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REFLECTIVE AND DIALOGICAL APPROACHES IN ENGINEERING ETHICS EDUCATION

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Reflection in higher education

Reflection is a central competency in higher education and one of the highest forms of cognitive achievement in Bloom's taxonomy (Bloom et al., 2020), meaning that it is difficult to achieve but worthwhile to pursue. In this section, we aim to describe what reflection is and what its benefits are for our context of application, namely engineering ethics education (EEE). We cannot offer an overview of the existing models or the history of the concept of reflection since this would require a chapter in itself. Prominent scholars like John Dewey (1933), Donald Schön (1984), and David Kolb (1984) proposed detailed accounts of reflection that have been used as conceptual underpinnings for developing structured processes of reflection and reflective practice. Dewey's description of reflection as a general mode of thought and cognitive process that highlights the interactions between experience and self provides a valuable lens to describe what reflection is and how it can be incorporated into general educational settings. Dewey defines reflective thought as "Active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends" (1933/2008, p. 118). Dewey's account was philosophical and guided by existential and phenomenological principles, and much of the ensuing research on reflection tried to operationalize Dewey's insights into more applicable principles for education (English, 2023).

Rodgers (2002, p. 845) summarizes Dewey's view, distilling four main criteria for defining reflection:

- It is "a meaning-making process"
- It is a "systematic, rigorous, disciplined way of thinking"
- It takes place "in community, in interaction with others"
- It would require "attitudes that value the personal and intellectual growth of oneself and of others."

Briefly, as Rodgers (2002) explains, the first criterion points out the primary function of reflection, to grapple with the various interpretive possibilities of ethical situations; the need to reconstruct the experience to understand the problem initially obscured in layers of complexity. The second

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criterion addresses the process of reflection as a way of conscious and deliberate thinking. In this process, one draws on the meaning of experience, develops possible alternatives and hypotheses for a given situation, and then subjects these to testing and experimentation. The third criterion highlights that reflection is not merely a solitary action. While it is plausible that moments of pause and engaging in solitary research may serve as a valuable exercise, it is through dialogue that one can see the experience from a different lens and further expand one's understanding. This is also true for those who teach praxis and facilitate reflection practices; relationality is the essence of reflective thought (Buber, 1958; Freire, 2005). The fourth criterion points to a set of attitudes needed for an individual to engage in reflective practice, mainly awareness of one's own limited perspective, open-mindedness and willingness to seek counter-evidence, and being responsive to the particularities of the unique situation and the needs of others.

Focusing on the practice of reflection within *higher education*, Ryan (2013) elucidated this concept by delineating two key elements and four levels. The two elements of reflection are "making sense of experience in relation to self, others, and contextual conditions" and "reimagining and/or planning future experience for personal and social benefit" (Ryan, 2013, p. 145). The two elements capture the core of the process of reflection illustrated by Dewey: experience and interpretation of the experience, and developing and experimenting with potential alternatives (Rodgers, 2002). Further, Ryan illustrates *four levels of reflection*, which provide direction to both the teacher/facilitator and students. In educational practice, the four levels of reflection are:

- reporting/responding
- relating
- reasoning
- reconstructing

These point to identifying and reporting key issues, relating issues to background and experience, analyzing situations considering different perspectives, and alternatively, reframing and experimenting with the course of action. In a similar vein, some scholars of service-learning provide practical advice for incorporating reflection into educational settings, highlighting the need for understanding the meaning of experience, surfacing and challenging assumptions, and creating opportunities for sharing perspectives to develop more complex views of situations or problems (Eyler, 2002; Hatcher & Bringle, 1997).

In this chapter, we are particularly interested in how reflection emerges in the context of EEE and what methods exist for systematically fostering ethical reflection in formal engineering education.

Reflection in engineering ethics: ethical reflection

In engineering education, reflection has been recognized as facilitating students' learning and skill development (e.g., Turns et al., 2014; Woods et al., 2000). Specifically, in the context of engineering ethics, scholars have emphasized the benefits of incorporating reflective practices, such as ethical reasoning, awareness of experience, the meaning-making process, fostering openness to new possibilities, and developing ethical sensitivity and commitment (e.g., Beever and Brightman, 2016; Bielefeldt et al., 2020; Bombaerts et al., 2022; Bucciarelli, 2008; Corple et al., 2020; Kim et al., 2019; Lönngren, 2021). Ethical reflection is considered foundational for most ethics classes in most professional fields (Chadwick, 2012, p. 718), beyond the cognitive reasons that make reflection a worthwhile process to pursue. In engineering ethics, the goal is not only to learn something

(i.e., an epistemic goal) but is also existential, that is, to transform how one views the profession as a whole in the context of larger political, economic, and social structures. Self-transformation without reflection is hard to imagine (Mezirow, 2006), which is why engineering ethics pedagogy, if it is to succeed, must also resist the tendency toward instrumentalization. Dewey theorized that reflection only 'gets off the ground' when students are given the space to question and experience ambiguity. Benefits for students are often described concerning the 'process' of ethical reasoning, considering broader non-technical factors and being more critical in decision-making. Reflection as a mode of thinking enables us to continuously monitor our assumptions and values and bridge experiences, self, and situation. While reflection is a general pedagogical practice that can be deployed in almost any curriculum, ethical reflection is a competency more specific to EEE scholarship (Bielefeldt et al., 2020; Bucciarelli, 2008; Colby & Sullivan, 2008; Marin, 2020; Royakkers & van de Poel, 2011). In this chapter, we are concerned with the process of ethical reflection, what it can borrow from reflective practice, and what is unique about ethical reflection *qua* reflection. If reflection is "a careful examination and bringing together of ideas to create new insight through ongoing cycles of expression and re/evaluation" (Marshall, 2019, p. 411), *how is ethical reflection distinctive?*

