

# Imagination and Moral Deliberation: A Case Study of an Ethics Discussion Session\*

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Despite the important advances in engineering ethics education, key problems with mainstream engineering ethics instruction have not been completely addressed. One critical aspect that has been overlooked in engineering education literature is the role of imagination in our moral deliberation. The lack of attention to one's values, background and experiences, treating mind and body as two separate entities, and downplaying the role of imagination as merely an emotional regulator, contribute to neglect for imaginative rationality one may engage in dealing with moral problems. We designed and implemented an ethics discussion session as part of the professional development activities in a National Science Foundation's Research Experiences for Undergraduate (NSF REU) program, in which we prioritized imagination as an essential character of moral reasoning and deliberation. In this paper, we describe the theoretical perspectives, the innovative ethics curriculum, and evaluation methods. Finally, we conclude with the results and reflection on the connection between the conceptual foundation and instructional choices.

**Keywords:** engineering ethics; pro-imaginal ethics; imagination; moral reasoning; innovative ethics curriculum

## 1. Introduction

The predominant method of instructing engineers about ethics places an emphasis on the role of individuals as problem solvers encountering novel cases. Often, these challenging case examples pose a given ethical quandary as an unusual mistake on the part of individual actors, and the prescribed and appropriate task of moral reasoning is, narrowly, to use fixed, presupposed rules as a formula to help search for certainty about a judgment. That is, ethical reasoning as presently situated in engineering education amounts to the search for a rationale that will overwhelmingly compel individual actors to override their preferences, contradict certain problematic intuitions, and then act morally. This dominant approach that we call "strategic ethics" presents only a very limited focus on accomplishing tasks with error-reducing strategies. Moral reasoning is more complex than strategic task-accomplishment. A specific focus of this article is to show that the teaching of ethical reasoning in engineering education requires exceeding strategic ethics by designing case study details that illustrate how addressing ethical quandaries rely on the agent's imaginative resources; is embedded in a broader context; and that strategic moral reasoning alone is insufficient.

Within the last two decades or so, scholars have

begun to question and critically analyze typical ethics instruction for engineers [1–7], noting the lack of the recognition of broader organizational, social, and political context, as well as the dismissal of collective responsibility of the profession, in particular in connection with macro-ethical problems. We agree that moral reasoning about specific cases will not render robust ethical judgments unless judgments are made in connection with broader context. However, beyond the question around micro- and macro-ethics, which are both essential, educators should pay attention to the debates and arguments around the ways we engage in moral judgment in real-world situations. Do humans intuitively arrive at judgments or decisions? Or is arriving to a particular judgment the matter of conscious deliberate reasoning centered around rationality? Readers may imagine other possibilities. The point here is that assumptions, beliefs, and orientations towards moral reasoning influence our decisions concerning curricular and pedagogical design and development.

The traditional format of ethics training in engineering relies heavily on applying standards, rules, and principles, e.g., ethical theory, codes of ethics, etc. Moral concepts are often defined as a set of fixed essential features [8], much like checklists or rubrics that can be applied in a formulaic way to

produce certain desired outcomes. This is in line with the general tendency within conventional engineering culture in promoting understanding as systematically breaking things down, analysis, and or categorizing. By extension, such views isolate an ethical situation from both its contextual reality – the broader social systems in which it hypothetically occurs – and the unique resources each individual can bring to the process of moral deliberation.

Where strategic ethics takes a narrow focus on rationality, we focus on what we call “pro-imaginal ethics” centering around imagination. Mark Johnson, the pragmatist philosopher, has argued, comprehensively, the primacy of imagination in moral reasoning and ethical decision-making, *imaginative rationality* or *imaginative moral deliberation* [8, 9]. Johnson [8] clarifies the principal role of imagination in moral reasoning:

“It is time to recognize that, whatever else we say about moral reasoning, we must acknowledge and seek to understand its deeply imaginative character. . . Failure to appreciate the imaginative character of our moral reasoning condemns us to misunderstand our situation in two equally mistaken ways: (1) by relying on illusory ideas of moral absolutes, pure reason, and algorithmic procedures, or (2) by falling into opposite error of irrationalism, extreme relativism, or subjectivism.” [8, p. 77]

