

all hold as an ideal.”¹²⁶ As engineering schools attempt to recruit and advance more women, it is important to assess the ways in which and the degree to which harmful gender schemas serve as barriers to women’s advancement. At some institutions, such as the University of Michigan, such efforts have involved conducting gender schema workshops, forming focus groups, conducting interviews, and collecting survey data to assess the prevalence of gender schemas contributing to underrating women faculty in science, technology, engineering, and mathematics fields.¹²⁷

One hypothesis is that once the harmful implicit schemas are made explicit, we can begin to address them at individual, departmental, and institutional levels and, at the very least, decrease their harmful impact.

Identify and discuss some of the subtle expectations both men and women have about gender. How do these gender schemas influence the advancement and promotion of women in engineering? Can you think of any examples from your own experience of men being advantaged and women being disadvantaged as a result of gender schemas?

CASE 45

*XYZ Hose Co.*¹²⁸

Farmers use anhydrous ammonia to fertilize their fields. The anhydrous ammonia reacts violently with water, so care must be exercised in disbursing it. Farmers’ cooperatives rent anhydrous ammonia in pressurized tanks equipped with wheels so the tanks can be pulled by tractors. The farmers also rent or purchase hoses that connect the tanks to perforated hollow blades that can be knifed through the soil to spread the ammonia. Leaks from the hose are potentially catastrophic.

For years, the industry standard hose was made of steel-meshed reinforced rubber, which was similar in construction to steel-reinforced automobile tires. Two separate trade associations had established these industry-wide standards.

Approximately 15 years ago, a new, heavy-duty plastic became available that could replace the steel in the hoses. The plastic-reinforced hoses were less expensive, lighter, and easier to process than the steel-braided rubber. The new hose met the industry standards. One company, the XYZ Hose Company, began marketing the plastic-reinforced hose to farmers. Officials of XYZ knew, as a result of tests by a consultant at a nearby state agricultural college, that the plastic did not react immediately to the anhydrous ammonia;

however, over the years the plastic did degrade and lose some of its mechanical properties. Accordingly, they put warnings on all the hoses they manufactured, indicating that they should be replaced periodically.

After the product had been on the market a few years, several accidents occurred in which the XYZ hoses ruptured during use and blinded and severely injured the farmers using them. Litigation followed, and XYZ argued in its defense that the farmers had misused the hoses and not heeded the replacement warnings. This defense was unsuccessful, and XYZ made substantial out-of-court settlements.

XYZ has since dropped this product line and placed advertisements in farmers’ trade journals and producers’ cooperatives newsletters asking farmers to turn in their XYZ hoses for full refunds. The advertisements state that the hoses are “obsolete,” not that they are unsafe.

Identify and discuss the ethical issues this case raises, paying special attention to relevant, key ideas presented in this chapter. What are the relevant facts? What factual, conceptual, and application issues are there? What methods for resolving these issues might be used?

NOTES

1. Steven Weisskopf, “The Aberdeen Mess,” *Washington Post Magazine*, January 15, 1989.
2. *The Aberdeen Three*, a case prepared under National Science Foundation grant number DIR-9012252. The principal investigators were

- Michael J. Rabins, Charles E. Harris, Jr., Charles Samson, and Raymond W. Flumerfelt. The complete case is available at the Texas A & M Engineering Ethics website (<http://ethics.tamu.edu>).
3. Case study prepared by Ryan Pflum, MA philosophy student at Western Michigan University.

