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# A Pragmatic Approach to Ethical Decision-Making in Engineering Practice: Characteristics, Evaluation Criteria, and Implications for Instruction and Assessment

**Qin Zhu**[1] · **Brent K. Jesiek**[2]

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**Abstract** This paper begins by reviewing dominant themes in current teaching of professional ethics in engineering education. In contrast to more traditional approaches that simulate ethical practice by using ethical theories to reason through micro-level ethical dilemmas, this paper proposes a pragmatic approach to ethics that places more emphasis on the practical plausibility of ethical decision-making. In addition to the quality of ethical justification, the value of a moral action also depends on its effectiveness in solving an ethical dilemma, cultivating healthy working relationships, negotiating existing organizational cultures, and achieving contextual plausibility in everyday professional practice. This paper uses a cross-cultural ethics scenario to further elaborate how a pragmatic approach can help us rethink ethical reasoning, as well as ethics instruction and assessment. This paper is expected to be of interest to educators eager to improve the ability of engineers and other professional students to effectively and appropriately deal with the kinds of everyday ethical issues they will likely face in their careers.

**Keywords** Pragmatic ethics · Engineering ethics · Ethics education · Ethics assessment · Scenario-based education

✉ Qin Zhu
qzhu@mines.edu

Brent K. Jesiek
bjesiek@purdue.edu

[1] Ethics Across Campus Program, Division of Liberal Arts and International Studies, Colorado School of Mines, 322 Stratton Hall, 1005 14th Street, Golden, CO 80401, USA

[2] School of Engineering Education, Purdue University, 1313 Armstrong Hall, 701 West Stadium Avenue, West Lafayette, IN 47907-2045, USA

## Introduction: Dominant Approaches to Teaching Ethical Decision-Making in Engineering Practice

As an academic field that originated in the mid-1970s (Lynch 1997), engineering ethics in the United States has witnessed considerable growth and has been characterized by the emergence of a number of prevalent themes and approaches (e.g., case studies, individual responsibility, codes of ethics, professionalism) that have largely come to dominate and define an “American-style engineering ethics” (Luegenbiehl 2003; Fujiki 2012). While we would not claim that these themes and approaches are fundamentally flawed, they are nonetheless pervasive and may stand as barriers to ongoing efforts to improve and reform ethics instruction, including through the introduction of innovative approaches to pedagogy and assessment. In other words, these dominant themes often serve as the core “frame of reference” used to distinguish emerging curricular and instructional reforms from more traditional approaches to engineering ethics education. Critical reflections on engineering ethics instruction often start by critiquing one or more of these themes (Son 2008; Conlon and Zandvoort 2011).

In this paper we discuss the possibility of constructing a more pragmatic approach to engineering ethics education, first by reflecting on some themes and approaches that are particularly prevalent in the field. By contrast, we additionally propose a more pragmatic approach that places great emphasis on the *practical plausibility* of ethical choices in the situated, everyday practice of the engineering profession. This pragmatic approach advocates a special responsibility that practicing engineers must assume in order to further improve the “particular situations they face” (Emison 2004) (e.g., cultivating healthy business and professional relationships). This in turn requires them to reason and act beyond the ethical justification of moral actions, which has been the focus of much traditional engineering ethics education.

As a further grounding for our argument, here we review in more detail six main themes and approaches in engineering ethics education. The first of these centers on the dominant “applied ethics” approach, which treats engineering ethics as an enterprise teaching students about ethical theories and how to apply such theories in specific situations, typically using either *hypothetical* or *historical* ethics case studies. Many engineering ethics textbooks start by introducing classical ethical theories, e.g., deontology, consequentialism, virtue ethics, etc.[1] In practice, however, consequentialism and especially deontology are more frequently employed in analyzing and discussing ethical dilemmas in the classroom as compared to other guides, such as virtue ethics (Harris 2008). The “applied ethics” approach therefore often lacks a clear rationale for singling out certain “main-stream” ethical theories as the fundamental tools for ethical reasoning and overlooking other Western (e.g., ethics of care, feminist ethics, pragmatism) and

[1] For instance, Vesilind and Gunn’s book *Engineering, Ethics, and the Environment* (1998) considers “applying” classical ethical theories as a way for engineers to practice environmental ethics. A few other examples that propose applying classical ethical theories include Mitcham and Duval’s book *Engineering Ethics* (1999) and Catalano’s book *Engineering Ethics: Peace, Justice, and the Earth* (Second Edition) (2014).

non-Western (e.g., Confucian ethics) ethical theories (Wong 2012). Another issue with the "applied ethics" approach is that students often find it difficult to apply general ethical principles in specific situations since "there continues to be serious disagreement among philosophers as to which principles or set of principles should be used" (Luegenbiehl 2010, p.149). Finally, engineering ethicists have found that applying different ethical frameworks tends to yield different outcomes (van de Poel and Royakkers 2011). Nonetheless, the ability to reflect on and compare the outcomes generated by different ethical frameworks should still be taught to students.

