

[Full Research Paper, Ethical Engineering in Industry and Applied Contexts] Responsibility and Accountability: Faculty Leaders, Ethics Frameworks, and Disciplinary Enculturation

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Responsibility and Accountability: Faculty Leaders, Ethics Frameworks, and Disciplinary Enculturation

Faculty leaders such as program directors and department chairs can play a pivotal role in shaping departmental and programmatic cultures. These leaders often have the opportunity to determine whether and to what extent certain types of content find a place in the explicit and/or implicit instruction of their students, especially relevant in terms of ethics content that guides individual senses of responsibility and institutional frameworks of accountability.

Faculty leaders take on this role while balancing curricular needs, professional expectations, constraints on resources, and pressures associated with time and place of the institution as situated within its community. Existing literature on disciplinary enculturation in general emphasizes the importance of faculty members guiding students toward a perception of belonging and adopting disciplinary practices and norms [1], [2]. Ahmadi et al., for example, compared formal and informal education strategies on doctoral students' socialization and found one of the most crucial factors was their interaction with experts in their disciplinary community [3]. Although studies such as Ahmadi's help us to better understand novice-expert interactions within enculturation, much of the empirical research centers on graduate and international students as novices, despite the fact that there are other novices, such as undergraduates, who comprise a significant portion of the emerging members of the discipline or profession. Additionally, much of the research focuses on the processes students go through to learn the conceptual knowledge, research processes, or writing norms of their disciplines [4], [5], [6], with little attention to the ways that the processes of designing, conducting, and communicating disciplinary research and fieldwork can evidence disciplinary values.

Researchers have highlighted the importance of ethics enculturation more specifically in disciplinary communities such as nursing [7], yet existing research rarely examines the introduction to and normalization of the values inherent within the disciplinary standards. Faculty are at the front line of enculturating students to the standards of ethical and responsible conduct (ERC) of their discipline [1], [2], [8], and more research is needed to examine the ways faculty introduce and normalize disciplinary guidelines such as codes of ethics throughout the enculturation process.

In this paper, we explore faculty-leader perspectives on “standards,” established statements of expected ethical behavior at disciplinary levels (see page 5), through the analysis of interviews with faculty from the engineering-adjacent disciplines of computer science and biology as an important mechanism to understand the larger ecology of STEM ethics enculturation in which engineers often find themselves. To situate these interviews, we first discuss the existing landscape of literature around faculty roles in shaping the normative values. Then, we report on a

set of faculty interviews that investigate the ethics frameworks (and their underlying values) at work in their departments and programs. Specifically, this paper reports a subset of data that is part of a larger NSF-funded research project (award #2024296) exploring the interplay among individual value foundations and disciplinary ethics frameworks in engineering and STEM education. We conclude by analyzing the conceptual and practical distinctions between responsibility and accountability as they relate to the standards identified by the disciplinary faculty we interviewed.

Faculty Roles in Shaping Normative Values

Students are often exposed to the ethical norms, or frameworks, of the discipline through many different vehicles, both implicit and explicit. Students might be implicitly enculturated through the mentor-mentee relationship in research training, contact with professional leaders in seminars, and related practices of academic conduct (e.g., avoiding plagiarism). In response to the role that implicit expectations can play, Middendorf and Pace developed the “Decoding the Disciplines” model to address the tacit norms across disciplines. Their model is aimed at increasing student learning by giving instructors strategies to make disciplinary practices and structures clearer. One of the main aspects of the Decoding process involves faculty working backward in their own learning and identifying the processes they go through when tackling the same tasks that they give to undergraduate students. This stage bleeds into a subsequent step which is all about making those processes more explicit [8]. The main impetus of this project is on the instructor. Middendorf and Pace’s model underscores the large role faculty have in student learning – not just of academic concepts, but also of discipline-specific knowledge and values.

As the Decoding the Disciplines project suggests, the explicit articulation of disciplinary activities, processes, or expectations can be beneficial to the enculturation process as it allows for stronger understanding and identification for both the novice and the expert. Many academic programs have increasingly integrated explicit forms of training. These can include formal instruction within a professional-skills course, research training, workshops, student orientation at intake to a program, and preparation for capstone experiences, like internships and senior-design projects. The shift toward explicit training in ethics, sometimes referred to as “ethics and responsible conduct” (ERC) training, has been driven by a range of factors including high-profile ethical transgressions, increased public scrutiny, mandates from funding agencies, and new accreditation standards.

