Work in Progress: Organizational Culture and Engineers' Moral Values Across Industry Sectors: Study Overview

Ms. Dayoung Kim, Purdue University, West Lafayette

Dayoung Kim is a Ph.D. Candidate in Engineering Education at Purdue University. Her current research interest centers on engineering ethics and social responsibility, and she is specifically interested in cultural influences on engineers' moral formation. She earned her B.S. in Chemical Engineering at Yonsei University (Seoul, South Korea) in 2017 and M.S. in Chemical Engineering at Purdue University (West Lafayette, USA) in 2021.

Prof. Brent K. Jesiek, Purdue University, West Lafayette

Dr. Brent K. Jesiek is an Associate Professor in the Schools of Engineering Education and Electrical and Computer Engineering at Purdue University. He also leads the Global Engineering Education Collaboratory (GEEC) research group, and is the recipient of an NSF CAREER award to study boundary-spanning roles and competencies among early career engineers. He holds a B.S. in Electrical Engineering from Michigan Tech and M.S. and Ph.D. degrees in Science and Technology Studies (STS) from Virginia Tech. Dr. Jesiek draws on expertise from engineering, computing, and the social sciences to advance understanding of geographic, disciplinary, and historical variations in engineering education and practice.

Dr. Michael C. Loui, University of Illinois at Urbana Champaign

Now retired, Michael C. Loui held the Dale and Suzi Gallagher Professorship in Engineering Education at Purdue University from 2014 to 2019. He was previously Professor of Electrical and Computer Engineering and University Distinguished Teacher-Scholar at the University of Illinois at Urbana-Champaign. He has conducted research in computational complexity theory, in professional ethics, and in engineering education. He is a Carnegie Scholar, a Fellow of the IEEE, and a Fellow of the American Society for Engineering Education. Professor Loui was the editor of the Journal of Engineering Education from 2012 to 2017 and the executive editor of College Teaching from 2006 to 2012. He was Associate Dean of the Graduate College at Illinois from 1996 to 2000. He directed the theory of computing program at the National Science Foundation from 1990 to 1991. He earned the Ph.D. at the Massachusetts Institute of Technology in 1980 and the B.S. at Yale University in 1975.

Prof. Chuck Huff

Work in Progress: Organizational Culture and Engineers' Moral Values across Industry Sectors: Study Overview

Abstract

Current engineering ethics pedagogies are limited because they primarily focus on teaching reasoning skills. To promote the professional development of engineers beyond ethical reasoning, engineering educators need fundamental knowledge about engineers' moral formation. To investigate engineers' moral formation, the first author has begun a dissertation project that has three parts. The first part is a mixed-methods study of the influence of organizational culture on the moral formation of practicing engineers. The second part is a similar mixed-methods study of engineering students. The third part is an educational intervention whose content will be informed by the results of the first two parts. This work-in-progress paper describes the dissertation project, with specific details about the quantitative phase of the first mixed-methods study.

Introduction

According to recent research, current engineering education programs may not prepare students well enough for ethical engineering practice [1]. A potential reason could be the limitations of current pedagogical approaches to engineering ethics, which have mainly focused on developing ethical awareness and reasoning skills [2]. Those skills may be insufficient for helping students to embody the values and virtues associated with engineering professionals. The process by which an individual internalizes moral values is called *moral formation*. For engineering professionals, the moral formation process occurs throughout professional socialization, which starts during engineering education [3]. Therefore, we are investigating how engineering education programs can effectively facilitate engineering students' moral formation by focusing on the concept of moral personality [4]. Next, we define moral personality.

According to the new Big Five model of McAdams and Pals [5], personality can be conceptualized as a coordination of three different levels: dispositional traits, characteristic adaptations, and life narratives. Dispositional traits are individual attributes, such as extraversion, which are relatively stable over time, and which "sketch a behavioral outline" [5, p. 212]. Characteristic adaptations refer to a more malleable level of personality, including goals, values, and beliefs. Life narratives are stories that express the meaning of one's life over time. Those three levels are additionally situated in cultural contexts. By extension, *moral personality* involves a coordination of "traits, adaptations, and stories that best support and sustain a moral life in culture" [5, p. 23]. In other words, moral personality also cuts across the three different levels of the personality, but it is defined in the domain of morality. In particular, moral narratives are the stories that support and sustain one's moral life.

