Environmentally Responsible Engineering in a New First-Year Engineering Experience

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***Abstract*—This full research paper explores two factors of increasing importance for first-year university engineering curricula: sustainability and diversity. Over the past fifteen years, many universities in the United States have adjusted their engineering programs in response to these two values expressed by industry, professional organizations, and the Accreditation Board for Engineering and Technology. This research study addresses these issues by integrating environmentally-responsible engineering (ERE) concepts into a series of courses in the pilot of a new first-year engineering experience.**

We surveyed students at the end of the experience to determine the impacts of integrating ERE into the course sequence on students' enthusiasm for engineering, interest in ERE and ERE professions, concern for the environment, and sense of belonging. We found that students reported much greater satisfaction and positive impacts than we expected. Student responses suggest that incoming first-year engineering students are concerned about environmental issues and feel both responsible and inspired to use engineering skills to design solutions for problems impacting the environment and society. These results provide motivation to pursue further research on the effects of integrating sustainability concepts into engineering curricula on students' motivation and consequential retention, especially among underrepresented students.

***Index Terms*—first year curriculum, programming, retention, sustainability, systems thinking, underrepresentation**

I. Introduction

Multiple organizations, including the National Academy of Engineering and the United Nations' World Commission on Environment and Development, have stated the importance of sustainability in engineering, which has driven curricular change in many American universities [1]. In the 21st century, the technological revolution has contributed to rapidly changing demands from society and the engineering industry [2]. Engineers are now expected to consider the impacts of engineering designs, including the environmental, social, and economic impacts which define sustainability [3].

However, without a paradigm shift, it is impractical to add classes solely focused on sustainability to current engineering degrees [4]. Since the average engineering degree takes four to five years to complete in the United States [4], students already invest significant time and money in their undergraduate education and are eager to enter the workforce rather than take courses that may not directly relate to their academic discipline. Additionally, sustainability concepts may be considered during every step of the engineering design process, so it may be most appropriate to teach them in an interdisciplinary engineering experience. As a result of these factors, many university engineering programs have integrated sustainability into existing course curricula using various implementations.

In the 2020/2021 academic year, the College of Engineering at Oregon State University piloted a series of three 10-week classes in a new first-year engineering program, which all students will complete in subsequent years. To increase retention and student engagement, especially among underrepresented students in engineering, the researchers worked with university instructors to integrate the Engineering for One Planet (EOP) sustainability framework [5] into the pilot curriculum for the new first-year engineering experience (FYEE) (see Figure 1).

This research study analyzed the impacts of integrating environmentally responsible engineering concepts from the EOP framework into the first-year engineering curriculum through examining student survey responses.

Fig. 1. EOP Framework Outcomes [5]

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II. Related Work

The university utilized the Engineering for One Planet framework to redesign the first year engineering curriculum, which was developed to prepare the next generation of engineers to be environmentally sustainable and responsible [5]. The EOP framework is built on three student learning outcomes: 1) systems thinking, 2) knowledge and understanding, and 3) skills, experiences, and behaviors (see Figure 1). Systems thinking is at the core of the framework. Knowledge and understanding includes environmental literacy, social responsibility, and responsible business and economy. Finally, the skills, experiences, and behaviors category is divided into technical and leadership skills including environmental impact measurement, materials choice, design, critical thinking, and communication and teamwork.

First, the authors of this paper conducted a literature review to compare the new first-year engineering coursework with other American universities' attempts to incorporate sustainability into engineering programs. Over the past 15 years, universities have found a variety of ways to teach sustainability concepts to undergraduate engineering students [6]–[9]. Many of the universities restructured existing engineering courses to include modules that increase students' awareness about sustainability and its relevance to existing engineering programs. These programs used exams to evaluate whether the course(s) increased students' awareness about sustainability issues, but past research did not investigate the personal impacts on students. Specifically, many universities did not discuss changes in students' passion, engagement, or future goals with respect to the emphasis on sustainability. Furthermore, some programs only emphasized the environmental element of sustainability, excluding the economic and social components which are also crucial for sustainability considerations.