Within engineering education literature, several scholars have emphasized the critical importance of imagination in recognizing and resolving ethical dilemmas, particularly in connection with envisioning possibilities and consequences resulting from different courses of actions [e.g., 10–15]. However, there have been few studies in which imagination has been treated as the foundation of moral inquiry and central to moral reasoning. More importantly, the importance of broader social context and principles of applying moral imagination, including experiences such as pain and suffering remained under-emphasized [16]. To gain greater insight into the role of imagination in engineering ethics instruction, we designed and implemented an ethics discussion session as part of the professional development activities in a National Science Foundation’s Research Experiences for Undergraduate (NSF REU) program at Virginia Tech [17] – more information about this REU site can be found at [18].

In this paper, we first describe the account of pro-imaginal ethics informed by theoretical literature in liberation theory and practice and Marc Johnson’s account of imaginative moral deliberation. Next, we review the innovative ethics curriculum and evaluation methods, and present the results. Finally, we conclude with reflection on the conceptual foundation and instructional choices.

## 2. Theoretical Foundations

### 2.1 Liberation Praxis and Theory

What does it take to intervene against systems of oppression that themselves set the norms and terms of evaluation, justification, and intervention? How can oppressed groups foster relational networks with liberatory potential, particularly given the ways that oppression taints and corrupts reasoning such that even our best solutions to intersectional oppression only seem to reify and instantiate it further? [19] Shall the oppressed just rely on principled evaluation and deductive arguments and justification? To attain equity and justice, the oppressed cannot appeal to the terms set by oppressive systems; they can never provide justifications demanded by oppressor, “The Master’s Tools Will Never Dismantle the Master’s House” [20]. It would take more than conventional modes to question and challenge the status quo – in which systematic pain and suffering is being obscured and normalized, both for the victim and the victimizer [21]. In contrast with mainstream product-oriented picture of ethical reasoning, liberation scholars illustrate different means of reasoning with a complementary role in which *alertive* modes are prioritized [22]. Although the social sciences place primary emphasis on the use of concepts as explanatory, evaluative, and justificatory, concepts also play an alertive role by calling urgent attention to pressing issues in need of response [23]. Think here of the exclamation “help!” as an urgent call of attention and a request for assistance. The alertive function of concepts does not merely signal one to notice something, it includes an emphasis on the need to quickly focus, to more deeply explore, and often to respond to an immediate need. Alertive concepts do not necessarily explain which kind of “help!” is needed, nor does the alertive “help!” tell you how severely urgent the situation is. Alertive epistemic moments call other faculties of reason and action to attention, engaging them to divert focus and, ideally, to act in response.

Initially, we turned to liberation praxis and theory as our primary conceptual source [17] – a more detailed analysis of liberation theory and praxis and the use of imagination in critical thinking and understanding presented at [24]. Within these resources, imagination is a quality connected with thinking, reasoning, and understanding that helps us create alternative views and actions and urges us to pay attention and address human suffering. It is a unique reflexive quality of bridging modes of theory and practice in service to others, the connection between “inner world” and “outer world.” Imagination is about envisioning and experiencing a

reality within and bringing it into everyday life. In other studies, some critical concepts and perspectives in liberation praxis and theory in connection with engineering ethics education have been presented [17, 25]. Here, we summarize a few key concepts informed by Gloria Anzaldúa, a highly influential feminist liberation scholar.

### 2.1.1 *Imagination as Living-in-Between*

Gloria Anzaldúa questions the dominant discourse of consciousness, described by her as (a) rational, reasoning mode connected with external reality, the upper world; and elaborates on a mode of consciousness that emphasizes spiritual, bodily experiences: “The other mode of consciousness facilitates images from the soul and the unconscious through dreams and the imagination. . .” [26, p. 59]. Anzaldúa’s account of imagination is deeply spiritual; imagination is the quality that bridges mind and body. Through integration of mind and body, we are able to arrive to the realm of the understanding, both spiritually and politically [27]. In this process, we construct and reconstruct images, through which we can see from other perspective, shift and transform ourselves, our identities where we reconnect with others with the healing images to address problems such as racial abuses, violence against children and women, etc. [27].