To define ethical reflection, we turn to a model put forth by van de Poel and van Gorp (2006). They take ethical reflection to be a form of moral deliberation in which:

> engineers should take into account all relevant moral values. Designing engineers should, for example, reflect on the choices they make regarding the relative importance of safety, economic, and sustainability considerations … Typical for ethical reflection is that the actual existing way of dealing with moral issues is not taken for granted.
>
> *(van de Poel & van Gorp, 2006, p. 335)*

Thus, for ethical reflection, students and practitioners first recognize that there is a normative issue at stake that existing ethical frameworks or codes of conduct cannot solve straightforwardly (Grunwald, 2000). If the need for a non-trivial solution is recognized, then they need to launch into a process of ethical reflection. Ethical reflection shares with the wider concept of reflection its four-component model (of cognitive assessment, active, iterative, and integrative aspects), but all these are applied to the ethical theory realm. What this realm contains is up for debate, though. While van den Poel and van Gorp (2006) confine the realm of ethical reflection to ethical values and theories, others, such as Erin Czech, also identify political and social values as legitimate ethical concerns, hence worthy of ethical reflection (see Morrison, 2020).

The process of reflection shares some of the elements of moral deliberation – from our engagement with an ethical problem to experiencing perception and action in imagining possible courses of action and transforming the situation and the self. Within educational praxis, the goal of the process is not necessarily to arrive at a particular answer but to provide opportunities for students to grapple with the perplexity of a given situation, envisioning various courses of action and critically evaluating their relative merits, thereby enhancing their understanding.

Ethical reflection can take many forms in educational practice, which we will delve deeper into in the third section. But for a quick insight into how it might look, let us consider the 'Revenge Test' (Jalali et al., 2021), a scenario in which students imagine taking revenge in a situation. The facilitator asks students to think about why they would take revenge. Group discussion provides an opportunity for communicating different perspectives and understanding alternative meanings of experience. Students can increase their awareness of their own values, question their assumptions, and see new emerging questions and ideas. Next, the facilitator presents a

challenge: while we often imagine someone else's future experiences in a negative or cruel manner, we may lack insight into envisioning positive future experiences for others and fostering meaningful relationships. The facilitator begins by asking students to describe a given story/scenario to encourage participation. Then, the discussion can move to identify the main issue, inviting students to consider 'what' and 'why' questions (Jalali et al., 2022). The facilitator can assist in uncovering (i.e., making explicit) the students' values, backgrounds, and experiences during this process, fostering an environment where students are encouraged to reframe their perspectives and adopt new lenses to examine the issue. Consistent with embodied perspectives of reasoning, pedagogical methods, and the design and reflection on intervention outcomes, these rely on students' lived experiences (Civjan & Jalali, 2022). Sharing, feedback, and reflection on students' perspectives provide opportunities for experimentation, out of which more questions may be raised. This example showcases important constituents of reflection – connecting experience with a given situation, questioning values and assumptions, discussing alternative perspectives, and stretching reasoning in considering different possibilities (Eyler, 2002; Rodgers, 2002; Ryan, 2013).

Based on research in phenomenology and cognitive science, we emphasize that addressing an ethical dilemma requires understanding the problem and simulating potential scenarios through imagination (Johnson, 1993). This process cannot be isolated from who we uniquely are and what experiences, values, and emotions bring to our sense and interpretation of the given situation (Marin & Steinert, 2022). Suppose moral deliberation is not about applying habitual patterns of thought and fixed rules. In that case, there needs to be an ongoing interplay between thinking and experience where we can continually expand our boundaries and reorient and adjust our thought patterns (Johnson, 1993). There is a clear connection between reflection and ethical awareness in engineering. A deeper understanding of the ethical implications of professional activities can foster an ethically informed community of tech and engineering students.

In this chapter, we propose that adopting reflective and dialogical approaches can familiarize (and habituate) engineering students with the process of ethical reflection. This may, over time, cultivate a professional culture that prioritizes ethics in technology development and implementation. We argue that all reflective approaches in ethics education are grounded in dialogical encounters with oneself, others, and texts. We show that reflection is fundamentally dialogical and that successful dialogical methods will stir reflection. We aim to examine the existing reflective methods used in EEE in order to reveal their modes of dialogical engagement, based on this theoretical premise. It is important to note that every reflective method has its own set of advantages and drawbacks, which we will briefly describe. We end the chapter with practical recommendations for instructors aiming to instill ethical reflection in their classrooms.

Some theory: the dialogical nature of ethical reflection

Reflection as a dialogical and mediated encounter

In this section, we will discuss how the phenomenological philosophical tradition informs how we think about reflection. Briefly, phenomenology is a major current in European philosophy that emerged at the turn of the twentieth century with Edmund Husserl's meticulous studies of lived experience. Following him came a procession of philosophers like Martin Heidegger, Jean-Paul Sartre, Simone de Beauvoir, and Maurice Merleau-Ponty. While these philosophers have distinctive and not-always-compatible philosophical views, they nevertheless share a methodological commitment to rigorous descriptions of concrete lived experiences.