This tendency to treat ethics education as teaching how to apply ethical theories leads to a second dominant theme. Namely, it is assumed that the value of ethics education is to improve the ability of students to justify their decisions largely or exclusively based on ethical precepts. In this sense, good and effective decisions are those that are *ethically justifiable*. However, there remain questions about to what extent ethically justifiable decisions are also realistic and practically plausible. For instance, whistleblowing is often encouraged but may potentially threaten the job security of the whistleblower. Even though whistleblowing is often ethically justifiable, it may be an unrealistic course of action if it puts an individual at substantial risk of losing their job and perhaps even severely damaging their future employability. The wider range of criteria and considerations that may be useful for assessing the practicability and plausibility of moral decisions is rarely discussed in the literature.

This emphasis on ethical justification further shapes the skills students are expected to develop. This suggests a third dominant theme, namely a widespread tendency to regard moral reasoning skills as *the* most indispensable among all required ethics skills. Moral decision-making is thus reduced to a kind of *individualistic moral psychology* that is exclusively focused on the "inner world" of individuals. This emphasis has been further reinforced by an emphasis on "measurable" psychological attributes of individual students and the wide use of quantitative moral psychometric tools such as DIT2 (Defining Issues Test, Version 2) for measuring these attributes. Nevertheless, a growing body of literature has questioned a primary or even exclusive focus on individualistic moral reasoning in ethics classes in the United States (Son 2008; Conlon and Zandvoort 2011).

Nevertheless, it is worth noting that some moral psychologists and philosophers have explored different theoretical frameworks to remedy the limitations of the individualistic approach. This paper has largely been inspired by such works. Although DIT2 has been frequently used—and perhaps sometimes misused—in engineering education to evaluate students' individual moral judgement, neo-Kohlbergian scholars who are the major developers of DIT2 explicitly point out that morality is a social construction that "evolves from the community's experiences" and "is not constructed in the mind of any one individual… but is negotiated among individuals" (Rest et al. 1999, p.301). Also notable here is Herkert's (2001) distinction between microethics and macroethics in engineering ethics education. In contrast to a microethical perspective emphasizing an individualistic approach, the macroethical view extends the meaning of professional ethics to the "collective responsibility of the engineering profession" and the "societal decisions about technology" (Herkert 2001, p. 403). Additionally, Pritchard and his colleagues interviewed practicing engineers and managers to study how the cultural contexts of the workplace shaped professional engineering decision-making processes (Pritchard 2001).

A fourth dominant theme in teaching ethical decision-making in engineering centers on the assumption that moral reasoning skills are universally applicable across circumstances, and that clear and unambiguous moral rules and principles can be readily drawn upon to provide "straightforward" action guidance for decision-makers (Healy 1997). Yet as a decision-maker, one might be able to generate different possible courses of actions in a given situation (Hollander 2015). However, engineering ethics textbooks typically provide no explicit guidance or criteria for how to choose appropriate course(s) of action among all possible actions, and why some actions may be better than others. Thus the "partiality" of choosing certain actions over others has not been adequately discussed in the extant literature.

A fifth theme centers on the use of case study approaches to cultivating the moral reasoning skills of students. Many such cases are either *hypothetical* or *historical* (Kline 2001; Hollander 2015). As pointed out by Hollander (2015), these cases additionally often fall into two major categories: "thin description" cases and "thick description" cases. While "thin description" cases can sometimes be relatively accessible tools for students, they are often simplified in order to better highlight or illustrate a particular concept while ignoring "real life messiness" and "how people may legitimately arrive at different solutions" (Hollander 2015, p. 57). This "thin description" approach often suggests that ethical reasoning and decision-making take place around one particular concept. It also places more attention on using hypothetical cases to potentially improve students' proficiency in ethical reasoning by employing a particular ethical theory, principle, or concept rather than a more practical and realistic process of generating "trade-off" solutions under the complex constraints and contexts that are typical of much engineering practice. Further, the historical cases used by instructors often involved key decisions, including what Ronald Kline calls big "disaster cases" (Kline 2001/2002). As argued by Kline (2001/2002), these cases are often loosely relevant, at best, to the everyday practices of engineering students and working professionals. In response, some scholars have turned their attention to the kinds of "everyday ethics problems" that are more typically and frequently encountered in engineering practice (e.g., Jonassen et al. 2009).

Some cases used to teach engineering ethics may also fall in a category of "adversarial examples" that assume someone must win and someone else must lose (Healy 1997). Healy (1997) provides an example case that is not uncommon in traditional engineering ethics courses and textbooks to further illustrate the adversarial character such cases: "When your boss tells you to fake the tests, it is easy to think that either I agree and lose my self-respect or refuse and threaten my job." Discussions about exploring approaches that might benefit all stakeholders and create "win–win" solutions for all parties have been rarely mentioned in discussions of such cases. The adversarial cases may therefore result in missed opportunities to generate creative solutions to ethical dilemmas, including through efforts to leverage multiple moral theories and strategies.

