In the Footsteps of the Pioneers:
My Journey in Engineering Ethics Education

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In the 1970s and 1980s, engineers and philosophers convened meetings in the United States to discuss their mutual interest in engineering ethics. I did not attend these early meetings, but I benefited from contacts with these engineering ethics pioneers as I contributed to the growth of engineering ethics education in the 1990s and early 2000s. In the middle of the first decade of the new century, engineering ethics education became institutionalized through the launch of the Ethics Education in Science and Engineering Program at the National Science Foundation, and the formation of the Engineering Ethics Constituent Committee (later the Engineering Ethics Division) of the American Society for Engineering Education. In this essay, I highlight my contributions to engineering ethics education during this formative period.

I begin teaching engineering ethics

Since I have always had broad intellectual interests, I obtained a liberal education before I earned a doctorate in computer science in 1980. To sustain these interests during the first decade of my academic career at the University of Illinois Urbana-Champaign, starting in 1981, I read books and articles on technology and society, which complemented the technical readings for my research in theoretical computer science and my teaching in electrical and computer engineering. I enjoyed books by Samuel Florman such as *The Civilized Engineer* (Florman, 1987), which included essays on engineering ethics. I integrated ethics instruction into a core junior-level course on computer systems programming: I regularly included a class session on ethics in computing, using short scenarios and cases (Parker, 1979; Parker et al., 1990).

In August 1991, after one year as a program officer in the Division of Computer and Computation Research at the National Science Foundation, I returned to my faculty position at Illinois. In my absence, the campus had created a new unit called the Program for Cultural Values and Ethics (CVE). (In 1997, this unit was replaced by the Illinois Program for Research in the Humanities.) I began attending monthly meetings of the CVE faculty group on professional ethics. The CVE program offered small summer awards to faculty members who would develop courses related to the program's themes. I wrote a proposal for a summer award to develop an undergraduate course on engineering ethics. The proposal was funded in the summer of 1992.

As part of the course development process, on the suggestion of Bill Hall, I made a pilgrimage to the Illinois Institute of Technology (IIT) in Chicago. At IIT, the Center for the Study of Ethics in the Professions maintained a library full of books and other resources. During my one-day visit, I met Michael Davis, Vivian Weil, and their colleagues at IIT. As I recall, over lunch, we discussed whether software engineering really qualified as a kind of engineering. Although both software engineers and traditional engineers design large artifacts to meet social needs, both back then (Davis, 1996) and more recently (Davis, 2011), Davis argued that engineering requires significant knowledge about the physical world. I disagreed, arguing that the scientific foundations of software engineering are entirely mathematical. I spent the afternoon in the library gathering references. In designing my own course, I chose readings from a variety of journals, magazines, and books.

I taught the new course, *Engineering Ethics*, for the first time in the spring of 1993. In the classroom, I used many active and collaborative learning techniques that I had read about (Bonwell & Elson, 1991; Johnson et al., 1991), but had not implemented in technical engineering courses: discussion of cases in small ad hoc groups, discussion in large groups, formal debate, Socratic dialogues, peer review of drafts of papers, and so on. In subsequent years, as I taught the *Engineering Ethics* course and similar courses on professional ethics, on computer ethics, and on technology and society, I adopted more adventurous techniques such as role-play, fieldwork, and academic controversy (Johnson et al., 1996).

In 1993, when I prepared the documents for permanent listing of the *Engineering Ethics* course, Burks Oakley recommended that I seek approval for the course as an elective to satisfy the campus's general education requirement in advanced English composition. I had not thought that the course was writing-intensive, but the course did satisfy the criteria for this requirement: in addition to informal reflections or journal entries, each student individually wrote and revised several formal short papers and a term paper. (The number of papers and the specific assignments evolved over the years as I gained experience in helping students improve their writing skills.) The course was also approved to satisfy the campus's general education requirement in humanities and creative arts.

In designing the *Engineering Ethics* course, I allocated only three 80-minute class sessions to normative moral theories because I wanted to avoid significant overlaps with existing philosophy courses. Although the *Engineering Ethics* course was philosophical, I conceived it as an engineering course, not as a philosophy course. By analogy, a course on control systems is mathematical, but it is invariably taught as an engineering course, not as a mathematics course. Nevertheless, as I prepared the proposal for permanent listing as a humanities course, I acceded to cross-listing of the course with the Department of Philosophy to gain approval of the proposal by colleagues in my department. These engineering professors had difficulty understanding how an engineering course could carry humanities credit, because they thought that engineering knowledge comprises only technical knowledge—a common misconception that overlooks project management and other nontechnical aspects of engineering. Later, in 2005, my department colleagues rejected my proposal for a course on technology and society because it lacked

technical content. I responded tartly by e-mail, "I was not aware that technical content is required for a nontechnical course in social sciences or humanities."