While there are more and less malleable levels in moral personality, an engineer's moral personality develops throughout their career and is situated in engineering culture. To investigate the process of moral formation for engineers, the first author has begun a dissertation project with three parts. The first part is a sequential triangulation mixed-methods study of how the organizational culture in workplaces influences the moral personality of practicing engineers. This study consists of a quantitative phase with a survey followed by a qualitative phase of interviews

of individual practitioners. The qualitative phase will result in a collection of practitioners' moral narratives. The second part of the dissertation project is a similar mixed-methods study of engineering students. The second study will use the same survey instrument and a similar interview protocol. We will compare the practitioners' data with the students' data. The third part of the dissertation project will develop an educational intervention, called Scaffolded Ethics Autobiography, through which educators can help to reduce potential mismatches between the values required for working as an engineer and the values held by individual students. Educators can then help students construct their own moral narratives by referring to the practitioners' narratives.

In this paper, we describe the first mixed-methods study, which investigates the impact of the organizational culture of engineers' workplaces on engineers' moral personality, with specific details about the quantitative phase. Because organizational culture can vary across industry sectors [6], we compare the moral values and narratives of practicing engineers across various industry sectors, while considering how organizational cultures affect the relationships between different levels of moral personality. This is because dispositional traits, characteristic adaptations, and narratives are not independent of each other [7]. Understanding the dynamics of personality development and the factors that influence these dynamics can inform the efforts of educators to facilitate the moral formation of individuals.

Research Question and Hypotheses

The research question for the first mixed-methods study is as follows: How does organizational culture influence the development of engineering practitioners' moral personality? Specifically, in the quantitative phase, we will test the following hypotheses:

Hypothesis 1: Organizational cultures differ across industry sectors.
Hypothesis 2: Practicing engineers' moral values vary across industry sectors.
Hypothesis 3: Organizational culture moderates the relationship between engineers'
dispositional traits and moral values.

As we explained previously, moral values are the second level of the moral personality (characteristic adaptations), and dispositional traits are the first level of moral personality. Therefore, testing these hypotheses can contribute to answering the research question. Table 1 below summarizes how the hypotheses cover each level of moral personality and cultural influence.

Table 1. The relationship between cultural influence, each moral personality level, and hypothesis

Moral Personality	Hypothesis
Dispositional traits (level 1)	Hypothesis 3
Characteristic adaptations (level 2)	Hypothesis 2 and Hypothesis 3
Narratives (level 3)	N/A (will explore through the follow-up interview)
Cultural influence	Hypothesis 1 and Hypothesis 3

Methods

For the quantitative phase, we collected survey data using published instruments for measuring organizational culture, moral values, and dispositional traits. For organizational culture, we utilized the Organizational Culture Assessment Instrument [6], which consists of 24 items with four dimensions – clan, adhocracy, market, and hierarchy. For moral values, we utilized the Moral Foundations Questionnaire [8], which consists of 32 items with five dimensions - care, fairness, loyalty, authority, purity. And for dispositional traits, we utilized the Big Five Personality Inventory [9], which consists of 44 items with five dimensions – extraversion, neuroticism, conscientiousness, openness, and agreeableness. The survey also included demographic questions for participants' age, gender, race/ethnicity, and work experience (e.g., current employer's industry sector, size of the organization). The survey was designed to take about 20 minutes to complete.

In the fall of 2020, we distributed the survey to engineers who were working in various industry sectors (e.g., IT industry, oil and gas industry) through alumni associations of the authors' institutions, as well as various social media platforms (e.g., LinkedIn, Twitter). We had four inclusion criteria for participation: 1) earned at least one degree (BS or higher) in engineering, technology, or a related field, 2) received BS degree more than 3 years ago (graduated before September 2017), 3) currently working full time in industry as an engineer or other technical professional (including management) or currently unemployed but worked full time in industry as an engineer or other technical professional recently, and 4) current country of residence is the United States. At the end of the survey, participants could optionally submit their contact information to be entered into a drawing for a $100 gift card (with a 1 in 20 odds of winning).

