and] mode switching… between empathetic and analytic modes" [37, pp. 133–4]. We view these skills as a kind of *gateway* or *prerequisite* to recognizing power dynamics, social inequity, and the potential for harmful design.

Walther, Sochacka, and colleagues have developed a series of instructional modules for fostering empathy-based communication skills, which we have adapted (see "Course Design," below) [38], [39]. With the case studies as a substrate, we focus on empathy as a concrete and teachable skill that supports students applying socio-technical thinking—"the ability to integrate social and technical dimensions in solving a design problem" [40, p. 244]—as they engage real-world scenarios. We understand this to be an incremental intervention. As Walther et al observe in [31], this type of instruction can expose tensions in students' identity formation processes; students' responses to this instruction may be nonlinear over time. Moreover, the development of empathy skills in one classroom context may be constrained by other elements of institutional/engineering culture.

III. Course Design

As noted above, the design of this course is partially inspired by two of Padiyath's findings:

1. "When students have preconceived notions about an ethical issue and those preconceived notions are challenged, they are accepting of the intervention" [1, p. 22:11].
2. "When students perceive that they will lack agency in their career and are challenged with an ethical dilemma set in the workplace that does not engage with power dynamics, they are more likely to resist the intervention" [1, p. 22:13].

Here, finding 1 intentionally contrasts with the "exposure theory" of ethics instruction; rather than assuming students have never considered a given ethical issue, it assumes that students have some (perhaps minimal) awareness of an ethical issue and/or its context. This approach to structuring an ethical intervention still attends to students who may indeed have not considered an ethical issue, but it also productively engages those students who have, rather than risking reactions of boredom or indifference. Finding 2 emphasizes the importance of situating ethical interventions in a "real world" that students can imagine themselves inhabiting, including recognition of the dynamics that may support/inhibit ethical responses.[3]

These, together with other foundational principles discussed in the Introduction, pointed us toward a course that was organized around hands-on activities, the development of skills, and a career/workplace context. In particular, the design of the course has developed through a year-long (and counting!) collaboration among the co-authors: Hoffman and Bland, at the College of Engineering's Center for Socially Engaged Design, adapted and developed the three case studies that structure the course; Wang, at the Center for Research on Learning and Teaching in Engineering, created course activities tied to the case studies that develop empathetic communication skills. Padiyath consulted on early stages of course design and also oversaw some quantitative assessment (see Evaluation and Assessment, below).

1. Case-Based Pedagogy

Over the course of several design iterations, three case studies were selected as the backbone of the course. Each case is based on authentic, real-world scenarios and designed to guide students in analyzing the social context of technical decision-making and taking on the perspectives of stakeholders, including both individuals in leadership roles and users and communities who might be impacted by decisions of those in leadership roles. The scope of the cases intentionally

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[3] Indeed, in response to an anonymous feedback opportunity early in the Winter 2026 semester, a student wrote, "I'd love to learn more about how to empower us in the workplace when our employer pushes us to do something we deem unethical and or not in the best interest of the public."

expands during the course, roughly aligning with micro, meso, and macro scopes of ethical responsibility.

Mindful of challenges that can arise in case-based learning, each case is intentionally scaffolded to help students manage the cognitive load of processing detailed information associated with each case as well as the cognitive and emotional demands of discussing these cases in class. The cases unfold across 2 or 3 weeks (where class meets once weekly) as follows:

- Preparatory/introductory class session introducing necessary foundational concepts;
- Case-specific guided pre-reading;
- Guided in-class activity, systematically debriefing and building on pre-reading, including "icebreaker" questions, core analytic/synthetic activities, and concluding reflection;
- Post-case assessment prompts/reflections;
- Additional in-class activities extending the case study to adjacent domains; and
- An empathy activity allowing students to practice a particular empathy skill connected with the focus on the case study.

In-class activity is intentionally designed to promote active learning through multimodal participation, combining individual reflection, pair/small group activities, and large group discussion. The goal is to help students feel comfortable participating in formats that might be uncommon in other CS contexts.

The specific cases:

Xbox. This case explores the early co-design process behind the Xbox Adaptive Controller (XAC), focusing on the 2015 pivot from a motion-sensing device to a customizable hub that lets players integrate third-party accessories tailored to their needs. Students examine how designer biases shaped the standard Xbox controller, unintentionally excluding many users; they analyze how participatory design reduces the effects of these biases and improves design. This case is used early in the semester to prime students to think about leadership, agency, and unintended consequences, with a focus slanted toward the micro level of ethical responsibility: the impacts of design decisions on individuals.

Airbnb. This case explores racial discrimination on the Airbnb platform, beginning with the negative publicity this generated for Airbnb in 2016. Students analyze how early design decisions at Airbnb, which focused on reducing users' fears of "stranger danger," unintentionally facilitated discrimination, and they evaluate the effectiveness of the steps Airbnb has taken in response. This case is used to analyze a historical example of well-documented unintended negative consequences of leadership vision and decision-making. Looking backward, students analyze contributing factors (i.e., lack of attention to the assumptions embedded in that vision and their own positional power) and grapple with potential limitations in leaders' ability to exert power over users through incremental changes to a service already in place. This case engages students at both the micro and meso level of ethical responsibility, connecting individual acts of discrimination to impacts on communities defined both by geography and by identity.