As this is an expanding area of research that affects different fields such as cognitive and neurosciences, philosophy of technology, healthcare pedagogy, and the social sciences, it has become evident that our experiences, precisely because we are bodies, are not trapped in a realm of personal mental representations, but rather that our embodied selves are always already caught up in and shaped by a historical and sociocultural milieu. This highlights the numerous ways in which our experiences are shaped by our physical bodies and the environment in which we live. When objects appear to us, they always do so within a particular horizon of implicit meanings, a tacit interpretive framework that structures the modes of appearance and the possibilities for our involvement. Thus, the field of our experience always has a social and 'intersubjective' character.

What does this mean specifically for reflection? First, we must pause and ask where reflection is happening and what its object is. The term 'reflection' itself might lead us to think that what is at issue here is an inquiry directed towards the self, toward one's own inner life. There is a long philosophical heritage going back to René Descartes' famous 'cogito' argument ('I think therefore I am') behind this idea of reflection as self-directed introspection. As the Cartesian tradition exemplifies, this approach tends to lead to a kind of 'mind–body dualism' insofar as it treats the mind as something 'interior' and detached from the world. This presupposition of detachment has profound implications for how we think about agency, ethics, and our involvement with others and with technologies. Phenomenology, on the other hand, when it uses the term 'reflection,' has in mind a kind of attentive directedness toward the field of lived experience itself. Its methodological aim is to avoid presuppositions and begin with a description of how experience happens. This brings to light certain features of experience that can be taken as guides for philosophical inquiry into ethical life.

First, in attending to the happening of experience, I notice that most of the time, *I* am not the object of my experience. My attention is instead directed toward taking care of projects in the world. For example, I am frequently absorbed in tasks like buying groceries and traveling between home and work, as well as attending to the larger projects of my career and family life. Many phenomenologists draw our attention to the way in which our experience is *seamless* – that we are, first of all, and for the most part, *absorbed* in meaningful tasks and contexts of action. For instance, utilizing my car to drive to the store, taking out my wallet while at the checkout counter, typing on my laptop, sharing announcements on the learning management software I use to interact with students, and employing various other technological devices – these are all continuously shaping the form that my experience takes. And yet, I am not reflecting on my use of those tools and devices but rather on the sense and the overall aim of my engagement. Again, I find that my lived experience is most often not explicitly self-aware.

Once we attend to the goal-directed character of our experience, we notice that these tasks are always undertaken within a coherent and contextualized whole. I never encounter raw 'data points' or feel 'bare' sensations. I am absorbed in situations that are always already sense laden. The inherent meaningfulness of these contexts lets me be absorbed and attentive to them. Driving to the store this morning, I did not have to explicitly cognize, step by step, how to shift the gears to slow down or signal left into the parking lot. At that very moment, all of my attention was on two pedestrians, a mother and child, who were motioning to cross the road in front of my car. Yet I can vaguely recall, many years ago, when I first learned to drive, that driving was an 'alienated' and self-conscious experience that is emphatically *not* how it is now. Because my body and my consciousness are inextricably intertwined, after practice and eventual habituation, my car functions as a seamless extension of my bodily intentions. I am a skillful driver precisely because I 'forget' the explicit details of driving, allowing me to pay attention to pedestrians. This example is not at all extraordinary – most of our experiences take this form. However, it does mean that we

often take the intelligence of our embodiment for granted because, much of the time, we are busy enacting meaning in the world through our projects. We are only able to make sense of the world through our actions. We are embodied because we are 'gearing into' the world, both literally and figuratively.

This brings us back to that essential component of lived experience that we mentioned at the beginning of this section – which is that it is always involved with others – and the essentially 'intersubjective' character of this involvement. The world appears to me as a 'context of significance' open to me and others, which confers on my experiential contexts their latent sense of 'objectivity.' I am immediately aware of the significance of others' actions, and I am aware that they are aware of mine. In our seamless bodily involvement with the world, our actions are also expressive. We are geared into a shared cultural horizon of meaning. This means that, fundamentally, others are *inside* of my experience. For example, while slowing down to make way for the pedestrians crossing the road, I made eye contact with the mother. In a split second, she read my intention – just as I felt her concern. My glance conveyed that I had seen them and that they were safe to cross.

Again, this is not extraordinary. Because my experience is constitutively intersubjective, my awareness of myself as a moral agent is dialogically mediated through others. All of our experiences take this general form: We are attentive to the meanings of our embodied actions with respect to their 'interrelatedness' or interpretability by others. It is my recognition of the 'gaze' of the other (whether literal or imaginatively anticipated) interpreting the meaning of my actions in particular contexts that directs my own 'gaze' back to myself. That my experience is always open to others calls me to respond and to be responsible. Recall that the first feature we noticed about our lived experience was that we are not explicitly self-aware most of the time. It takes others to get us there.

Before we conclude this section, it is worth noting that being attentive to the 'intersubjective' character of experience is further complicated by the fact that more and more of our relations with others are technologically mediated. Reflection on the social and shared character of meaning-making necessarily includes grappling with the material contexts of our relations with others – because the meaning of those relations is transformed when mediated through technological artifacts and systems. American sociologist Sherry Turkle has reflected deeply on the contemporary digitally mediated social world, and she describes the particular and peculiar phenomenon of 'being alone together' (Turkle, 2011). According to Turkle, our phones and other communication technologies create a false sense of connection with others by disconnecting us from the meaningful contexts in which we first encounter them. Instead, they connect us in ways that are abstract and do not account for the shared meaning and understanding that comes with face-to-face communication. Here, we find a danger that certain technical mediations of our experience can thwart our capacity to attend to the real sources of meaning, including ethical meaning, in our experience.