After the *Engineering Ethics* course was approved to satisfy general education requirements, student demand rose through the late 1990s. Since the course was writing-intensive, each course section was limited to 25 students, and consequently, more sections were offered each year. Other instructors who taught sections used a common syllabus that I prepared each semester. Currently two sections of the course are offered every semester by Philip Hillmer, under the title *Ethics and Engineering*.

The only prerequisites for the *Engineering Ethics* course were a standard first-year composition course and junior standing. With the latter requirement, I expected most students in the course to have had some work experiences, such as summer internships, which they could share in the classroom discussions and connect with the course material. Because the prerequisites were minimal, the course attracted students from a variety of majors. Most students came from engineering disciplines, but some came from the College of Business. Although the business students were concerned about the engineering content, I told them to substitute "accounting" for "engineering," and then everything would make sense, because as professions, accounting and engineering have many similarities. Like engineering, but unlike other business occupations, accounting has codes of ethics and licensing of practitioners. Further, the professional relationships of accountants and engineers with their clients are complicated by their relationships with their employers.

The 1990s were an exciting time to teach engineering ethics. Michael Davis (1991) had published an essay that compared an engineering code of ethics to a covenant that committed professional engineers to prioritize safety. Caroline Whitbeck (1992) had published an essay on treating moral problems from the viewpoint of the agent; she developed this idea into an analogy between moral problems and design problems in engineering (Whitbeck, 1995). These essays influenced my thinking about teaching ethics. Deborah Johnson (1991) had published an anthology of readings that I used in my course. Ed Harris and Mike Rabins, and separately, Michael Pritchard (1992) had developed sets of cases intended for teaching. These cases were based on actual events, and Pritchard's included expert commentaries. I obtained these pedagogical materials even before their textbook first appeared (Harris et al., 1995). We exchanged correspondence and materials by postal mail, because the World Wide Web was not yet used widely to distribute documents, and at the time, I used an email system that did not handle messages with attached documents.

During the 1990s, ideas about engineering ethics and its teaching were disseminated through a new annual conference and a new journal. The new conferences were hosted by the Association for Practical and Professional Ethics (APPE). The new journal *Science and Engineering Ethics* began publishing quarterly. As a scholar, I began to publish what I had learned by teaching the *Engineering Ethics* course. I collaborated with two undergraduates to expand their term papers for the course into co-authored articles that they presented at APPE annual meetings and then

published in journals (Bakker & Loui, 1997; Doss & Loui, 1995). I wrote an article on innovative methods of teaching professional ethics such as fieldwork and role-play (Loui, 2000).

After the initial offering, I taught the *Engineering Ethics* course each spring through 1996, as part of my regular teaching assignment—I never use the term "teaching load," which implies that teaching is a burden. From 1996 to 2000, my duties as a campus administrator supplanted my regular classroom teaching. After I returned to a standard faculty appointment, I taught the course two more times, in 2003 and in 2004. My final syllabus and assignments are online at the Online Ethics Center for Engineering and Science (Loui & Hillmer, 2004). The course was sufficiently noteworthy to be featured in a local magazine ("Engineering Ethics," 1994) and in a national magazine (Daniel, 2007).

Over the years, a total of about 200 students took the *Engineering Ethics* course with me—fewer than in a single offering of a typical first- or second-year engineering course that I taught—but I reached thousands of students in isolated class sessions for departments that sought to minimally comply with accreditation requirements for engineering ethics. (One professor called these sessions "drive-by ethics.") I told the students that these one or two hours with me would be the most important of the 1,600 hours of class sessions they would attend over their four years—or five years or more—of undergraduate studies, because after graduation, they might never again solve a circuits or a statics problem, but they would spend their entire careers as professionals. So in these sessions with me, they should take this time to think seriously about their responsibilities as professionals. When I addressed students in mechanical engineering, I told them, "You will design cars in which people will die. Your job is to make those cars safer."

While I knew about ABET's accreditation requirements for ethics in the 1980s, those requirements provided only a minor justification to teach engineering ethics, because all engineering departments at Illinois aimed to meet ABET's requirements with minimum effort. In my department, in response to ABET's EC 2000 accreditation requirements, Philip Hillmer worked with our colleagues in the early 2000s to experiment with an ethics-across-the-curriculum approach, following a visit by Michael Davis, who had championed that approach. My colleagues decided to incorporate engineering ethics into one class session in the introductory course for first-year students and one week in the course on digital systems and computer design for sophomores. When I taught the introductory course, I interacted with the students to identify the differences between professions, such as engineering, and other occupations. I explained the professional responsibilities of engineers stated in the Code of Ethics of the IEEE (formerly the Institute for Electrical and Electronics Engineers). When I taught the sophomore course, I used the Code of Ethics of the Association for Computing Machinery and the accompanying scenarios (Anderson, et al., 1993), the *Incident at Morales* video (see below), and the Therac-25 disaster case (Leveson & Turner, 1993). In this course, I had enough time to assign homework and to include one problem on the final exam. After the introductory sequence of computer engineering courses was reconfigured in 2012–13, however, instruction in engineering ethics disappeared from the sophomore course, but the one class session in the first-year electronics course

remained. I do not know why the ethics instruction was reduced: I did not participate in the redesign of the courses because I was on sabbatical.

