Ethics Instruction and the Role of Liberatory Praxis and Theory

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1. **Introduction**

Within the past few decades, engineering educators have placed increased emphasis on the importance of engineering ethics. Educators have begun incorporating engineering ethics in curricula in a variety of formats: as a component in introductory or capstone courses, a central element in stand-alone courses, and/or through deliberate integration across curriculum [1], [2]. The main approaches in teaching of ethics continue to use case studies or case-based discussions supplemented by moral theory and/or professional codes of ethics. Service learning is another approach that has increasingly been used and reported as an effective pedagogical strategy in instruction of engineering ethics [3]-[5]. In the U.S., the main driver in incorporating ethics in engineering curriculum was the changes in ABET engineering criteria requirements on students' outcomes, which was instituted initially at the ABET meeting in 1995 and led to Engineering Criteria 2000 [2]. Today, among ABET students' outcomes, one outcome "understanding of professional and ethical responsibility" specifically promotes teaching of ethics [6]. Even beyond the demand of accreditation agencies, there should be an internal motivation within colleges and universities for deliberate instruction centered on teaching ethics and values. As Lageman and Lewis [7] argue, requiring students to give attention to the matters of ethics and values as a core consideration in pursuit of their studies is an important canon of the civic purpose of higher education. On a similar line of analysis, within engineering education, Sheppard, et al. [8] propose that in this rapidly changing world the boundaries between technical and non-technical challenges are not clear; engineering education should prepare students to be "better engineers and more informed human beings and citizens" [8, p. 231]. The authors emphasize the integration of ethical reasoning as a key priority, more intentionally and holistically, in planning for education.

Independent of the motives and intentions of educators in teaching ethics, the importance of *imaginal capacity* has been recognized as one of the major goals in instruction of ethics.

Callahan [9], for instance, offers a useful comprehensive, and widely accepted, list of objectives that can be adapted by educators; the goals include:

1. Stimulating moral imagination.
2. Recognizing ethical issues.
3. Eliciting a sense of moral obligations.
4. Developing analytical skills.
5. Tolerating- and reducing- disagreement and ambiguity.

Within engineering education more specifically, Harris, et al. [10] informed by Callahan's list, discuss nine possible objectives of ethics instruction:

1. Stimulating the ethical imagination.
2. Recognizing ethical issues.
3. Analyzing key ethical concepts and principles relevant to profession or practice.
4. Dealing with disagreement and ambiguity.
5. Taking ethical responsibility seriously.
6. Increasing sensitivity to ethical issues.
7. Increasing knowledge of relevant standards.
8. Improving ethical judgment.
9. Increasing ethical will-power.

Likewise, Herkert [1] argues that there is a general consensus on four goals of engineering ethics instruction presented by Davis [11]: 1) increasing ethical sensitivity, 2) increasing knowledge of relevant standards of conduct, 3) improving ethical judgment, and 4) improving ethical will-power.

Many scholars assert the importance of ethics, name imagination as a factor, and yet do not explicitly discuss addressing imagination and imaginal reasoning as the priority in pedagogical approaches to instruction on ethics. Attempts to prioritize ethics as central facet of education in general and among engineers in particular cannot yield effective results if, as seems to be the current norm, instructors and students lack practice in imaginal reasoning. Recent Scholarship on imagination, ethics, and critical thinking usually portrays these features of education as important and related, but distinct. In other words, those who argue for both the study of ethics and for consideration of moral imagination have framed the role of morality, imagination, and critical thinking in association with one another, but without more closely theorizing the relationship of these constitutive parts. Imagination and fostering *imaginal capacity* as foundational to critical

thinking is the main subject of this paper, which aims to call closer attention to the role of imaginal reasoning in the education of engineers.

Among few studies that treated imagination as crucial in engineering education, Gorman, et al. [12] use case method based on ethical dilemmas involving multiple decision perspectives and decision points to address three major outcomes: 1) knowledge of ethical theories, 2) skills of moral reasoning in applying ethical theory and professional codes, and 3) wisdom in which students get into virtuous practitioners when students can embrace the spirit of ethical and professional codes and apply them in new contexts and situations. Moral imagination, then, is the central component of the process connected to the third goal; it provides a tool for reasoning about different perspectives, and to consider principles, consequences, and the implications for one's own character in complex decision-making situations. The major goal of addressing moral imagination, as described by the authors, is the ability to see a given problem from another perspective.