A sixth and final theme in engineering ethics education is concerned with a lack of attention to the global and cross-cultural character of much contemporary engineering practice. As a socio-political context that defines an emerging character of engineering practice, "global" has been largely overlooked in the existing engineering ethics curriculum. As argued by Kline (2001/2002), codes of ethics in engineering are often written from one nation's viewpoint and this monocultural assumption is contradictory to the fact that engineering is increasingly a global profession. However, engineering ethics instructors often assume that there is "a general familiarity with the value structure of that society among learners" (Luegenbiehl 2010, p. 147).

In summary, these six dominant themes and approaches together contribute to a notion of understanding engineering ethics as a practice that *decontextualizes* ethics practice from the situated contexts in which ethical theories are to be "applied," the sociotechnical realities of real-world work environments, and the broader social and political contexts of engineering practice. While there remains some merit in these themes, in this paper we propose a counterbalancing stance with a more pragmatic approach to conceptualizing and teaching engineering ethics. By pragmatic, we mean that ethical decision-making should be considered as a practical inquiry that is situated in specific environments and contexts of professional practice. As such, moral deliberation requires our use of moral imagination to rehearse every possible course of action and anticipate the consequences of executing each. The goal of moral deliberation is to arrive at a practical judgment that needs to be informed in accordance with a dynamic and ever-changing environment. Through this thought experiment, an individual gets opportunities to improve their own moral intelligence, turn their dispositions into moral habits, cultivate a moral self, and become more morally mature.

In general, value judgments need to be evaluated in terms of the extent they contribute to the resolution of moral problems, enrich the learning experience of the decision-maker, and improve the circumstance of the decision-maker. As pointed out by LaFallotte (2007), moral habits are of critical importance to moral practice as they are often influenced by rich interactions with the social environment and are exhibited in overt behavior in a variety of circumstances. Continuous and conscious moral deliberation is helpful for cultivating "operative" moral habits. A pragmatic approach that emphasizes the "situatedness" of engineering ethical decision-making can help illuminate how to make these themes more relevant to the complicated nature of everyday engineering practice.

## A Pragmatic Approach to Ethical Decision-Making in Engineering Practice: Characteristics and Evaluation Criteria

Compared to the dominant themes discussed in the previous section, we propose a pragmatic approach to teaching ethical decision-making in engineering practice. In contrast to the dominant approaches, the pragmatic approach views engineering ethics as a *situated* practice rather than a decontextualized form of practice. The "situated" characteristics of the pragmatic approach lie at the interaction between ethical reasoning and: (1) the social, organizational, and cultural contexts of engineering practice that shape how ethical theories are interpreted and ethical decisions are made and carried out; and (2) ethical habits and decisions that are evaluated on the basis of their social impacts. In what follows, we discuss how the two characteristics of this pragmatic approach are related to ethical decision-making in engineering practice.

Rather than view ethical theories as fixed and “ready” to be applied, we perceive ethical theories as neither *logically prior* to nor directly applicable across circumstances. The value of ethical theories is not proved through argumentation. Instead, ethical theories need to be treated as hypotheses subject to tests, i.e., evaluated in light of how one evaluates the actual projected consequences of putting them into practice. Similar to ethical theories, codes of ethics are typically highly abstract and do not give practicing engineers unequivocal direction on how they should behave in every specific circumstance. A proper course of action in one situation may not be effective in the future if the situational elements change. Thus the circumstance must inform the choice of ethical theories depending on which make the most sense and to what extent these theories still hold (Emison 2004). For instance, it would be inappropriate for practicing engineers working with underserved communities to simply “apply” principles in existing codes of ethics or treat community members as “customers, employers, or customary national publics” (Lucena et al. 2007). Rather, engineers working in such situations must carefully consider the needs of local residents, reflect on their own professional and social responsibility, contextualize considerations of health and safety, and import other ethical theories (e.g., global justice, human capabilities approaches) into their practice. Thus *the social context* matters for making effective and appropriate ethical decisions.

In contrast to traditional approaches to engineering ethics education that focus on individualistic moral reasoning, the pragmatic approach we propose here also calls attention to the broader social and organizational contexts in which engineers are situated and their decisions are made. Engineers are encouraged to employ a variety of social and organizational factors (e.g., work cultures, organizational structures, professional relationships, and the social and political cultures of a society, etc.) in specific circumstances as tools for generating creative solutions that are otherwise unavailable in the individualistic moral reasoning processes. A classic example in this regard is Diane Vaughan’s work on the ill-fated *Challenger* launch decision. Vaughan argues that this case requires that we shift our attention away from the individual responsibility of engineers and toward a deeper root cause of failure, namely an organizational culture at NASA that allowed normalization of deviances in O-ring performance. Another more recent and well-known example that emphasizes the role of the social context in the engineering profession is Joseph Herkert’s work related to the concept of macroethics (Herkert 2001). In contrast to Vaughan’s work emphasizing the role of organizational cultures, Herkert’s theory of macroethics is mainly concerned with the “collective responsibility of the engineering profession” and the “societal decisions about technology” (Herkert 2001, p. 403). Therefore, our work is more aligned with Vaughan’s understanding of how social context inflects ethical decision-making.