I led single sessions on engineering ethics in other contexts too. For instance, I delivered the William & Patricia Stacy Engineering Ethics Lectures at the University of Kentucky in 2011 and in 2012. I conducted single sessions for summer undergraduate research programs. From 2009 to 2012, I incorporated a series of sessions on computer ethics and research ethics into a Research Experiences for Undergraduates Sites program on reliable and secure computing that was funded by the National Science Foundation (Revelo & Loui, 2015). This series was recognized as an exemplar by the National Academy of Engineering (Center for Engineering Ethics and Society, 2016).

I expand my professional network

In the early 1990s, I learned that my doctoral advisor, Albert Meyer, had collaborated with Caroline Whitbeck to lead research ethics activities for graduate students at M.I.T. Through this connection, I invited Caroline to visit the University of Illinois Urbana-Champaign in 1995, during the year that she was a Sigma Xi national lecturer. In return, she asked me to serve as a member of the Advisory Board for her Online Ethics Center at Case Western Reserve University. This center provided online access to instructional materials for teaching ethics in engineering and research. I continued to serve on the board after the center moved to the National Academy of Engineering in 2007.

In 1996, I was invited by Brian Schrag, then the executive director of APPE, to chair a small committee that would organize a mini-conference on ethics in engineering and computing as part of the APPE annual meeting in March 1997. I traveled to Texas A&M University to meet the other two committee members, Ed Harris and Mike Rabins. They introduced me to scholars at other institutions who then collaborated with us develop the mini-conference program. At the APPE meeting and especially at the mini-conference, I met others who taught professional ethics. The opening speaker for the mini-conference was William LeMessurier, who had recently been celebrated for blowing the whistle on himself for deficiencies in the construction of the Citicorp Center in New York City (Morgenstern, 1995).

Our mini-conference program included a panel discussion on teaching ethics in engineering and computer science. The panelists were Charles Glagola, Moshe Kam, and Caroline Whitbeck. As the panel chair, I asked them to be lively, opinionated, and controversial; Caroline added, “and nonviolent.” We discussed the integration of ethics into technical courses, the assessment of student outcomes, the uses of cases and codes of ethics, the enlisting of support of engineering faculty, the background needed to teach ethics, and especially the role of ethical theory in teaching applied ethics. The panel also responded to astute questions and insightful comments from the audience.

According to the edited transcript of the panel discussion session (Glagola et al., 1997), I introduced the topic of theories by asking, "Should the course start with a boring summary of ethical theories? On a scale of one to ten, where one is absolutely not and ten is metaphysical certitude, should it start with ethical theories?" Caroline replied,

> It is a shame for engineering ethics . . . to be tied to an approach to a philosophical ethics that was current in the 1950s, '60s, and '70s. . . . The project to found ethics on reason alone—on what supposedly all rational people would agree to—is a great mistake. They just assume that some sort of rationalist foundationalist program must be true and that the only question is whether the deontological version is better than the utilitarian, or the rights theorists give a better account than either. . . . You might have some reading from Kant or Mill, but I would not teach rationalist foundationalism of any stripe. . . . What I object to is philosophers presuming to tell everyone else what ethics is, that it all comes down to acting so as to produce the greatest good for the greatest number, or the like, and seeking then to apply such super principles to cases. Morality is a social product, and we have to understand the moral traditions that are involved. (pp. 466–467).

I followed Caroline's advice to minimize attention to ethical theories when I taught professional ethics.

At the next APPE annual meeting, in 1998, Bill Sweet of the IEEE organized a roundtable panel discussion on education in engineering ethics, and he invited me to participate as one of the twelve panel members. The panel included an all-star cast of leaders in engineering ethics; I was likely the youngest member. According to the report of the roundtable (Sweet, 1998), we discussed how an engineer who had taken an engineering ethics course might differ from someone who had not. I said that engineers who had studied ethics would have the language to articulate ethical concerns such as "conflict of interest" (and how it differs from a "conflicting interest"). They would be able to take others' perspectives into account. They could recall cases that they had examined and reason by analogy in new situations. At the time, however, I did not have evidence to support these claims about the outcomes of ethics education.