Affectiva. This case explores Affectiva's attempts to develop accurate "emotion AI" technology for market research contexts, and the risks inherent and its application to new automotive contexts after the company was acquired by SmartEye. Students explore Affectiva's approach to creating effective market research technology and the limitations of that technology when it is transferred to a new context. Here, stakeholders' concerns go beyond the accuracy of the product to risks around privacy, consent, surveillance, and the product's embedding in a larger data ecosystem. This case is used to help students look forward to considering how leaders might test their vision for an emerging technology and predict/mitigate unintended consequences before they are deeply rooted. In this case, students focus on the macro level of ethical responsibility, considering the impacts of a technology when it is made ubiquitous.

2. Empathy Activities

To support students developing concrete empathy skills, we adapted the empathy workbook developed by Sochacka, Walther, and colleagues [38], pairing four empathy activities with other course activities. As a first-day icebreaker, we discuss and practice active listening; after the Xbox case study we practice and reflect on approaching others; after the Airbnb case study we practice perspective-taking and mode-switching, and after the Affectiva case study we explore mode-switching and social empathy. This integration allows students to practice empathy while reinforcing their understanding of socio-technical engineering in complex real-world situations. Ultimately, our goal is to help students recognize that social reasoning is integral to technical decision-making in the engineering profession.

3. Project-Based Work

In addition to the case-based learning activities, students also complete two small group-based projects designed to address learning outcome 4 (working with inclusive artifacts). Project 1 extends the Xbox case study to explore the accessibility of videogame hardware and software; Project 2 uses the GenderMag framework [41] to analyze the inclusiveness of software user interfaces [42]. In addition to the primary course learning outcomes, these projects also give students a space in which to practice empathy skills, as well as other skills related to teamwork; an opportunity to develop presentation skills; and some concrete reminders that many ethical behaviors in software design and development are supported by evidence-based tools and frameworks.

IV. Evaluation and Assessment

We have assessed the effectiveness of the course through several qualitative instruments and one quantitative measure, the Critical Reflection and Agency in Computing Index ("the Index"), described below. Qualitatively, students have several opportunities to respond to the course, both anonymously and not, both required and not. These include University-administered midterm and end-of-term opinion surveys (nominally quantitative, but lacking psychometric grounding), an in-person focus-group style midterm feedback session facilitated by trained staff unaffiliated with the course, nearly-weekly written reflection assignments, weekly in-class check-ins connecting classroom activities with the course learning outcomes; and a final course written reflection. We focus here on results from the Index.

1. Critical Reflection and Agency in Computing Index

At the start and end of the each term, students completed the *Critical Reflection and Agency in Computing Index*, an instrument with evidence for validity and reliability [43], [44]. The Index measures students' attitudes and perceptions towards two constructs: *critical reflection*, an awareness of sociotechnical issues; and *critical agency*, the confidence and power to address sociotechnical issues. The construct of critical reflection is operationalized into three factors: (1) *anti-technosolutionism*, a skepticism of the belief that technological solutions alone can solve all problems [45]; (2) *valuing marginalized perspectives;* and (3) *valuing ethics education*. Whereas the construct of critical agency is operationalized as (1) *personal effectiveness*, "the belief in one's ability to uphold ethical conduct and communicate ethics perspectives"; and (2) *system responsiveness*, "the belief that ethical concerns raised will be heard and addressed in computing projects and workplaces" [44]. Each operationalization contains a set of Likert scale items. To preserve validity, we used the same six-point Likert scale for each item, as done in the validation study. We also included one commitment question [46]. Responses failing to commit to provide thoughtful responses were discarded. Responses were anonymous, as no identifying information was collected. Response rates for the Fall surveys were 22/22 (100%) for the pre-survey and 17/19 (89%) for the post-survey. Response rates for the Winter surveys were 21/22 (95%) for the pre-survey and 23/23 (100% for the post-survey).[4]

[4] This study was carried out with University IRB approval, code HUM00280220.

	Fall 2025		Winter 2026	
Operationalization	pre	post	pre	post
Valuing Marginalized Perspectives	**0.73**	**0.75**	0.58	--
Anti-technosolutionism	0.67	--	--	0.47
Valuing Ethics Training	**0.81**	**0.92**	**0.85**	**0.80**
Valuing Technical Training	--	0.67	**0.86**	**0.91**
Personal Effectiveness	**0.74**	**0.77**	**0.77**	**0.81**
System Responsiveness	**0.70**	**0.93**	0.45	--

Table 2. Reliability of operationalizations, Cronbach's alpha.

Each operationalization was assessed for internal reliability using Cronbach's alpha. Operationalizations were analyzed as an average when $\alpha >= 0.7$ for both pre- and post-surveys. As shown in Table 2, the following operationalizations met our threshold in Fall 2025: *Valuing marginalized perspectives, Valuing Ethics Training, Personal Effectiveness*, and *System Responsiveness*. In Winter 2026, these operationalizations met the threshold: *Valuing Ethics Training*, *Valuing Technical Training*, and *Personal Effectiveness*.