But a capacity for ethical reasoning does not just depend on applying one's imagination to any hypothetical or actual other. Divorcing ethics from social justice risks rendering moral reasoning as a process of evaluating among roughly equivalent circumstances, such as the weighing of costs and benefits of one course of action versus another. Moral theory and ethical reasoning concerns complicated factors such as harm, responsibility, healing, dignity, and other such notions that garner concern because they play a role in one's response to power imbalances. Suppose a student carefully studies a case example about a team of engineers who find themselves in conflict with one another because of their different interest and perspectives on a few available courses of action. A student reading such a case and then weighing of costs and benefits of choosing one design strategy over another can apply their imagination in order to gain insight about conflict and group dynamics. But such a case differs from when students consider power relations stemming from broad social, political, and economic factors, such as race, gender, class, disabilities, etc. Ethical reasoning depends in some critical ways on imagining

others who face power imbalances as a result of historical and contemporary patterns of oppression.

The example cases provided by Gorman, et al. [12] highlight some conceptions that are usually underemphasized in engineering ethics such as social justice. However, it does not create a clear and realistic picture of patterns and contexts underlying engineering practices in which flawed courses of action may get rationalized [13] and the status quo may get legitimized and reinforced [14].

An additional branch of relevant research focuses on concerns about pedagogical approaches to case studies as the primary mode of teaching engineering ethics. Bucciarelli [15] argues that focus on an individual agent confronting an ethical dilemma as a rational problem solver creates an unrealistic picture of engineering. In particular, the focus on an individual rational problem solver misconstrues the reality of most complicated ethical decision-making as something that occurs in organizational and social contexts, those in which engineers regularly work, where the importance of collective, social responsibility of engineering profession is paramount. Downplaying and/or underestimating the social and organizational aspects of moral reasoning leaves the analysis of cases in the context of abstract individualism.

Bucciarelli's positive proposal emphasizes two important factors (though they are not mutually exclusive): the importance of macroethics, i.e. collective social responsibility of engineering profession and societal decisions about technology [16, p.4], and the need for paying attention to contexts and patterns of the engineering workplace and culture. Taking another approach, Riley and Lambrinidou [17] recommend teaching engineering ethics centered around social justice as the core value in which power differentials, social and political dimensions, and value-laden culture of engineering are highlighted for close consideration.

Working for justice, which can be traced back to critical tradition, has been an aspirational project for educators in designing, developing, and implementing pedagogies. However there is a

strong tendency for prescribing what is just or what needs to be done, which is often carries out with explicit and directive language, may create conflicting context in valuing each other's perspective. This is even more important when we think about ambiguity in the varied notions of justice that intellectuals and practitioners use, knowingly and unknowingly, such as arguments on the impossibility of justice [18] to those that question common understanding of justice (e.g., incorporating international considerations such as migration [19]).

Consider a shift in focus along several key assumptions. First, a shift from product of ethical reasoning to diverse process. Second, rethinking and diversifying the role or function that different modes of reasoning play. Namely, to prioritize *alertive* modes in addition to descriptive/prescriptive modes. Put differently, suppose that imaginal reasoning about complex ethical considerations improves students' ability to not just notice moral harms, political injustices, and economic disparities, but to treat them as pressing, urgent, and deserving of an interruption in business-as-usual, strategic rationality. Taking alertive modes into careful consideration as a complement to the more familiar modes of descriptive, explanatory, evaluative, and justificatory reasoning, we can then better understand imaginal reasoning about ethical cases.

What if we move beyond predominant tools and frameworks to think about reforming how we teach ethics? Scholars in liberatory tradition, in response to oppressive systems, illustrate frames of thoughts and practices that are different from dominant systems of ethics, politics, and economics. What if dominant systems of ethics, politics, or economics exclude part of humanity systematically? This is not a new claim. Many disciplines and fields of study proliferated throughout the 19th, 20th, and 21st centuries in response to the ways that dominant ethical, political, economic, and epistemic models arose not just exclusive of, but in direct antagonism towards historically oppressed populations. Systems that depend on oppression and marginalization provincialize testimony by those who suffer, and nullify, or "numb", against urgency of addressing the institutionalized domination that produces systematic cruelties. Liberatory frames of thought, however, aim to question and challenge the legitimacy of

dominant system and to diminish human suffering; such frames play a complementary role to moral and political thinking [20], [21].