One year later, Bill Sweet organized a roundtable panel on ethics, intellectual property, and information technology in conjunction with the International Conference on Ethics in Engineering and Computer Science that Caroline Whitbeck hosted at Case Western Reserve University in Cleveland, Ohio. Joe Herkert and I co-moderated the discussion with nine other panelists (Herkert & Loui, 1999). At the end of the discussion, in response to a comment that faculty and students need better education about copyright law, I said that instead of force-fitting new technologies into existing notions of intellectual property, we need to rethink models of copyrights. Since 1999, the Creative Commons movement has addressed some of these concerns.

At the conference in Cleveland, I demonstrated a role-play. Later in 1999, I demonstrated active learning techniques in a keynote speech, titled "How to succeed in teaching ethics without really trying," at the Conference on Integrating Ethics into Technical Education, held at Raritan Valley Community College. I demonstrated techniques and described resources for teaching

engineering ethics at annual conferences of the American Society for Engineering Education (Bates et al., 2012; Bates & Loui, 2013).

I participated in conferences in the 1990s while serving full time as Associate Dean of the Graduate College at the University of Illinois Urbana-Champaign from 1996 to 2000. In this position, I had administrative responsibility for all graduate academic programs on campus. Although academic administration is not a profession, I noticed ethical issues in administrative decisions (Loui, 2010a). From 1998 to 2000, I also served as the campus's research integrity officer. In that role, besides handling allegations of research misconduct (Loui, 2002), I led workshops for graduate students on the responsible conduct of research, which I consider to be another species of professional ethics. As a campus administrator, with limited time for my own research activities, I drastically reduced research on technical topics and mainly focused on professional ethics. I supervised a master's thesis with an early analysis of the privacy implications of Internet cookies. The thesis and its published version (Lin & Loui, 1998) were titled "Taking the Byte out of Cookies: Privacy, Consent, and the Web"—my favorite article title of my career.

After I left the campus administration, I continued to grow my professional network in engineering ethics and computer ethics through the IEEE Society on Social Implications of Technology (SSIT), which sponsored the annual IEEE International Symposium on Technology and Society. I attended this conference for the first time in 2001. At a plenary session, computer ethicist Keith Miller and I read aloud the parts of the two main characters in a play written by Richard Epstein, *The Sunshine Borgs*, which raised numerous ethical issues in computing and information technology. In 2003, I organized a one-day regional meeting of the IEEE SSIT at my university, titled "Ethical and Social Issues in Engineering and Computing." For this meeting, I invited five speakers from other universities in the Midwest. Two professors on campus required students in their courses to attend at least one presentation.

I continued to participate in engineering ethics activities through professional societies. For the IEEE, I served on the Board of Governors of the IEEE SSIT from 2002 through 2007, and on the IEEE Ethics and Member Conduct Committee from 2012 through 2014. For the American Society for Engineering Education (ASEE), I attended the birth of the Engineering Ethics Constituent Committee, led by Dennis Horn and Gerald Jakubowski, in 2003. I later served on the ASEE Ethics Committee. In 2006, I was elected Fellow of the IEEE "for leadership in teaching of engineering ethics."

I contribute to online education in engineering ethics

As ethics instruction became offered online, I delivered an invited presentation, "Educational technologies and the teaching of ethics," at the Web-based Ethics Curriculum Workshop at Indiana University convened by Joan Sieber in 2002. I presented a similar talk at the APPE annual meeting in 2003. In the article version of my presentation (Loui, 2005a), I described four techniques to teach ethics in science and engineering by using educational technologies for

interactive and collaborative exercises. I neglected to disclose that I had never tried these techniques myself.

In 2010, I was a member of a team, led by C. K. Gunsalus, that received a large grant from the National Science Foundation (NSF) for a project to create an online resource center for ethics education in science and engineering. After the first-year review in 2011, our project received a half-year of funding to be terminated at the end of 2012. From this painful episode, I learned the importance of hiring a dedicated project manager for a large project. The NSF opened bids for proposals again, and it awarded a grant to the Online Ethics Center for Engineering and Science at the National Academy of Engineering. I served in an advisory capacity for this latter project. Many of the same people were involved in both projects, but in different roles.

I become a filmmaker

In 1997, Vivian Weil nominated me to serve on the executive board of the National Institute for Engineering Ethics (NIEE). At the annual board meeting in 2000, we discussed the difficulty of raising funds to develop a successor to *Gilbane Gold*, the instructional video that NIEE had created in the 1980s. I modestly suggested that we write a proposal to the NSF for a grant to obtain sufficient funding for a new video. Our proposal was funded on our second attempt in early 2002. I understand that at the time, the grant was the largest that Rochelle Hollander, the NSF program director, had ever awarded in the Ethics & Values Studies Program.