4. Case study prepared by Ryan Pflum.
5. This account is based on John H. Cushman, Jr., "G.M. Agrees to Cadillac Recall in Federal Pollution Complaint," *New York Times*, December 1, 1995, pp. A1 and A12.
6. Leonardo Da Vinci, *The Notebooks of Leonardo Da Vinci*, vol. I, Edward MacCurdy, ed. (New York: George Braziller, 1939), p. 850. Cited in Mike Martin and Roland Schinzinger, *Ethics in Engineering*, 3rd ed. (New York: McGraw-Hill, 1996), p. 246.
7. This account is based on Joe Morgenstern, "The Fifty-Nine Story Crisis," *The New Yorker Magazine*, May 29, 1995, 49–53. For more on William LeMessurier and the Citicorp building, see the Online Ethics Center for Engineering (<http://www.onlineethics.org/CMS/profpractice/exemp.index.aspx>).
8. Much of what follows is based on Michael S. Pritchard, "Professional Responsibility: Focusing on the Exemplary," *Science and Engineering Ethics*, 4, 1998, pp. 230–233. In addition to sources cited here, there is an excellent PBS *Frontline* documentary on Cuny, "The Lost American." This is available at PBS Video, P.O. box 791, Alexandria, VA 22313-0791. There is a wealth of additional information on Cuny online at <http://www.pbs.org/wgbh/pages/frontline/shows/cuny/bio/chron.html>. Also, Cuny is featured as a moral leader on the Online Ethics Center for Engineering.
9. Karen W. Arenson, "Missing Relief Expert Gets MacArthur Grant," *New York Times*, June 13, 1995, p. A12.
10. Ibid.
11. Scott Anderson's gripping account of Frederick Cuny's life portrays him as a person with many foibles and shortcomings who still managed to save the lives of thousands threatened by man-made and natural disasters. See Scott Anderson, *The Man Who Tried to Save the World: The Dangerous Life and Mysterious Disappearance of Fred Cuny* (New York: Doubleday, 1999).
12. From Intertect's corporate brochure.
13. Ibid.
14. Quoted in William Shawcross, "A Hero of Our Time," *New York Review of Books*, Nov. 30, 1995, p. 35. The next paragraph is based on Shawcross's article.
15. The following is based on Chuck Sudetic, "Small Miracle in a Siege: Safe Water for Sarajevo," *New York Times*, January 10, 1994, pp. A1 and A7.
16. This account is based on "The Talk of the Town," *The New Yorker*, 69, no. 39, Nov. 22, 1993, pp. 45–46.
17. Anderson, *The Man Who Tried to Save the World*, p. 120.
18. Ibid.
19. Ibid. This expresses a thought attributed to Cuny.
20. Frederick C. Cuny, "Killing Chechnya," *The New York Review of Books*, April 6, 1995, pp. 15–17.
21. Marilyn Greene, "Texas Disaster Relief 'Visionary' Vanishes on Chechnya Mission," *USA Today*, May 10, 1995, p. A10.
22. Shawcross, "A Hero of Our Time," p. 39.
23. "Talk of the Town," p. 46.
24. Sudetic, "Small Miracle in a Siege," p. A7.
25. John Allen, "The Switch," *On Wisconsin*, Fall 2001, pp. 38–43.
26. Ibid., p. 42.
27. Ibid., p. 41.
28. Ibid.
29. These case studies were written by Theodore D. Goldfarb and Michael S. Pritchard for their *Ethics in the Science Classroom* (<http://www.onlineethics.org>). This text is a product of two National Science Foundation grants on teaching ethics in the science classroom: SBR-9601284 and SBR-932055.
30. Sources for information on the Darsee case include Sharen Begley, with Phyllis Malamud and Mary Hager, "A Case of Fraud at Harvard," *Newsweek*, February 4, 1982, pp. 89–92; Richard Knox, "The Harvard Fraud Case: Where Does the Problem Lie?" *Journal of the American Medical Association*, 249, no. 14, April 3, 1983, pp. 1797–1807; Walter W. Stewart, "The Integrity of the Scientific Literature," *Nature*, 325, January 15, 1987, pp. 207–214; Eugene Braunwald, "Analysing Scientific Fraud," *Nature*, 325, January 15, 1987, pp. 215–216; and Eugene Brunwald, "Cardiology: The John Darsee Experience," in David J. Miller and Michel Hersen, eds., *Research Fraud in the Behavioral and Biomedical Sciences* (New York: Wiley, 1992), pp. 55–79.
31. David DeMets, "Statistics and Ethics in Medical Research," *Science and Engineering Ethics*, 5, no. 1, January 1999, p. 111. At the 1994 Teaching Research Ethics for Faculty Workshop at Indiana University's Poynter Center, DeMets recounted in great detail the severe challenges