Anzaldúa uses the symbolic and metaphorical illustration of walking/living in “nepantla” through which we can negotiate/interact between different possibilities and reimagine our positions in the world and our relationships with one another. Anzaldúa elaborates how through this imaginal journey we can arrive at a state where there is not a struggle of “us versus them”, where one does not belong to a particular category and the concept of identity becomes *relational* [28].

## 2.2 *Imaginative Moral Deliberation*

The decisions about the pedagogical and curricular design of the ethics case study in 2019 are mainly informed and inspired by the naturalistic perspective of moral deliberation offered by Mark Johnson [8, 9]. The account presented by Johnson is in turn informed by John Dewey’s philosophical pragmatism and centered around the interaction between *natural* and *cultural* self. The details of various imaginative resources and structures we rely on in moral deliberation (e.g., image schemas and metaphors) are presented at [8].

To make the point more clear, we elaborate on some of the connections, similarities, and differences between the design process – focusing on a common way of introducing design to engineering students – and the process of imaginative moral deliberation.

The design process begins with a problem given by another department within an organization, a consumer, the manager, etc. The problem first needs to be understood and defined; in the earlier stages, engineers engage in communication with stakeholders and collect preliminary information to arrive at a proper understanding of a task at hand. The next stage is the formal process of gathering information about similar existing designs, technology, specifications of different parts and sub-systems, etc. We also engage in developing formal requirements for design, especially those that may limit our choices in developing alternatives: time, budget, or existing technology, for example. In fact, through the process of collecting information and developing requirements, we move towards a more comprehensive definition and understanding of the problem.

The next stage is to identify potential possibilities given what has been acquired. These alternatives will undergo the process of evaluation, testing, or prototyping, and ultimately, the most satisfactory option will be chosen. The final solution may inform a new product, or its limitation may be enhanced in future designs. Overall, the picture educators provide is a creative, iterative process where interaction and communication between the design team and other stakeholders are essential.

Moral deliberation shares some similar stages and characteristics. It starts with an ethical problem, a situation often ambiguous and ill-defined. One who engages in resolving the situation needs to engage with the *qualitative unity* of a situation fully – the term Johnson borrowed from Dewey. In contrast with the design process, we should first pay close attention to the central role of one who takes the journey in the process of moral deliberation. First and foremost, this process is about what is brought to the situation, individual’s values and experiences, embedded in the socio-cultural history and interactions within the world.

These values, or constructed principles and standards, may perform as a set of requirements and criteria for comparison in developing and evaluating different courses of action. The danger in the first stages of moral inquiry is the *bias* towards applying familiar patterns of thoughts that poisons curiosity and openness towards possibilities and closes the door of the inquiry. We respond to the problem emotionally and intuitively, again influenced by history, background, experiences; this is the natural process.

Resolving the situation is not only about one who comes to transform it; it is about the problem itself too. Considering the unique character specific to each situation, unless there is a pause in reimagining our relation with perceptual properties and entities

involved in the situation, those who engage in this process forced themselves to a judgment or a particular course of action that is based on an incomplete interpretation of the situation.

“Although it is true that they do feel it, that does not make the quality merely subjective or personal. The qualitative unity is in and of the situation. In the sense, it is objective, shared, and available to others.” [9, p. 98]

Ultimately, the qualitative unity demands a set of emotional responses that develop through a critical reflective process of reimagining and possibly adjusting to what we feel, value, and know concerning the situation.

Like the design process, understanding the nature of the problem is a part of moral deliberation. As we reflect and reposition ourselves in connection to the nature of the problem, and as we begin to reconstruct our habits and actions, we move towards a degree of awareness that helps us with imagining various possibilities. Possible courses of action similar to different alternatives for design are subject to reflection and evaluation. However, the process here is not about applying universal rules or pre-given principles or standards; it is also not about using reasoning in arriving at ends. Instead, it is about imagining and mentally experiencing *perception* and *action* to bring about emotional responses and help with moving towards resolution and coming to an emergent end.

