Online Ethics Center
FOR ENGINEERING AND SCIENCE

Evaluation & Assessment Bibliography

Author(s)

Kelly Laas

Year

2016

Description

This bibliography includes resources for assessing students' competence in ethics as well as for evaluating the effectiveness of ethics instruction. It also has a section looking at methods for assessing the ethical climate of an organization.

Body

Evaluation of Instructional Methods - Course Level

Antes, Allison, Stephen T. Murphy, Ethan O. Waples, Michael D. Mumford,, Ryan P. Brown, Shane Connelly, Lynn D. Deveport. 2009. "A Meta-Analysis for Ethics Instruction Effectiveness in the Sciences *Ethics and Behavior* 19(5), 379-402." Doi: 10.1080/10508420903035380

In the present study, the authors conducted a quantitative meta-analysis based on 26 previous ethics program evaluation efforts of responsible conduct of research courses in the sciences, and the results showed that the overall effectiveness of ethics instruction was modest. The effects of ethics instruction, however, were

related to a number of instructional program factors, such as course content and delivery methods, in addition to factors of the evaluation study itself, such as the field of investigator and criterion measure utilized. An examination of the characteristics contributing to the relative effectiveness of instructional programs revealed that more successful programs were conducted as seminars separate from the standard curricula rather than being embedded in existing courses. Furthermore, more successful programs were case based and interactive, and they allowed participants to learn and practice the application of real-world ethical decision-making skills.

Cates, Cheryl, and Bryan Dansberry. 2004. "A Professional Ethics Learning Module For Use in Co-operative Education*." *Science & Engineering Ethics* 10 (2):401-407.

The Professional Practice Program, also known as the co-operative education (co-op) program, at the University of Cincinnati (UC) is designed to provide eligible students with the most comprehensive and professional preparation available. Beginning with the Class of 2006, students in UC's Centennial Co-op Class will be following a new co-op curriculum centered around a set of learning outcomes Regardless of their particular discipline, students will pursue common learning outcomes by participating in the Professional Practice Program, which will cover issues of organizational culture, technology, professional ethics, and the integration of theory and practice. During their third co-op work term, students will complete a learning module on Professional Ethics. To complete the learning module students must familiarize themselves with the code of ethics for their profession, create a hypothetical scenario portraying an ethical dilemma that involves issues covered by the code, resolve the dilemma, and explain why their resolution is the best course of action based upon the code of ethics. A three-party assessment process including students, employers and faculty complete the module.

Clancy, Edward A, Paula Quinn, and Judith E. Miller. 2005. “Assessment of a Case Study Laboratory to Increase Awareness of Ethical Issues in Engineering.” IEEE Transactions on Education. 48 2:313-17.

This article discusses the assessment of a three-hour “laboratory period,” during which students read and discussed three short cases on engineering ethics. The assessment included focus groups and surveys, and while in focus groups students agreed that this activity enhanced their awareness of ethical issues, the survey results, however, were equivocal.

Cruz, José A., and William J. Frey. 2003. "An Effective Strategy for Integrating Ethics Across the Curriculum in Engineering: An ABET 2000 Challenge." *Science & Engineering Ethics* 9 (4):543-568.

This paper describes a one-day workshop format for introducing ethics into the engineering curriculum prepared at the University of Puerto Rico at Mayagüez (UPRM). It responds to the ethics criteria newly integrated into the accreditation process by the Accreditation Board of Engineering and Technology (ABET). It also employs an ethics across the curriculum (EAC) approach; engineers identify the ethical issues, write cases that dramatize these issues, and then develop exercises making use of these cases that are specially tailored to mainstream engineering classes. The different activities and strategies employed in this workshop are set forth. Specific references are made to the cases and exercises developed as a result of these workshops. The paper ends by summarizing the different assessments made of the workshop by addressing the following questions: how did it contribute to the overall ABET effort at UPRM; could other universities benefit from a similar activity; and how did the participants evaluate the workshop?

Davis, Michael, and Alan Feinerman. 2012. "Assessing Graduate Student Progress in Engineering Ethics." *Science and Engineering Ethics* 18 (2):351-367.

Under a grant from the National Science Foundation, the authors (and others) undertook to integrate ethics into graduate engineering classes at three universities -- and to assess success in a way allowing comparison across classes (and institutions). This paper describes the attempt to carry out that assessment. Standard methods of assessment turned out to demand too much class time. Under pressure from instructors, the authors developed an alternative method that is both specific in content to individual classes and allows comparison across classes. Results are statistically significant for ethical sensitivity and knowledge. They show measurable improvement in a single semester.

Fan, Y., X. Zhang, and X. Xie. 2015. "Design and Development of a Course in Professionalism and Ethics for CDIO Curriculum in China." *Science and Engineering Ethics* 21 (5):1381-9. doi: 10.1007/s11948-014-9592-2.

At Shantou University (STU) in 2008, a stand-alone engineering ethics course was first included within a Conceive-Design-Implement-Operate (CDIO) curriculum to address the scarcity of engineering ethics education in China. The philosophy of the

course design is to help students to develop an in-depth understanding of social sustainability and to fulfill the obligations of engineers in the twenty-first century within the context of CDIO engineering practices. To guarantee the necessary cooperation of the relevant parties, we have taken advantage of the top-down support from the STU administration. Three themes corresponding to contemporary issues in China were chosen as the course content: engineers' social obligations, intellectual property and engineering safety criteria. Some popular pedagogies are used for ethics instruction such as case studies and group discussions through role-playing. To impart the diverse expertise of the practical professional practice, team teaching is adopted by interdisciplinary instructors with strong qualifications and industrial backgrounds. Although the assessment of the effectiveness of the course in enhancing students' sense of ethics is limited to assignment reports and class discussions, our endeavor is seen as positive and will continue to sustain the CDIO reform initiatives of STU.

Feldhaus, Charles R., and Patricia L. Fox. 2004. "Effectiveness of an Ethics Course Delivered in Traditional and Non-Traditional Formats*." *Science & Engineering Ethics* 10 (2):389-400.

This paper details a three-credit-hour undergraduate ethics course that was delivered using traditional, distance, and compressed formats. OLS 263: Ethical Decisions in Leadership is a 200-level course offered by the Department of Organizational Leadership and Supervision in the Purdue School of Engineering and Technology at Indiana University Purdue University Indianapolis (IUPUI). Students in engineering, technology, business, nursing, and other majors take the course. In an effort to determine student perceptions of course and instructor effectiveness, end-of-course student survey data were compared using data from traditional, distance, and compressed sections of the course. In addition, learning outcomes from the final course project were evaluated using a standardized assessment rubric and scores on the course project.

Finelli, Cynthia J., Matthew A. Holsapple, Ra Eunjong, Rob M. Bielby, Brian A. Burt, Donald D. Carpenter, Trevor S. Harding, and Janel A. Sutkus. 2012. "An Assessment of Engineering Students' Curricular and Co-Curricular Experiences and Their Ethical Development." *Journal of Engineering Education* 101 (3):469-494.

We apply a conceptual framework to the study of engineering students' ethical development. This framework suggests that both formal curricular experiences and

co-curricular experiences are related to students' ethical development. Using survey data collected from nearly 4,000 engineering undergraduates at 18 institutions across the U.S., we present descriptive statistics related to students' formal curricular experiences and their co-curricular experiences. Additionally, we present data for three constructs of ethical development (knowledge of ethics, ethical reasoning, and ethical behavior). Our data highlight opportunities for improving the engineering undergraduate/bachelor's level curricula in order to have a greater impact on students' ethical development. We suggest that institutions integrate ethics instruction throughout the formal curriculum, support use of varied approaches that foster high-quality experiences, and leverage both influences of co-curricular experiences and students' desires to engage in positive ethical behaviors.