However, two articles proved particularly useful for establishing a foundation of expectations to guide our research. Researchers from Virginia Tech investigated the motivation of engineering students, including observations about future goals, over the course of their first year [10]. They reported a decrease in engineering intrinsic interest and engineering career expectations from the first semester to the second, which was not what we expected [10]. Another research effort corroborated the claim that first-year university students' engineering enthusiasm across various metrics decreases over the first year of undergraduate study [11].

Based on these prior research studies and our goal to assess ways to improve recruitment and retention, we tested whether the pilot program had a positive impact on students. Our alternative hypothesis was that the average student response was positive (greater than neutral). We selected the null hypothesis to be that the average student survey response was neutral.

III. Research Method

The first year of the pilot program consisted of three 10-week courses taken in series. Each course had two sections that were taught by different instructors with different assignments, except for the last course which had the same assignments but different programming languages (Python versus C++). All sections were situated in Environmentally Responsible Engineering (ERE) themes based on the EOP framework learning outcomes.

In the first course, the curriculum met some course learning objectives by using learning objectives from the Social Responsibility core and Environmental Literacy core in the EOP framework [12]. Students were introduced to a variety of engineering disciplines and applications and learned how interdisciplinary teams collaborate to solve engineering problems. The next course guided students' development in their problem-solving skills, engineering design, and collaboration skills. Instructors used some EOP learning objectives from the Communication and Teamwork core, Responsible Business and Economy core, Systems Thinking core, Environmental Impact Measurement core, and Materials Choice core to cover some learning objectives in the second course [12]. The final 10-week course utilized the Design core and Critical Thinking core learning objectives to meet some learning objectives in the third course of the first-year engineering experience (FYEE), which emphasized algorithmic thinking and programming using a general-purpose language (one section used Python and one used C++).

The researchers in this study obtained Institutional Review Board approval to survey first-year engineering students participating in the year-long pilot program. Students represented a variety of majors. The survey was presented to all students at the end of the course with directions that stated research participation was optional. Out of 147 students in the Spring term sections, 132 students provided consent to release their responses for analysis. From these 132 students, 27 were female (20.45%) and 105 were male (79.55%). Additionally, 92 were white (69.70%) and 40 identified with a different race (30.30%). Compared to the 2021-2022 College of Engineering demographics at the university (22.59% female and 29.98% non-white), this data seems to represent the population [13]. We also used "underrepresented minority" or "URM" to describe students who were either female or non-white and "non-URM" to describe white male students. Each question that we analyzed had three or five response options, which were quantified using a Likert-scale.

To measure the impacts of ERE-themed courses in the pilot FYEE, we surveyed students to explore the following research questions:

1) Do incoming undergraduate engineering students experience an increase in enthusiasm for engineering during their first year?
2) How do students feel about pursuing a job or research involving ERE in general, and do the ERE-themed courses increase their desire to work in a job or conduct research involving ERE?
3) Do the ERE-themed courses increase students' concern for environmental issues?
4) Do students like the computer programming assignments focused on sustainability?

5) Do students feel like they belong in the College of Engineering after the new FYEE?
6) Do student responses vary according to gender or race?

The researchers quantified these responses by using a Likert scale based on the number of possible responses. For example, we used 1 for the most negative response ("no" or "strongly disagree"), and 3 or 5 for the most positive response ("yes" or "strongly agree"). To answer research question 2, we collected open-ended responses about why students would or would not want to pursue future job or research opportunities in ERE, and we categorized their responses into common themes.

IV. Results and Discussion

Since our sample size was greater than 100, parametric t-tests were used to compare means, instead of non-parametric tests. After piloting the ERE-themed FYEE courses, one-sample t-tests were used to determine whether students responded positively about their enthusiasm for engineering, desire to pursue jobs and research involving ERE, approval for sustainability programming assignments, and feeling of belonging in engineering, and two-sample t-tests were used to compare the average responses between demographic groups. Unfortunately, the group sample sizes were not large enough to compare medians between groups using a Chi-square test. For all statistical t-tests, an α = 0.05 was selected to be the significance level for reporting results with 95% confidence. For each research question 1-5, we analyzed the data with respect to gender and race, and we report the demographic results with each question.