- he and his team of statisticians faced in carrying out their investigation.
32. Eugene Braunwald, "Cardiology: The John Darsee Experience," in David J. Miller and Michel Hersen, eds., *Research Fraud in the Behavioral and Biomedical Sciences* (New York: Wiley, 1992), pp. 55–79.
 33. William F. May, "Professional Virtue and Self-Regulation," in Joan Callahan, ed., *Ethical Issues in Professional Life* (New York: Oxford University Press, 1988), p. 408.
 34. For readings on the Bruening case, see Robert L. Sprague, "The Voice of Experience," *Science and Engineering Ethics*, 4, no. 1, 1998, p. 33; and Alan Poling, "The Consequences of Fraud," in Miller and Hersen, pp. 140–157.
 35. Robert L. Sprague, "The Voice of Experience," *Science and Engineering Ethics*, Vol. 4, 1, 1998, p. 33.
 36. This video was produced by the National Society for Professional Ethics (Alexandria, VA) in 1989. Information about obtaining it can be found at the Murdough Center for Engineering Ethics website, <http://www.niece.org/pd.cfm?pt=Murdough>. This website also contains the entire transcript for this video.
 37. One would be to find a cheap technical way to eliminate the heavy metals. Unfortunately, the video does not directly address this possibility. It begins in the midst of a crisis at ZCORP and focuses almost exclusively on the question of whether David Jackson should blow the whistle on his reluctant company. For a detailed exploration of some creative middle way alternatives, see Michael Pritchard and Mark Holtzapple, "Responsible Engineering: *Gilbane Gold* Revisited," *Science and Engineering*, 3, no. 2, April 1997, pp. 217–231.
 38. This case is based on Kirk Johnson, "A Deeply Green City Confronts Its Energy Needs and Nuclear Worries," *New York Times*, November 19, 2007 (<http://www.nytimes.com/2007/11/19/us/19collins.html?th=&cmc=>).
 39. This case is based on Felicity Barringer and Micheline Maynard, "Court Rejects Fuel Standards on Trucks," *New York Times*, Nov. 16, 2007 (<http://www.nytimes.com/2007/11/16/business/16fuel.html?th&cmc=th>).
 40. Ibid.
 41. We first learned of this true case (with names changed) from Sam's daughter, who was an honor student in two of the authors' engineering ethics classes and a member of a team of students from that class that competed in the College Ethics Bowl competition held at Loyola/Marymount College in Los Angeles. She suggested that the team present a case based on her father's experience. The team won the competition with its discussion of the case described here (which has been reviewed by "Sam" for accuracy).
 42. This is an adaptation of a case developed by James Taylor, Civil Engineering, Notre Dame University.
 43. ASCE Hurricane Katrina External Review Panel, *The New Orleans Hurricane Protection System: What Went Wrong and Why* (Reston, VA: American Society for Civil Engineers, 2007). Available at <http://www.asce.org/static/hurricane/erp.cfm>.
 44. Ibid., p. 47.
 45. Ibid., p. 61.
 46. Ibid.
 47. Ibid., p.73.
 48. Ibid., p. 79.
 49. Ibid.
 50. Ibid.
 51. Ibid., p. 81.
 52. Ibid., p. 82.
 53. Ibid., p. 82.
 54. Jacqueline Finger, Joseph Lopez, III, Christopher Barallus, Matthew Parisi, Fred Rohs, John Schmalzel, Amrinder Kaur, DeMond S. Miller, and Kimberly Rose, "Leadership, Service Learning, and Executive Management in Engineering: The Rowan University Hurricane Katrina Recovery Team," *International Journal for Service Learning in Engineering*, 2, no. 2, Fall 2007.
 55. Katie Hafner and Claudia H. Deutsch, "When Good Will Is Also Good Business," *New York Times*, September 14, 2005 (<http://nytimes.com>).
 56. Ibid.
 57. This account is drawn from R. W. Flumerfelt, C. E. Harris, M. J. Rabins, and C. H. Samson, eds., *Introducing Ethics Case Studies into Required Undergraduate Engineering Courses*, NSF Grant no. DIR-9012252, November 1992. The full version is available at the Texas A & M Engineering Ethics website (<http://ethics.tamu.edu>).
 58. Paula Wells, Hardy Jones, and Michael Davis, *Conflicts of Interest in Engineering*, Module Series in Applied Ethics, Center for the Study of Ethics in the Professions, Illinois Institute of Technology (Dubuque, IA: Kendall/Hunt, 1986), p. 20.