Goldin, Ilya M., Rosa Lynn Pinkus, and Kevin Ashley. 2015. "Validity and Reliability of an Instrument for Assessing Case Analyses in Bioengineering Ethics Education." ***Science and Engineering Ethics*** **21 (3):789-807. doi: 10.1007/s11948-015-9644-2.**

Assessment in ethics education faces a challenge. From the perspectives of teachers, students, and third-party evaluators like the Accreditation Board for Engineering and Technology and the National Institutes of Health, assessment of student performance is essential. Because of the complexity of ethical case analysis, however, it is difficult to formulate assessment criteria, and to recognize when students fulfill them. Improvement in students' moral reasoning skills can serve as the focus of assessment. In previous work, Rosa Lynn Pinkus and Claire Gloeckner developed a novel instrument for assessing moral reasoning skills in bioengineering ethics. In this paper, we compare that approach to existing assessment techniques, and evaluate its validity and reliability. We find that it is sensitive to knowledge gain and that independent coders agree on how to apply it.

Hashemian, Golnaz, and Michael C. Loui. 2010. "Can Instruction in Engineering Ethics Change Students’ Feelings about Professional Responsibility?" ***Science & Engineering Ethics*** **16 (1):201-215. doi: 10.1007/s11948-010-9195-5.**

How can a course on engineering ethics affect an undergraduate student’s feelings of responsibility about moral problems? In this study, three groups of students were interviewed: six students who had completed a specific course on engineering ethics, six who had registered for the course but had not yet started it, and six who had not taken or registered for the course. Students were asked what they would do

as the central character, an engineer, in each of two short cases that posed moral problems. For each case, the role of the engineer was successively changed and the student was asked how each change altered his or her decisions about the case. Students who had completed the ethics course considered more options before making a decision, and they responded consistently despite changes in the cases. For both cases, even when they were not directly involved, they were more likely to feel responsible and take corrective action. Students who were less successful in the ethics course gave answers similar to students who had not taken the course. This latter group of students seemed to have weaker feelings of responsibility: they would say that a problem was "not my business." It appears that instruction in ethics can increase awareness of responsibility, knowledge about how to handle a difficult situation, and confidence in taking action.

Heitman, Elizabeth, Cara H. Olsen, Lida Anestidou, and Ruth Ellen Bulger. 2007. "New graduate students' baseline knowledge of the responsible conduct of research." Academic Medicine 82(9): 838-845. doi: 10.1097/ACM.0b013e31812f7956

To assess (1) new biomedical science graduate students' baseline knowledge of core concepts and standards in responsible conduct of research (RCR), (2) differences in graduate students' baseline knowledge overall and across the Office of Research Integrity's nine core areas, and (3) demographic and educational factors in these differences, the authors developed a 30 question multiple choice test and asked new graduate students to take the test. They found that the students had inadequate and inconsistent knowledge of RCR, regardless of what type of former training they had gone through.

Keefer, Matthew W., and Michael Davis. 2012. "Curricular Design and Assessment in Professional Ethics Education: Some Practical Advice." ***Teaching Ethics: The Journal of the Society for Ethics across the Curriculum*** **13 (1):81-90.**

Written by a philosopher and an educational psychologist, this article offers some practical advice and examples on designing assignments for a professional ethics course and assessing students' work.

Keefer, Matthew, Sara Wilson, Harry Dankowicz, and Michael Loui. 2014. "The Importance of Formative Assessment in Science and Engineering Ethics Education: Some Evidence and Practical Advice." ***Science &***

***Engineering Ethics* 20 (1):249-260. doi: 10.1007/s11948-013-9428-5.**
Recent research in ethics education shows a potentially problematic variation in content, curricular materials, and instruction. While ethics instruction is now widespread, studies have identified significant variation in both the goals and methods of ethics education, leaving researchers to conclude that many approaches may be inappropriately paired with goals that are unachievable. This paper speaks to these concerns by demonstrating the importance of aligning classroom-based assessments to clear ethical learning objectives in order to help students and instructors track their progress toward meeting those objectives. Two studies at two different universities demonstrate the usefulness of classroom-based, formative assessments for improving the quality of students' case responses in computational modeling and research ethics.

Kirkman, R. (2008). Teaching for Moral Imagination: Assessment of a Course in Environmental Ethics. *Teaching Philosophy, 31*(4), 333-350.
This paper reports the results of an assessment project conducted in a semester-length course in environmental ethics. The first goal of the project was to measure the degree to which the course succeeded in meeting its overarching goal of enriching students' moral imagination and its more particular objectives relating to ethics in the built environment. The second goal of the project was to contribute toward a broader effort to develop assessment tools for ethics education. Through qualitative analysis of an exit survey and of a pair of writing assignments, the study yielded some promising results, outlined here, and suggested particular ways of improving both the course and the assessment procedure.

Kalichman, Michael W., Matthew A. Allison and Sean T. Powell. 2007. "Effectiveness of a Responsible Conduct of Research Course: A Preliminary Study." *Science and Engineering Ethics* 13(2), 246-264.
Training in the responsible conduct of research (RCR) is required for many research trainees nationwide, but little is known about its effectiveness. For a preliminary assessment of the effectiveness of a short-term course in RCR, medical students participating in an NIH-funded summer research program at the University of California, San Diego (UCSD) were surveyed using an instrument developed through focus group discussions. In the summer of 2003, surveys were administered before and after a short-term RCR course, as well as to alumni of the courses given in the summers of 2002 and 2001. Survey responses were analyzed in the areas of knowledge, ethical decision-making skills, attitudes about responsible conduct of

research, and frequency of discussions about RCR outside of class. The only statistically significant improvement associated with the course was an increase in knowledge, while there was a non-significant tendency toward improvements in ethical decision-making skills and attitudes about the importance of RCR training. The nominal impact of a short-term training course should not be surprising, but it does raise the possibility that other options for delivering information only, such as an Internet-based tutorial, might be considered as comparable alternatives when longer courses are not possible.

Moore, Christy, Hart, Hilar., Randall, D'Arcy, & Nichols, Steven P. 2006." PRiME: Integrating Professional Responsibility into the Engineering Curriculum". *Science & Engineering Ethics,* 12(2), 273-289. doi: 10.1007/s11948-006-0027-6

Engineering educators have long discussed the need to teach professional responsibility and the social context of engineering without adding to overcrowded curricula. The PRiME (Professional Responsibility Modules for Engineering) Project (http://www.engr.utexas.edu/ethics/primeModules.cfm) described in this paper was initiated at the University of Texas, Austin to provide web-based modules that could be integrated into any undergraduate engineering class. Using HPL (How People Learn) theory, PRiME developed and piloted four modules during the academic year 2004-2005. This article introduces the modules and the pilot, outlines the assessment process, analyzes the results, and describes how the modules are being revised in light of the initial assessment. In its first year of development and testing, PRiME made significant progress towards meeting its objectives.

Mumford, Michael D., et al. 2008. "A Sensemaking Approach to Ethics Training for Scientists: Preliminary Evidence of Training Effectiveness. " *Ethics & Behavior,* 18(4), 315-339. doi:10.1080/10508420802487815

In recent years, we have seen a new concern with ethics training for research and development professionals. Although ethics training has become more common, the effectiveness of the training being provided is open to question. In the present effort, a new ethics training course was developed that stresses the importance of the strategies people apply to make sense of ethical problems. The effectiveness of this training was assessed in a sample of 59 doctoral students working in the biological and social sciences using a pre–post design with follow-up and a series of ethical decision-making measures serving as the outcome variable. Results showed not only that this training led to sizable gains in ethical decision making but also that

these gains were maintained over time. The implications of these findings for ethics training in the sciences are discussed.

Mumford, Michael D., Steele, Logan., & Watts, Logan. L. 2015. "Evaluating Ethics Education Programs: A Multilevel Approach." ***Ethics & Behavior,*** **25(1), 37-60. doi:10.1080/10508422.2014.917417**

Although education in the responsible conduct of research is considered necessary, evidence bearing on the effectiveness of these programs in improving research ethics has indicated that, although some programs are successful, many fail. Accordingly, there is a need for systematic evaluation of ethics education programs. In the present effort, the authors examine procedures for evaluation of ethics education programs from a multilevel perspective: examining both within-program evaluation and cross-program evaluation. With regard to within-program evaluation, we note requisite designs and measures for conducting systematic program evaluation have been developed and multiple measures should be applied in program evaluation. With regard to cross-program evaluation, we argue that a meta-analytic framework should be employed where analyses are used to identify best practices in ethics education. The implications of this multilevel approach for improving responsible conduct of research educational programs are discussed.