The NSF grant supported the development of the video *Incident at Morales* (Nichols et al., 2003). The video development team was led by Jimmy Smith, with splendid administrative support by Patti Harper at Texas Tech University. *Incident at Morales* dramatized a fictional but realistic story in engineering ethics. Aware of how globalization had begun to affect the practice of engineering, our team set the story in an international context. We decided early to eschew a whistleblowing crisis, which *Gilbane Gold* had shown. Instead, in our story, engineers encountered ethical issues in ordinary situations in the design of a chemical plant to manufacture a new paint remover. The engineers navigated issues such as the confidentiality of trade secrets and the safety of the public as they addressed technical and managerial problems such as the brittleness of the pipes, the reliability of the control modules, and the cost of compliance with environmental regulations. We deliberately chose a variety of technical problems across different fields of engineering. I contributed the idea of software controls to the plot. As the characters considered the name of the new paint stripper, I suggested “Power Strip,” which appeared in the script. While working with the professional writer/director, Paul Martin, we requested the removal of sexual innuendos such as a picture of a curvaceous fan dancer—the name of the previous paint stripper was “Old Stripper”—and an ambiguous reference to “Love Canal.”

When we saw the rough cut of the video, we requested several minor edits. Some of us were uncomfortable with the long kissing scene between the characters Maria and Fred, so we chose the shortest take of that scene. After Maria asks Fred, “Promise me you’ll line the ponds,” we deleted Fred’s breathy reply “Yes,” to leave the decision open. We worried that our Mexican colleagues

would think we were criticizing their environmental practices, so we added a voice-over by the Mexican official: "Most of our regulations are similar to your own." We debated whether we could show engineers walking around a chemical plant without wearing adequate safety gear: Phil Ulmer, a member of the video development team, had previously served as the president of the American Society of Safety Engineers. We resolved the issue by adding a disclaimer, which stated that NIEE does not necessarily endorse the practices shown in the video.

Toward the end of the development of the video, we debated vigorously whether the title should be "Incident *in* Morales" or "Incident *at* Morales." We also created an instructor's guide with dozens of discussion questions and a homework assignment for students. I made a mistake in advocating that we offer *Incident at Morales* in both VHS and DVD formats. In 2002, I did not anticipate the demise of VHS tapes.

We premiered *Incident at Morales* at the APPE annual meeting in 2003. At the premiere, as I recall, one attendee caused an uproar when he claimed that the video showed no ethical issues. We felt satisfied because we had designed the story so that the ethical issues would not be obvious: they required careful attention and analysis. Other attendees wondered whether the video should have shown a larger engineering team. We responded that more actors would have required more money. Later in 2003, I demonstrated how instructors could use active learning techniques with the video in a special session at the IEEE Frontiers in Education Conference (Loui et al., 2003).

After the publication of *Incident at Morales*, we at NIEE began planning a new instructional video, *Henry's Daughters*. In 2009, we obtained funding to produce the new video from the United Engineering Foundation, from the IEEE Foundation, and from private donors. *Henry's Daughters* (Loui et al., 2010) tells a story about developing autonomous cars. Joe Herkert deserves credit for convincing our skeptical NIEE colleagues that autonomous cars would soon be a reality. Led again by Jimmy Smith, the video development team stuffed the plot full of timeless issues such as conflicts of interest, bribery, privacy, and sexual harassment. The team met with the screenwriter—Paul Martin again—and I reviewed five drafts of the script. I contributed the line with the term "multivariable dynamical system," which the actress pronounced perfectly. I collaborated with other team members to produce the study guide too. We premiered *Henry's Daughters* at the APPE annual meeting in 2010.

While working on the two videos with NIEE, I knew that many college professors were recording videos for instructional use. At Illinois, the College of Engineering had allocated resources to record lectures for online engineering courses. In 2008, I recorded a series of ten short video lectures on professional ethics in engineering for the illinoisfoundry (iFoundry) channel on YouTube. As part of iFoundry's mission to broaden the education of engineering students (Goldberg & Somerville, 2014), this channel provided short videos on nontechnical topics such as creativity and entrepreneurship, which are typically omitted from technical engineering courses. Each of my videos was unscripted and recorded in one take in less than ten minutes. Available for free online (Loui, 2010b), these videos discuss professionalism, responsibility,

confidentiality, conflict of interest, codes of ethics, and responsible conduct of research. I now meet people from around the world who have watched my video series.

I pursue the scholarship of teaching and learning in engineering ethics

In 2003, I was one of 26 faculty members to be named a Carnegie Scholar by the Carnegie Foundation for the Advancement of Teaching. We joined the burgeoning scholarship of teaching and learning (SoTL) movement, in which the Foundation was investing substantial resources. As SoTL scholars, we would gather evidence to answer questions about student learning in our own classrooms, and we would share our findings with others. Our SoTL studies would build the pedagogical content knowledge of our disciplines. For me, SoTL was the "gateway drug" to more formal education research with theoretically grounded, methodologically rigorous studies.