A total 651 practicing engineers started the survey, and 518 of those engineers completed the survey. Three of the 518 did not meet the inclusion criteria, so they were excluded from the dataset. Therefore, total 515 survey responses could be utilized.

Current Status and Future Directions

We are conducting statistical analyses for the quantitative phase of the mixed-methods study, including an ANOVA for Hypothesis 1 and Hypothesis 2 and a moderated regression for Hypothesis 3. We will present the findings from the data analysis at the ASEE Annual Conference.

Based on the results from the quantitative phase, we will interview 25 engineers in the follow-up qualitative phase. For the interview, we will purposefully invite the engineers 1) who are in the industries which represent contrasting organizational culture types and 2) who show contrasting profiles of moral values. In other words, we will recruit engineers to ensure variations in the organizational culture and moral values. This is because the purpose of the interviews will be understanding the moral narratives of engineers across industry sectors and the influence of organizational culture on those narratives. We will consider variation in moral values as a selection criterion because we assume that individuals' moral values are closely related to their moral narratives [10], [11]. We will use narrative inquiry as the main research methodology for the qualitative phase.

The results of this first mixed-methods study will enable engineering educators to better understand engineering practitioners' moral personality, including their moral values and narratives, and how moral personality interacts with the cultures of the organizations in which

engineers work. This understanding will provide engineering ethics educators with better insights on how to prepare engineering students for ethical engineering practice.

Acknowledgements

References

[1] R. E. McGinn, "'Mind the gaps': An empirical approach to engineering ethics, 1997-2001," *Sci. Eng. Ethics*, vol. 9, no. 4, pp. 517–542, 2003, doi: 10.1007/s11948-003-0048-3.

[2] D. Kim, "Work-in-progress: Emotion and intuition in engineering students' ethical decision-making and its implications for engineering ethics education," in *Proceedings of the 2019 ASEE Annual Conference and Exposition.* 2019.

[3] D. Kim, "Promoting professional socialization: A synthesis of Durkheim, Kohlberg, Hoffman, and Haidt for professional ethics education," *Bus. Prof. Ethics J.*, to appear.

[4] D. Kim, "Investigating individual engineers' moral personality: Socialization and judgment," in *Proceedings of the 2019 IEEE Frontiers in Education Conference.* 2019.

[5] D. P. McAdams & J. L. Pals, "A new big five: Fundamental principles for an integrative science of personality," *Am. Psychol.,* vol. 61, no. 3, pp. 204-217, 2006.

[6] K. S. Cameron & R. E. Quinn, *Diagnosing and changing organizational culture: Based on the Competing Values Framework.* San Francisco, CA: Jossey-Bass, 2011.

[7] J. Haidt, *The righteous mind: Why good people are divided by politics and religion.* New York, NY: Vintage Books, 2012.

[8] J. Graham, J. Haidt, & B. A. Nosek, "Liberals and conservatives rely on different sets of moral foundations," *J. Pers. Soc. Psychol.*, vol. 96, no. 5, pp. 1029-1046, 2009.

[9] O. P. John, E. M. Donahue, & R. L. Kentle, *The Big Five Inventory – Versions 4a and 54.* Berkeley, CA: University of California, Berkeley, Institute of Personality and Social Research, 1991.

[10] D. P. McAdams, M. Albaugh, E. Farber, J. Daniels, R. L. Logan, & B. Olson, "Family metaphors and moral intuitions: How conservatives and liberals narrate their lives," *J. Pers. Soc. Psychol.,* vol. 95, no. 4, pp. 987-990, 2008.

[11] J. Haidt, J. Graham, and C. Joseph, "Above and below left-right: Ideological narratives and moral foundations," *Psychol. Inq.*, vol. 20, pp. 110-119, 2009.