Pimple, Kenneth. 2001 "Assessing Student Learning in the Responsible Conduct of Research" Poynter Center for the Study of Ethics in American Institutions, Indiana University.

Discusses challenges in assessing ethics instruction, forming realistic expectations and goals, and suggests some possible ways to assess students in courses and workshops.

Pinkus, Rosa, Claire Gloeckner, and Angela Fortunato. 2015. "The Role of Professional Knowledge in Case-Based Reasoning in Practical Ethics." ***Science & Engineering Ethics*** **21 (3):767-787. doi: 10.1007/s11948-015-9645-1.**

While there is a general consensus that case studies play a central role in the teaching of professional ethics, there is still much to be learned regarding how professionals learn ethics using case-based reasoning. This paper reports the results of a study designed to investigate one of the issues in teaching case-based ethics: the role of one's professional knowledge in learning methods of moral reasoning. Using a novel assessment instrument, we compared case studies written

and analyzed by three groups of students whom we classified as: (1) Experts in a research domain in bioengineering. (2) Novices in a research domain in bioengineering. (3) The non- research group-students using an engineering domain in which they were interested but had no in-depth knowledge. This study demonstrates that a student's level of understanding of a professional knowledge domain plays a significant role in learning moral reasoning skills.

Plemons, Dena K., Suzanne A. Brody and Michael W. Kalichman. 2006 "Student Perceptions of the Effectiveness of Education in the Responsible Conduct of Research." ***Science and Engineering Ethics.*** **12(3), 574-582.**
Responsible conduct of research (RCR) courses are widely taught, but little is known about the purposes or effectiveness of such courses. As one way to assess the purposes of these courses, students were surveyed about their perspectives after recent completion of one of eleven different research ethics courses at ten different institutions. Participants (undergraduate and graduate students, post-doctoral fellows and faculty, staff and researchers) enrolled in RCR courses in spring and fall of 2003 received a voluntary, anonymous survey from their instructors at the completion of the course. Responses were received from 268 participants. Seventy-seven percent of open-ended responses listed specific kinds of information learned; only a few respondents talked about changes in skills or attitudes. The two principal findings of this multi-institutional study are that respondents reported: (1) a wide variety of positive outcomes for research ethics courses, but that (2) the impact on knowledge was greater than that for changes in skills or attitudes.

Rudnicka, Ewa A. 2005. "Ethics in an Operations Management Course." Science and Engineering Ethics. 11 4:645-654.
Article includes a model of a grading rubric for evaluating students' understanding of ethics case studies.

Schonfeld, Toby, Erin L. Dahlke, and John M. Longo. 2011. "Pre-test/Post-test Results from an Online Ethics Course: Qualitative Assessment of Student Learning." ***Teaching Philosophy*** **34 (3):273-290.**
This paper describes a project that attempted to assess whether or not an online course was an effective way to teach applied ethics to students preparing for the health professions by qualitatively analyzing responses to a pretest and post-test administered to students in the course. While previous studies have reported various findings regarding the success of online ethics courses, the authors of this study

failed to demonstrate that students gained a greater understanding of key concepts in ethics -- respect for autonomy, decisional capacity, informed consent, and role of the provider. The findings demonstrate the need for better subjective methods of evaluation and raise questions regarding the efficacy of current models of online ethics courses for health professional students.

Schonfeld, Toby, Hugh Stoddard, and Cory Andrew Labrecque. 2014. "Examining Ethics Developing a Comprehensive Exam for a Bioethics Master's Program." *Cambridge Quarterly of Healthcare Ethics* 23 (4):461-471. doi: 10.1017/s0963180114000139.

In this article, the authors describe the rationale, development process, and features of the comprehensive exam they created as a culminating experience of a master's program in bioethics. The exam became the students' opportunity to demonstrate the way they were able to integrate course, textual, and practical knowledge gained throughout the experience of the program. Additionally, the exam assessed students' proficiency in the field of bioethics and their ability to critically and constructively analyze bioethical issues. In this article, the authors offer tips to other exam creators regarding our experiences with question and answer development, scoring of the exam, and relationships between coursework and exam preparation and completion.

Seiler, Stephanie N., Brummel, Bradley J., Anderson, Kerri L., Kim, Kyoung Jin., Wee, Serena., Gunsalus, C. K., & Loui, Michael C. 2011.“ Outcomes Assessment of Role-Play Scenarios for Teaching Responsible Conduct of Research.” *Accountability in Research: Policies & Quality Assurance,* 18(4), 217-246. doi:10.1080/08989621.2011.584760

The authors describe the summative assessment of role-play scenarios used to teach topics in the responsible conduct of research (RCR) to graduate students in science and engineering. Interviews with role-play participants, with participants in a case discussion training session, and with untrained students suggested that role-playing might promote a deeper appreciation of RCR. The authors also present the results of a think-aloud case analysis study and describe the development of a behaviorally-anchored rating scale (BARS) to assess participants' case analysis performance.

Sim, Kang, Sum, Min Yi, & Navedo, Deborah. 2015.” Use of narratives to enhance learning of research ethics in residents and researchers.” *BMC*

***Medical Education,* 15, 41. doi:10.1186/s12909-015-0329-y**
This article discusses the assessment methods and results of incorporating narratives into the learning environment of a research ethics course. The narratives were chosen from the history of research ethics and the humanities literature related to human subject research. and learners were asked to provide post-session feedback through an anonymised questionnaire on their learning session. An outcomes logic model was used for assessment with focus on immediate outcomes such as engagement, motivation, understanding and reflective learning. The study found that the majority of learners felt engaged, more motivated to learn, and better equipped about the subject matter. Better appreciation of the learning topic, engagement, motivation to learn, equipping were strongly correlated with the promotion of reflective learning, effectiveness of teaching, promotion of critical thinking and overall positive rating of the teaching session on research ethics.

Wilson, William. 2013. "Using the Chernobyl Incident to Teach Engineering Ethics." *Science & Engineering Ethics* 19 (2):625-640. doi: 10.1007/s11948-011-9337-4.
This paper discusses using the Chernobyl Incident as a case study in engineering ethics instruction. Groups of students are asked to take on the role of a faction involved in the Chernobyl disaster and to defend their decisions in a mock debate. The results of student surveys and the Engineering and Science Issues Test indicate that the approach is very popular with students and has a positive impact on moral reasoning. The approach incorporates technical, communication and teamwork skills and has many of the features suggested by recent literature.

Zhu, Qhu., & Zoltowski, Carla B., & Feister, Megan. K., & Buzzanell, Patrice M., & Oakes, William. C., & Mead, Alan D. 2014. "The Development of an Instrument for Assessing Individual Ethical Decisionmaking in Project-based Design Teams: Integrating Quantitative and Qualitative Methods." Paper presented at 2014 ASEE Annual Conference, Indianapolis, IN.
This paper introduces the development of an instrument for assessing individual ethical decision making in a project-based design context.

Evaluation and Assessment of Institution-wide Programs and

Educational Approaches

Ajuwon, A. J., and N. Kass. 2008. "Outcome of a research ethics training workshop among clinicians and scientists in a Nigerian university." *BMC Med Ethics* 9:1. doi: 10.1186/1472-6939-9-1.