Upon analyzing the responses, the environmentally responsible emphasis of the engineering coursework was associated with positive impacts on the students who were surveyed. The average responses for all students across all questions were higher than neutral, and many results were statistically significant.

A. Research Question 1: Do incoming undergraduate engineering students experience an increase in enthusiasm for engineering during their first year?

We asked students, *"After completing the new pilot FYEE courses, are you more enthusiastic about engineering in general than before (Yes, No, Maybe)? Why or why not?"*. We expected the average response to be neutral or potentially even negative, due to past research discussed above. Therefore, we compared the observed average change in enthusiasm to no change ($H_0 : \mu = 2$). As Figure 2 shows, the average responses from all students (x = 2.56), as well as each demographic group (female, male, non-white, white, URM, and non-URM), were significantly higher than neutral. At the 5% significance level, there was sufficient evidence to support the claim that the mean response from students was greater than neutral (p-value $< .001$).

More than 62% of students claimed that their enthusiasm for engineering increased after taking the course sequence (see Figure 3). Interestingly, white male students reported the highest percentage of "Yes" responses (64.47%) to an

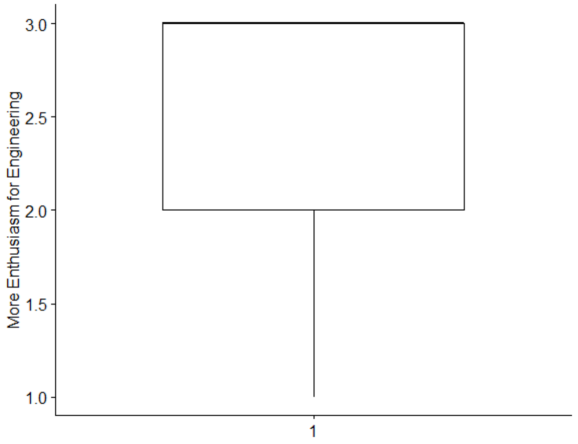

Fig. 2. Mean Response for Impact on Enthusiasm for Engineering

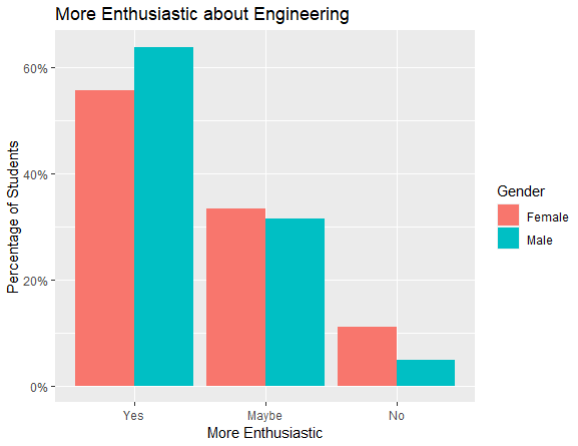

Fig. 3. Impact on Enthusiasm for Engineering Based on Gender

increased enthusiasm for engineering. However, there were no significant differences in means between groups based on race or gender.

Some students explained their categorical response in the open-ended part of the question. While students expressed varying levels of interest in the course material, there were multiple students who mentioned that this course introduced them to the social impact and human interaction involved with engineering, which increased their motivation and excitement to continue. Multiple responses included approval of the engineering design process, which made them want to pursue product design. One student expressed that engineering was "broken down to be mentally digestible" which made it seem less intimidating, therefore increasing their enthusiasm. Some students reported that this course series was their introduction to engineering or taught them a great deal about the possible applications. In contrast, some others claimed that the series was unhelpful to them because they already had prior knowledge about the field or had different expectations for the course. Many of the complaints were related to the remote format due to the COVID-19 pandemic.

These responses suggest that emphasizing the environmental and social impacts of engineering has a positive impact on students' enthusiasm for engineering and their desire to continue in their academic program. These conclusions corroborate past research which suggests that STEM engagement requires real-world applications of technical concepts to be articulated and reinforced [14]. This concept is significant because emphasizing environmental and social impacts of engineering in introductory courses may improve retention rates, especially for URM students.