59. American Society of Mechanical Engineers, Boiler and Pressure Vessel Code, section IV, paragraph HG-605a.
60. Charles W. Beardsley, "The Hydrolevel Case—A Retrospective," *Mechanical Engineering*, June 1984, p. 66.
61. *Ibid.*, p. 73.
62. This case is based on an article that appeared in *The Seattle Times*, July 24, 2000.
63. This case study was written by Theodore D. Goldfarb and appeared in Theodore D. Goldfarb and Michael S. Pritchard, *Ethics in the Science Classroom* (<http://www.onlineethics.org>). It is a product of two National Science Foundation grants on teaching ethics in the science classroom: SBR-9601284 and SBR-932055.
64. This case is based on Stephen H. Unger's account in *Controlling Technology: Ethics and the Responsible Engineer* (New York: Holt, Rinehart & Winston, 1994), pp. 27–30.
65. Much of this account is adapted from Theodore D. Goldfarb and Michael S. Pritchard for their *Ethics in the Science Classroom* (<http://www.onlineethics.org>). This text is a product of two National Science Foundation grants on teaching ethics in the science classroom: SBR-9601284 and SBR-932055.
66. See Richard A. Shweder, Elliot Turiel, and Nancy C. Much, "The Moral Intuitions of the Child," in John H. Flavell and Lee Ross, eds., *Social Cognitive Development: Frontiers and Possible Futures* (Cambridge, UK: Cambridge University Press, 1981), p. 288.
67. Gareth Matthews, "Concept Formation and Moral Development," in James Russell, ed., *Philosophical Perspectives on Developmental Psychology* (Oxford: Basil Blackwell, 1987), p. 185.
68. For balanced, accessible discussions of recent findings in moral development, see William Damon, *The Moral Child* (New York: Free Press, 1988); and Daniel K. Lapsley, *Moral Psychology* (Boulder, CO: Westview Press, 1996).
69. See, for example, Lawrence Kohlberg, *The Philosophy of Moral Development: Essays on Moral Development*, Vol. 1 (San Francisco: Harper & Row, 1981).
70. Michael Pritchard has written extensively on many of them elsewhere. See his *On Becoming Responsible* (Lawrence: University Press of Kansas, 1991); *Reasonable Children* (Lawrence: University Press of Kansas, 1996); and "Kohlbergian Contributions to Educational Programs for the Moral Development of Professionals," *Educational Psychology Review*, 11, no. 4, 1999, pp. 397–411. James Rest, Muriel Bebeau, Darcia Narvaez, and Stephen Thoma have developed what they call a neo-Kohlbergian account. They identify three "schemas": personal interest, maintaining norms, and postconventional. In general, these three schemas correlate significantly with Kohlberg's three basic levels of moral development. However, they maintain that a much higher percentage of adults meet their postconventional criteria than Kohlberg suggests meet his postconventional level. See Rest et al., *Postconventional Moral Thinking* (Mahwah, NJ: Erlbaum, 1999); and their essays in *Educational Psychology Review*, 11, no. 4, 1999.
71. This case was developed by P. Aarne Vesilind, Department of Civil and Environmental Engineering at Duke University.
72. This account is based on Loren Graham's *The Ghost of the Executed Engineer: Technology and the Fall of the Soviet Union* (Cambridge, MA: Harvard University Press, 1993).
73. *Ibid.*, p. 106.
74. Information for this case is based on a case study prepared by Manuel Velasquez, "The Ford Motor Car," in Manuel Velasquez, *Business Ethics: Concepts and Cases*, 3rd ed. (Englewood Cliffs, NJ: Prentice-Hall, 1992), pp. 110–113.
75. *Grimshaw v. Ford Motor Co.*, app., 174 Cal. Rptr. 348, p. 360.
76. This is reported in Ralph Drayton, "One Manufacturer's Approach to Automobile Safety Standards," *CTLA News*, VIII, no. 2 (February 1968), p. 11.
77. Mark Dowie, "Pinto Madness," *Mother Jones*, September/October 1977, p. 28.
78. Amy Docker Marcus, "MIT Students, Lured to New Tech Firms, Get Caught in a Bind," *The Wall Street Journal*, June 24, 1999, pp. A1, A6.
79. *Ibid.*, p. A6.
80. *Ibid.*
81. *Ibid.*
82. John Markoff, "Odyssey of a Hacker: From Outlaw to Consultant," *New York Times*, January 29, 2001.
83. David Lorge Parnas, "SDI: A Violation of Professional Responsibility," in Deborah Johnson, ed., *Ethical Issues in Engineering* (Englewood Cliffs, NJ: Prentice-Hall, 1991), pp. 15–25. This case is based on Pritchard's discussion in "Computer