“The appropriate cognitive-conative-affective simulation of possible courses of perception/action would give rise to emotional responses to the imagined situations, permitting us to assess their likelihood of resolving our problematic situation.” [9, p. 110]

Simulated alternatives and courses of action are subject to critical assessment. Johnson distinguishes between conventional understanding of reasoning and critical reflective activity in moral deliberation and uses the term “reasonableness”. A successful resolution will eventually depend on arriving at a realm where competing values and preferences are at least partially harmonized and unified, such a process of deliberation is *rational* or *reasonable*.

“I am arguing that, just as emotions play a key role in our intuitive judging of right and wrong, so also our emotions and feelings are central to our more reflective moral deliberations. These deliberative processes are at once emotional, rational, and imaginative. Reasonableness is an achievement of deliberative activity, something realized through inquiry and transformation of our present circumstances. We have to sense – feel – the order, perspective, and proportion achieved through our deliberate inquiry into the situation at hand.” [9, pp. 116–117]

The imaginative process of moral deliberation not only transforms the situation, but also *transforms*

and *reconstitutes* the self. Through this process, new qualities of mind and character will be formed that influence our perceptions and actions in dealing with new experiences.

The design process and the imaginative moral deliberation share a vital piece: they involve divergent thinking, creation, and imagination. It should also be noted that the moral character of the design process is often underestimated in educational practices. Reflecting on the moral deliberation process, we move beyond merely imagining possibilities objectively; there are continuous interactions between emotions and feelings. Put differently, the moral deliberation process is not a mere technical journey, rather a more introspective experience that thoughtfully considers the relation between self and the world. It evokes sensitivity that urges us to pay attention to what happens within the social context, what others experience, and, importantly, pain and suffering experienced or potentially experienced by someone else or groups of people.

### 3. Setting: Ethics Discussion Session

#### 3.1 Background

As discussed in the Introduction section, we initiated a research study to incorporate an innovative ethics module in an NSF REU site program. In the recent cycle of the Site, 2017–2019, 30 students completed a 10-week summer program. They worked with different research mentors on projects centered around the broad area of interdisciplinary water science and engineering. In addition, students participated in various professional development activities, including weekly seminars on topics such as library research skills, communication skills, and ethics. In organizing and developing these activities, we were intentional to address the goals and objectives of the NSF/REU program: promoting graduate studies, fostering communication skills, improving research skills, developing independent researchers, and improving understanding of ethics and professional responsibility.

In 2019, the ethics discussion session was incorporated in week nine of the program. One of the authors of this paper facilitated the 150 minute session. The participants were ten science and engineering undergraduate students, including eight female and two male students, from different U.S. institutions. Five students identified themselves as White, one Black/African-American, one Asian and White, one Black/African-American and White, one Hispanic/Latino, and one Hispanic/Latino and White.

The major topics addressed in the session

included: moral reasoning, moral theory, bias, identity, interpersonal relationships, discussions of broader organizational and political context, and reimagining human suffering. Compared to our previous attempt in the year 2018, we were more intentional to include personal reflection exercises, discussion of positive ethic and broader social problems. We also expanded the discussion on how we think and reason and added an exercise in which students watched part of the movie *12 Angry Men*. Students were assigned to study two readings in advance of the session: a brief introduction to ethical theories by Mackinnon [29] and a fiction, “The Ones Who Walk Away from Omelas” by Ursula Le Guin [30]. We borrowed from resources in liberation theory and praxis to address identity and the role of power relations in our daily interaction and within the broader context of social and political structure.

### 3.2 Major Activities and Instructional Methods

The instruction primarily followed a dialogical approach. The role of the instructor was mainly to facilitate the discussion and encourage a dialogue environment among participants. The setting helped create a more inclusive environment. The room was equipped with a whiteboard, video projector system, adjustable light, where we were sitting around a round table. Guiding questions and comments provided by the facilitator helped students to engage throughout the discussion.

The primary activities and guiding questions were developed centered around two major themes: *interpersonal context*, ethics in interpersonal relationships (e.g., personal awareness and reimagining others’ experiences), and *systems context*, ethics in social dynamics (e.g., organizational culture and reimagining systematic oppression). Overall, the session consisted of four parts: moral reasoning, ethical theory, bias and identity, and social structures and power differential.