To put it briefly, phenomenology is a technique that helps us understand and explore our experiences in their own context, with the goal of uncovering the ways in which significance arises. Taking seriously these phenomenological insights (that experience is embodied, intersubjective, and technically mediated) poses a challenge to traditional approaches to professional ethics that rely on abstract rules or codes. This approach often views ethical living as analogous to using tools, where the focus is solely on determining the appropriate rules for using the tools available to us. Phenomenology, by highlighting the way ethical meaning arises in our experiences, redirects our attention towards exploring how our tools (and collections of tools) influence our relationships with the world and others. It prompts us to examine how they bring certain things into focus while obscuring others, and how they shape our perception of what (and who) is significant. Ethics then becomes less 'a simple matter of correct tool use' and more a question of 'design and responsible agency.' Such phenomenological reflection, in the context of engineering ethics pedagogy, enables

students to see for themselves the emergence of ethical meaning and responsibility in their experience and in the professional context for which they are becoming prepared.

Dialogical education and dialogism

Dialogical education has been a growing trend in educational theory in the last decades (Mercer et al., 2020). Dialogism as an educational movement started from and inspired by Mikhail Bakhtin's theoretical work : "Dialogism is a philosophy of language which places central importance on the reality of socio-verbal interaction in understanding the kind of phenomenon that language is" (Skidmore, 2020, p. 27). A constitutive principle of dialogism is that "Truth is not born nor is it to be found inside the head of an individual person; it is born between people collectively searching for truth, in the process of their dialogic interaction" (Bakhtin, 1929/1984, p. 110, cited from Wegerif, 2020). Dialogue is then defined as a method in which "students learn through being called out by others into active engagement in ongoing dialogues" (Wegerif, 2020, p. 23), where this other can be another human being, a generalized other (e.g., society, a body of knowledge), or a non-human other (e.g., nature, a technological artifact). The fundamental principle of dialogism is ethical and epistemic, as it entails that epistemic values and achievements are always found in encounters with another. Moreover, seeking opportunities for encounters is something valuable that one should seek systematically if one wants to develop oneself.

Dialogue is not a mere conversation – talking about something in front of another; it is also affected by how the other responds (verbally or non-verbally). There are many educational formats centered around dialogue in EEE: interacting with stakeholders (e.g., interviews), having discussions with peers about a case study, interacting and deliberating via online platforms, role-playing, mock trials, and so on. Yet, not all such interactions are dialogical; the possibility of being affected by others varies based on the specific configuration. There are also other practices that one could call *monological* (based on a simple distinction of how many voices one finds in practice), such as writing reflective journals or essays, which are used in engineering ethics instruction to promote reflection.

Our central claim is that any pedagogical activity aiming to instill an experience of ethical reflection in the ethics classroom needs to be infused with dialogism at some level. This claim is based on discriminating between superficial dialogical exchanges and genuine dialogical exchanges. A superficial dialogical exchange is one where we merely enact a dialogue as an exchange of replies: A says this, B replies, and A then takes their turn, and so on. We call this 'superficial exchange' because taking turns while speaking does not ensure a dialogue between those involved. One can see such a non-dialogical exchange in formal debates or in the 'Ethics Bowls,' where students can respond to each other's arguments for the sake of winning the debate without letting the debate change their opinions on the matter at hand. In a genuine dialogical exchange, by contrast, the other – be this human, non-human, or a generalized other – can challenge and change the interlocutors, who are vulnerable and open to listening. This means that dialogical experiences are not necessarily about encountering others; one can encounter oneself through technological mediation or when writing a text. Even 'classical' monological practices, such as lecturing, journaling, or watching a movie, can be injected with dialogical elements (formally) and serve the same purposes depending on how open and engaged the participants are.

Drawing from the theory of dialogism with its ethos of being attentive and vulnerable to the voices of others as potentially changing ourselves, and the phenomenological nature of reflection – as a transformative experience, mediated, happening 'in between' – we will now examine activities and methods that promote dialogical encounters and that thus seem promising as sites for ethical reflection.

Some praxis for fostering ethical reflection – methods and approaches

Before we review the existing educational methods for fostering ethical reflection, we need to emphasize that there are complexities in instilling reflection, and there is not one single bullet-proof method for this endeavor. Here, we single out two main difficulties to be expected and planned for when fostering reflection systematically.

The first difficulty concerns the effort required for reflection and the self-transformation entailed. These may come as unpleasant surprises for many students and, perhaps, for instructors as well. Regarding fostering reflection in classroom practices, some commonly used methods include reflective notebook writing and in-class discussions (Walker, 2013). These are valuable methods when used systematically, yet they do not work by themselves without being tweaked and adapted to the specific cohort of students. Teachers will not trigger reflection by merely assigning a journal entry or leading a class discussion on ethical issues, because reflection is not idea generation. Reflection is not merely 'thinking about' something, a brainstorming session, or jotting down strings of opinions about a controversial case. When we, as educators, ask for reflection from our students in the ethics classroom, we ask for more than simple assignments. We ask for an effort that is uncomfortable emotionally (Mikalayeva, 2020); we ask for vulnerability and self-disclosure. For this, we need to showcase what reflection is and provide examples of it. We can start with simple models and move toward more complex ones.