Indeed, most engineers now work in environments where their capacity to make decisions is largely constrained by the "corporate or organizational culture" in which they work (Lynch and Kline 2000). Recent studies have shown that technical and business professionals in Europe, the US, and Asia tend to adopt different approaches to the power structure and moral leadership in the workplace, understanding of which could be used to more effectively navigate ethical issues in these different cultural contexts (Wang and Thompson 2013). For instance, such a framework can help individuals better identify: (1) who is responsible for ethical conduct in business; (2) who the key actors are in business ethics; (3) what the key guidelines are for ethical behavior; (4) what the key issues are in business ethics; and (5) what the dominant stakeholder management approaches are for project planning and management (Wang and Thompson 2013).

The social character of the pragmatic approach is also exhibited in the broader impacts of moral decision-making on surrounding people and things. As argued by pragmatic ethicists, all inquiry is fundamentally *social* (LaFollette 2007). An effective ethical approach therefore needs to consider human conduct in interpersonal situations, including how certain courses of action are associated with other actors and thus how to appropriately treat the rights and interests of such actors. For a course of action to be effective and appropriate, it should take into consideration how to maintain and even improve individual relationships on a long-term basis. A moral action is not simply an individual engineer's own business, but will also have social impacts on other (visible and invisible) stakeholders, as well as the broader culture. Thus when a practicing engineer makes a decision, it is his or her responsibility to anticipate the potential or likely consequences on other actors and stakeholders, as well as on the public and society more generally.

In this sense, a pragmatic approach to engineering ethics is *consequence-oriented*. It views the effects of choices rather than the intentions as mattering most (Emison 2004). Nevertheless, what distinguishes pragmatic ethics from other forms of consequentialism such as utilitarianism is that pragmatic ethics is more concerned with the practical consequences than simply the usefulness or utility of moral actions. An action might be useful for solving a problem but not necessarily practically plausible for creating a healthy moral culture. For instance, slapping a child might be "useful" for stopping him or her from stealing. But it might be contrary to teaching the child the virtue of honesty, or of cultivating a healthy parent–child relationship. In the workplace, employee monitoring might similarly be considered as a "useful" way to ensure company resources are not misused. However, it may also raise challenges associated with employee privacy, and impede the construction of mutual trust between employer and employees.

Furthermore, and again in contrast to utilitarianism, pragmatic ethics places greater emphasis on the role of practice in improving moral experience, enhancing moral habits, and cultivating moral character (Rosenthal and Buchholz 2000). Compared to a utilitarian focus on the "usefulness or utility" of a moral act, pragmatic ethics also evaluates a moral act based on *the extent to which it helps enrich the learning experience of the decision-maker and improve the circumstance of the decision-maker*. Pragmatic ethics might also condemn utilitarianism in that not every moral choice can be reduced to a calculation. Through participating in moral decision-making, one also chooses what specific experience he/she acquires, what kind of person one wants to become, what kind of self is in the making, and what kind of world is in the making. In this sense, pragmatic ethical practice has a very strong orientation toward moral development and education, as well as significant methodological implications for ethics education reform.

The consequence orientation of pragmatic moral decision-making calls for practicing engineers to communicate and collaborate with other actors and listen to their feedback regarding available courses of action. As such, they will need to take into account the varied interests and perspectives of diverse stakeholders. Feedback from other stakeholders can then further inform engineers on what courses of action are potentially more plausible. Revisiting the adversarial scenario posed above, Healy (1997) suggests some creative "win–win" solutions which are less adversarial and more empathetic and communicative, such as asking the boss what pressures she is facing, how you could help her respond to these pressures, and how you could help her make sense of the ethical problems associated with the given situation and her associated request.

Thus, ethical decision-making in engineering becomes a *communicative* and *relational* practice, with engineers acting as decision-makers who are connected with humans and non-humans who may be directly and/or indirectly impacted by their decisions. Moral decision-making then involves a kind of comparison and even "competition" between different possible and plausible courses of action based on their potential for different social impacts and consequences. Decision-making itself turns out to be an iterative and even "evolutionary" process in which engineers always seek better (if not always the best) solutions. Such "dramatic rehearsal" of the possible consequences of each course of action is also called moral deliberation in the tradition of Dewey's pragmatic ethics (Serra 2009). Hence, ethical decisions in the engineering profession need to be evaluated based on whether the impacts of these decisions will jeopardize or nourish the working relations between engineers and other stakeholders, including employers, clients, and broader publics.