Following key derivations from liberatory praxis and theory, such as the aforementioned priority of imaginal reasoning and the function of alertive modes of analysis, we argue that scholars of liberatory praxis and theory, in particular, the approaches outlined by Gloria Anzaldúa and Paulo Freire, offer unique contributions for creating an environment that encourages imagination and engagement with ambiguity. Though it remains an open question whether imagination and ambiguity benefit technical aspects of engineering design, learning and practicing ethical reasoning requires imaginal reasoning that supports adaptive responses to ambiguous circumstances. What is the goal of pedagogical interventions against moral harms, injustices, and oppression if not at least to teach students the importance of a critical pause, to suspend and modify their usual design procedures in response to alertive moments, and to then apply close ethical analysis and imaginal reasoning. Those who have taught on ethics and social justice will likely find it familiar the want among students for compelling, decisive, and intractable arguments that justify changes in belief and behavior, the desire for conclusive and evidence-based "proof" or deductive "certainty" as the line between defending or altering the status quo. The praxis of liberation takes it as a non-controversial starting point that the very systems of oppression causing patterned suffering necessarily set the terms of evaluation, justification, and intervention, and that no oppressed group has ever attained equity and justice by appeal to the terms set by the oppressive system.

A cruel system that obscures its cruelties as normal, that appears ethical and just to the benefactors and rulers, will demand justifications that the oppressed can never provide. If and when principled evaluations and rational, deductive justifications, alone or in concert, help intervene against oppression then those with unearned power move the target, alter the terms. Liberatory praxis and theory reject *initial* appeal to evaluative and justificatory modes of reasoning about ethical and political oppression. By appeal first to imaginal reasoning as a way to cultivate alertive responses, students can take seriously the suffering of marginalized groups,

showing deference prior to and in the absence of compelling, deductive evidence and arguments. Either we teach students to defer to the powerless and disempowered about their suffering, or the plot is gamed permanently in the favor of the status quo.

In what follows we present our experiences with developing a specific lesson plan aimed at bolstering imaginative modes for an ethics module that has been implemented in a NSF-sponsored Research Experiences for Undergraduates (REU) program. Next, we further clarify the grounding in liberation as a complement to ethical, political, economic, and more familiar modes of social thought. With that context set we then focus on the emergence of *imaginal capacity* in struggles against oppression. Finally, the pilot curriculum is described and data collection and analysis are discussed.

2. **Liberation**

We shall first elaborate on the major elements of the liberatory struggle, *relationships*, *understanding*, *transformation*, and *solidarity* [22]. The first element, *relationships*, highlights the status of the oppressed and oppressor in oppression, "institutionalized dominance of one part of humanity by another" [23, p. 41]. There are oppressors who tend to reproduce the status quo, and there are the oppressed, who are target group in institutionalization of discrimination and dominance. *Understanding*, is the stage in which the oppressed acknowledge the fact that they are oppressed and critically seek for the causes. As a result of such critical reflection on the state of oppression, the oppressed may discover who they really are. However, the oppressed need to overcome the internalized state of oppression. Fanon [24] describes it as an inferior feeling. As a result of systematic oppression, the oppressed do not have values, or in extreme cases, present the negation of values [24]. Freire points out the very same issue. In describing cultural invasion, Freire explains the necessity of convincing the oppressed of their intrinsic inferiority [25]. Biko [26] uses the phrase of spiritual poverty which can be resulted from dehumanization process followed by oppressors. The Black Consciousness and Black Internationalism Movements, as proposed by Biko [26] and Nardal [27] respectively, both emphasize the importance of valuing the African tradition and heritage as a mean for getting the oppressed ready for a liberation

movement. To reflect upon the current reality as Freire [25] describes, the oppressed need to discover themselves from outside. Frye [28] explains the difficulty of seeing oppression from the inside and emphasizes on seeing macroscopically. The result of this discovery provides a foundation for a liberation movement. Once the oppressed see themselves from the outside and understand the causes of the current state of their suffering as systematic and beneficial to a ruling elite, the oppressed are not "things" anymore, they are subjects in a liberation struggle. When the oppressed act upon reality, reality goes under *transformation*; through this project, the oppressed question forms of knowledge, evaluation, justification, resource distribution, etc. Lastly, the process of liberation cannot happen in isolation; there is a need to move from the notion of individualism to *solidarity* fostering new and resilient relationships among the oppressed in a liberation struggle [25].