The second significant difficulty lies in the open-ended nature of reflection. Reflection, as we construe it here (drawing as we have from Dewey), is an experience of thinking that the subject undergoes once they encounter resistance from the world. Engineering students are well-versed in problem-solving. Even when confronted with an ethical dilemma, their first approach is to treat it as a problem with only one correct solution. The problem-solving mindset (sometimes called the 'techno-fix mindset,' see Huesemann & Huesemann, 2011[1]) conceptualizes ethical concerns as something ultimately solvable through the power of reason and knowledge in a rationalistic vein (Warford, 2022). This attitude focuses more on finding a solution to what is perceived as a problem rather than dwelling on the problem itself and exploring its complexity. A central goal of reflection is not merely to 'solve' the problem as such – although, based on ethical reflection, arriving at new designs is encouraged (van den Poel & van Dorp, 2006) – but rather to make the student aware of their situated thinking and how their assumptions play a role in what they perceive as viable solutions. The techno-fix mindset clashes with the ethos of reflection, which treats problems as open-ended, complex, and as a source for self-knowledge. Due to its prevalence in engineering education, the techno-fix mindset often stands in opposition to the practice of ethical reflection. Moreover, the so-called 'hidden curriculum' in engineering (Tormey et al., 2015) makes it seem that ethics and ethical reflection are not necessary for doing solid engineering work and are somewhat at odds with engineering. Engineering students are, by and large, trained not to care about ethical issues and to avoid ethical reflection on the issues emerging in everyday engineering practices.

Nonetheless, the methods advanced throughout this chapter are meant to encourage collaborative learning, divergent thinking, and critical, constructive in-class debates, which might open students to reflection. More importantly, all these methods are egalitarian, as they stress the need to listen and respond to others and to build on their inputs while focusing not on the interlocutor's social position but on their arguments and grounds. No matter how sophisticated our methods may be, engaging in reflection is a task that is effortful and emotionally vulnerable – especially when we ask students to reflect in front of others. As educators, it's crucial to delineate our intentions behind incorporating reflection into a course. We must identify when, during the course or learn-

ing process, we aim to promote reflection, whether it involves individuals, classmates, or even inanimate objects. Subsequently, we should tailor our pedagogical methods to effectively foster this reflective practice.

How can educators create opportunities for students to participate in critical inquiry processes that prioritize essential aspects of moral deliberation? Ones that place emphasis on the 'qualitative unity' of a situation, individual values, backgrounds, and experiences, as well as encouraging the imagination and evaluation of various alternatives? This section explores the main existing methods to incorporate ethical reflection. We have divided these methods into four main categories – dialogical and monological, synchronous and asynchronous – based on the temporality of the method. Via monological/dialogical polarity, we aim to stress that the dialogical experience will vary depending on whether the main challenge of the method is encountering others (e.g., colleagues with diverging ethical intuitions and arguments or the unseen stakeholders for whom one is designing) or encountering oneself (e.g., one's beliefs, attitudes, and biases).

Four main types of activities for instilling ethical reflection

We have identified four main categories of methods for teaching reflection:

A. Monological and synchronous
- Writing prompts in the classroom for individual students
- Exam with essay-type answers (e.g., argue for … explain why … analyze this case …)

B. Dialogical and synchronous
- Case studies with complex iterative deliberation (ethical cycle)
- Role-plays
- Mock-trials with deliberation
- Tinkering with artifacts (design, redesign, optimization)
- Group design of educational activities
- Group essays written collaboratively, simultaneously

C. Monological and asynchronous
- Essay as homework
- Reflective notebooks

D. Dialogical and asynchronous
- Online deliberation (forum-like debates with threads of nested messages)
- Commenting on another's written reflection (peer feedback)
- Group essays written sequentially
- Below, we analyze a token from each of the four categories of methods for instilling reflection.

A. Dialogical and synchronous

Case studies

One common dialogical approach used, especially in engineering and business ethics, is the case study that presents students with various morally problematic situations and invites them to find solutions or to imagine new ways of tackling the issues presented (Colby & Sullivan, 2008; see also Chapter 20). The case-study method can help students familiarize themselves with moral judgment processes and acquaint them with the ethical standards for their profession (Davis, 1997). Despite its

centrality in engineering ethics classes, the case-study method has been criticized for being exclusively individualistic in its scope, leaving aside the complexities of the context (Bucciarelli, 2008) and the broader macro-ethical context, meaning 'the profession's collective social responsibility … to societal decisions about technology' (Herkert, 2005, p. 374). Moreover, the overuse of dramatic disaster case studies tacitly suggests to students that ethical decision-making is an exceptional occurrence rather than a day-to-day demand (Morrison, 2019). One way to remedy these deficiencies of the case-study method is the role-play strategy, as proposed by Martin et al. (2019). In role play–based case studies, students are asked to form groups representing the stakeholders involved (Doorn & Kroesen, 2013). This encourages students to take a more active stance when trying to find a solution to the problem presented in the case study. It also familiarizes students with the different interests of the parties involved. Assuming a role is about adopting a situated position in the world, with its epistemic limitations and values, is helpful if we want students to reflect on the situatedness of their own position and help them contextualize their thinking. There are caveats to role-playing, however. The role can be assumed superficially, played based on stereotypes about the profession, or overtly focused on performance rather than reflection – and ultimately fail to highlight ethical positions.

Deliberation on case studies can help – and can be done in various ways, some more sophisticated than others. We have identified several effective ways to facilitate deliberation based on our experience as educators.