Looking beyond the quality of ethical justification, we must additionally reiterate that good ethical decisions also need to exhibit a certain degree of practical plausibility. That is, effective ethical decisions in real situations need to be both *ethically justifiable* and *practically plausible*. In particular, based on the analysis above, we propose four criteria for evaluating the practical plausibility of ethical decisions in engineering practice. We argue that the value of a moral action depends on its effectiveness in: (1) solving an ethical problem; (2) enriching one's moral learning experience; (3) improving the circumstance of the decision-maker (e.g., cultivating healthy working relationships, changing existing organizational cultures); and (4) achieving contextual plausibility in everyday practice. In other words, a practically plausible moral decision must be effective in both solving a moral problem and bringing a positive moral learning experience to the decision-maker. It also needs to be conducive to improving the circumstance of the decision-making. For instance, a seemingly "workable" decision cannot be undertaken at the expense of jeopardizing working relationships, including peer relationships, business partnerships, etc.

The four criteria proposed here compel engineers to look more broadly at social and organizational dynamics (e.g., who makes decisions, what values are prioritized, where power is located) in their working environment and employ them as practical tools for generating creative solutions that benefit multiple parties. Practically plausible decisions need to make "good sense" in *specific situations* of everyday practice, and must also be aligned with our common knowledge of morality. Charles E. Harris et al. (2014) calls this kind of sensemaking of moral decisions "immediate plausibility" or "immediate intuitive appeal." In general, these plausible actions are inherently practical in that they: (1) are not derived from direct applications of moral theories but instead from our concrete and everyday experience; and (2) must be conducive to a process of self-realization, moral intelligence liberation, and character building.

A pragmatic approach to engineering ethics focused on practical plausibility may prove even more compelling when engineers are working in "non-familiar" environments and cultures. Engineers working in multi/cross-cultural contexts can easily and unconsciously jeopardize the business and professional relationships with their colleagues from other cultures. This may especially be the case if they fail to pay close attention to the broader cross-cultural impacts of their decisions, even though these decisions may be ethically justified in their home countries and cultures. The greater potential for uncertainty in cross-cultural engineering practice requires that engineers think more carefully about the intentional and unintentional impacts of their decisions on the people (visible and invisible) in alternate cultural environments, hopefully leading them toward actions that are effective and appropriate as well as ethically defensible.

Nonetheless, it is worth emphasizing that ethical justifiability remains a fundamental and prerequisite to practical plausibility when taking a pragmatic approach to professional ethics. Problematic or even morally indefensible positions might be taken if an oversimplified or overly "utilitarian" interpretation of practical plausibility is used to guide one's ethical decision-making. For instance, in the whistleblowing example presented above, it remains morally problematic to conclude that one has no obligation at all to "blow the whistle" *simply* because one feels worried about being unable to change his company's course of action and negatively impacting one's career, although anonymous whistle blowing may sometimes help reduce the negative impact on one's career. What a pragmatic ethical approach might instead advise is careful thinking about what moral experience the protagonist is gaining, what kind of person he or she is becoming, and what kind of environment or circumstance is cultivated if any particular course of action is taken.

## A Scenario-Based Approach to Engineering Ethics Instruction and Assessment

In this part of the paper we use an example of a cross-cultural engineering ethics scenario to further elaborate the significance of practical plausibility for making appropriate ethical decisions in non-familiar contexts. We then discuss how this approach might help us more generally reimagine ethical reasoning, as well as ethics instruction and assessment. The scenario presented here is one among many from a larger effort to develop innovative instructional and assessment strategies focused on multiple aspects of global engineering competency, which we define as "those capabilities and job requirements that are uniquely or especially relevant for effective engineering practice in a global context" (Jesiek et al. 2014). One of the three specific dimensions of global engineering practice identified through this work is "ethics, standards, and regulations," which we have defined as an "awareness of, and ability to effectively handle, situations that involve local differences in standards, regulations, and expectations of what counts as ethical engineering practice" (Jesiek et al. 2014).

With the goal of supporting both instruction and assessment of global engineering competency among students and professionals, we developed a large variety of situations and dilemmas that might plausibly be encountered by global engineers. These scenarios were created based on two sources of inspiration: (1) previously published case studies on global technical practice, and (2) qualitative data from one-on-one interviews and focus groups (2–5 participants in each) with 25 U.S.—based engineers, all with extensive experience working in and/or with other cultures. Most of the participants also held one or more engineering degrees. Data collection started with sensitizing interviewees to the domain of interest through discussion of a scenario prompt similar to the one included in this paper. We then employed a critical incident approach to elicit other stories of cross-cultural work experience from the participants. All of the scenarios were constructed based on the real case studies or stories collected from the participants.