3. **Liberatory struggle and imagination**

To bring imagination, not as a mere emotional faculty or stimulation to sentiment, and not as a tool in service of creativity [29], but as a bridge between modes of theory and practice for liberatory purposes, we turn to liberation scholars and in particular, Gloria Anzaldúa, an influential feminist scholar, and Paulo Freire, a prominent scholar of liberatory pedagogy. Anzaldúa [30] illustrates imagination as the cornerstone for her program, *spiritual activism*, for decolonizing reality and transforming the world. She uses the similarities between writing and imagination and argues that to imagine reality differently one needs to move in liminal space where there is not struggle of "us versus them". In such space, negotiation and integration of identities and cultures becomes meaningful. Her symbolic and metaphorical description of walking/living in "nepantla" provides such a strong pedagogical tool; Anzaldúa argues living in between different worlds, where one does not belong to a particular race, gender, etc. creates a situation to negotiate across borders and to get to a hybrid multi-culture state, where one can simultaneously be insider, outsider, and other-sider. Anzaldúa repeatedly discussed this frame of thought, in which ambiguity is valued:

> *"la mestiza constantly has to shift out of habitual formulations; from convergent thinking, analytical reasoning that tends to use rationality to move toward a single goal*

(a Western mode), to divergent thinking, characterized by movement away from set patterns and goals and toward a more whole perspective, one that includes rather than excludes." [31, p. 101]

The importance of divergent thinking and seeing different perspectives has also been addressed by Paulo Freire:

"...thus it becomes necessary, not precisely to deny the fact, but to "see it differently." This rationalization as a defense mechanism coincides in the end with subjectivism. A fact which is not denied but whose truths are rationalized loses its objective base. It ceases to be concrete and becomes a myth created in defense of the class of the perceiver." [25, p. 52]

Paula Freire's strategy for liberation is to critically act and reflect upon reality to resolve what Freire calls the *oppressor-oppressed contradiction*, which leads to a new birth. Freire argues that the oppressed need to establish a dialogue which encompasses reflection and action, to be able to achieve transformation of reality, i.e. liberation towards freedom [25]. Freire introduces problem posing education as an effective pedagogical approach for the struggle in a liberatory movement. Freire argues through application of such instrument, teacher and students will become "subject" work "with" each other to fight for freedom and walk through the process of consciousness of reality. Freire's illustration of consciousness, which portrays a bridge between thought/critical thought and action, encompasses both relational and imaginal components. These components are the very same components that can be captured from Anzaldúa's illustration of *conocimiento*. In both programs, to act upon, change, reinvert reality, and engage in personal and social transformation, the oppressed need to use *imaginal capacity*.

"...the capacity to see in surface phenomena the meaning of deeper realities, to see the deep structure below the surface. It is an instant sensing, a quick perception arrived at without conscious reasoning. It is an acute awareness mediated by the part of the psyche that does not speak, that communicates in images and symbols which are the faces of feeling, that is, behind which feelings reside/hide. The one possessing this sensitivity is excruciatingly alive to the world." [31, p. 60]

4. **Pilot study**

The sample ethics discussion session was developed as part of the professional development activities in the NSF REU program at Virginia Tech in summer 2018. This NSF REU site was established in 2007 with the focus on interdisciplinary water science and engineering; to date 105 students completed the program. During this 10-week summer research experience, students spend 40 hours in their respective labs and attend professional development activities on fridays. Professional development activities include seminars and presentations on different topics such as communication and ethics. More details about this NSF REU site including the results of the program evaluation can be found at [32].

In summer 2018, ten undergraduate researchers, including eight women and underrepresented minorities, from ten different institutions in the U.S. completed the summer research experience. Two of the students spent six weeks at Indian Institute of Technology Madras in India. The students represented various disciplines including biology, chemical engineering, civil engineering, environmental engineering, computer science, geological engineering and geoscience. In addition to gaining research skills and experience, they participated in different field trips and workshops including an ethics discussion session that were developed to address professional development skills. The first author of this paper facilitated a two and half hour ethics discussion session. The workshop took place in an averaged-size conference room with a physical set up appropriate for a discussion-based and student-centered classroom. Students were assigned to study two readings in advance, Le Guin's The Ones Who Walk Away from Omelas [33], and a short introduction to ethical theories [34]. Major topics discussed in the session included ethical theory, ethical reasoning, bias, power, oppression, identity, and two case studies on environmental injustice. During the session, students were engaged in several freewrite tasks and reflected on their thoughts and feelings. We deliberately incorporated discussion about ways we think, individual and collective responsibility, power relations, and systematic patterns of oppression.