Iterative and complex ethical cycle

A method that deploys case-study deliberation is the 'ethical cycle,' created to help students grapple with and embrace the ambiguous, non-linear character of ethical judgment (van de Poel & Royakkers, 2011, 2007). With the ethical cycle, students can make well-considered judgments on real-life situations through a series of iterative steps. Typically, the first 'walk through' of the cycle is done individually, and then the students get together to compare and discuss the divergences in their interpretations and evaluations. For the individual 'walk through,' students write down their reflections on each stage of the cycle; this solitary work also has dialogical elements. As we argued above, it is more accurate to describe the meaning-making realm as being 'in-between' us and others rather than as residing in some incorrigible and inscrutable 'interiority.' Writing is always a process that involves circling repeatedly, and the ethical cycle emphasizes this. Ethical reflection takes time, and although it requires knowing facts about a situation or 'case,' it also requires self-awareness. Often, we only come to understand our earlier motivations for making particular choices long after we've chosen. Our desire for expediency and to see ourselves in a certain way often hinders honest self-assessment. If implemented thoughtfully, the ethical cycle can help to habituate these reflective behaviors.

The five basic steps of the ethical cycle involve moral problem identification, problem analysis, options for action, ethical evaluation, and reflection. At each stage, there are opportunities to expand and increase the theoretical and contextual considerations that could deepen or even fundamentally change the students' initial interpretations of the earlier stages, prompting them to return to an earlier stage and rearticulate, for example, their initial moral problem statement. Depending on the complexity of the case and the depth of the critical inquiry engaged by the students, the cycle may take several iterations over subsequent weeks. Groups come together to select their ethical scenario or 'case study' and reconvene periodically throughout the term as they are exposed to additional frameworks for analysis. Since many of their ethical scenarios involve technologies, they may need to consider the agentive character of a particular technology. Sometimes, they need time to gather more relevant information, such as the issue's history in the communities

involved in their chosen scenario. Other times, if there is too much group consensus, they might need to engage more deeply with different normative frameworks to uproot a deeply embedded culturally hegemonic way of seeing. Experimenting with the ethical cycle group process over the term underscores the importance of pragmatic social contexts and the necessity of time and care for robust ethical reflection. Furthermore, this kind of dialogue-based approach stresses the importance of the meaning-generating nature of concrete experience. Not only are students engaging in ethical reflection about an imagined professional scenario, but together, they are simultaneously enacting the process of ethical community building. Suppose their instructor underscores the value of difference rather than consensus throughout the process – that can free the students to gain awareness and respect for the uniqueness of the varied lived experiences of other persons. This iterative approach starts from the presupposition that ethics is not about individuals simply applying principles but rather that group dialogue is about building moral and emotional relationships of mutual trust and respect for difference.[2]

Design your own ethics curriculum

Another method for stimulating engineering students' engagement with ethics has been advanced by Alpay (2013). Instead of offering a predefined task that students must solve in class or at home, instructors can ask students to develop, in groups, resources, methods, or activities that are meant to familiarize their colleagues with ethics meaningfully. In this way, roles are reversed, and students instruct. To avoid over-burdening students who might not be acquainted with the ethics of their profession, a series of lectures prepares them for the task by introducing the main concepts, issues, and applications of moral philosophy relevant to the students' profession (Alpay, 2013, p. 1457). After these introductory lectures provide a baseline understanding, the students work collectively in groups to develop proposals for their peers about how ethics should be taught. Proposing educational resources and activities prompts students to reflect on the importance of ethics for their profession and fosters "a culture of shared responsibility in learning and development" (Alpay, 2013, p. 1466). Moreover, students might devise interesting approaches that can be enacted subsequently to stimulate reflection and critical thinking among engineering students. Each group should present its proposal to the class and receive feedback that can further be integrated into the advanced activities. In this way, everybody participates in the other groups' work, which can stimulate reflection – and a sense of community and shared responsibility. This method aims to make students think of the relevant ethical topics that could be useful for their profession. In this way, they see beyond the immediate technical aspects of what they are learning and think about the implications of what they are doing. As we mentioned in the previous section, reflection is dialogical; it can be stimulated by engaging in a conversation with others, which is precisely what the collaborative dimension of this method aims at.

The emotional deliberation approach

The group deliberative methods described above can complement the emotional deliberation approach (Roeser & Pesch, 2016). Emotions should be taken into consideration in attempts to foster reflection in EEE. Creating a symmetric setup for discussion, where the students and instructors are placed on an equal footing (i.e., in a circle), helps everyone feel freer to express their analysis and emotions regarding what is being discussed. According to Roeser and Pesch, the main idea is to convey respect to every participant so that they can feel safe talking and critically reflect on their emotions and thoughts. This ties back to the idea mentioned in previous sections: reflection

is not solely a rational process. It involves an emotional component. Ignoring the emotions stirred by discussions will not make them disappear. Instead, Roeser and Pesch argue that it is more fruitful to start with emotions in mind and analyze these emotional reactions as indications of the values and norms one endorses. This can prompt reflecting on what one takes for granted about the normative fabric of the world. This method's effectiveness is dependent on classroom size; large groups struggle with emotional deliberation, whereas tutorial groups find it easier.