The landscape of disciplinary ethics frameworks, or the value content and structured experiences that shape professional development and disciplinary enculturation, reaches wide across the curriculum and deep into the discipline [10], [11], [12]. This landscape might include frameworks ranging from accrediting bodies and institutional compliance structures to state and

national laws and departmental cultures. Coupled to the diversity of specializations within a single discipline, this landscape is richly complex.

Explicit instruction necessarily involves more top-down organization, driven by faculty leaders [9]. Faculty leaders must obtain resources for ERC courses, workshops, and other teaching-vehicles, then assign instructional duties to faculty, and allocate resources to them. Explicit frameworks can be more coordinated, but they may decrease individual instructors' real or perceived sense of responsibility for enculturating students to professional norms. The effectiveness of ERC instruction will also be affected by students' perception of its importance. Explicit structures for training may lend gravitas to ERC which may help students better appreciate its importance to the profession and their own success, even when those structures may lessen individual instructors' sense of responsibility for promoting them. However, as ERC has become more explicit, it has also sometimes become heavily weighted toward compliance and training in the rules and practices of the discipline, with less emphasis on ethical foundations and ethics frameworks for decision making.

Previous work by this research team has demonstrated that faculty leaders commonly describe courses as a platform for students to become enculturated to the ethical frameworks of their field [13]. This would suggest that it is common for faculty to relay information on ethics to their students through particular curricular tools. However, further evidence from this study suggested that faculty may feel ill-equipped to train students in ethics due to a lack of ethics educational resources directed toward them during their own disciplinary training and continued enculturation. That is, faculty in this study noted few opportunities to experience the kinds of frameworks that they were expected to engage in with students.

We build on that previous work by examining more closely the roles that disciplinary standards play in faculty perceptions of their responsibilities toward ERC, offering a picture of the complex dynamics of ethical decision-making which is informed *not only* by an internal rational capacity which might be cultivated by education, training, and enculturation *but also* by external relations to and within disciplinary and professional frameworks of ethics. Tensions between formal (professional) and informal (local) codes of ethics shape the relationship between responsibility on the one hand and accountability on the other. Internally-driven responsibility couples to externally-driven accountability.

Research Questions

Our research stems from several interrelated questions about how and where faculty encounter the standards of their field and the ways that they engage these standards within their work with students:

RQ1: What standards do faculty leaders identify as relevant frameworks of value enculturation in their disciplines and programs?

RQ3: How do STEM faculty leaders engage, as leaders, with the ethics frameworks they identify?

RQ4: What degree of responsibility and accountability do STEM faculty leaders perceive having in disseminating knowledge about disciplinary ethical frameworks to their faculty and students?

Methods

In this paper, we examine seven interviews that were conducted with faculty—three in a Computer Science Department and four in a Biology Department at a large high research intensive Hispanic-serving institution. Initial interviewees in each of the disciplines were recruited through identification as a unit leader as indicated by the program and departmental faculty websites.

Formal leadership roles vary between institutional structures. Faculty leaders regularly include departmental heads/chairs, undergraduate and graduate program coordinators, and chairs of curriculum committees. We recognize that faculty who do not have institutionally identified leadership positions may in fact function as departmental drivers of ERC when its themes are strongly reflected in their scholarship, training, and teaching. But, for this study, our initially identified faculty leaders have been current or recent chairs or directors of departments or programs within the discipline and typically have held administrative leadership responsibilities within their unit. We recruited leaders in their respective disciplines as these are the individuals that are often responsible for implementing mandated ethics frameworks. Additionally, due to their hierarchical position, these individuals have unique opportunities to support a culture of ethics beyond mandates.