For each operationalization passing our reliability threshold, we used Mann-Whitney U tests to assess whether the distribution of scores differed significantly between the pre- and the post-survey. This test was chosen due to the non-normal distribution of variables, relatively small sample size, ordinal data, and data without identifiers. Tests were conducted in StataSE 19 and statistical significance was set at $p < 0.05$.

2. Results

We compared pre- and post-survey scores for the operationalizations that passed our reliability threshold using the Mann-Whitney U test; see Table 3 for Fall 2025 results and Table 4 for Winter 2026 results. In both terms, *Personal Effectiveness* post-survey scores were significantly higher than pre-survey scores, indicating a moderate-to-large effect ($r = 0.45$) by the end of the Fall term and a small-to-medium effect ($r = 0.38$) by the end of the Winter term. This means through both terms, students show significant growth in their belief in their "ability to uphold ethical conduct and communicate ethics perspectives," an important step in activating one's socio-technical mindset. In contrast, no statistically significant differences were found between the pre-survey and post-survey scores for any other operationalization.

We note a moderate ceiling effect, in the Fall term, for *Valuing Marginalized Perspectives* and *Valuing Ethics Training*. Our median scores for both pre- and post-surveys are relatively close to the max score of 6. We attribute this to sample bias, as this was the first offering of the course and likely attracted a relatively high proportion of students with propensities for critical reflection prior to this intervention.

Fall 2025 Operationalization	**Pre-Survey Median [IQR]**	**Post-Survey Median [IQR]**	**z**	**p**
Valuing Marginalized Perspectives	5.5 [1.5]	5.5 [1.5]	-0.02	0.99
Valuing Ethics Training	5 [1.14]	5.57 [1.86]	-0.71	0.48
Personal Effectiveness	4.6 [0.80]	5.2 [0.80]	-2.78	**0.006**
System Responsiveness	3.88 [1]	3.75 [3]	0.11	0.91

Table 3. Effects for reliable operationalizations, Fall 2025. Valuing Marginalized Perspectives and Valuing Ethics Training show a moderate ceiling effect, as the maximum score is 6. Personal Effectiveness shows a moderate-to-large effect ($r = 0.45$).

Winter 2026 Operationalization	**Pre-Survey Median [IQR]**	**Post-Survey Median [IQR]**	**z**	**p**
Valuing Ethics Training	4.4 [0.9]	4.6 [1.1]	-0.38	0.71
Valuing Technical Training	5.4 [1.1]	5.4 [1.3]	-0.15	0.88
Personal Effectiveness	4.1 [1.6]	4.8 [0.8]	-2.50	**0.0125**

Table 4. Effects for reliable operationalizations, Winter 2026. Personal Effectiveness shows a small-to-medium effect ($r = 0.38$).

V. Discussion and Conclusion

After two semesters of piloting this course with a small number of students, we are cautiously optimistic. Written reflections and other student feedback suggest that students value the opportunity to discuss ethical issues and learn from each other. The students in these pilots are likely self-selecting for higher interest in and awareness of ethical issues; these students reported, in both qualitative and quantitative terms, that the course allowed them to (further) develop their capacity for ethical analysis and behavior.

The results of the pre- and post-course administration of the *Critical Reflection and Agency in Computing Index* suggest a few things. First, the significant effect for *Personal Effectiveness* alongside the Fall semester ceiling effect in *Valuing Ethics Education* and *Valuing Marginalized Perspectives*, suggests that this course is valuable for students who are already interested in this area. Qualitative data confirms this and shows that the course did indeed challenge and extend student's existing knowledge of ethical and sociotechnical issues. Second, the *absence* of a significant effect for *System Responsiveness* (the belief that ethical concerns raised at a workplace will be heard and addressed) points to a gap in the course we alluded to above: students want tools, techniques, and/or experience for *effectively raising ethical concerns* in the workplace. That is, in addition to training students to recognize and analyze ethical challenges that may arise in the workplace, we must, further, support them in developing *agency* in raising these concerns and effectively advocating for themselves and the people and communities who are impacted by the products they develop.

We are responding to this gap by developing an additional activity inspired by the *Giving Voice to Values* pedagogy developed by Mary Gentile at the University of Virginia Darden School of Business [47]. This pedagogy helps students apply their ethical analysis by giving them practice answering, "What if I were going to act on my values? What would I say and do? How could I be most effective?" We piloted this in the Winter 2026 semester, but it was not well integrated with other course activities, which we suspect diminished its impact. During summer 2026, we plan to revise the sequencing of course activities and improve the transparency of connections across course activities.

Further planned refinements to the course relate to the expectation that in Fall 2026 the course will transition to a required course serving as many as 300 students per term. This is a change in both size and student demographics, necessitating the recruitment of student instructional staff to lead small discussion sections. Our focus in preparing for this is on defining clear outcomes for each weekly discussion and ensuring that student staff are well-trained to support discussions of complex ethical topics.

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