B. Monological and asynchronous methods

Reflective journaling/notebooks or essays

Another interesting method of fostering ethical reflection in engineering education is to invite students to reflect on their own values and reasons for studying engineering – by prompting them to write an auto-biographical essay or to keep a reflective notebook in which, given a specific ethical situation and learning activity, students log the development of their opinions. Although these methods might seem ill-fitted for science-oriented education, they provide essential methods to explore one's development as an individual and a professional (Kim et al., 2019). The auto-biographical essay puts students in the position to think in a structured way about their own lives and experiences. Thus, it promotes self-understanding, reflection, and critical examination of one's choices. Kim et al. (2019) present some interesting questions that help guide students in approaching such an assignment. The auto-biographical essay starts with questions regarding one's personal life, such as *What experience has contributed to the person I am becoming?* or *What were or are the challenges in my life, and how do I make sense of them?* It moves to questions touching upon professional life, like *What kind of an engineer (or other professional) do I want to become?* and *What is it that I want to do with a degree in engineering (or another field)?* The journal method asks students to reflect, for a whole semester, on a particular technology (be it smartphones, cars, artificial intelligence systems, etc.) or a moral issue raised by technologies (privacy in the case of Internet apps, pollution in the case of cars, fragmentation of attention in the case of social media). By writing a weekly entry in the journal, students are encouraged to reflect freely about how design choices influence their interaction with different technologies and how they shape their lives.

Despite their appeal, both the auto-biographical essay and the journal appear to be monological pedagogy techniques. One way to add interactivity to these methods is to ask students to discuss their entries in class, with the instructor and other colleagues. Infusing the auto-biographical essay and the journal with the benefits of dialogical approaches can allow students to find affinities and common interests with their colleagues and also to critically filter their thoughts and reflections through the perspectives and worldviews of others.

C. Monological and synchronous methods

Monological and synchronous methods ask students to reflect on their own during classroom time. For example, the instructor may tell students to take 5 minutes to think about problem X before students discuss it in groups or individually write brief responses concerning the ethical issue. Such methods are suitable for generating material to think about further in groups or pairs, and these exercises are helpful as pre-reflection by asking students to make up their minds concerning an ethical issue – such that this initial opinion can be challenged and further refined through subsequent activities. The value of such exercises is that they are not confrontational, specifically because what the student reflects is kept private. A teacher could assign such exercises at the begin-

ning of the semester and again at the end of the semester so that students can assess on their own how far they have arrived in refining their reflective capacities.

D. Dialogical and asynchronous methods

In asynchronous methods, the student's reflection is mediated by an online collaboration platform. Such methods entail, for example, asking students to comment on a paper online, annotate a text online, or build a mind map on a collaborative online platform. What students get to see from each other are only digital traces in the form of comments and, perhaps, some images. These methods are more akin to brainstorming, but when students edit an existing text by adding questions or suggestions, the collective reflection can be quite deep.

It may seem then that the main difference in synchronous versus asynchronous methods lies in the mediation aspect. However, the kind of dialogism entailed by mediation concerns us, rather than the mediation itself. This is because all pedagogical methods are mediated to some extent. The phenomenology of intersubjectivity recognizes mediated access – our sense-making activities are, at the same time, expressing themselves through behavior and speech. Given this mediated access to our own thoughts, the difference made by digital or paper-based platforms should not be radically different. There is a mediation of technology when we ask students to collaborate on a paper and comment on each other's responses to a text. This mediation does something other than the mediation of speech and body when students are in a room. When our methods require that students engage digitally with one another in an asynchronous way (i.e., not at the same time and not seeing each other instantly as would be the case with a video call), the resistance posed by others to the thinking process becomes less tangible and less immediate, and one could choose to ignore it. Reflection is still possible in asynchronous digital methods. However, it hinges on how seriously one engages with others' textual traces; it may be easier for students to engage in self-reflection rather than reflecting with others.

Assessment of reflection in EEE

Assessing the success of the educational methods in instilling reflection depends on the kind of classroom and the format where we find ourselves. Ethics in engineering education is taught either in standalone classes or integrated into learning pathways, where it is incorporated throughout engineering courses (van Grunsven et al., 2021).

If ethics is taught in a standalone class, we can take several steps, spaced through time, to foster reflection and iteratively revisit the results of reflective practice. Asynchronous methods, where the students keep a log or a notebook, will work effectively since the students will have a reference point to return to and re-evaluate. These asynchronous methods also facilitate students' self-assessment. Teachers can assign reflective notebooks at the beginning of the class, asking students to jot down their thoughts and insights throughout the semester. At the end of the course, students can be asked to reflect on their reflective processes and what they learned. Educators can assess this meta-reflection while the logbooks stay private to protect the students' fledging reflective processes. Rubrics for assessing reflection should involve the four previously described categories – integration with previous knowledge, interaction, systematicity, and active engagement (Rodgers, 2002). When assessing the dialogical activities, the instructor should also assess the group dynamics: *Did only one student engage in reflection, or was the activity constructed with insights from most group members?* This can be achieved by observing the interactions or, when this is not possible, by asking students to log their discussions in class and provide graphic emphasis to signify when they changed their minds or arrived at a new conclusion.

Reflection assessment is included in the general assessment methods of engineering courses when ethics is taught through modules embedded in the curriculum. Either way, reflection assessment should usually be linked with other learning goals' assessment in EEE or engineering education. Most engineering ethics classes do not prioritize reflection as their primary learning objective. Rather, reflection is a process to be fostered that enhances other ethics learning goals such as ethical awareness, ethical judgment, and deliberation. Hence, it makes sense to assess these other learning goals primarily – and then to have reflection as a sub-category of these. For example, when we assess ethical awareness/sensitivity, we can add a rubric on whether this ethical awareness improved through reflection or was showcased in a non-reflective way. While reflection is a high-level learning goal (Bloom et al., 2020), it should be assessed alongside other contributing goals in EEE. With ethical reflection, we can see assessment more as feedback rather than grading. As ethics instructors, we need to create opportunities for formative assessment throughout the semester by facilitating the self-assessment of students – peer assessment, feedback on journals, and even group presentations and discussions should receive feedback regarding how reflective these were.