The session started with a brief introduction of the purpose and major themes and activities, then a reflection exercise on students’ prior experiences with classes and training on ethics. Then, students were invited to reflect on ways they engage with an ethical situation to arrive at a judgment or action course. It was followed by the discussion on deliberate conscious process and intuitive emotional process.

In the second part, ethical theory, its benefits, and limitations in the process of reasoning and actions dealing with real-world problems were discussed. A book chapter, “Ethics and Ethical Theory” by Mackinnon [29], was chosen to help facilitate the discussion. This resource was used because it provided a brief clear introduction of ethics, reasoning,

and ethical theory and highlighted the importance of intuition. Following the text, the facilitator asked about potential instances of judgments based on *motive*, nature of an *act*, and *consequences* resulting from an action.

Within the third part, we first had an exercise based on the movie *12 Angry Men*. We watched the first fifteen minutes of the movie. Students were asked to reflect on judgments made by the characters and note potential issues they encounter. The discussion moved from some implications of argument fallacies – for example, appeal to the majority – to potential issues with unconscious reasoning that might lack reflective critical capacity. Here, the facilitator emphasized the importance of pause and reflection to come to a judgment – which again heavily relies on our imaginative resources. The discussion expanded with the focus on bias and underlying assumptions and preferences. Students reflected and shared their ideas on interconnection between stereotypes, prejudice, and discrimination, and then the facilitator integrated an activity centered around various aspects of social identity. Two resources were used to guide the discussion further: the metaphorical illustration of *living in-between* presented by Anzaldúa [27], and an article by Peggy McIntosh [31] that provides different examples of white privilege. The facilitator discussed the role of privilege and social identity and integrated a reflection exercise on unearned advantages. This exercise helped transition to the last part of the session, where we discussed the broader social structures.

The next major activity concentrated on the short fiction by Ursula Le Guin [30]. Students first were asked an open question about the story to describe the city and how people live. Then, the instructor asked about the underlying issue and reasons some could not stand the status quo. Importantly, students reflected on and discussed the concepts of social justice and utilitarianism. The discussion expanded to examine the role of power within a setting and social structures with power differentials. Finally, students were given a copy of news about fish consumption rate and water quality standards in Seattle, Washington [32]. This was rather a complex issue involving different stakeholders, among them native people, the U.S. Environmental Protection Agency, the State Department of Ecology, the Northwest Indian Fisheries Commission, businesses, and industry. The facilitator asked students about the underlying issue(s) in their views. This activity remained incomplete; ideally, the exercise should be expanded to exploring relevant information, the detailed discussion around cost-benefit analysis, and suggestions for adjustment to current standards, if any.

Throughout the session, the instructor provided several opportunities for personal introspection by the students to reflect on their experiences, thoughts, and feelings, as well as similarities and differences among people. The facilitator also participated in sharing personal experiences. At the end, students were asked first to imagine and make a note and then share ways through which their disciplines can play a role in diminishing human suffering.

#### 4. Data Collection

The major method for data collection conventionally included pre-program and post-program surveys and focus group interview. The goal has been to assess REU students' experiences on the various aspects of the program. An external assessment expert helped with the project evaluation and reporting. We made some changes to the assessment tools to better understand students' experiences with the ethics discussion session and how they found the session influenced their ethical judgment and decision-making. We included six survey questions, mostly open-ended. Sample questions are included in Table 1.

In addition to the post-survey, the assessment expert helped with conducting a focus group interview. Among the questions, three questions focused on students' experiences during the ethics discussion session. Sample question included: You had an ethics session with [Instructor] this summer; in general, what were the positive things about the session? What improvements would you like to see in this session?

#### 5. Data Analysis and Results

Considering the exploratory-interpretive nature of this work, we sought to construct an understanding of students' experiences and the influence of the session. For the open-ended questions in the survey, the data were segregated, and connections were explored to find potential themes and explanations. As indicated in Table 1, we also included one ranking question and asked students to rank the five most important concepts to ethical reasoning and ethical decision-making – among the fourteen

items provided. The randomization feature in the Qualtrics survey was used to randomize answer choice. We included different concepts based on ethical theory and other topics discussed in the session, such as character, virtue, identity, and suffering. The top selected three choices were consequences, bias, and suffering. Eight students identified consequences (three as the top choice), six identified bias (three as the top choice), and six identified suffering in their selection. The choice of "bias" may illustrate the value students noticed in personal awareness and personal thought processes; on the other hand, "consequences" and "suffering" may reflect the importance of the impacts of judgments and decisions in different contexts.