4.1 **Lesson plan**

Ethics Discussion- NSF REU Program- Interdisciplinary Water Science and Engineering

    I.   Opening and Introductions

    II.   Freewrites What role do you think you can play in diminishing human suffering?

    III.   Purpose/Objectives

           A.   To think about the role of science and engineering profession/discipline in diminishing human suffering

           B.   To imagine future/consequences of actions

           C.   To imagine being someone else

    IV.   Ethical Theory and Ethical Reasoning

           A.   Reading: Barbara MacKinnon: "Ethics and Ethical Reasoning" (3-10).

           B.   Emphasis on ethical reasoning

           C.   Role of imagination

    V.   Cycle of Bias

           A.   Stereotype

           B.   Prejudice

           C.   Discrimination

    VI.   Freewrite Thoughts and feelings about others who are different from you

    VII.   Institutional Culture/Power

      A.   Truth and loyalty

      B.   Brief note on whistleblowers

      C.   Scenario- Write up

    VIII. Systematic Oppression

Reading: Ursula Le Guin: "The Ones Who Walk Away From Omelas"

    IX.   Freewrite

      A.   Imagine what you experience in this situation

      B.   Imagine yourself as different individuals

    X.   Cases

      A.   Fish consumption rate

      B.   Environmental injustice- hazardous facilities

    XI.   Closing

4.2 **Data collection and analysis**

After the program, students were invited to complete a post-program survey and participate in a focus-group interview. Students reflected on their research experiences, social experiences, and different professional development activities including the ethics discussion session. With regards to the session, our intention was to learn about students' experiences rather than exploring a particular question or quantifying the effectiveness of the session. The survey required about 20 minutes to complete and the survey items were used for analysis were:

1. Please comment on your experience with ethics discussion session.
2. What is your take-away message from ethics discussion session?
3. Which aspects of the ethics session need improvement, and why?
4. Please comment on the weekly professional development activities you attended during the past 10 weeks. Feel free to list the topics you liked and didn't like. Suggestions for next year are most welcome.

In general, we identified four major categories regarding students' experiences; null curriculum, engagement with ambiguity, thinking, and the need for more interaction. Students noticed that some materials discussed in the session, while important, are omitted from formal education. One student in describing their experience said:

> *"[The instructor] has really been incredible in his discussions with us, the ethics discussion we did on [date] really so eye opening and something that is often ignored during most undergraduate curriculums. So I am glad that in an informal setting I gained a better experience as opposed to my paid education..."*

Another student explained it in this way: *"I really really enjoyed it. Again, I think it was extremely beneficial because most of us lacked ethics classes/discussions in our educations."*

Another important category emerged from data was ambiguity. One student reflected on the complexity and challenges in settling ethical dilemmas:

> *"The ethics discussion session was a little hard to follow. I guess the point of ethics is that there is not cut and clear conclusion. I enjoyed it because [The instructor], I think, has a great perspective. I'm not sure I would have enjoyed a similarly organized discussion with someone else."*

Another student in response to their take-away message acknowledges the existence of multiple perspectives: *"My takeaway is that ethics is not black and white, there are many complicated layers and perspectives involved in ethics."*

Some students reflected on their thinking and reconstructed the connection between thinking and action. In responding to take-away message, one student said: *"I was introduced to ideas I often rarely thought about and how to think more ethically when making decisions, especially should such decisions."*

Finally, some students reflected on the session and highlighted the need for more interaction. In response to the question on what areas should be improved, one student said: *"Good session with good content however, more student interaction would've been good."*

5. **Summary**

In this paper, we presented our initial effort in bringing liberation praxis and theory into educational setting in *developing* and *facilitating* an ethics discussion workshop. Overall, we received positive and unexpected responses from participants that may shed light on the importance and relevance of liberatory praxis and theory as key resources in bridging conventional STEM design paradigms and ethics. Reflecting on what we have learned, we plan to improve upon this study for the upcoming year. In connection with method, we incorporate open ended questions in a survey as well as individual interviews to better understand students' perspectives on the role of imagination and the influence of the workshop.

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