Subsequent interviewees were identified through snowball sampling—at the end of the initial interviews, participants were asked, “Is there anyone else in your department or program, who is also involved in the development of or teaching of ethical frameworks for your students?” All potential participants that were named by an initial interviewee were invited to interview. Each participant who agreed to enroll in the study was interviewed via Zoom by the same faculty member from the research team to ensure consistency between the interviews. These semi-structured interviews typically lasted 30-60 minutes and included questions such as “Does your field have any ethics frameworks at the professional, national, or international levels?” and “What resources related to ethics frameworks have you or your students experienced at the institutional level? Do you see them as supplementing, conflicting, or replacing disciplinary resources?” Follow-up questions were posed as needed to clarify answers or to enable the interviewee to elaborate. Zoom-generated transcripts were reviewed and edited by trained research assistants for accuracy before they were coded.

We conducted qualitative thematic analysis of the transcribed interviews. Transcribed interviews were first coded to identify segments that discussed ethics frameworks, which in this project are defined as “the explicit content and structured experiences that shape professional development and disciplinary enculturation.” Frameworks might include case studies, professional experiences, peer conversations, trainings or workshops, among others. Each ethics framework provides some ethics-guidance from the outside, as it were. Once a framework was identified, the segment was then reviewed for the following additional features:

- Content - What is the form in which the framework is communicated?
- Experience - How does the intended audience engage the framework?
- Audience - Who is the intended audience for the framework?

For a more detailed discussion of the coding scheme and the features discussed above, see [13].

Second, we coded the segments for which the content category was identified as “standards” for which we used the following definition:

Any response that refers to an established statement of expected behavior for individuals within a group associated with a profession or discipline.

- (a) Refers to documents that are specifically called “Codes of Ethics”
- (b) Refers to documents that describe membership or participation rules
- (c) May include group-based standards such as those for accreditation
- (d) Must be codified in a shared form of communication (typically writing) but does not need to be formally published.

Our coding of “standards” includes not only formal codes of ethics that might be published by disciplinary organizations but also the rules of participation within more and less localized disciplinary groups. To be identified as a “standard” within our coding scheme, the content need not be formalized through publication but it must be communicated to participants. For example, expectations for conduct within a lab setting that might be shared within an orientation or lab meeting and, therefore, could be identified as a standard.

A research assistant hired by the team conducted both rounds of coding for the thematic analysis. The research assistant (RA) was trained by one of the primary investigators (PI) who helped them understand the codebook. The PI and RA then practiced coding several transcripts from interviews not included in this paper. Once the PI and RA reached acceptable levels of agreement on how they coded the practice interviews, the RA coded the interviews. Our reporting in the next section, then, presents a cross-section of ethics frameworks, narrowly focused on standards as defined above.

Results and Discussion

When we examine an account of ethics enculturation, several interrelated concepts are at stake. Among them are agency, autonomy, responsibility, and accountability. For the sake of this project, we take agency as the mere capacity to act. As such, it is a capacity of any causally-

related entity, from ants to automata. In the context of ethics (and thus engineering ethics more specifically), autonomy more than agency is the relevant capacity. Autonomy, the capacity for free self-governance [14] [15], is a paramount ethics principle in research contexts, identifying and defending this capacity as morally-relevant. In conjunction, agency and autonomy shape *moral agency*, the capacity to conceive of and make ethical decisions. There exist ongoing philosophical debates about the limits of moral agency of artificial agents [16], organizations [17], or collectives [18]. However, in engineering ethics as in many ethics domains the scope of moral agency has traditionally been restricted to human individuals.

On our account, individual autonomy is a necessary condition for *responsibility*, which we take to be an internally-motivated sense of moral duty. That is, to be responsible is to feel a sense of duty toward some or another end. A moral agent feels this responsibility for their actions precisely because of their capacity for autonomous action. Responsibility is, thus, “the capacity of every active subject to recognize and accept the consequences of a freely performed act” [19]. However responsibility is by itself insufficient for understanding how ethical decision-making works and why it matters. Coupled to responsibility is *accountability*, or the external regulation of responsibility. To be held accountable is to have one’s responsibility critiqued by an externally-enforced regulation or mechanism [20]. Internally-driven responsibility couples to externally-driven accountability, offering a picture of the complex dynamics of ethical decision-making which is informed *not only* by an internal rational capacity which might be cultivated by education, training, and enculturation *but also* by external relations to and within disciplinary and professional frameworks of ethics. Our analysis uses this distinction as a lens through which to sharpen the view of faculty leaders’ roles in disciplinary value enculturation.