- Ethics: The Responsible Professional,” in James A. Jakska and Michael S. Pritchard, eds., *Responsible Communication: Ethical Issues in Business, Industry, and the Professions* (Cresskill, NJ: Hampton Press, 1996), pp. 146–148.
84. Ibid., p. 17.
 85. Ibid., p. 15.
 86. Ibid., p. 25.
 87. Parnas was convinced that the public, when informed, would agree with his conclusions about the SDI program. For a contrary view, see the debate between David Parnas and Danny Cohen, “Ethics and Military Technology: Star Wars,” in Kristen Shrader-Frechette and Laura Westra, eds., *Technology and Values* (New York: Rowman & Littlefield, 1997), pp. 327–353.
 88. Ibid.
 89. This account is based on the authors’ conversations with Ed Turner as well as information available at <http://www.responsiblecharge.com>.
 90. This account is based on G. P. E. Meese, “The Sealed Beam Case,” *Business & Professional Ethics*, 1, no. 3, Spring 1982, pp. 1–20.
 91. H. H. Magsdick, “Some Engineering Aspects of Headlighting,” *Illuminating Engineering*, June 1940, p. 533, cited in Meese, p. 17.
 92. Much of this case is adapted from Michael S. Pritchard, “Service-Learning and Engineering Ethics,” *Science and Engineering Ethics*, 6, 2000, pp. 413–422. An earlier version of this article is available at the Online Ethics Center (<http://www.onlineethics.org/CMS/edu/resources/servicelearning.aspx>).
 93. Accreditation Board for Engineering and Technology, *Fifty-Third Annual Report*, 1985, p. 98.
 94. Campus Compact supports the development of service learning programs throughout the country. For an early statement of its efforts, see Timothy Stanton, *Integrating Public Service with Academic Study* (Providence, RI: Campus Compact, Brown University, 1989).
 95. Edmund Tsang, “Why Service Learning? And How to Integrate It into a Course in Engineering,” in Kathryn Ritter-Smith and John Saltmarsh, eds., *When Community Enters the Equation: Enhancing Science, Mathematics and Engineering Education through Service-Learning* (Providence, RI: Campus Compact, Brown University, 1998). Currently at Western Michigan University as associate dean in the College of Engineering & Applied Sciences, Tsang continues his work in service learning. He has also edited *Projects that Matter: Concepts and Models for Service-Learning in Engineering*, Vol. 14 (Washington, DC: American Association for Higher Education, 2000). Service learning is appropriate throughout both undergraduate and graduate programs in engineering. This is well illustrated by Kevin Passino, Professor of Electrical and Computing Engineering at Ohio State University. In addition to founding the student-centered Engineers for Community Service at his university, he is developing international service learning projects for PhD students. See his “Educating the Volunteer Engineer,” available on his website (<http://www.ece.osu.edu/~passino/professionalism.html>) and forthcoming in *Science and Engineering Ethics*.
 96. This account is based on a conversation with Tom Talley and Dave Wylie’s, “AVIT Team Helps Disabled Children,” *Currents* (Texas A & M University), Summer 1993, p. 6.
 97. *Research Agenda for Combining Service and Learning in the 1990s* (Raleigh, NC: National Society for Internships and Experiential Education, 1991), p. 7.
 98. CESG brochure.
 99. CESG Strategic Plan Draft: 1997–2000, pp. 1–2.
 100. This case is based on Glenn Collins, “What Smoke? New Device Keeps Cigarettes in a ‘Box,’” *New York Times*, October 23, 1997, pp. A1, C8.
 101. Case presented by Pritchard in “Computer Ethics: The Responsible Professional,” pp. 144–145.
 102. Joe Gertner, “The Future Is Drying Up,” *New York Times Magazine*, October 21, 2007.
 103. One is environmental engineer Bradley Udall, son of U.S. Congressman Morris Udall and nephew of Stewart Udall, Secretary of the Interior under Presidents John F. Kennedy and Lyndon Johnson.
 104. From Michael S. Pritchard, “Professional Responsibility: Focusing on the Exemplary,” *Science and Engineering Ethics*, 4, 1998, p. 224.
 105. See the May 1997 report by the Biomass Energy Design Project Team, “Design and Feasibility Study of a Biomass Energy Farm at Lafayette College as a Fuel Source for the Campus Steam Plant.”
 106. Accreditation Board for Engineering and Technology, *Engineering Criteria 2000*, 3rd ed. (Baltimore: Author, 1997). See also <http://www.abet.org/eac2000html>.