B. Research Question 2: How do students feel about pursuing a job or research involving ERE in general, and do the ERE-themed courses increase their desire to work in a job or research involving ERE?

To determine how students considered ERE in their academic and professional goals, we asked three post-survey questions about their general interest in ERE, whether they prefer ERE to non-ERE job opportunities, and whether their interest changed due to the course, in addition to an open-ended question about why they would or would not want to pursue ERE job or research opportunities. We expected the average response to be neutral for all three Likert-scale questions.

- Would you say you are more interested in environmentally responsible engineering than engineering that does not have an environmentally-responsible focus (Yes, No, or Maybe)?
- Would you want to work in a job or do research that involves environmentally responsible engineering in the future (Yes, No, or Maybe)? Why or why not?
- The courses increased my desire to work in a job or do research in environmentally responsible engineering in the future (Strongly Agree, Somewhat Agree, Neither Agree Nor Disagree, Somewhat Disagree, Strongly Disagree).

The average student response to whether they prefer engineering with an ERE focus to engineering without (x = 2.17) was statistically significant above neutral ($H_0 : \mu == 2$). By demographic group, only male (x = 2.15), non-white (x = 2.28), and URM students (x = 2.23) were statistically significant. We expect that the small sample size (27 female students compared to 105 male students) contributed to women not being statistically significant because their average was higher (x = 2.22). There was enough evidence to conclude with 95% confidence that on average some students prefer ERE to non-ERE in general. However, there was no significant difference between groups based on gender or race.

Figures 4 and 5 show that the average responses from all students across demographic groups for general interest in an ERE job and the change in interest in an ERE job were greater than neutral ($H_{0-future}$: μ = 2 with x_{future} = 2.49 and $H_{0-increase}$: μ = 3 with $x_{increase}$ = 3.95, respectively) and statistically significant (p-values $<$ .001 and = 0.012, respectively). Even though 11 students had said they were not interested in ERE work in the future (see Figure 6), no students answered "Strongly Disagree" to whether the pilot courses

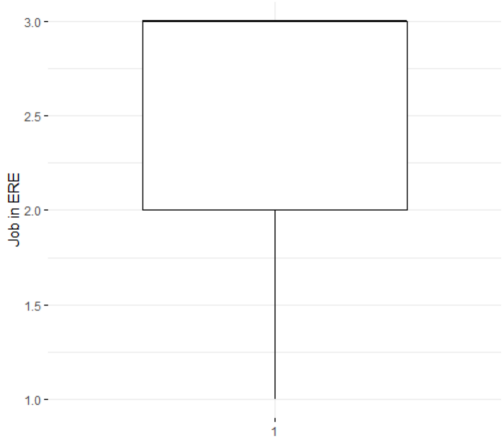

Fig. 4. Mean Response for Interest in ERE Job or Research

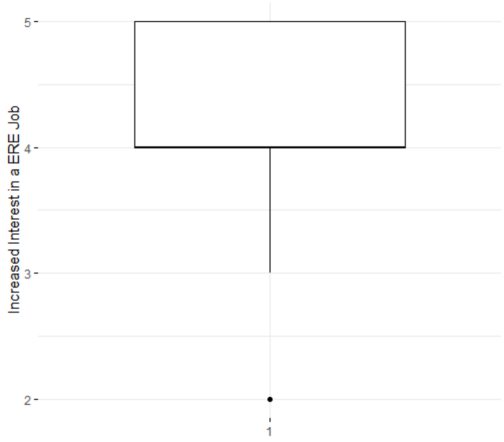

Fig. 5. Mean Response for Increased Interest in ERE Job or Research

increased their interest to pursue an ERE job or research in the future, (see Figure 7). This suggested that the course did not have a significant negative impact on students' future plans for working in ERE.