Standards within Computer Science: Repeat Codes and Different Experiences

Across the three interviews conducted with computer science faculty, twenty-three (23) segments were coded as referring to standards. Within these, sixteen (16) distinct standards are introduced. Multiple participants named the same standards, for example, each participant brought up the Association for Computing Machinery (ACM) code of ethics. In fact, each participant brought it up either two or three times. The Institute for Electric and Electronic Engineers (IEEE) code of ethics was the only other repeated standard among computer science faculty, with two participants mentioning this.

Out of twenty-three (23) total participant mentions of standards, twenty-one (21) indicated that standards would be experienced in either courses or member groups, or both. Interestingly, the ACM code of ethics, which is brought up seven (7) times across interviews, is explained to be encountered in different circumstances by different faculty interviewees. For example, one faculty member brings up this code twice and ties it to member groups and intended participation of faculty and professionals on both occasions. Conversely, another interviewee relates this code to courses and students on two occasions and to member groups and professionals in a third instance. This repeated reliance on a professional code of ethics (in this case the ACM) is

evidence of a framework of accountability: ACM stands, from the disciplinary perspective of these interview participants, as an external regulator, moderator, or arbitrator of ethics.

Standards within Biology: Unique Codes and Informal Experiences

Within four interviews conducted with Biology faculty, forty-one (41) segments involving standards items (not necessarily professional codes of ethics) were identified. The majority of standards mentioned are unique and there are no repeated mentions between participants. In a few cases one interviewee brought up a specific standard multiple times in their interview, such as Morgan's Rules in one interview and the International Animal Care & Use Committee (IACUC) in another.

There is considerably more variation in the contexts that interviewees within Biology where interviewees refer to standards being experienced in than there is in the computer science interviews. The majority of quotations mention standards being encountered through member groups at twenty-eight (28) mentions out of forty-one (41), followed by mentoring at twelve (12) mentions, and practice at five (5) mentions. Standards encountered through courses only come up on four occasions, accounting for roughly 10% of quotations. Standards being communicated most often through informal contexts in biology such as member groups and mentoring may have to do with the fact that most mentioned standards are generalized. For example, rather than naming a specific ethics framework, one faculty member plainly states that ethics frameworks are designated at professional society-specific levels. Although not explicit, here again is implicit reliance on external professional organization codes of ethics: evidence of faculty leaders being led by frameworks of accountability rather than individual senses of responsibility.

Two Cases: A Look at Two Selected Participants in Computer Science and Biology

Closely examining the segments of individual participants offers perspective on the complex relationships among responsibility and accountability.

One Computer Science interview participant demonstrates the consistency we saw across faculty interviews within computer science about the centrality of the Association for Computing Machinery's code of ethics. As demonstrated in Table 1 below, this participant references the ACM Code of Ethics three times, which represents half of the times they spoke about standards in any form.

This participant seems to nest the disciplinary standards within their field, with the ACM code as relevant to all members of the field of computer science and the IEEE Code of Ethics as a guideline that will be relevant depending on students' selected areas of interest and specialization: "Computer science is a little bit weird because you could get kind of go into more of a engineering profession or you could try to do kind of software development." The faculty member feels responsible for introducing the students to the standards that might guide them into their future roles despite lacking knowledge about exactly what kind of future they will pursue.

Table 1: All “Standards” content segments from a Computer Science Participant

Standards Segments: Computer Science Participant
“[In senior design], we go over the ACM [Association for Computing Machinery], which is our professional organization like IEEE [Institute for Electric and Electronic Engineers] is for electrical engineering. ACM is for computer science, so we go over the ACM code of ethics.”
“Sure it's the ACM, which is the Association for Computing Machinery, little bit of a weird acronym but that's the professional organization for computer science and if you just Google ACM code of ethics it'll come up.”
“There's also IEEE. Computer science is a little bit weird because you could get kind of go into more of a engineering profession or you could try to do kind of software development...I go over the IEEE, which is the Institute for Electric and Electronic Engineers, IEEE code of ethics as well, that's much shorter it's one page.”
“The individual companies that they apply to and work for in computer science also have some internal code of ethics on a sort of company by company basis.”
“Right it's hard to say what they do with that information after I see them right. I hope that they've you know at least retained the ACM Code of Ethics”
“Things you know, as a member of the profession, anyone who's a member of the profession is expected to sort of abide by you know follow this code. And if you don't you can be subject to censure.”