107. This case is based on Claudia H. Deutsch, "A Threat So Big, Academics Try Collaboration," *New York Times*, December 25, 2007 (<http://www.nytimes.com/2007/12/25/business/25sustain.html?8br>).
108. Ibid.
109. Ibid.
110. Ibid.
111. Joshua M. Pearce, "Service Learning in Engineering and Science for Sustainable Development," *International Journal for Service Learning in Engineering*, 1, No. 1, Spring 2006.
112. Karim Al-Khafaji and Margaret Catherine Morse, "Learning Sustainable Design through Service," *International Journal for Service Learning in Engineering*, 1, No. 1, Spring 2006.
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114. John Erik Anderson, Helena Meryman, and Kimberly Porsche, "Sustainable Building Materials in French Polynesia," *International Journal for Service Learning in Engineering*, 2, No. 2, Fall 2007.
115. From Michael S. Pritchard, "Professional Responsibility: Focusing on the Exemplary," *Science and Professional Ethics*, 4, 1998, pp. 225–226. This is based on Donald J. Giffels's commentary on Pritchard's speech, "Education for Responsibility: A Challenge to Engineers and Other Professionals," presented at the Third Annual Lecture in Ethics in Engineering, Center for Academic Ethics, Wayne State University, April 19, 1995.
116. This case is presented in greater detail, complete with an instructor's guide and student handouts, in R. W. Flumerfelt, C. E. Harris, M. J. Rabins, and C. H. Samson, eds, *Introducing Ethics Case Studies into Required Undergraduate Engineering Courses*, final report to NSF on grant no. DIR-9012252, November 1992, pp. 231–261. The case is available at the Texas A & M Engineering Ethics website (<http://ethics.tamu.edu/>).
117. This case is based on Molly Galvin, "Unlicensed Engineer Receives Stiff Sentence," *Engineering Times*, 16, no. 10, October 1994, pp. 1 and 6.
118. This discussion was researched and authored by Peggy DesAutels, a philosopher at University of Dayton who has special interests in gender and engineering issues.
119. 2001 statistics from the National Science Foundation, <http://www.nsf.gov/statistics/wmpd>.
120. 2003 statistic reported in *Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering* (Washington, DC: National Academies Press, 2006), pp. 14–17. This report was produced by the Committee on Maximizing the Potential of Women in Academic Science and Engineering and the Committee on Science, Engineering, and Public Policy, National Academy of Sciences, National Academy of Engineering, and Institute of Medicine of the National Academies.
121. 2003 statistic reported in *Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering*, pp. 14–17.
122. This table is modified from a table in *Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering*, pp. 5–6.
123. *Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering*, pp. 158–159.
124. Virginia Valian, "Beyond Gender Schemas: Improving the Advancement of Women in Academia," *Hypatia* 20, no. 3, Summer 2005, pp. 198–213.
125. F. Trix and C. Psenka, "Exploring the Color of Glass: Letters of Recommendation for Female and Male Medical Faculty," *Discourse and Society*, 14, 2003, pp. 191–220.
126. Valian, p. 202.
127. NSF ADVANCE Project at the University of Michigan (<http://www.umich.edu/~advproj>).
128. This case is supplied by an engineering colleague who was an expert witness in the case. We have given the company the fictitious name of "XYZ." For a more complete account, see R. W. Flumerfelt, C. E. Harris, M. J. Rabins, and C. H. Samson, *Introducing Ethics Case Studies into Required Undergraduate Engineering Courses*, pp. 287–312.