In analyzing qualitative data from the survey, we focused on two aspects: students' views and perceptions about the session and their reflections about the influence of the session on their ethical reasoning and decision-making. One question was about ways students describe the ethics session to someone else: If you wanted to describe the ethics session to someone else, perhaps your peer or someone else considering whether to attend a session like this, what would you tell them (sentences, phrases, keywords, etc.)?

Three students highlighted the cultural aspects of the session. One student noted: "We learned about cultural ethics, ethical dilemma, and ethics in general." Another student responded: "Cultural awareness, identifying and addressing personal biases." It remained unclear whether students' emphasis on culture reflects discussion on organizational (and institutional) culture or our different interpretations regarding beliefs, values, and norms.

Also, three students pointed out the novelty of the experience. One student said: "It is very interesting because you get to learn ethics from a viewpoint you never thought before." This notion of novelty in what students experience was also discussed when they were asked about ways the session changed their expectations or understanding of ethics. Four students noted that the session helped them to see ethics as part of *everyday life*. One student responded: "It allowed me to see the broad range of issues that ethics can cover and

**Table 1.** Pre- and post-survey sample questions

Type	Sample question
Open-ended	In what ways, if any, did the session change your expectations or understanding of ethics? How has the session influenced your thoughts about making ethical judgments and ethical decision-making?
Ranking	Based on your experience in ethics session, how would you rank top 5 concepts among the concepts below? In other words, how important or unimportant is each idea when it comes to ethical reasoning and ethical decision-making?

how ethics can be applied to everything in life.” Another student described it as: “It made me realize that ethics are part of everyday interactions, and extend beyond formal settings.” It appears that students could envision that ethics (and moral reasoning) are part of various situations beyond what they expected.

Students were also asked about the influence of the session on their ethical judgments and ethical decision-making. In response, three students illustrated how they developed a more *comprehensive perspective* in face of ethical problems. For example, one student said:

“I think it is very important to look at what you are doing and inspect it from all angles. Even if you have good intention, it may not look that way to everyone. . . I think I will take a multi-point view aspect to the ethical decisions that I make now.”

Another student said:

“It made me think more about the ways I think and how it may be perceived or affect other individuals. Ensuring that I think about all the ways that a certain decision or solution that I pursue does not have a negative effect on others. . . It made me think about different ethical reasoning routes and how the way I think about things ethically may be through a different length or thought process than other folks.”

It appears that students, overall, appreciated the importance of envisioning different possibilities in their judgments and decision-making.

Also, five students described an *awareness* of their thoughts in ethical reasoning. One student responded:

“I did not realize that decision making was so complicated. I thought that it was very black and white, you either do this or do that. But now I understand that is [a] much more complex process than that. . . I now notice that my thinking varies depending on the situation, and that I frequently use this to my advantage to justify doing something that I want to do.”

Another student noted: “I didn’t think much about my ethical reasoning before. I usually try to make the logical decision, but I realize now that sometimes my logic depends on my ethics. Since I am more aware of it now, I can make more informed and appropriate decisions in the future.”

While students did not explicitly address imagination or feelings in describing advances in realization of moral reasoning, self-reflection on their personal capacity may show a greater understanding of themselves as moral agents independent of the predominant view on primacy of neutral, objective reasoning that only relies on their rationality.

With regards to the focus group interview, the authors were provided with a report including the findings. Here, we provide a summary of what has been included in the report:

- They liked the session.
- Different ones of them got different things out of the exercise when reading the assignment.
- The session was poorly placed, however, coming towards the end of the 10-week period. They felt that they would have gotten more out of it if it had been done earlier in the period, within the first couple of weeks if possible.
- It is important to address all three of the aspects considered in decision making by scientists and engineers.
- They found that there was too much emphasis on philosophy and not enough on applying concrete examples.
- They liked the movie clip.

Overall, besides a few important suggestions on improving the session, the focus group interview did not provide rich data to understand students’ experiences at the session better.