This interviewee’s responses not only demonstrate recognition of professional frameworks of accountability for introducing students to the relevant guidelines or standards that they may need regardless of their selected path, but it also demonstrated the understanding that there will be continued expectations at the professional level within the organizations and companies that students join as employees. This participant notes: “The individual companies that they apply to and work for in computer science also have some internal code of ethics on a sort of company by company basis.” This demonstrates the notion that a standard will be the norm, but that the specifics of that standard may vary from site to site or community to community.

One Biology interview participant (see Table 2) suggests that standards are specific to subdisciplines or research areas. When asked whether Biology has any ethics frameworks at the professional, national, or international levels, the participant replied, “Yes, but really society specific. I hope they’re somewhat consistent.” There’s a recognition that the nature of research necessitates different expectations, and in turn, different standards. However, the participant also desires consistency.

This participant identifies a more nuanced perspective frameworks of accountability; namely, that accountability frameworks may be numerous, local, and distributed across competing

professional organizations and societies but must reflect consistency to participants to be effective. Thus the external motivations for ethical conduct may be but might not necessarily be consistent. So, rather than single overarching and coherent external framework of accountability, this participant identifies a landscape of accountability frameworks competing for adherence. Yet, once again, our research participant does not identify internally-motivated frameworks for responsibility, such as personal values, formative experiences, or senses of professional duty. Instead, standards are externalized.

Table 2: All “Standards” segment from a Selected Biology Participant

Standards Segments: Biology Participant
“Yes, [my field has ethics frameworks at the professional, national, or international levels] but really society-specific. I hope they’re somewhat consistent.”
“If they're ... collecting [microscopic animals in water]—little tiny things you have to look at with a microscope—we don't have protocols in place because they not vertebrate animals. And there's really not an ethical concern with killing 1000 organisms in a liter of water because they're microscopic little things. So it's a different consideration with each lab.”
“There's not an all encompassing biological society. So there's lots of different societies that people belong to that may not have one consistent framework that all students would be exposed to.”
“I suspect that it really is then individualized depending on which laboratory an undergrad student might be working in. For that matter, a graduate student as well.”
“I think the ones that I can think of explicitly would be the ethical guidelines that we agreed to become members of societies. For example, the ecological society has ethical guidelines. And being a member means I subscribe to those”
“I presume then that they also become exposed to other ethical frameworks related to publications, etc.”
“Other than I would say obvious ones—that are related to sacrificing animals, you know there's a whole protocol for that—that requires lots of approvals. And that I think should be made explicit to them.”
“Same for publications you sign off on ethics statements, when you send something to be published.”
“We use a guideline [for who should count as a co-author] in our lab but other labs seem surprised that that exists.”

For this participant, there is room for shared frameworks, but those do not seem as prominent within the field and the participant describes their own resistance to the idea of standardization while still wanting consistency across labs or subdisciplines. The participant explained:

I think there's got to—there should be more conversations about ethics of the publishing process and who should count as a co-author. I don't think that that is often discussed enough. I try to make a point of that—we do that in the professional development class right away, too. But I don't know that it's considered among faculty. We use a guideline in our lab but other labs seem surprised that that exists. So I think that there's probably some conversations that need to be had that way. I loathe to say that they have to be standardized for everything, but I think they should be discussed openly up front, more than they are.