We observed differences between demographic groups with respect to their interest in future work or research focused on ERE. Two-sample t-tests comparing the means of non-white students (x = 2.65) vs. white students (x = 2.42) and URM students (x = 2.63) vs. non-URM students (x = 2.39) were both statistically significant (p-value = .043 and .034, respectively). At the 5% significance level, there was sufficient evidence that the mean responses from non-white and URM students were greater than their white and non-URM peers, respectively.

The majority of students (57.58%) expressed "Yes" that they want to pursue a job or research in the future that emphasizes environmentally responsible engineering (ERE). In this case, it was a greater percentage of female (62.96% compared to 56.19% of male students) and non-white (67.50% compared to 53.26% of white students) who responded "Yes" in the survey (see Figure 6 for an example). Furthermore, female students unanimously answered "Yes" or "Maybe", and only

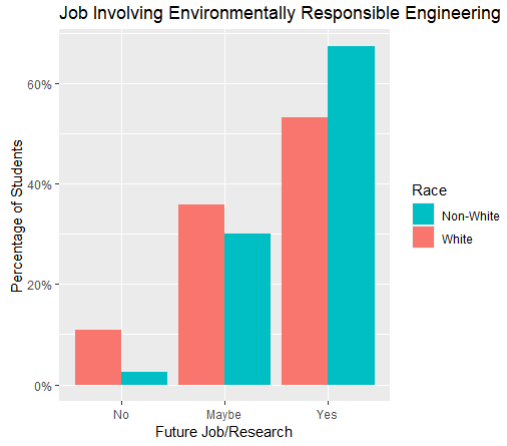

Fig. 6. Responses for Interests in ERE Job Based on Race

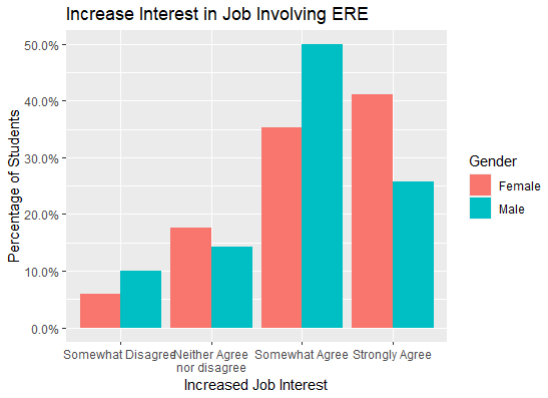

Fig. 7. Responses for Increased Interests in ERE Job Based on Gender

one non-white student answered "No".

In the justification for the response to the third question, students across different responses acknowledged that environmentally sustainable considerations already (or should already) exist in most engineering jobs that they consider (see Table I). Significant themes for those in favor of pursuing ERE were personal responsibility, specific applications, and environmental concern. However, some students could not picture examples of ERE jobs/research or show that they did not understand applications of ERE through their examples. For example, some students said that they were interested in a certain field, such as artificial intelligence or electric vehicles, which was their reason for choosing not to pursue ERE (even though these applications of engineering are strongly related to environmental and social responsibility). Other students who did not want to pursue ERE mentioned that they wanted to avoid the regulations and governing bodies that enforce environmental laws, and some students expressed the idea that they would not sacrifice financial stability for a job in ERE.

The average response to whether the course increased their interest was statistically significant above neutral, and we observed that each demographic group was also statistically significant. The lowest demographic mean was non-URM

Future ERE Job Interest: Open-Response Themes			
Theme: Definition	**# No**	**# Maybe**	**Example Quote**
Not interesting: Expresses lack of interest in ERE	5	0	"Environmental was not very interesting to me."
Mutually exclusive: Desired job is mutually exclusive or distinct from ERE	2	4	"I would rather take an job at an industrial company, rather than doing a environmentally friendly one."
Personal value: Considers environmental wellness as intrinsically valuable	1	16	"Although environmental responsibility is important I don't want to make that my profession"
Convenience: ERE is secondary factor for job interest	1	12	"as long as it includes robotics I wouldn't mind working with environmental factors."
Regulations: Desire to avoid environmental laws/regulations	1	2	"I don't want to be the person regulating what can and can't be done"
Inherent: ERE considered a component of job of interest	0	7	"my major is already focused upon it"
Missing application: Doesn't know an example of an appealing job in ERE	0	4	"I am not sure what that entails"
Undecided: Open-minded or expresses lack of commitment to a job	0	4	"I'm not entirely sure what I want to do when I am older yet"
Financial Security: ERE is secondary to financial security	0	3	"I wouldn't sacrifice financial security for it"
Responsibility: Claiming responsibility for environmental issues	0	3	"I am not super passionate about sustainability however it is something that everyone should chip in towards"