In Nigeria, as in other developing countries, access to training in research ethics is limited, due to weak social, economic, and health infrastructure. The project described in this article was designed to develop the capacity of academic staff of the College of Medicine, University of Ibadan, Nigeria to conduct ethically acceptable research involving human participants. Three in-depth interviews and one focus group discussion were conducted to assess the training needs of participants. A research ethics training workshop was then conducted with College of Medicine faculty. A 23-item questionnaire that assessed knowledge of research ethics, application of principles of ethics, operations of the Institutional Review Board (IRB) and ethics reasoning was developed to be a pre-post test evaluation of the training workshop. Ninety-seven workshop participants completed the questionnaire before and after the workshop; 59 of them completed a second post-test questionnaire one month after the workshop. The training improved participants' knowledge of principles of research ethics, international guidelines and regulations and operations of IRBs. It thus provided an opportunity for research ethics capacity development among academic staff in a developing country institution.

Bebeau, Muriel J. 2002. “The Defining Issues Test and Four Component Model: Contributions to Professional Education.” Journal of Moral Education. 31 3: 271-295.

Describes the development of a standardized test that can be used to measure the growth of moral reasoning skills in students over time.

Berry, Roberta M., Jason Borenstein, and Robert J. Butera. 2013. "Contentious Problems in Bioscience and Biotechnology: A Pilot Study of an Approach to Ethics Education." *Science and Engineering Ethics* 19 (2):653-668. doi: 10.1007/s11948-012-9359-6.

This manuscript describes a pilot study in ethics education employing a problem-based learning approach to the study of novel, complex, ethically fraught, unavoidably public, and unavoidably divisive policy problems, called "fractious problems," in bioscience and biotechnology. Diverse graduate and professional

students from four US institutions and disciplines spanning science, engineering, humanities, social science, law, and medicine analyzed fractious problems employing "navigational skills" tailored to the distinctive features of these problems. The students presented their results to policymakers, stakeholders, experts, and members of the public. This approach may provide a model for educating future bioscientists and bioengineers so that they can meaningfully contribute to the social understanding and resolution of challenging policy problems generated by their work.

Borenstein, Jason, Matthew J. Drake, Robert Kirkman, and Julie L. Swann. 2010. "The Engineering and Science Issues Test (ESIT): A Discipline-Specific Approach to Assessing Moral Judgment." ***Science & Engineering Ethics*** **16 (2):387-407. doi: 10.1007/s11948-009-9148-z.**

Describes a tool called the Engineering and Science Issues Test (ESIT). ESIT measures moral judgment in a manner similar to the Defining Issues Test, second edition, but is built around technical dilemmas in science and engineering. The authors used a quasi-experimental approach with pre- and post-tests, and compared the results to those of a control group with no overt ethics instruction. Their findings are that several (but not all) stand-alone classes showed a significant improvement compared to the control group when the metric includes multiple stages of moral development.

Brock, Meagan E., Andrew Vert, Vykinta Kligyte, Ethan P. Waples, Sydney T. Sevier, and Michael D. Mumford. 2008. "Mental Models: An Alternative Evaluation of a Sensemaking Approach to Ethics Instruction." ***Science & Engineering Ethics*** **14 (3):449-472. doi: 10.1007/s11948-008-9076-3.**

In spite of the wide variety of approaches to ethics training it is still debatable which approach has the highest potential to enhance professionals' integrity. The current effort assesses a novel curriculum that focuses on metacognitive reasoning strategies researchers use when making sense of day-to-day professional practices that have ethical implications. The evaluated trainings effectiveness was assessed by examining five key sensemaking processes, such as framing, emotion regulation, forecasting, self-reflection, and information integration that experts and novices apply in ethical decision-making. Mental models of trained and untrained graduate students, as well as faculty, working in the field of physical sciences were compared using a think-aloud protocol 6 months following the ethics training. Evaluation and

comparison of the mental models of participants provided further validation evidence for sensemaking training. Specifically, it was found that trained students applied metacognitive reasoning strategies learned during training in their ethical decision-making that resulted in complex mental models focused on the objective assessment of the situation. Mental models of faculty and untrained students were externally-driven with a heavy focus on autobiographical processes. The study shows that sensemaking training has a potential to induce shifts in researchers' mental models by making them more cognitively complex via the use of metacognitive reasoning strategies. Furthermore, field experts may benefit from sensemaking training to improve their ethical decision-making framework in highly complex, novel, and ambiguous situations.

Carrese, Joseph A., Janet Malek, Katie Watson, Lisa Soleymani Lehmann, Michael J. Green, Laurence B. McCullough, Gail Geller, Clarence H. Braddock, III, and David J. Doukas. 2015. "The Essential Role of Medical Ethics Education in Achieving Professionalism: The Romanell Report." ***Academic Medicine*** **90 (6):744-752. doi: 10.1097/acm.0000000000000715.**
This article-the Romanell Report-offers an analysis of the current state of medical ethics education in the United States, focusing in particular on its essential role in cultivating professionalism among medical learners. Education in ethics has become an integral part of medical education and training over the past three decades and has received particular attention in recent years because of the increasing emphasis placed on professional formation by accrediting bodies such as the Liaison Committee on Medical Education and the Accreditation Council for Graduate Medical Education. Yet, despite the development of standards, milestones, and competencies related to professionalism, there is no consensus about the specific goals of medical ethics education, the essential knowledge and skills expected of learners, the best pedagogical methods and processes for implementation, and optimal strategies for assessment. Moreover, the quality, extent, and focus of medical ethics instruction vary, particularly at the graduate medical education level. Although variation in methods of instruction and assessment may be appropriate, ultimately medical ethics education must address the overarching articulated expectations of the major accrediting organizations. With the aim of aiding medical ethics educators in meeting these expectations, the Romanell Report describes current practices in ethics education and offers guidance in several areas: educational goals and objectives, teaching methods, assessment strategies, and other challenges and opportunities (including course structure and faculty

development). The report concludes by proposing an agenda for future research.

Carpenter, D., Harding, T., Sutkus, J., and Finelli, C. 2014. "Assessing the Ethical Development of Civil Engineering Undergraduates in Support of the ASCE Body of Knowledge." ***Journal of Professional Issues in Engineering Education and Practice*** **140 (4):A4014001. doi: doi:10.1061/(ASCE)EI.1943-5541.0000177.**

Developing engineers must be aware that technological development and emerging global issues will require a keen sense of ethical responsibility. Therefore, they must be prepared to reason through and act appropriately on the ethical dilemmas they will experience as professionals. From a civil engineering professional perspective, graduates need to conform to the ASCE Body of Knowledge as they prepare for the Vision of 2025. This investigation evaluated different institutional approaches for ethics education with a goal of better preparing students to be ethical professionals. The project included visiting 19 diverse partner institutions and collecting data from nearly 150 faculty and administrators and more than 4,000 engineering undergraduates including 567 civil engineering undergraduates who completed the survey. Findings suggest that co-curricular experiences have an important influence on ethical development, that quality of instruction is more important than quantity of curricular experiences, that students are less likely to be satisfied with ethics instruction when they have higher ethical reasoning skills, and that the institutional culture makes affects how students behave and how they articulate concepts of ethics. Overall, regression analysis indicates that civil engineering student responses were consistent with the overall engineering undergraduate population. Finally, the research suggests the curricular foundation is in place, but that institutions need to improve their curricular and co-curricular offerings to facilitate ethical development of students and fulfill ASCE Body of Knowledge outcomes.

Culver, Steven, Ishwar Puri, Richard Wokutch, and Vinod Lohani. 2013. "Comparison of Engagement with Ethics Between an Engineering and a Business Program." ***Science & Engineering Ethics*** **19 (2):585-597. doi: 10.1007/s11948-011-9346-3.**

Increasing university students' engagement with ethics is becoming a prominent call to action for higher education institutions, particularly professional schools like business and engineering. This paper provides an examination of student attitudes regarding ethics and their perceptions of ethics coverage in the curriculum at one institution. A particular focus is the comparison between results in the business

college, which has incorporated ethics in the curriculum and has been involved in ethics education for a longer period, with the engineering college, which is in the nascent stages of developing ethics education in its courses. Results show that student attitudes and perceptions are related to the curriculum. In addition, results indicate that it might be useful for engineering faculty to use business faculty as resources in the development of their ethics curricula.