More than 70 total scenarios were created covering six national/culture contexts (China, Japan, India, France, Germany, and Mexico), and with about a third of the scenarios falling in the "ethics, standards and regulations" category. Developed as part of this larger set, the scenario presented in Table 1 is proposed as a typical kind

**Table 1** Sample cross-cultural ethics scenario

| |
|---|
| Your work as an industrial engineer for a major North American OEM automotive parts supplier has landed you at a plant your firm recently acquired outside of Shanghai, China. As a member of an acquisition transition team, you are assigned to work on safety and compliance issues. For several weeks, you have been encouraging workers at the plant to wear eye protection when using certain machines. Yet even after posting signs, making safety glasses widely available, and talking to individual workers, you find that most employees continue to ignore the requirement. What would you do in this situation? |
| a. Ask the Chinese plant manager to work with the line managers to enforce compliance |
| b. Ask the Chinese line manager(s) to announce the requirement and enforce compliance |
| c. Continue to encourage the workers to wear eye protection, as you have been doing |
| d. When workers are found not wearing eye protection, scold them in front of their peers |
| e. Propose a new system that acknowledges and rewards individuals and groups who comply with the requirement |
| f. Report the issue back to management at your company's U.S. Headquarters |
| g. Perform a study to find out why the employees are not wearing eye protection |

of ethical situation that an engineer may encounter in a manufacturing environment, and especially so in developing countries (e.g., China or India). The seven response options cover a wide range of possible actions that were generated based on: (1) input from both expert and novice engineers who responded to the scenarios in an open-ended format, and (2) a theoretical framework positing that the relative effectiveness of a given response option reflects varying levels of professional or domain knowledge, cultural knowledge, and cultural sensitivity. More details about the research design and scenario writing processes can be found in Jesiek et al. (2014).

When using this type of scenario for instructional or assessment purposes, respondents are typically asked to evaluate each item (a–g) according to their relative effectiveness in addressing the ethical problem (e.g., on a scale from 1 = Not at all effective to 10 = Very effective). In the classroom or other professional development settings, individuals could also be asked to "rehearse" each of the response options and anticipate the possible consequences of each. The moral deliberation process may additionally require that participating individuals acquire and utilize contextual and cultural knowledge about a "typical" Chinese manufacturing firm, including: (1) the power dynamic at the workplace among different employees, including workers, engineers, line managers, and the plant manager; (2) who makes decisions; (3) how decisions are made and implemented; and (4) knowledge about the typical character of individual interactions and social norms in Chinese society (e.g., the culture of saving face, tensions between natives and foreigners, etc.).

Existing frameworks for comparing and contrasting cultures are particularly relevant forms of cultural knowledge for interpreting and analyzing such scenarios. According to Hofstede's empirical research highlighting differences between countries along a number of major cultural dimensions, China has very high scores on both power distance (80/100) and long-term orientation (87/100) and relatively low scores on individualism (20/100) and uncertainty avoidance (30/100) (The Hofstede Center 2015). Taken together, these factors indicate that Chinese society generally tends to be highly hierarchical, pragmatic (context-dependent), collectivist, and comfortable with ambiguity (The Hofstede Center 2015). Additionally, Wang and Thompson's (2013) research findings on Asian business contexts reveal that top management rather than individual technical workers are typically responsible for ethical conduct. This reflects influences from Confucian ethical traditions, where the *role ethic* associated with a company's management creates an expectation that managers will oversee and ensure that subordinates comply with communal rules and norms (Gardner 2014). The highly collectivist culture in the society and workplace also grants political power to the management, who are viewed as superior to workers. As this overview suggests, contextual knowledge related to Chinese culture in general and the workplace in particular is indispensable for understanding the moral and political impact of management on lower-ranking workers.

Nevertheless, it may be unrealistic to simply conclude that Chinese technical workers do not care about workplace safety. Rather, high scores on Hofstede's dimension of long-term orientation means that they are likely more tolerant of uncertainties in their work and confident (and sometimes overly so) about providing pragmatic resolutions to emergent technical issues. How Chinese workers define and solve technical problems might also be very dependent on the specific situation, context, and time when problems emerge (Chen 2012). The historic lack of professionalism in Chinese culture has further resulted in the absence of systematic and clear standards and regulations for technical practice. Chinese technical workers are thus usually not trained with a moral habit of appealing to rules, principles, and regulations that are often viewed as central to Western understandings of professionalism.

Based on the analysis above, items (a) and (b) are likely more effective than the other options, reflecting relatively higher levels of domain knowledge, cultural knowledge, and cultural sensitivity. Unlike many of the other options, these two options would also be less likely create tensions between a non-native engineer and local workers, which could in turn make the future work of the outsider engineer more difficult. To determine whether option (a) or option (b) is better, one must carefully consider the power structure in the proposed situation. If the line managers have established effective moral leadership among workers, then it is not necessary to involve the plant manager. Due to the communitarian and nationalist character of Chinese culture and also the language barrier, Chinese technical workers often maintain a closer relationship with other Chinese co-workers than with foreigners (Ling et al. 2007). Thus, options (c) and (d) would likely not be very effective. In a collectivist culture, simply acknowledging and rewarding individuals (e) may have an impact, but could run the risk of dividing workers, jeopardizing communal solidarity, and increasing costs. Other recent research has also shown that Chinese workers have become less interested in monetary incentives and more concerned about long-term professional development (King-Metters and Metters 2008). Option (f), in contrast, could violate organizational and/or cultural expectations about hierarchical reporting relationships and chain of command, with the potential for damaging results. Finally, option (g) may be effective if it generates information and understanding in the face of uncertainty, but may also reflect a lack of knowledge or confidence on the part of the protagonist.