For my Carnegie Scholars project during the 2003–04 academic year, I wanted to investigate whether taking a course on engineering ethics could promote a student's moral courage—the motivation to make the right choice, despite countervailing pressures. As I read previous work in moral psychology (e.g., Colby & Damon, 1993), I learned that moral exemplars made courageous choices based on their self identities: they acted on their moral judgments with certainty when their goals were consistent with who they were and what core values they held. So I changed the focus of my project to understanding how my *Engineering Ethics* course might influence the development of a student's professional identity (Loui, 2005b). As Golli Hashemian and I argued,

> If a course on engineering ethics can strengthen the student's sense of professional identity . . . then it might also promote moral courage, i.e., not only the courage to blow the whistle—a rare occurrence—but more important, the volition to choose the right action even in everyday situations. (Hashemian & Loui, 2010, p. 211)

We found evidence that students who had taken the *Engineering Ethics* course did indeed gain confidence in handling ethical problems (Hashemian & Loui, 2010).

As I conducted more SoTL studies and investigated claims about student learning outcomes, such as my claims at the roundtable on engineering ethics education in 1998, I learned methods of assessing student learning, separate from grading student assignments. To assess the effectiveness of instructional sessions that used *Incident at Morales*, I used the Defining Issues Test (DIT-2) and a five-item survey (Loui, 2006). My early SoTL and assessment efforts were relatively simple. In fact, I now urge graduate students to avoid my early published papers because these papers have so many flaws. In the last ten years, research on engineering ethics education has become much more sophisticated. As just one example, Hess et al. (2017) applied the critical incident technique, a type of qualitative research method, to analyze how students develop the skill of empathic perspective-taking during an engineering ethics course. For a comprehensive overview of contemporary research on engineering ethics education, see the new *Routledge International Handbook of Engineering Ethics Education* (Chance et al., 2025).

Summary

As I reflect on my journey in engineering ethics education since 1992, I am grateful for the many senior colleagues—the true pioneers—who graciously and generously shared their time and ideas with me. Their ideas inspired my own scholarly work. In particular, after Vivian Weil said that she wanted students in her engineering ethics course to "begin to develop an identity as professionals" (Sweet, 1998, p. 60), I investigated the potential connection between ethics and professional identity for my Carnegie Scholars project (Loui, 2005b). I also recall that Vivian remarked, "there is precious little information about how to run role plays well" (as "Audience Member #5" in Glagola et al., 1997, p. 476), and I subsequently examined the effectiveness of role-play (Brummel et al., 2010; Loui, 2009; Seiler et al., 2011).

For more than three decades, we have continued to ask the same fundamental questions about teaching engineering ethics. How much ethical theory should we include? How can we assess student learning? How can we train engineering instructors to teach professional ethics? Perhaps, as with most philosophical questions, we can never find ideal answers, only pragmatic answers that fit our particular circumstances. In this sense, teaching engineering ethics is like engineering itself—a quest for workable solutions to practical problems that fulfill our professional responsibilities as teachers and scholars.

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Appendix

Audience members who spoke at the panel discussion on teaching ethics in engineering and computer science in 1997 (Glagola et al., 1997): Roger Boisjoly, Peter Dean, Deborah Johnson, Keith Miller, Helen Nissenbaum, Stuart Offenbach, Mike Rabins, Wade Robison, Aarne Vesilind, Vivian Weil

Panelists at the roundtable on engineering ethics education in 1998 (Sweet, 1998): Michael Davis, Ed Harris, Joe Herkert, Michael Loui, Indira Nair, Michael Pritchard, Mike Rabins, George Samet, Carl Skooglund, Jimmy Smith, Vivian Weil, Caroline Whitbeck

Panelists at the roundtable on ethics, intellectual property, and information technology in 1999 (Herkert & Loui, 1999): Trudy Bell, Don Gotterbarn, Lesley Ellen Harris, Joe Herkert, Peggy Hoon, Jay Kesan, Michael Loui, Keith Miller, Brian O'Connell, Linton Salmon, Caroline Whitbeck

Video development team for *Incident at Morales*: Walt LeFevre, Michael Loui, Steve Nichols, Carl Skooglund, Jimmy Smith, Frederick Suppe, Phil Ulmer, Vivian Weil

Video development team for *Henry's Daughters*: Joe Herkert, Michael Loui, William Marcy, Steve Nichols, Jimmy Smith

References

Anderson, R. E., Johnson, D. G., Gotterbarn, D., & Perrolle, J. (1993, February). Using the new ACM code of ethics in decision making. *Communications of the ACM*, *36*(2), 98–107. https://doi.org/10.1145/151220.151231

Bakker, W., & Loui, M. C. (1997). Can designing and selling low-quality products be ethical? *Science and Engineering Ethics*, *3*(2), 153–170. https://doi.org/10.1007/s11948-997-0007-5