Some practical take-away points for teaching ethical reflection

Integrating regular reflection into engineering ethics curricula and practices is necessary, as reflection is the primary component of ethical reasoning and moral judgment. In creating opportunities for reflection, it is critical to pay attention to the choice of situations and, in general, the cases and scenarios used in instruction. Students should be guided to see and engage in ethical situations considering (i) the situation's contextual reality; (ii) their own assumptions, values, and experiences; and (iii) dialogical practices. For instance, in writing reflective journals or essays, students can be prompted to redefine the problem; address their values, feelings, and assumptions; raise potential questions; and analyze the situation considering the aforementioned factors and a given model or text. Further, reflection can be operationalized through engagement with stakeholders in real ethical cases – as well as class presentations and discussions. For educators, it is important to address the complexities involved in developing the competencies required for reflection and to establish clear criteria for evaluating the reflective process.

We offer several practical takeaways for instructors aiming to instill the experience of reflection in the ethics classroom.

- Integrate reflection as a learning experience with other, more easily measurable learning goals:
  - When assessing these other goals, such as ethical deliberation, ethical sensitivity, and so on, provide a separate sub-rubric regarding how reflective the process and the outcomes were.
- When ethical reflection is embedded in another engineering course, use reflection as a sub-goal for the other learning goals (e.g., when assessing the design of an artifact, one can add the reflective component to the design evaluation).
- Create a safe space for reflective engagement by providing clear guidelines at the beginning, recognizing that dialogical exercises are spontaneous; people can easily hurt each other when they speak their minds without considering the effect on others.
  - Provide a set of clear rules and expectations so that all students can feel included in this process.
  - Start by announcing the rules of respectful engagement at the start of the class, reminding students of these rules and enforcing them.

  - Make sure that all students feel heard and seen.
  - Acknowledge students' contributions.
- Showcase examples of reflection, for example:
  - Engage in reflection yourself concerning a sample case study, or comment on a role-play acted by students in front of the classroom.
  - The examples teachers provide can be personal and should model spontaneity and vulnerability. For example, when teaching, you can explain how you changed your mind about issue X, mention the emotions entailed in that experience, and thus show students that emotions are to be expected and that nobody is a perfect epistemic agent, having the 'correct' answer from the start.
- Start with simple models of reflection and increase their complexity as the semester continues.
- Try to use a mix of dialogical and monological methods and have these interact, for instance:
  - You can promote dialogical methods during class time and then ask students to reflect privately in their notebooks on what they learned through the interactions.
  - Do not rely solely on monological or dialogical methods since these do not target the same kinds of reflective experience, and you'll want to create a variety of experiences for the students.
- Use reflection beyond the fleeting experience created in class:
  - The more students think and reflect about their reflections, the easier it becomes for them to perform.
  - You can ask students to refer back to their classroom or online discussions and use these insights or be critical about them in their individual assignments such as essays.

Conclusions

This chapter addressed the ambiguities and challenges in understanding and implementing reflective thinking in EEE. We argue that EEE instructors should pursue ethical reflection in a context-specific manner, as a worthwhile goal. We conceptualized reflection drawing from existing literature in pragmatism and phenomenology and argued that it is a sophisticated experience that can be nicely captured by experiential, first-person accounts. First-person experience, however, is what makes reflection tricky to assess and notice in the classroom. Whereas for ethical reasoning, instructors can look at the quality and complexity of the propositions advanced by students and thus use early responses as benchmarks for evaluating students' later proposals for dealing with an ethical problem, assessment of student reflections is trickier. In reflection pedagogy, teachers should not evaluate as such the propositions or design outcomes, but the process itself. (We do, however, recognize that reflection is often combined with ethical reasoning, and thus these do come as a package.) The process that teachers assess should encompass students' self-awareness, transformation, and spontaneity in interaction.

In this chapter, we used a phenomenological lens to argue why dialogism and emotional engagement are foundational for engaging in genuine, spontaneous reflection. While dialogism is a tool in the reflection toolbox, used alongside other monological tools, it has often been overlooked. We think dialogism shows a lot of potential when used correctly.

In the final section of the chapter, we presented several methods for instilling reflection as well as some ideas for assessment. Then, we provided some practical tips for educators who want to instill ethical reflection in engineering classes. Although we argued for the potential of the dialogical dimension of reflection, we also encourage instructors to use a mix of dialogical and monologi-

cal methods – to introduce variation and provide periodical moments of feedback – and to provide time for students to think. Ethical reflection is a transformative experience and, as such, works well for formative assessments, for enriching the quality of the moral deliberation judgment, and for fostering ethical awareness.

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Notes

1 The term "techno-fix" points to "a variety of technologies employed to respond to intractable societal problems, which have proven to be difficult or insoluble through political, legal and cultural reform" (Sand et al., 2023).

2 From one author's experience, comments like the following have not been uncommon regarding the updated version of the ethical cycle process: "I appreciated being pushed to rethink my initial formulation of the problem statement. My classmates' point that by using the utilitarian normative framework I wasn't able to see the real moral problem was eye-opening" (MTU EE student testimony, 2021).

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