Strictly speaking, none of the seven response options is ethically wrong, although moral rigorists may accuse option (c) of being morally irresponsible: the protagonist sees that his or her previous effort to encourage workers to wear protection is not effective but still keeps trying the same strategy anyway. However, the relatively most effective option needs to be chosen based on its potential effects on the surrounding people, culture, and society, as well as consideration of how foundational ethical principles are contextualized and redefined in specific situations. It should further be emphasized that the "circumstance" in which ethical decisions are made is critical for evaluating the effectiveness of ethical decisions. If this sample case happened in a different circumstance (e.g., in an individualistic culture where technical workers had different professional roles and identities, received different training, etc.) the effectiveness of each response option would likely need to be reassessed. Hence, pragmatic ethics does not necessarily demand moral uniformity between people and across cultures (LaFollette 2007).

When comparing and anticipating these response options, students and professionals should also be encouraged to keep in mind the aforementioned four criteria for evaluating the practical effectiveness of moral decisions. In particular, a good decision should not jeopardize the professional relationship between the expatriate engineer and local technical workers, or the business relationship between the North American headquarters and the Chinese plant. Rather, an appropriate and effective course of action is expected to maintain and reinforce working relationships, make the transition process after acquisition smoother, and make the future work of the expatriate engineer easier.

Subsequent data collection has helped generate additional empirical support for the theoretical and conceptual analysis presented above. When the preceding scenario was administered to 14 engineers and other technical professionals who reported prior experience working in China and/or with Chinese contacts, options (a) and (b) performed as expected. Specifically, these options received the highest mean scores (8.36 and 7.79, respectively) when respondents were asked to rate the effectiveness of every option using the aforementioned 10-point scale (where 1 = not at all effective to 10 = very effective). Interestingly, item (e) received an unexpectedly high mean score (7.36), although this may be due to respondents gravitating toward the more culturally appropriate "group" vs. "individual" aspect of this option. Items (c) and (g) received somewhat lower average ratings of 5.57 and 5.71, respectively, while (d) and (f) received the lowest ratings, scoring 3.29 and 3.93 respectively. Interestingly, these four latter options (c, d, f, and g) were the only items to receive at least one instance of a 1 score (i.e., meaning "not at all effective") from respondents, further highlighting their likely ineffectiveness. But while these results are promising, further data collection is needed to make even stronger reliability and validity claims for these types of assessment items.

As suggested, the succinct yet generative nature of these scenarios gives them considerable potential for use as instructional scaffolds in a wide variety of contexts, ranging from in-depth discussion and analysis in courses or modules that are focused on ethics, to brief exercises inserted into courses that are primarily concerned with other topics (e.g., core technical coursework). Yet no matter how specifically deployed, the iterative use of such scenarios can potentially help cultivate students' moral imagination regarding the potential outcomes of different courses of action, their sensitivity to the effectiveness of ethical actions, and their habit of pursuing effective actions. By anticipating and comparing the consequences of different actions, students are encouraged to reflect on why some responses are more practically plausible than others, and not just more or less ethical. In our previous experience using this scenario-based tool to teach engineering ethics, we found that it also helped improve students' moral creativity. For instance, when presented with the preceding scenario some students proposed sequences or combinations of options, e.g., responses (b) and (g). They further pointed out that adding option (g) could improve the practical effectiveness of the attempt at intervention, as it could help the expatriate engineer identify and better understand the specific reason(s) for why employees were not wearing eye protection, which could in turn lead to ideas for better interventions.

The preceding overview also begins to illustrate how responses to scenarios of this type—whether in an open-ended format or by rating a set of possible actions—could serve as a kind of "diagnostic" tool for assessing what ethical knowledge and decision-making capabilities are lacking among students but needed for "on-the-job" decision-making. More specifically, the responses could potentially be scored or evaluated based on the three foundational components mentioned above: (1) ethical knowledge (e.g., knowledge of codes of ethics, ethical principles, and other forms of ethical knowledge); (2) professional and contextual knowledge (e.g., knowledge of the work culture, organizational structures, professional relationships), and (3) cultural sensitivity.[2] For the scenario presented in this paper, engineering ethics knowledge includes understanding of workplace safety and health issues, while contextual knowledge includes the political hierarchy and decision-making strategy in a typical Chinese technical company, including the typical role of engineers in such a company. The cultural sensitivity component is reflected in a willingness to adjust one's behavior in response to relevant cultural considerations (e.g., the importance of face-saving and maintaining harmonious relationships in Chinese culture), as well as to the ways Chinese technical workers may be more inclined to propose pragmatic resolutions to emergent technical issues. The scenarios and response options can therefore serve as tools for assessing ethical competency by evaluating how students and professionals rate the effectiveness of each response option associated with an ethical situation. This theoretical framework for ethical competency assessment is presented in Fig. 1.