## 6. Discussion

The pro-imaginal ethics, illustrated in this paper, first and foremost *prioritizes* the role of imagination in moral reasoning. An important *concept* essential to this view is “embodied” – that reasoning is embodied, that is, it bridges mind and body and gives primacy to one’s experiences and backgrounds. Our reasoning relies heavily on *emotion*, and it benefits from *conscious deliberative* process. Considering the critical importance of our thought patterns and self-transformation in the process of imaginative moral deliberation, practice at imagining will help to shift our habits and expand reasoning practices. We believe this process will cultivate a sense of *sensitivity* that bridges *negative ethic* (no explicit intent to do harm/no obvious harm done) and *positive ethic* (explicit intent to add good/compelling ought or should) as well as *interpersonal* and *macro-ethical* problems, not only organizational and technological issues, but broader social problems, such as poverty, racism, and sexism.

Which kinds of curricular and pedagogical approaches support students to reflect on and advance their understanding of imaginative character of moral reasoning they rely on through ethical challenges? As described in this paper, learning is not merely about facts, concepts, principles, or applications; it is also about personal awareness and, importantly, dialogue and relationship building. Discussion would serve as the primary mode of instruction, and the role of a facilitator is to help foster a learning environment allowing students opportunities to reflect on their past experiences and imagine how they perceive different decisions. This introspection should be

expanded to individuals and communities' backgrounds and experiences [16]. Notably, the facilitator plays an essential role in creating a dialogue-rich environment. Facilitators should be conscious and sensitive of group dynamics and differences, including modes of communication and various cultures, and genuinely care about productive interaction, and continually reimagine themselves as a catalyst to building relationships. Specific curriculum and pedagogical strategies for bringing these resources into classroom practice have been discussed for a graduate-level engineering ethics class [16] and a senior-level design class [25].

Reflecting on the results presented in the previous section, most students emphasized a subjective character of moral deliberation in describing the nature of ethical problems. From the authors' perspectives considering the group's diversity, the level of students' engagement in discussions, and dialogue among them, this intervention was a success. However, in terms of the influence and benefits of the session, we cannot make a conclusive argument based on the limited data collected after the intervention. In particular, some of the responses to open-ended questions need further clarification. Individual interviews or a different format of focus-group interviews could further explore students' experiences and develop meaning and explanation. Also, administrating the post-program survey and focus group on the same day limited us to evaluate and reflect on the survey's result to inform the interview; ideally, the evaluation method should be expanded into two phases. We should also point out the improvements that could be made. As noted in the focus group results, the session was limited concerning more examples of science and engineering cases. In addition to incorporating relevant examples, we posit that explicit discussion on imaginative character of moral reasoning can further improve the session.

How we reason in real-world situations will depend on skills and abilities gained from previous experiences, particularly in partially or wholly relevant cases. We posit that by designing comprehensive scenarios that pay attention to both interpersonal and broader social context and with engaging students to practice at imagining, they

can get objective distance from their reasoning resources, appreciate the primacy of moral imagination, and develop sensitivity to others' experiences, and treat the occurrences of harm and suffering as urgent to address. The session described in this paper can build a foundation for productive discussion around other cases and exercises. We expect this work to resolve some of the complexities with theoretical accounts of imagination and encourage its incorporation into the mainstream practice of engineering ethics instruction. We also hope the intervention presented – that can be expanded into several classroom sessions – and our instructional choices provide a model for educators.

## 7. Conclusion

In this paper, we presented a case study of an ethics module for science and engineering students built around an account of moral reasoning that relies heavily on imagination. To make the case for the necessity of imagination as fundamental to moral reasoning, which is more compatible with the ways we engage with ethical quandaries in real-world situations, we turned to scholars in liberatory traditions and pragmatism. In particular, we used the account of imaginative moral deliberation developed by Mark Johnson and highlighted certain features such as: experiences and values, specificity of situations, emotions and feelings, rationality, mental stimulation, and moral growth. Recognizing our imaginative resources and practice at imagining would help students to enhance their reasoning skills and practices. The theoretical foundation and module described in this paper can inform educators and scholars in research and pedagogical practice.

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