Curzer, Howard J., Sabrina Sattler, and Devin G. DuPree. 2014. "Do Ethics Classes Teach Ethics?" ***Theory and Research in Education*** **12 (3):366-382.**
The ethics assessment industry is currently dominated by the second version of the Defining Issues Test (DIT2). In this article, we describe an alternative assessment instrument called the Sphere-Specific Moral Reasoning and Theory Survey (SMARTS), which measures the respondent's level of moral development in several respects. We describe eight difficulties that an instrument must overcome in order to assess ethics classes successfully. We argue that the DIT2 fails to solve these problems, and that the SMARTS succeeds. The SMARTS was administered as pretest and post-test during several semesters to ethics and nonethics classes. Ethics students improved significantly more than nonethics students in both moral theory choice and moral reasoning. Thus, ethics classes do indeed teach ethics.

Davis, Michael, Elisabeth Hildt, and Kelly Laas. 2016. " Twenty-Five Years of Ethics Across the Curriculum." ***Teaching Ethics*** **16 (1). doi: 10.5840/tej201633028**
After twenty-five years of integrating ethics across the curriculum at the Illinois Institute of Technology (IIT), the Center for the Study of Ethics in the Professions conducted a survey of full-time faculty to investigate: a) what ethical topics faculty thought students from their discipline should be aware of when they graduate, b) how widely ethics is currently being taught at the undergraduate and graduate level, c) what ethical topics are being covered in these courses, and d) what teaching methods are being used. The survey found that while progress spreading ethics across the curriculum has been substantial, it remains incomplete. The faculty think more should be done. From these findings the authors draw six lessons for ethics centers engaged in encouraging ethics across the curriculum.

Feldhaus, Charles R., Robert M. Wolter, Stephen P. Hundley, and Tim Diemer. 2006. "A Single Instrument: Engineering and Engineering Technology Students Demonstrating Competence in Ethics and Professional Standards." ***Science & Engineering Ethics*** **12 (2):291-311.**
This paper details efforts by the Purdue School of Engineering and Technology at Indiana University Purdue University Indianapolis (IUPUI) to create a single instrument for honors science, technology, engineering and mathematics (STEM) students wishing to demonstrate competence in the IUPUI Principles of Undergraduate Learning (PUL's) and Accreditation Board for Engineering and Technology (ABET) Engineering Accreditation Criterion (EAC) and Technology

Accreditation Criterion (TAC) 2, a through k. Honors courses in Human Behavior, Ethical Decision-Making, Applied Leadership, International Issues and Leadership Theories and Processes were created along with a specific menu of activities and an assessment rubric based on PUL's and ABET criteria to evaluate student performance in the aforementioned courses. Students who complete the series of 18 Honors Credit hours are eligible for an Honors Certificate in Leadership Studies from the Department of Organizational Leadership and Supervision. Finally, an accounting of how various university assessment criteria, in this case the IUPUI Principles of Undergraduate Learning, can be linked to ABET outcomes and prove student competence in both, using the aforementioned courses, menu of items, and assessment rubrics; these will be analyzed and discussed.

Fowers, Blaine J. 2014. "Toward Programmatic Research on Virtue Assessment: Challenges and Prospects." ***Theory and Research in Education*** **12 (3):309-328.**

Poor construct definition has characterized research on virtue, beginning with Hartshorne and May's honesty studies and continuing to the present. Recently, scholars have begun to define virtues in ways that improve the prospects for measuring virtue constructs, but a coordinated, programmatic approach is necessary for success in virtue measurement. A brief overview of the construct of virtue includes six key elements that can structure virtue assessment design. Recent research on the trait/situation problem suggests that situational factors do not obviate traits. Veridicality issues such as social desirability and positive illusions are significant challenges for self-report virtue measurement. In summary self-report measures, these challenges can be met with a number of methods, including directly assessing social desirability and item construction to remove social desirability. These challenges can also be met using other reports, experience sampling, or experimental procedures. A brief discussion of construct validity in virtue measurement leads to the conclusion that many studies with a variety of methods are necessary to establish valid measures of virtue.

Funk, Carolyn L., Kirsten A. Barrett, and Francis L. Macrina. 2007. "Authorship and Publication Practices: Evaluation of the Effect of Responsible Conduct of Research Instruction to Postdoctoral Trainees." ***Accountability in Research: Policies & Quality Assurance*** **14 (4):269-305. doi: 10.1080/08989620701670187.**

We have studied postdoctoral trainees funded by NIH F32 fellowship awards in order

to test the effectiveness of responsible conduct of research (RCR) education in the areas of authorship and publication practices. We used a 3-wave telephone and on-line survey design, conducted over a period of two years, in order to test for individual change before and after completing RCR education. Overall the responses of the subjects suggested a clear awareness of standards and practices in publication. However, our results failed to suggest that RCR education in this group significantly increased the level of ethically appropriate behavioral responses measured in the study. Similarly we saw no significant effect on increasing awareness of or attention to ethical guidelines about authorship and publication practices. Our interpretation of these null findings was influenced by the significant publication experience of our cohort of subjects. We forward possible explanations for these null findings in this context. Most importantly, we do not suggest that our results argue against continued instruction in RCR education. Instead, we believe our data reinforce the importance of careful articulation of course goals and objectives with attention to the background and experience of the student audience when developing RCR curricula.

Helton-Fauth, Whitney, Blaine Gaddis, Ginamarie Scott, Michael Mumford, Lynn Devenport, Shane Connelly, and Ryan Brown. 2003. "A New Approach to Assessing Ethical Conduct in Scientific Work." ***Accountability in Research: Policies & Quality Assurance*** **10 (4):205-228. doi: 10.1080/08989620390263708.**

The intent of the current article is to describe the development of a new approach to the study of ethical conduct in scientific research settings. The approach presented in this article has two main components. The first component entails the development of a taxonomy of ethical events as they occur across a broad range of scientific disciplines. The second involves the identification of proximate criteria that will allow systematic and objective evaluation of ethical behaviors through low-fidelity performance simulations. Two proposed measures based on the new approach are intended to identify and measure variations in the scientific environment that might predispose certain individuals to make unethical decisions.

Kligyte, Vykinta, Richard T. Marcy, Ethan P. Waples, Sydney T. Sevier, Elaine S. Godfrey, Michael D. Mumford, and Dean F. Hougen. 2008. "Application of a Sensemaking Approach to Ethics Training in the Physical Sciences and Engineering." ***Science & Engineering Ethics*** **14 (2):251-278. doi: 10.1007/s11948-007-9048-z.**

One ethics education approach that shows some promise in improving researchers' integrity has focused on the development of ethical decision-making skills. The current effort proposes a novel curriculum that focuses on broad metacognitive reasoning strategies researchers use when making sense of day-to-day social and professional practices that have ethical implications for the physical sciences and engineering. This sensemaking training has been implemented in a professional sample of scientists conducting research in electrical engineering, atmospheric and computer sciences at a large multi-cultural, multi-disciplinary, and multi-university research center. A pre-post design was used to assess training effectiveness using scenario-based ethical decision-making measures. The training resulted in enhanced ethical decision-making of researchers in relation to four ethical conduct areas, namely data management, study conduct, professional practices, and business practices. Broad implications of the findings for ethics training development, implementation, and evaluation in the sciences are also discussed.

Martin, April, Zhanna Bagdasarov, and Shane Connelly. 2015. "The Capacity for Ethical Decisions: The Relationship Between Working Memory and Ethical Decision Making." *Science & Engineering Ethics* 21 (2):271-292. doi: 10.1007/s11948-014-9544-x.

Although various models of ethical decision making (EDM) have implicitly called upon constructs governed by working memory capacity (WMC), a study examining this relationship specifically has not been conducted. Using a sense making framework of EDM, we examined the relationship between WMC and various sensemaking processes contributing to EDM. Participants completed an online assessment comprised of a demographic survey, intelligence test, various EDM measures, and the Automated Operation Span task to determine WMC. Results indicated that WMC accounted for unique variance above and beyond ethics education, exposure to ethical issues, and intelligence in several sensemaking processes.