Nonetheless, further input from experts is needed to more robustly validate this theoretical framework, as well as the associated assessment questions. As described above, engineers with extensive experience working in and/or within a given culture must be asked to evaluate the plausibility of each scenario, as well as the plausibility and relative effectiveness of all associated response options. Larger-scale data collection can then be used to evaluate the reliability and validity of the scenarios, particularly to establish the extent to which experts agree on the least and most effective options, and if response patterns from novices (e.g., engineering students or early career engineers) are readily distinguished from how expert typically rate the items. Once such evidence has been collected, the scenarios could be used to evaluate different levels of professional knowledge, cultural knowledge, and cultural sensitivity among students and/or practitioners. Based on the results of such assessments, customized training interventions can be created for individuals and/or groups, targeted to address identified gaps in knowledge or other weaknesses. Such assessments can also be given before and after such interventions (e.g., ethics courses or workshops) to evaluate the impact of a given experience on the ethical capabilities of participants.

[2] The three dimensions were derived from a separate study that compared expert and novice responses to these cross-cultural engineering ethics scenarios. Results from this study will be reported in a separate paper.

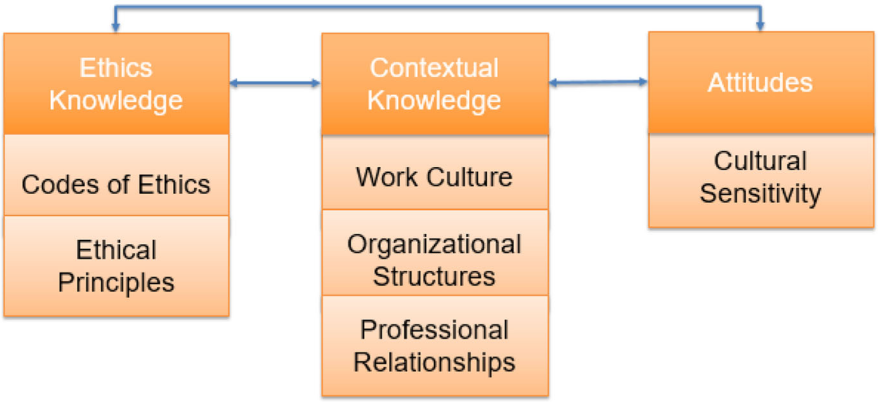


**Fig. 1** Theoretical framework for ethical competency assessment

## Conclusion

In contrast to the most prevalent, current approaches to engineering ethics education that mainly focus on ethical justification, the pragmatic approach places greater emphasis on the practical plausibility of ethical decision-making, that is, the effectiveness for resolving particular and situated ethical problems. In this sense, preferable ethical decisions are "workable", i.e., they need to be both ethically justifiable and practically plausible. Pragmatic ethics argues that the effectiveness of a moral action might vary when circumstances change and certain courses of action become more or less effective and appropriate.

Nonetheless, a pragmatic approach does not necessarily demand complete moral uniformity among individuals and across cultures. Further, placing greater emphasis on practical plausibility does not imply that ethical justification should be ignored or overridden. Or put differently, although pragmatic ethics challenges *predetermined* or logically prior ethical principles, it does not mean that ethical principles should be disregarded. Especially in the cross-cultural context where globally agreed ethical precepts are lacking, professional engineers cannot simply regress to moral relativism. Bribery should never be encouraged and human dignity should always be respected regardless of cultural context. Nevertheless, how to deal with bribery and promote human dignity in ways that cultivate a healthy or worthy climate requires consideration of situated and contextual factors. To a large extent, this pragmatic ethics approach extends the professional ethics of engineers from preventative (or passive) responsibility, where strict adherence to codes of ethics is required, to aspirational (or active) responsibility, which involves working both within and beyond codes of ethics as one strives to cultivate a sustainable and ethical culture of professional practice (Bowen 2014; Harris et al. 2014).

Compared to traditional approaches to ethics education, another feature of the pragmatic approach is that it tends to bring corporate and organizational cultures into the discussion of ethics. This approach can potentially help better prepare students to become competent professional engineers who are capable of employing the variety of tools existing in their work environments (otherwise invisible to them)[3] to generate creative solutions to ethical problems. However, in contrast to utilitarianism and other forms of consequentialism, pragmatic ethics does not simply end with finding solutions to ethical dilemmas. Rather, an ultimate goal of pragmatic ethics is to cultivate and hone moral habits that also represent socially-shaped dispositions to partially unique environments of professional practice (Anderson 2014). In engineering education, cultivating the habit of pursuing effective moral actions can help students be more sensitive to the ethical significance of everyday engineering practice and become more reflexive and reflective practitioners. From the perspective of pragmatic ethics, engineers are thus characterized as active change agents for a better world.

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[3] Examples include cultural tools in organizational and local contexts.

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