TABLE I
FUTURE ERE JOB INTEREST: OPEN-RESPONSE THEMES

students (x = 3.88) and the highest observed mean was from female students (x = 4.12). There were no statistically significant differences between demographic groups. At the 5% significance level, there was sufficient evidence to conclude that the average student reported an increased interest in a profession with an environmentally responsible focus as a result of the FYEE program.

C. Research Question 3: Do the ERE-themed courses increase students' concern for environmental issues?

We asked students to report their concern for the environment at the end of their first year and whether the FYEE course series increased their concern for the environment.

- Please choose the response that matches your level of concern for environmental issues (I am extremely con-

cerned and want to do something about them (5), I am concerned (4), I am somewhat concerned (3), I feel neutral (2), I am not concerned (1)).
- Have the FYEE courses increased your level of concern for environmental issues (Yes (3), Maybe (2), or No(1))?

The average response to measure concern for environmental issues was 3.94, which suggests that the average engineering student was concerned about environmental issues at the end of their first year at the university (see Figure 8). We explored the relationship between environmental concern and students' desire to pursue an ERE profession with the expectation that we would observe a direct relationship.

Figure 9 shows the distribution of responses to concern for environmental issues from each response to future ERE interest (yes/no/maybe). We were not surprised that 100% of students who were not concerned about environmental issues were not even somewhat interested in a future job in environmentally responsible engineering. We were however interested that some students who were concerned with environmental issues did not report having interest in an ERE profession.

To investigate further, we analyzed the open-ended justification responses regarding students' interest in future ERE. We focused on students who responded "maybe" or "no" to a future ERE profession and had concern for environmental issues of at least "I am somewhat concerned" (see Table I). By categorizing open-response statements into themes, we identified areas for improvement in the pilot curriculum.

First, we noticed that students in nuclear engineering comprised most of the 'inherent' responses, and some other students struggled to find applications of environmentally responsible engineering within their engineering discipline. In future years, we could ensure that there are examples for each discipline and include a discussion about the ways that environmentally responsible engineering could be inherent to each discipline, even for the less-obvious disciplines. Students do not have to work in/on the environment to be environmentally and socially responsible. Additionally, some students expressed the idea or concern that they may have to sacrifice financial security to incorporate ERE in their job, which is a stereotype that could be addressed in the course. Since some of the open-response questions from students who answered 'maybe' are directional, we identified the three response options, and especially 'maybe', as an area of improvement. The survey could be revised to resemble the questions that have five options (strongly agree, somewhat agree, neutral, somewhat disagree, strongly disagree).

We expected that students would on average respond "maybe" that the FYEE courses increased their level of concern for environmental issues. Overall, the student average response was 2.12 and was not statistically different from 2. However, non-white students (x = 2.28) and URM students (x = 2.23) were statistically greater than 2. This evidence suggested that on average, non-white and URM students reported that the FYEE courses positively increased their level of concern for environmental issues.