Mecca, J. T., K. E. Medeiros, V. Giorgini, C. Gibson, M. D. Mumford, S. Connelly, and L. D. Devenport. 2014. "The Influence of Compensatory Strategies on Ethical Decision Making." Ethics and Behavior 24 (1):73-89. doi: 10.1080/10508422.2013.821389.

Ethical decision making is of concern to researchers across all fields. However, researchers typically focus on the biases that may act to undermine ethical decision making. Taking a new approach, this study focused on identifying the most common

compensatory strategies that counteract those biases. These strategies were identified using a series of interviews with university researchers in a variety of areas, including biological, physical, social, and health as well as scholarship and the performing arts. Interview transcripts were assessed with two scoring procedures, an expert rating system and computer-assisted qualitative analysis. Although the expert rating system identified Understanding Guidelines, Recognition of Insufficient Information, and Recognizing Boundaries as the most frequently used compensatory strategies across fields, other strategies, Striving for Transparency, Value/Norm Assessment, and Following Appropriate Role Models, were identified as most common by the computer-assisted qualitative analyses. Potential reasons for these findings and implications for ethics training and practice are identified and discussed.

Monzon, J. E., O. L. Ariasgago, and A. Monzon-Wyngaard. 2010. "Assessment of moral judgment of BME and other health sciences students." ***Conf Proc IEEE Eng Med Biol Soc*** **2010:2963-6. doi: 10.1109/IEMBS.2010.5626266.**

The accreditation criteria for engineering programs require that the curriculum introduce students to the ethical, social, economics and safety issues arising from the practice of engineering. This paper presents the assessment of moral judgment of biomedical engineering, dentistry and biochemistry students through the standardized Defining Issues Test (DIT). Results show that college students, as most active members of society, remain at a stage of moral development where morality is still predominantly dictated by outside forces. It is expected that after formal Ethics studies, students will score higher in the last stages of moral development, where laws are regarded as social contracts and moral reasoning is based on universal ethical principles.

Mumford, Michael. D., Steele, L., & Watts, L. L. 2015. “Evaluating Ethics Education Programs: A Multilevel Approach.” ***Ethics & Behavior, 25*** **(1), 37-60. doi:10.1080/10508422.2014.917417**

Although education in the responsible conduct of research is considered necessary, evidence bearing on the effectiveness of these programs in improving research ethics has indicated that, although some programs are successful, many fail. Accordingly, there is a need for systematic evaluation of ethics education programs. In the present effort, the authors examine procedures for evaluation of ethics education programs from a multilevel perspective: examining both within-program

evaluation and cross-program evaluation. With regard to within-program evaluation, we note requisite designs and measures for conducting systematic program evaluation have been developed and multiple measures should be applied in program evaluation. With regard to cross-program evaluation, we argue that a meta-analytic framework should be employed where analyses are used to identify best practices in ethics education. The implications of this multilevel approach for improving responsible conduct of research educational programs are discussed.

Olson, Lynne E. 2014. "Articulating a Role for Program Evaluation in Responsible Conduct of Research Programs." ***Accountability in Research: Policies & Quality Assurance*** **21 (1):26-33. doi: 10.1080/08989621.2013.822265.**

Since “Integrity in Scientific Research: Creating an Environment That Promotes Responsible Conduct” was released in 2001, there has been increased interest in evaluating programs designed to foster the responsible conduct of research (RCR). The field of program evaluation is designed to determine the worth or value of programs and can serve as a resource for institutions interested in evaluating their RCR programs. This article provides a very brief overview of program evaluation, demonstrates how it can be applied to RCR, and provides key reference information. Evaluating RCR programs can promote institutional accountability for the resources that are used in supporting those programs.

Olsen, Lynne. 2010 “Developing a Framework for Assessing Responsible Conduct of Research Education Programs.” ***Science and Engineering Ethics. 16 (1): 185-200.*** **doi: 10.1007/s11948-010-9196-4.**

This article discusses the process of developing a program evaluation module that could be used to document and assess educational programs focused on teaching responsible conduct of research. A programmed series of questions for each of the nine RCR content areas identified by the United States Office of Research Integrity was created based on a performance-monitoring evaluation model. The questions focus on educational goals, resources provided to support the educational efforts, educational content, content delivery, educational outcomes, compliance requirements and feedback. Answers collected in response to the questions could be used to both document and continually improve the quality of RCR educational programs through on-going formative assessment and feedback.

Ponton, Richard F. 2015. "Evaluating continuing professional education in ethics." *Psychologist-Manager Journal (American Psychological Association)* 18 (1):12-30. doi: 10.1037/mgr0000026.

Currently 31 states and the District of Columbia require psychologists to acquire some form of continuing education in ethics throughout their careers. Of the jurisdictions that do have mandated continuing ethics training, there is wide variation in the minimum hours, specificity of content, and acceptable delivery methods. Psychologist-managers both for their own development and to promote the ethical behavior of organizations often evaluate ethics training programs. This review suggests that a framework for the conceptualization of the goals of ethics education and the evaluation of ethics training programs is needed to move beyond the current self-reported satisfaction model of evaluation toward valid outcome measures. Rest's (1986) model of moral decision making is extended to organizational ethics and a conceptual model of evaluation is suggested.

Quesenberry, Le Gene, Jamie Phillips, Paul Woodburne, and Chin Yang. 2012. "Ethics assessment in a general education programme." *Assessment & Evaluation in Higher Education* 37 (2):193-213. doi: 10.1080/02602938.2010.515017.

This study sought to assess whether flagged ‘values intensive’ courses within a public university's general education curriculum impacted on students' abilities to reason ethically. The major research question to be explored was, ‘what effect does taking a values intensive course have on students' ethical reasoning ability, when factors such as initial matriculation ability and total coursework are taken into account?’ Papers written by a sample of students in Legal Environment of Business (BSAD 240), mainly first-year students and sophomores, were holistically scored to determine the level of values reasoning exhibited by the students. It was found that students who had completed more values intensive courses scored higher on the samples used for this research. After providing an overview of the university and the State System of Higher Education (of which the subject university is a part), this paper provides an overview of the university's General Education Programme.

Sacco, Donald, Samuel Bruton, Alen Hajnal, and Chris Lustgraaf. 2015. "The Influence of Disclosure and Ethics Education on Perceptions of Financial Conflicts of Interest." *Science & Engineering Ethics* 21 (4):875-894. doi: 10.1007/s11948-014-9572-6.

This study explored how disclosure of financial conflicts of interest (FCOI) influences naïve or 'lay' individuals' perceptions of the ethicality of researcher conduct. On a between-subjects basis, participants read ten scenarios in which researchers disclosed or failed to disclose relevant financial conflicts of interest. Participants evaluated the extent to which each vignette represented a FCOI, its possible influence on researcher objectivity, and the ethics of the financial relationship. Participants were then asked if they had completed a college-level ethics course. Results indicated that FCOI disclosure significantly influenced participants' perceptions of the ethicality of the situation, but only marginally affected perceptions of researcher objectivity and had no significant influence on perceptions of the existence of FCOIs. Participants who had previously completed a college-level ethics course appeared more sensitive to the importance of FCOI disclosure than those who lacked such background. This result suggests that formal ethical training may help individuals become more critical consumers of scientific research.

Schuurbiers, Daan. 2011. "What happens in the Lab: Applying Midstream Modulation to Enhance Critical Reflection in the Laboratory." ***Science & Engineering Ethics*** **17 (4):769-788. doi: 10.1007/s11948-011-9317-8.**

In response to widespread policy prescriptions for responsible innovation, social scientists and engineering ethicists, among others, have sought to engage natural scientists and engineers at the 'midstream': building interdisciplinary collaborations to integrate social and ethical considerations with research and development processes. Two 'laboratory engagement studies' have explored how applying the framework of midstream modulation could enhance the reflections of natural scientists on the socio-ethical context of their work. The results of these interdisciplinary collaborations confirm the utility of midstream modulation in encouraging both first- and second-order reflective learning. The potential for second-order reflective learning, in which underlying value systems become the object of reflection, is particularly significant with respect to addressing social responsibility in research practices. Midstream modulation served to render the socio-ethical context of research visible in the laboratory and helped enable research participants to more critically reflect on this broader context. While lab-based collaborations would benefit from being carried out in concert with activities at institutional and policy levels, midstream modulation could prove a valuable asset in the toolbox of interdisciplinary methods aimed at responsible innovation.