For this participant, the conducting of research should adhere to subdiscipline specific guidelines but the publication of the research might be general enough to adhere to meta or interdisciplinary guidelines. Yet these guidelines aren't always in place according to this interviewee. Therefore, we think, individual faculty in individual labs are required to take responsibility for introducing and enculturating their members into the expectations that may be perceived as collective but not communicated as such. Indeed, this interviewee makes the point that *their* lab supports this ethics framework, even though others' labs do not. Here, in this faculty leader's approach, we see prioritization of individual responsibility - albeit implicit - as a response to a perceived lack of coherence among various and competing frameworks of accountability. Further, the interview participant implies that others, too, ought to take up this same responsibility to engage in conversations about publishing ethics in their mentoring.

Contrasting Responsibility Across the Disciplines of Computer Science and Biology

Within Computer Science, faculty members like the one discussed above (see Table 1) differ in where they perceive a core standard in their discipline as being encountered by individuals in the field. These differences illustrate tensions among responsibility and accountability in the transmission of ethics content between individual faculty, higher disciplinary administration, and professional organizations. They also demonstrate that, at the institutional level, there is a need for variation in ethics course content in computer science, at least at the undergraduate course level, as a response to perceived gaps in ethics engagement by individual leaders. It is worth noting that none of the twenty-three (23) mentions of guidelines across computer science interviews explicitly reference scenarios where graduate students encounter formal codes of ethics – leaving the graduate experience with disciplinary codes of ethics a topic for further research.

In the context of biology, our data suggests that professional organizations take the upper hand when answering the question of the source of ethics content. Our participants were more likely to rely on external frameworks of accountability (like professional codes of ethics) than they were to rely explicitly on internal frameworks of responsibility (like senses of professional duty). The majority of items coded as standards related to professional groups relevant to our participants.

Further, relevant standards varied between societies even inside of a single discipline like biology. In contrast to interviews with computer science participants, multiple quotations refer to the relaying of standards to graduate students specifically, expanding the scope of accountability from not only faculty leadership of undergraduate student ethics enculturation, but also faculty leadership of graduate student ethics enculturation.

Conclusions

In this project we focused on disciplinary standards, ranging from formalized professional codes of ethics to informal department-level programming and individual mentoring, in order to better understand the ways that these standards shape disciplinary value enculturation. Through these interviews with faculty leaders, we discovered an unanticipated diversity in the types of ethics frameworks identified by faculty leaders, demonstrating the complexity of just how value frameworks inform disciplinary enculturation through leadership and training. However, our findings do support current literature about the span and depth of disciplinary ethics frameworks [10], [11], [12]. The landscape of disciplinary ethics frameworks is richly complex but can be assessed during faculty training and student courses [13]. This implies that engineering education should not shy away from offering specific ethics courses so that faculty can help guide students in converging the diversity of ethics frameworks.

Limitations

Our study faces three primary limitations concerning our sample, our methods, and our scope. Additionally, we offer suggestions for future research connected to each of our limitations.

First, our findings come from a narrow sample. The interviewees came from two departments at one large university in the southern United States. Therefore, findings drawn from their perspectives are limited in their generalizability. Despite these limitations, however, we did reach a level of data saturation with our current sample which gives us confidence in the findings we did obtain. Future researchers should conduct this same research on a larger scale and with faculty leaders across disciplines and fields of research, specifically in engineering and engineering education. Future scholarship on this topic should also begin to investigate faculty and student perceptions about disciplinary ethics frameworks.

Second, using interviews inherently comes with limitations as the researchers interact with the participants. It is important to recognize how we as researchers influence the outcomes of our research, especially when conducting interviews. In this case, one of the PIs on the project conducted all of the interviews using the same interview schedule. Some of the participants knew the PI or had similar demographic information to our PI interviewer, either of which could have impacted how the participants responded to the interview questions. We are mindful of this limitation and of our own positionality when conducting interviews. We employ a wider variety of methods across our larger project to more richly triangulate our results.

Third, the scope of our project was centered on discovering *what* types of disciplinary ethics frameworks faculty leaders relied on and the degree of responsibility or accountability they have to communicate those with faculty and students. We did not investigate *why* they relied on those disciplinary ethics frameworks or *why* such degrees of responsibility and accountability exist. Further, our interview questions did not ask explicitly about internal senses of responsibility, skewing results intentionally toward identification of external frameworks of accountability. Future scholarship should explore these questions to further the academic conversation about disciplinary ethics frameworks and who is responsible or accountable for communicating them to others in the discipline.