Fig. 8. Responses for Concern for the Environment

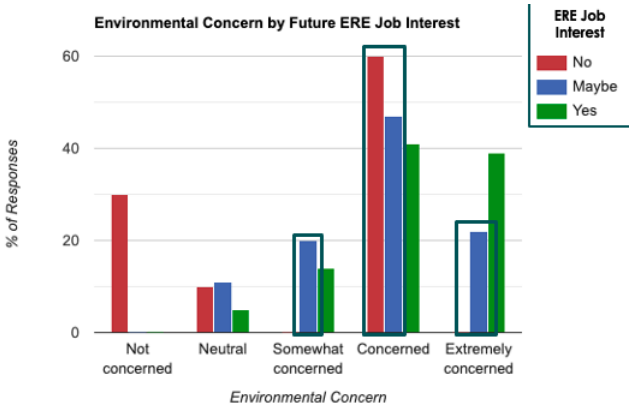

Fig. 9. Environmental Concern Grouped by Future ERE Job Interest

D. Research Question 4: Do students like the computer programming assignments focused on sustainability?

In the third course of the series, students were introduced to programming concepts through assignments focused on one of the 17 United Nations Sustainable Development Goals [15] and adapted from Penn State's Sustainability in Intro to CS [16]. For example, students were asked to write a program to calculate wind power for different turbines, simulate a water catchment system, and determine the amount of CO2 captured by planting trees [16].

Although both sections assigned the same programming projects, they used different programming languages (C++ versus Python). In addition, students reported varying levels of experience and confidence with programming. Related research suggests that students' belief in their ability to succeed is related to their motivation for engineering and their actual performance [10], [11]. Initial observations suggest that students in the section that taught Python performed better than those who used C++. As a result, we identified programming language and prior experience as additional predictors of programming assignment likability. Future research into the relationship between these factors could inform inclusive curriculum design.

To determine the impacts of the new programming require-

ment with an ERE emphasis, we asked students, *"How much do you like programming assignments focused on sustainability (Like a great deal, like somewhat, neither like nor dislike, dislike somewhat, or dislike a great deal)?"*. Using a 5-point scale, we expected the average response to be neutral ($H_0 : \mu = 3$).

Figure 10 shows that students provided an average response higher than neutral (x = 3.77). In these tests, all groups were statistically significant, suggesting that sustainability programming assignments may be generally appreciated and appropriate for first-year engineering students.

More than half of all students (52%) reported that they liked the programming assignments related to sustainability, and only 6 students ($< 5\%$) disliked the assignments somewhat or a great deal. Figure 11 shows that over 70% of female students reported liking the ERE-focused programming assignments, but 37% of the female students responded that they liked the assignments a great deal compared to 18% of male students, who only somewhat liked the assignments.

Students from different demographic groups (race and gender) and additional predictors (prior programming experience and section) reported statistically significant greater than neutral average responses regarding the extent to which they enjoyed sustainability programming assignments. There were no statistically significant differences between the demographic groups, students with different programming experiences, or from different sections.

E. Research Question 5: Do students feel like they belong in the College of Engineering after the new FYEE?

Lastly, to determine students' sense of belonging in the College of Engineering after the new FYEE pilot, we asked students to rate their agreement with the following statement, *"I feel like I belong in the College of Engineering community (Strongly Agree, Somewhat Agree, Neither Agree Nor Disagree, Somewhat Disagree, Strongly Disagree)."*.

The overall average response in this study (x = 4.08) was greater than neutral ($H_0 : \mu = 3$) and statistically significant (p-value < 0.001), as was the average for each demographic group. Unfortunately, there was not an open-response question for students to elaborate on which factors impacted their sense of belonging, which we will add in future surveys

Although it was not a random sample, we had 303 responses to the question, *"I feel like I am a part of the College of Engineering community"* with the same response options, from an optional survey of first-year students in the College of Engineering at Oregon State University from Fall 2018.

The survey average was also greater than the overall average response from 2018 (x = 3.71). Since the 2018 data was an optional survey that only captured a small sample of first-year engineering students, we did not conduct hypothesis testing for the difference in means.

