



## **Work in Progress: Common Reading Experience: Assessing the Impact on Perceptions, Identity, and Belonging Among First-year Engineering Students**

### **Dr. Laura Hirshfield, University of Michigan**

Laura Hirshfield is a lecturer and researcher at the University of Michigan. She received her B.S. from the University of Michigan and her Ph.D. from Purdue University, both in chemical engineering. She then transitioned into the engineering education field with postdoctoral positions at Oregon State University, Olin College of Engineering and University of Michigan. Her research interests lie in assessing and amending curricula to help students transition from undergraduate to professional practice.

### **Mr. Michael Dailey, University of Michigan**

Mike is a Program Specialist in the Engineering Honors & Engagement Programs office at the University of Michigan. He received his B.B.A. from Eastern Michigan University in Business Management and M.A. from Sam Houston State University in Higher Education Administration. Mike has worked in advising, recruiting and outreach, student life, and engaged learning.

### **Stacie Edington, University of Michigan**

Stacie Edington is the Director of Honors and Engagement Programs, within the College of Engineering at the University of Michigan.

## Introduction

In 2013, the College of Engineering at the University of Michigan launched the Common Reading Experience (Edington, Holmes Jr., & Reinke, 2015). This program was developed for incoming first-year engineering students with three goals in mind:

1. Students build and develop a sense of community (including a sense of belonging and engineering student identity)
2. Students broaden their thinking about the skills (both technical and non-technical) that they need to be a successful engineer in the 21st century
3. Model intellectual engagement

Throughout the history of the Common Reading Experience (CRE), program evaluations have been compiled annually. However, to determine if the program was meeting its intended goals, additional assessment commenced with the 2017 incoming class of students. Data was collected and analyzed to determine the immediate impact of the CRE on students in the short term, particularly with regards to goals 1 and 2.

## Background

### ***Common Reading Experience***

The book selection process begins in the fall of each year to prepare for the next incoming class. Throughout the year, students, staff, faculty, and community members recommend books for the Common Reading Experience. This list is narrowed down to 25 books, and sent to student volunteers, who select two books that sound interesting to them. Based on the student selections, the list is reduced to between eight and twelve books. The student volunteers each receive two books to read over the winter break. After reading each book, students complete an online survey reporting on their initial impressions of the book in relation to the goals of the program. Subsequently, in-person focus groups are held to collect more detailed thoughts about each text. The students' recommendations determine the selection for future years of the Common Reading Experience.

In early summer, incoming first-year College of Engineering students receive a copy of the Common Reading Experience book to read prior to arriving on campus in the fall. Previous book selections have included *Spare Parts* by Joshua Davis, which details the story of four undocumented Mexican American teenagers who participated in a robotics competition, and *The Boy Who Harnessed the Wind* by William Kamkwamba and Bryan Mealer, about a boy in Malawi who built a windmill to power his community. In 2017, the book selection was *The Immortal Life of Henrietta Lacks* by Rebecca Skloot, which focuses on ethics and issues of class and race within science.

During the fall semester, students participate in a 1.5-hour discussion session led by two upper-level College of Engineering students. These discussions focus on important themes in the book and how these relate to engineering and the experiences of a first-year student. The shared

experience is intended to encourage community-building and promote a sense of belonging among the students. This discussion also prompts reflection about what it means to be an engineer, including the technical aspects and the non-technical competencies, such as creativity and innovation, intercultural intelligence, and a collaborative spirit. Finally, this experience encourages students to engage in the broad array of intellectual opportunities provided during their undergraduate education, including additional CRE events and other programs across campus.

In previous years, the CRE has brought in a keynote speaker related to the book to engage students even deeper with the text. William Kamkwamba, author and protagonist of *The Boy Who Harnessed the Wind*, spoke on campus in November 2014 to engage the engineering community on the topic, “How I Harnessed the Wind: Creating Currents of Electricity and Hope.” David Merritt, founder of Detroit-based Merit apparel spoke to students about “Doing Well and Doing Good” as part of the 2013 program, following the CRE book *The Travels of a T-Shirt in the Global Economy* by Pietra Rivoli. Other events related to the themes in the CRE books have included a student organization fair, volunteering activities, and t-shirt distribution events.