Bates, R. A., Broome, T. H., Burge, L. L., Hollander, R., & Loui, M. C. (2012). Ethics education and resources: A summary of issues facing the field and resources to address them *American Society for Engineering Education Annual Conference and Exposition*, San Antonio, Tex. June 10–13, 2012. https://doi.org/10.18260/1-2--21342

Bates, R. A., & Loui, M. C. (2013). Interactive session: Including ethical discussions in your technical classes, *American Society for Engineering Education Annual Conference and Exposition*, Atlanta, GA, June 23–26, 2013. https://doi.org/10.18260/1-2--19808

Bonwell, C. C., & Elson, J. A. (1991). *Active learning: Creating excitement in the classroom*. School of Education and Human Development, George Washington University,

Brummel, B. J., Gunsalus, C. K., Anderson, K. L., & Loui, M. C. (2010). Development of role-play scenarios for teaching responsible conduct of research. *Science and Engineering Ethics*, *16*(3), 573–589. https://doi.org/10.1007/s11948-010-9221-7

Center for Engineering Ethics and Society (2016). *Infusing ethics into the development of engineers: Exemplary education activities and programs*. The National Academies Press. https://doi.org/10.17226/21889

Chance, S., Børsen, T., Martin, D. A., Tormey, R., Lennerfors, T. T., & Bombaerts, G. (Eds.). (2025). *The Routledge International Handbook of Engineering Ethics Education*. Routledge.

Colby, A., & Damon, W. (1993). The uniting of self and morality in the development of extraordinary moral commitment. In G.G. Noam & T.E. Wren (Eds.), *The moral self* (pp. 149–174). MIT Press.

Daniel, A. (2007, October). Walking the line. *ASEE Prism*, *17*(2), 50–53. http://www.prism-magazine.org/oct07/tt_01.cfm

Davis, M. (1991). Thinking like an engineer: The place of a code of ethics in the practice of a profession. *Philosophy and Public Affairs*, *20*(2), 150–167.

Davis, M. (1996). Defining "engineer:" How to do it and why it matters. *Journal of Engineering Education*, *85*(2), 97–101. https://doi.org/10.1002/j.2168-9830.1996.tb00217.x

Davis, M. (2011, November). Will software engineering ever be engineering? *Communications of the ACM*, *54*(11), 32–34. https://doi.org/10.1145/2018396.2018407

Doss, E., & Loui, M. C. (1995). Ethics and the privacy of electronic mail. *The Information Society*, *11*(3), 223–235. https://doi.org/10.1080/01972243.1995.9960194

Engineering ethics: Teaching ethics—one approach. (1994, Summer). *Engineering Outlook*, *35*(3), 3–5. University of Illinois at Urbana-Champaign.

Florman, S. (1987). *The civilized engineer*. New York, NY: St. Martin's Press.

Glagola, C., Kam, M., Loui, M. C., & Whitbeck, C. (1997). Teaching ethics in engineering and computer science: a panel discussion, *Science and Engineering Ethics*, *3*(4), 463–480. https://doi.org/10.1007/s11948-997-0048-9

Goldberg, D. E., & Somerville, M. (2014). *A whole new engineer: The coming revolution in engineering education*. ThreeJoy Associates.

Harris, C. E., Pritchard, M. S., & Rabins, M. J. (1995). *Engineering ethics: Concepts and cases*. Wadsworth.

Hashemian, G., & Loui, M. C. (2010). Can instruction in engineering ethics change students' feelings about professional responsibility? *Science and Engineering Ethics*, *16*(1), 201–215. https://doi.org/10.1007/s11948-010-9195-5

Herkert, J. R., & Loui, M. (1999, August). The ethics of intellectual property and the new information technologies. *IEEE Spectrum*, *36*(8), 29–37. https://doi.org/10.1109/MSPEC.1999.780996

Hess, J. L., Strobel, J., & Brightman, A. O. (2017). The development of empathic perspective-taking in an engineering ethics course. *Journal of Engineering Education*, *106*(4), 534–563. https://doi.org/10.1002/jee.20175

Johnson, D. G. (1991). *Ethical issues in engineering*. Prentice-Hall.

Johnson, D. W., Johnson, R. T., & Smith, K. A. (1991). *Cooperative learning: Increasing college faculty instructional productivity*. The George Washington University, School of Education and Human Development.

Johnson, D. W., Johnson, R. T., & Smith, K. A. (1996). *Academic controversy: Enriching college instruction through intellectual conflict*. The George Washington University, Graduate School of Education and Human Development.

