2021 ASEE ANNUAL CONFERENCE
Virtual Meeting | July 26–29, 2021 | Pacific Daylight Time
Paper ID #34355

Ethical Development in Undergraduate Engineering: Results from a Multi-University Survey

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Introduction

Undergraduate engineering programs tend to focus exclusively on technical information, omitting or minimizing lessons on ethical engineering and decision-making. However, these ethics lessons are critical to students' understanding of the broader impact of their work on society. For students to develop an optimal understanding of engineering ethics, it should be woven throughout the curriculum, included in multiple courses and discussed in terms of real-life scenarios. The Accreditation Board for Engineering and Technology (ABET) requires all engineering disciplines to consider public health and welfare [1]. While ethics lessons within engineering curriculum are important for all students, it is possible that some student recognize the social implications of their work more than others.

In this study, we aim to understand the differences in ethical development among students based on sociodemographic factors. In April 2020, we deployed a survey to undergraduate students at two universities to assess ethical development using the Defining Issues Test-2 (DIT-2). The results of this test include a numeric rating indicating the student's level of ethical development based on Kohlberg's Stages of Moral Development [2]. By using the DIT-2, we were able to utilize a standardized metric to evaluate ethical development across universities, majors, and sociodemographic factors. We used statistical inferencing to explore how sociodemographic factors were associated with ethical development.

Here we present the survey analyses, showing that certain sociodemographic factors may impact a student's ethical development. While about 25 sociodemographic factors were tested, three were found to be significantly associated with DIT scores. Specifically, the results show that differences in gender, political leaning, and religiosity correlate with a difference in DIT-2 scores. Further research can identify why and how these sociodemographic factors may influence ethical decision-making.

Methods

In April 2020, we deployed a web-based survey to undergraduate engineering students at two public institutions (n=216) via list serves. The survey was administered using Qualtrics Survey Software [3]. It was pilot tested by a small group of undergraduate and graduate engineering students to check for accessibility and clarity; these responses were not included in the final sample. The survey included two components that are relevant to this study: (1) the Defining Issues Test-2 (DIT-2) and (2) a range of sociodemographic information (e.g. gender, ethnicity, age).

The DIT-2 included three stories detailing ethical dilemmas where survey respondents were asked to determine the actions that the protagonists should take. These stories included (1) a poor man who considered stealing bread from a rich man to feed his family, (2) a journalist who uncovered secrets about a political candidate and, (3) a doctor who was asked for a lethal medication dosage by his terminally ill, elderly patient. Survey responses were sent to the Center for the Study of Ethical Development at the University of Alabama for evaluation [2]. Numeric scores were given

to each respondent based on their answers. Here we use the N2 Score which captures stages 2, 3, 5, and 6 of Kohlberg's Stages of Moral Development [2]. Higher N2 scores indicate higher levels of ethical development.

The survey included about 25 sociodemographic questions relating to students' backgrounds, including university, major, gender, religiosity, political affiliation, and race/ethnicity. These questions included multiple choice responses, including a "prefer not to respond" option. We performed ANOVA and two-sample t-tests to evaluate relationships between DIT-2 scores and sociodemographic data.

Results and Discussion

The statistical analysis shows that gender, religiosity, and political leaning are associated with respondents' DIT-2 scores. Other sociodemographic factors (e.g., year in school, age) were tested and did not show any significance. Specifically, respondents who identified as women scored higher on the DIT-2 than those who identified as men. This may indicate that women in engineering have a higher ethical development than their male counterparts. This finding is significant because women are still underrepresented in engineering programs – NSF reports that in 2016, only 20.9% of engineering bachelor's degrees were awarded to women [4]. Traditionally male-dominated programs might recruit more women to potentially foster a more ethical community.

The statistical analysis showed that those who stated that their political beliefs were liberal scored higher on the DIT-2 survey than those who identified as conservative. Additionally, respondents who stated that they were less religious than their peers scored higher on the DIT-2 survey than those who identified as more religious. These results demonstrate that there are differences in priorities between students with varying political and religious views. Overall, this study identifies the need to diversify engineering student bodies so that students of different beliefs and opinions can learn from one another. Using this information, engineering programs may tailor their lessons to better suit their students' needs.

Conclusion

This work is part of a larger study to observe ethical development of undergraduate engineering students and the impact of student organization involvement. Through survey questions and individual interviews with organization members, we will further assess students' understanding of engineering ethics.

Acknowledgements

This material is based in part on work supported by National Science Foundation grants # 1926330/1926172. Any opinions, findings and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

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