Implications

Our focus on standards ranging from national level (like the ACM Code of Ethics) to institutional level (like academic integrity policies) was intentionally narrow. Coding for other ethics-enculturation frameworks is left for future analysis, and we recognize this as a limitation of this paper: ethics frameworks shape disciplinary enculturation at all levels from formalized professional codes of ethics to informal department-level programming to individual mentoring. Participation in ethics education and training comes from this exchange between internally-motivated responsibility and externally-driven accountability.

Our findings suggest a complex and potentially orthogonal relationship between responsibility and accountability in the process of values-driven disciplinary enculturation. Faculty leaders were more likely to rely on accountability to external ethics frameworks, including what we identified in this paper as formal and informal codes of ethics, than they were on individual senses of responsibility. While our research did not examine reasons for this reliance on accountability frameworks, we hypothesize that those reasons may include lack of sensitivity to the role or nature of individual values in their own decision-making, or institutional cultures of compliance which have trained faculty leaders to look elsewhere for ethics guidance. This conclusion demonstrates that faculty leaders, despite literature that emphasizes their responsibility for ERC, may not recognize or act on that responsibility [8], [9]. Therefore, students may not be fully enculturated to the ethics of their discipline because they are not receiving guidance from their instructors [10], [11]. For engineering education, this conclusion implies that faculty and students in engineering programs may not be fully aware or knowledgeable about engineering ethics because they are not receiving the necessary guidance from faculty leaders. As a stop-gap for this limitation, engineering faculty could use Middendorf and Pace's process as one tool for communicating discipline-specific knowledge such as ethical frameworks [9].

We also recognize that our accounting of faculty leaders' identification of "standards" is just one sense of value frameworks informing their view of ethics in their disciplines. Further complicating the question of faculty leader perspectives within our responsibility/accountability framing to disseminate ethics content is the variety of contexts in which faculty interact with

students. Differing curricular and professional development expectations of undergraduate and graduate students create differing opportunities as well as values related to the discussion and instruction of ethics content. Specifically, the structure of undergraduate education lends itself to more opportunity for generalized, large-group discussion of ethics in courses. Whereas, the mentoring relationship present in graduate education makes individual conversation of ethics likely to arise in small higher-level seminars or at the point of research participation in the lab. Multiple of our faculty interviewees state that the majority of graduate students' ethical knowledge comes from their time working in a lab. This implies that the lab setting may be one instance where individual sense of responsibility is relied on significantly and not identified in the data analysis we did for this paper.

There is a noteworthy parallel between the relationship of professional standards to the values of its members and whether the responsibility to promote ERC rests primarily with departmental leaders or is shared among all instructors within a unit. A professional community ostensibly shares common values in ERC, yet individuals within the group may well hold widely varying personal views on what those standards should be. The two shape one another from bottom-up and top-down. Leaders within the profession promulgate, promote, and potentially enforce professional standards. Yet those standards are informed by the values of its individual members, and they may well shift with time and circumstance. The responsibility of a profession to introduce and engage its ERC standards resides at both the individual and leadership levels.

An important distinction can also be made between the responsibility to teach students ERC and the ability to do so with or without the necessary resources and support. For example, departmental leaders are constrained when institutions cut funding. That may cause leaders to limit course offerings, and to de-emphasize certain themes in professional training, such as ERC. But that does not lessen their responsibility, or that of individual instructors, to promote ERC explicitly [9].

Whether there is a normative burden to shift faculty leaders from relying on externalized accountability to internalized responsibility is beyond the scope of this project, but an important question for engineering ethics education and disciplinary value enculturation. Tensions between formal (professional) and informal (local) codes of ethics shape the relationship between responsibility on the one hand and accountability on the other. Participation in ethics education and training comes from this exchange between internally-motivated responsibility and externally-driven accountability. Given the role that faculty leaders play in affecting the implicit and explicit factors shaping disciplinary ethics cultures, they are well-positioned to aid in disciplinary ethics enculturation but may be impacted not only by their own senses of responsibility but also by their institutional or programmatic mechanisms for accountability.

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