Leveson, N. G., & Turner, C. S. (1993, July). An investigation of the Therac-25 accidents. *Computer*, *26*(7), 18–41. https://doi.org/10.1109/MC.1993.274940

Lin, D., & Loui, M. C. (1998, June). Taking the byte out of cookies: Privacy, consent, and the Web. *Computers and Society*, *28*(2), 39–51. https://doi.org/10.1145/276755.276775

Loui, M. C. (2000). Fieldwork and cooperative learning in professional ethics. *Teaching Philosophy*, *23*(2), 139–156. https://doi.org/10.5840/teachphil200023217

Loui, M. C. (2002). Seven ways to plagiarize: Handling real allegations of research misconduct. *Science and Engineering Ethics*, *8*(4), 529–539. https://doi.org/10.1007/s11948-002-0005-6

Loui, M. C. (2005a). Educational technologies and the teaching of ethics in science and engineering. *Science and Engineering Ethics*, *11*(3), 435–446. https://doi.org/10.1007/s11948-005-0012-5

Loui, M. C. (2005b). Ethics and the development of professional identities of engineering students. *Journal of Engineering Education*, *94*(4), 383–390. https://doi.org/10.1002/j.2168-9830.2005.tb00866.x

Loui, M. C. (2006). Assessment of an engineering ethics video: Incident at Morales. *Journal of Engineering Education*, *95*(1), 85–91. https://doi.org/10.1002/j.2168-9830.2006.tb00879.x

Loui, M. C. (2009). What can students learn in an extended role-play simulation on technology and society? *Bulletin of Science, Technology & Society*, *29*(1), 37–47. https://doi.org/10.1177/0270467608328710

Loui, M. C. (2010a). How should the policy apply? Trustworthy decisions in the administration of graduate academic programs. In E. E. Englehardt, M. S. Pritchard, K. D. Romesburg, & B. E. Schrag (Eds.), *The ethical challenges of academic administration* (pp. 135-141). Springer. https://doi.org/10.1007/978-90-481-2841-9_10

Loui, M. C. (2010b). Professional ethics in engineering. Retrieved July 28, 2018 from https://nationalethicscenter.org/resources/27
Also https://www.youtube.com/view_play_list?p=746AE3CCB29B64B8

Loui, M. C., & Hillmer, P. M. (2004). *Engineering ethics*. Retrieved July 28, 2018 from http://www.onlineethics.org/Resources/TeachingTools/Syllabi/21277.aspx

Loui, M. C., LeFevre, E. W., Nichols, S. P., Skooglund, C. M., Smith, J. H., Suppe, F., Ulmer, P., & Weil, V. (2003, November 5–8). Incident at Morales: An engineering ethics video. *Frontiers in Education Conference*, Westminster, CO, IEEE. https://doi.org/10.1109/FIE.2003.1265931

Loui, M. C., & Revelo, R. A. (2015, Fall). Cooperative learning and assessment of ethics sessions in a summer undergraduate research program. *CURQ on the Web*, *36*(1) 4-10. https://hdl.handle.net/2142/125132

Loui, M. C., Smith, J. H., Herkert, J. R., & Nichols, S. P. (2010, October 27–30). Henry's Daughters: A new engineering ethics movie. *Frontiers in Education Conference*, Washington, DC, IEEE. https://doi.org/10.1109/FIE.2010.5673513.

Morgenstern, J. (1995, May 29). The fifty-nine-story crisis. *The New Yorker*, 45–53.

Nichols, S. P., Smith, J., H., & Loui, M. C. (2003, June 22–25). Incident at Morales: A video/DVD "case study" in professional responsibility. *American Society for Engineering Education Annual Conference*, Nashville, TN. https://doi.org/10.18260/1-2--11595

Parker, D. B. (1979). *Ethical conflicts in computer science and technology*. Arlington, VA: AFIPS Press.

Parker, D. B., Swope, S., & Baker, B. N. (1990). *Ethical conflicts in information and computer science, technology, and business*. QED Information Sciences.

Pritchard, M. (1992). *Teaching engineering ethics: A case study approach*. Western Michigan University.

Seiler, S. N., Brummel, B. J., Anderson, K. L., Kim, K. J., Wee, S., Gunsalus, C. K., & Loui, M. C. (2011). Outcomes assessment of role-play scenarios for teaching responsible conduct of research. *Accountability in Research*, *18*(4), 217–246. https://doi.org/10.1080/08989621.2011.584760

Sweet, W. (1998, June). Educating ethical engineers. *IEEE Spectrum*, *35*(6), 51–61. https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=681972

Whitbeck, C. (1992). The trouble with dilemmas: Rethinking applied ethics. *Professional Ethics*, *1*(1/2), 119–142. https://doi.org/10.5840/profethics199211/24

Whitbeck, C. (1995). Teaching ethics to scientists and engineers: Moral agents and moral problems. *Science and Engineering Ethics*, *1*(3), 299–308. https://doi.org/10.1007/BF02628805