Sindelar, Mark, Larry Shuman, Mary Besterfield-Sacre, Ronald Miller, Carl Mitcham, Barbara Olds, Rosa Pinkus and Harvey Wolfe. 2003. “Assessing Engineering Students’ Abilities to Resolve Ethical Dilemmas” November 5-8, 2003: 33rd Annual Frontiers in Education, 2003, Boulder, Colorado. S2A-25-30. doi: 10.1109/FIE.2003.1265937

ABET's accreditation criteria provides additional impetus for preparing engineering graduates to act in an ethically responsible manner. However, methods to assess the effectiveness of educational efforts to do this remain primitive at best. We describe the first phase of a joint study at the University of Pittsburgh and the Colorado School of Mines to develop a measurement tool for assessing students' abilities to recognize and resolve ethical dilemmas. Pre- and post-tests at the beginning and end of a semester-long course focusing on engineering ethics are used to assess students' comprehension, analysis, and resolution of ethical dilemmas. Each test consists of two ethical dilemmas addressed through a response essay that is then holistically scored using a rubric that classifies students' level of achievement. Results are analyzed using statistical methods to determine if any "shifts " have occurred to indicate a significant positive change in the cohort's collective ability. A second phase will involve the development of a web-based assessment instrument similar to CSM's Cogito© that can be easily used by engineering faculty.

Steneck, Nicholas H. 1999. "Designing Teaching and Assessment Tools for an Integrated Engineering Ethics Curriculum." *Proceedings of the 29th ASEE/IEEE Frontiers in Education Conference.* 12d6-11, 12d6-17.

Describes how the faculty at the College of Engineering at the University implemented an across-the-curriculum approach for teaching engineering ethics, the development of strategic goals that shaped the program’s design, and the development of numerous assessment techniques to measure the effectiveness of the program.

Thompson, Carla. 2014. “ Responsible Conduct of Research Assessment of Doctor of Education Candidates, Graduate Faculty, and Curriculum Considerations.” *Innovative Higher Education, 39*(5), 349-360. doi:10.1007/s10755-014-9289-0

The study included an assessment of doctoral students, graduate faculty, and curriculum considerations to determine the degree of infusion of research integrity and responsible conduct of research (RCR) principles within a Doctor of Education program. Study results showed substantial increases in doctoral candidates' knowledge levels of RCR, and faculty members serving as dissertation committee chairs reported greater understanding of RCR tenets than did non-dissertation chairs. The study also revealed a strong presence of research within the Ed. D. core curriculum.

Ethical Environment of Organizations

Anderson, Melissa. S., Ronning, Emily. A., De Vries, Raymond., & Martinson, B. C. 2007. "The perverse effects of competition on scientists' work and relationships." ***Science and Engineering Ethics, 13*****(4), 437-461.**
Competition among scientists for funding, positions and prestige, among other things, is often seen as a salutary driving force in U.S. science. Its effects on scientists, their work and their relationships are seldom considered. Focus-group discussions with 51 mid- and early-career scientists, on which this study is based, reveal a dark side of competition in science. According to these scientists, competition contributes to strategic game-playing in science, a decline in free and open sharing of information and methods, sabotage of others' ability to use one's work, interference with peer-review processes, deformation of relationships, and careless or questionable research conduct. When competition is pervasive, such effects may jeopardize the progress, efficiency and integrity of science.

Anderson, Melissa. S., Martinson, Bria. C., & De Vries, Raymond. 2007. "Normative dissonance in science: Results from a national survey of U.S. scientists." ***Journal of Empirical Research in Human Research Ethics, 2*****(4), 3-14. doi: 10.1525/jer.2007.2.4.3.**
Norms of scientific research represent ideals to which most scientists subscribe. Our analysis of the extent of dissonance between these widely espoused ideals and scientists' perceptions of their own and others' behavior is based on survey responses from 3,247 mid- and early-career scientists who had research funding from the U.S. National Institutes of Health. We found substantial normative dissonance, particularly between espoused ideals and respondents' perceptions of

other scientists' typical behavior. Also, respondents on average saw other scientists' behavior as more counternormative than normative. Scientists' views of their fields as cooperative or competitive were associated with their normative perspectives, with competitive fields showing more counternormative behavior. The high levels of normative dissonance documented here represent a persistent source of stress in science.

Crain, A., Brian Martinson, and Carol Thrush. 2013. "Relationships Between the Survey of Organizational Research Climate (SORC) and Self-Reported Research Practices." ***Science & Engineering Ethics*** **19 (3):835-850. doi: 10.1007/s11948-012-9409-0.**

The Survey of Organizational Research Climate (SORC) is a validated tool to facilitate promotion of research integrity and research best practices. This work uses the SORC to assess shared and individual perceptions of the research climate in universities and academic departments and relate these perceptions to desirable and undesirable research practices. An anonymous web- and mail-based survey was administered to randomly selected biomedical and social science faculty and postdoctoral fellows in the United States. Respondents reported their perceptions of the research climates at their universities and primary departments, and the frequency with which they engaged in desirable and undesirable research practices. More positive individual perceptions of the research climate in one's university or department were associated with higher likelihoods of desirable, and lower likelihoods of undesirable, research practices. Shared perceptions of the research climate tended to be similarly predictive of both desirable and undesirable research practices as individuals' deviations from these shared perceptions. Study results supported the central prediction that more positive SORC-measured perceptions of the research climate were associated with more positive reports of research practices. There were differences with respect to whether shared or individual climate perceptions were related to desirable or undesirable practices but the general pattern of results provide empirical evidence that the SORC is predictive of self-reported research behavior.

Croney, C. C., and R. Anthony. 2010. "Engaging science in a climate of values: tools for animal scientists tasked with addressing ethical problems." ***Journal of Animal Science.*** **88 (13 Suppl):E75-81. doi: 10.2527/jas.2009-2353.**

In the United States, escalating concerns about current farm animal science and

production methods have resulted not only in increased food animal protection policies, but also in animal welfare legislation. Animal scientists and industry leaders are apprehensive that such policies may be driven primarily by emotion and a lack of scientific understanding, and thus may have unforeseen consequences. However, decisions about animal care, and particularly animal welfare, cannot be made solely on the basis of science because the potential effects on producers, animals, and concerned citizens and the implications for the environment and on food prices must also be considered. Balancing the interests and values of all stakeholders in regard to animal welfare problems has presented a considerable challenge. Ethical accounting processes, such as the Ethical Matrix and the ethics assessment process by Campbell, offer models to combine socioethical concerns with relevant factual information, thereby facilitating decision making that is ethically responsible and that offers viable solutions. A case study is used to illustrate application of the ethics assessment process by Campbell that includes identification of the ethical problems, the embedded values, the relevant facts, and moral tests that can be applied. Awareness of these emerging ways of examining ethics that offer real solutions to conflicts of interests and not merely "one size fits all" answers should be an asset to animal and poultry scientists.