It is important to note that there are countless factors involved with students' sense of belonging. Prior experience in engineering, course difficulty, and access to academic support resources are only a few examples that may impact how

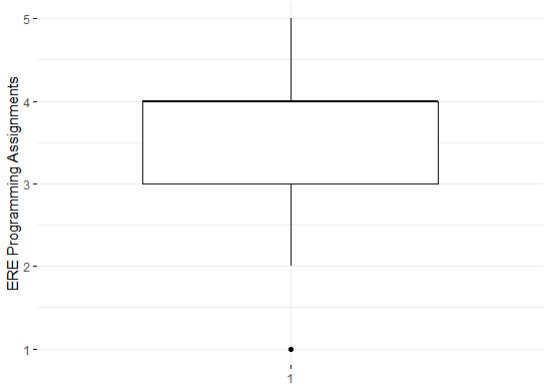

Fig. 10. Mean Feelings about ERE-Focused Programming Assignments

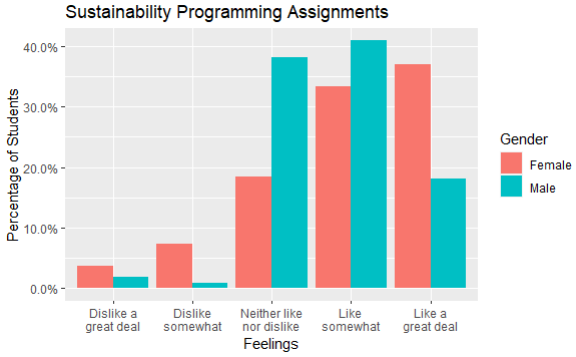

Fig. 11. Distribution of Feelings about ERE-Focused Programming Assignments Based on Gender

students feel about their identity as engineering students. These and other factors could be measured with additional guided survey questions and an open-response question for students to elaborate. This study suggests that more research is needed to determine significant predictors of sense of belonging and inclusive culture to identify strategies for improvement.

V. Limitations/Threats to Validity

The first limitation in this research was the sample size, which did not satisfy the requirements for parametric chi-square tests for goodness-of-fit and independence. With a larger sample, this statistical test could compare the distributions of responses between groups. Also, a larger sample would make the statistical results more reliable and powerful.

Some questions were too general, which made isolating specific driving factors and direct impacts of the sustainability emphasis in the pilot FYEE difficult. Also, we considered "maybe" to be the neutral response for questions with three options (yes/no/maybe), which may not accurately reflect students' attitudes. We learned from qualitative responses that some of the "maybe" answers were more positive or negative, which was not captured by the statistical tests. In the future, we will add more open-ended questions and refine existing survey questions and choices to more accurately capture the reasons for student responses.

In this study, students were only surveyed at the end of the pilot FYEE. In the future, we will survey students at the beginning and end of each term to determine the impacts of each course in the three-course series on students' goals. We will also add optional open-ended questions for each closed-response question to gain more insight about the impacts of specific course components on students.

We recognize that we did not control for the increase in familywise error rate across the series of reported statistical tests. In other words, there was a likelihood that we incorrectly rejected a null hypothesis in this study. However, we consider this research to be preliminary and encourage replication.

VI. Conclusions

Overall, students' enthusiasm for engineering and sense of belonging increased in the pilot focused on ERE. However, more research is needed to identify driving factors of students' identity within Oregon State University's College of Engineering, specifically the relationship between ERE-themed courses and sense of belonging.

In this study, students reported that they were interested in pursuing ERE in their profession and the pilot course series increased their interest in ERE. The students also reported that programming assignments with sustainability concepts provided a meaningful and challenging application for most students. Therefore, more discussion on discipline-specific applications of responsible and sustainable engineering, especially regarding fields and jobs that are not directly related to the environment, could increase desire to pursue ERE, in addition to increase enthusiasm and belonging in engineering.

It was not surprising that students with higher concern for the environment reported higher interest in future ERE professions, but it was surprising to learn that some who were concerned for the environment were not interested in ERE professions because of reasons like financial security, missing application of ERE to their field, environmental regulations, and mutual exclusion between industry and ERE. It was surprising that only non-white and URM students reported that the ERE-themed courses increased their concern for environmental issues. In the future, we will find out what contributes to differences among URM students with focused interviews and additional open-ended survey questions.

Based on this preliminary research study, we believe using the Engineering for One Planet (EOP) Framework [5] for introducing ERE into first-year engineering courses is worth further investigation. In the future, we plan to integrate ERE into more sections of the full implementation of the FYEE with 1200-1500 students. This will provide us a larger sample size and a control group to explore the impacts of integrating ERE into courses.

Acknowledgment

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