Fisher, Celia B., Gala True, Leslie Alexander, and Adam L. Fried. 2013. "Moral Stress, Moral Practice, and Ethical Climate in Community-Based Drug-Use Research: Views From the Front Line." ***AJOB Primary Research*** **4 (3):27-38. doi: 10.1080/21507716.2013.806969.**

The role of front-line researchers, those whose responsibilities include face-to-face contact with participants, is critical to ensuring the responsible conduct of community-based drug use research. To date, there has been little empirical examination of how front-line researchers perceive the effectiveness of ethical procedures in their real-world application and the moral stress they may experience when adherence to scientific procedures appears to conflict with participant protections. This study represents a first step in applying psychological science to examine the work-related attitudes, ethics climate, and moral dilemmas experienced by a national sample of 275 front-line staff members whose responsibilities include face-to-face interaction with participants in community-based drug-use research. Using an anonymous Web-based survey we psychometrically evaluated and examined relationships among six new scales tapping moral stress (frustration in response to perceived barriers to conducting research in a morally appropriate manner); organizational ethics climate; staff support; moral practice dilemmas

(perceived conflicts between scientific integrity and participant welfare); research commitment; and research mistrust. As predicted, front-line researchers who evidence a strong commitment to their role in the research process and who perceive their organizations as committed to research ethics and staff support experienced lower levels of moral stress. Front-line researchers who were distrustful of the research enterprise and frequently grappled with moral practice dilemmas reported higher levels of moral stress.

Helton-Fauth, Whitney., Gaddis, Blaine., Scott, Ginamarie., Mumford, Michael., Devenport, Llynn., Connelly, Shane., & Brown, Ryan. 2003." A New Approach to Assessing Ethical Conduct in Scientific Work." ***Accountability in Research: Policies & Quality Assurance, 10*****(4), 205-228. doi:10.1080/08989620390263708**

The intent of the current article is to describe the development of a new approach to the study of ethical conduct in scientific research settings. The approach presented in this article has two main components. The first component entails the development of a taxonomy of ethical events as they occur across a broad range of scientific disciplines. The second involves the identification of proximate criteria that will allow systematic and objective evaluation of ethical behaviors through low-fidelity performance simulations. Two proposed measures based on the new approach are intended to identify and measure variations in the scientific environment that might predispose certain individuals to make unethical decisions.

Kisamore, Jennifer, Thomas Stone and I. Jawahar. 2006. "Academic Integrity: The Relationship Between Individual and Situational Factors on Misconduct Contemplations" ***Journal of Business Ethics.*** **75(4), 381-394. doi:10.1007/s10551-006-9260-9**

Recent, well-publicized scandals, involving unethical conduct have rekindled interest in academic misconduct. Prior studies of academic misconduct have focussed exclusively on situational factors (e.g., integrity culture, honor codes), demographic variables or personality constructs. We contend that it is important to also examine how␣these classes of variables interact to influence perceptions of and intentions relating to academic misconduct. In a sample of 217 business students, we examined how integrity culture interacts with Prudence and Adjustment to explain variance in estimated frequency of cheating, suspicions of cheating, considering cheating and reporting cheating. Age, integrity culture, and personality variables

were significantly related to different criteria. Overall, personality variables explained the most unique variance in academic misconduct, and Adjustment interacted with integrity culture, such that integrity culture had more influence on intentions to cheat for less well-adjusted individuals. Implications for practice are discussed and future research directions are offered.

Louis, Karen S., Holdsworth, Janet M., Anderson, Melissa. S., & Campbell, Eric G. 2007." Becoming a scientist: The effects of work-group size and organizational climate ." *Journal of Higher Education, 78*(3), 311-336.
The purpose of this article is to explore the effects of organizational and work-group characteristics on the socialization of new scientists. It focuses on the experiences of graduate students and postdoctoral fellows in science. The authors chose to look at outcomes that reflect behaviors (early productivity) and attitudes (willingness to share research findings) since both likely have an impact on the future attitudes and behavior of individuals once they enter the scientific work force. The first point suggested by the data is that the "local setting matters" in graduate education. For both of the outcome variables, a limited number of indicators of organizational structure and climate predict a relatively robust percentage of the variance. Although the rewards of science, from grants to the Nobel Prize, go to individuals, there is evidence that graduate students and postdoctoral fellows who find themselves in the right kind of work setting may have a leg up in their trajectories toward becoming successful scientists. A second overall finding is that "work group size is positively associated with early productivity." The authors conclude that, in a typical university setting, both graduate and postdoctoral students are better off being in larger laboratories. With respect to early productivity, the authors found that life science graduate students and postdoctoral fellows publish and present more than their chemical engineering peers. In spite of the increasingly cross-disciplinary nature of scientific research, this finding suggests the need to continue to explore underlying disciplinary differences that may make generalizations about graduate education inappropriate.

Martinson, Brian C., Anderson, Melissa S., & De Vries, Raymond. 2006. " Scientists' perceptions of organizational justice and self-reported misbehaviors." *Journal of Empirical Research on Human Research Ethics, 1* (1), 51-66.
Policymakers concerned about maintaining the integrity of science have recently expanded their attention from a focus on misbehaving individuals to characteristics

of the environments in which scientists work. Little empirical evidence exists about the role of organizational justice in promoting or hindering scientific integrity. Our findings indicate that when scientists believe they are being treated unfairly they are more likely to behave in ways that compromise the integrity of science. Perceived violations of distributive and procedural justice were positively associated with self-reports of misbehavior among scientists.

Martinson, B., Thrush, C., & Lauren Crain, A. (2013). Development and Validation of the Survey of Organizational Research Climate (SORC). *Science & Engineering Ethics, 19*(3), 813-834. doi:10.1007/s11948-012-9410-7

Development and targeting efforts by academic organizations to effectively promote research integrity can be enhanced if they are able to collect reliable data to benchmark baseline conditions, to assess areas needing improvement, and to subsequently assess the impact of specific initiatives. A web- and mail-based survey was administered in 2009 to 2,837 randomly selected biomedical and social science faculty and postdoctoral fellows at 40 academic health centers in top-tier research universities in the United States. Measures included the Survey of Organizational Research Climate (SORC) as well as measures of perceptions of organizational justice. Exploratory and confirmatory factor analyses yielded seven subscales of organizational research climate, all of which demonstrated acceptable internal consistency and adequate test-retest reliability. The study found that the SORC demonstrates good internal (alpha) and external reliability (test-retest) as well as both construct and discriminant validity.

Mumford, Michael D. Ethan P. Walples, Alison L. Antes, Stephen T. Murphy, Shane Connelly, Ryan P. Brown and Lindsay D. Devenport. 2009.” Exposure to Unethical Career Events: Effects on Decion-making, Climate, and Socialization.” *Ethics and Behavior.* 19(5) 351-378.

An implicit goal of many interventions intended to enhance integrity is to minimize peoples' exposure to unethical events. The intent of the present effort was to examine if exposure to unethical practices in the course of one's work is related to ethical decision-making. Accordingly, 248 doctoral students in the biological, health, and social sciences were asked to complete a field appropriate measure of ethical decision-making. In addition, they were asked to complete measures examining the perceived acceptability of unethical events and a measure examining perceptions of

ethical climate. When these criterion measures were correlated with a measure examining the frequency with which they had been exposed to unethical events in their day-to-day work, it was found that event exposure was strongly related to ethical decision-making, but less strongly related to climate perceptions and perceptions of event acceptability. However, these relationships were moderated by level of experience. The implications of these findings for practices intended to improve ethics are discussed.

United States National Research Council and the National Institute of Medicine. 2002. *Integrity in Scientific Research: Creating an Environment That Promotes Responsible Conduct.* Washington D.C.: National Academies Press. doi:10.17226/10430.

The pursuit and diffusion of knowledge enjoy a place of distinction in American culture, and the public expects to reap considerable benefit from the creative and innovative contributions of scientists. Major social institutions, including research institutions, are expected to be accountable to the public. Fostering an environment that promotes integrity in the conduct of research is an important part of that accountability. As a consequence, it is more important than ever that individual scientists and their institutions periodically assess the values and professional practices that guide their research as well as their efforts to perform their work with integrity. Considerable effort has been devoted to the task of defining research misconduct and elaborating methods for investigating allegations of misconduct. Much less attention has been devoted, however, to the task of fostering a research environment that promotes integrity. This report focuses on the research environment and attempts to define and describe those elements that enable and encourage unique individuals, regardless of their role in the research organization or their backgrounds on entry, to act with integrity. Although integrity and misconduct are related, the focus of this report is on integrity.

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