## **Assessment Measures**

An assessment instrument was developed to gauge how the CRE was meeting its goals: helping students develop a sense of belonging, sense of community, and engineering student identity, in addition to widening their perceptions of engineering and diversity in engineering. These five measures are important for first-year students to develop as they begin their engineering career.

### *Sense of Belonging*

A *sense of belonging* “reflects the feeling that one fits in, belongs to, or is a member of the academic community in question” (Good, Rattan, & Dweck, 2012, p700). If a student does not feel that they belong to a certain major, they may have difficulty engaging in the material or the community, and they may be less likely to persist (Smith et al., 2012). Increasing sense of belonging can be of particular importance for students in underrepresented groups – in engineering, women and underrepresented minorities – as they already may feel doubts that they can integrate into the major (Jordan, Sorby, & Amato-Henderson, 2012; Litzler & Samuelson, 2013; Walton & Cohen, 2011; Weaver, Decaro, Hieb, & Ralston, 2008) .

### *Sense of Community*

More broadly, a *sense of community* means that students have a “feeling of belonging within a group” (Osterman, 2000, p324). Having a sense of community means that a person feels they belong in the group, matter to the group, can have their needs met by the group, and have a shared connection with other members in the group (McMillan & Chavis, 1986). While a sense of belonging implies that a student feels that they can fit in the major they have chosen, a sense of community means that they also feel connected to their peers. A community is considered to have two dimensions: a social community and a learning community (Rovai, Wighting, & Lucking, 2004). A social community involves “spirit, cohesion, trust, safety, interactivity, interdependence and sense of belonging” (K., 2014, p16). Students need “social support” from others in their first year to persist (Wilcox, Winn, & Fyvie-Gauld, 2005). The learning

community aspect means that students feel that they have shared academic goals and interests with their peers, and are able to feel supported academically, socially and personally by those that they work with (Tinto, 1997).

### *Identity*

Another construct related to a sense of belonging is *identity* (Antonsich, 2010). Identity relates to how students view themselves as a member of a particular community and can be defined as “how students see themselves as powerful thinkers and doers of a specific subject” (Godwin, Potvin, Hazari, & Lock, 2016, p314). Having a stronger sense of identity also relates to learning and engagement. Students who have a stronger identity will participate more fully and engage more with the material (Lave & Wenger, 2000), and also better value deeper thinking and conceptual understanding (Boaler & Greeno, 2000).

### *Perceptions of Engineering and Diversity in Engineering*

Development of professional engineering identity can be linked to *perceptions of engineering* (Chachra, Kilgore, Loshbaugh, McCain, & Chen, 2008). As students form their identity, how they perceive engineering or engineers may change. Ideally, students have perceptions that engineering is an important, impactful field; also, strong *perceptions of the importance of diversity in engineering*. Modern engineers must value a broad range of skills to be successful, such as oral and written communication, teamwork and social skills, and a strong sense of ethics (ABET, 2016; Rugarcia, Felder, Woods, & Stice, 2000). Engineers work with diverse groups of people, with an array of perspectives and skills. As students enculturate into the engineering field (and as their sense of belonging, sense of community and engineering identity grow), it is important that engineering students have the perception that engineers value diverse perspectives and need to work in diverse teams to be successful.

## **Research Questions**

To assess the impact of the CRE, the following research questions were explored:

1. How do engineering students’ sense of belonging, sense of community, engineering student identity and perceptions of engineering and diversity change throughout the Common Reading Experience?
2. What differences exist in these measures between students of different gender identities?
3. What differences exist in these measures between students of different races and/or ethnicities?
4. How do non-engineering students’ sense of belonging, sense of community, and identity as a student in their program change as they begin college?
5. How do engineering and non-engineering students compare in how their sense of belonging, sense of community, and identity change as they begin college?

## **Methods**

In the summer of 2017, over 2,900 incoming first-year students (1,450 engineering students and 1,450 non-engineering students) were sent a pre-CRE survey that gauged students’ sense of

belonging, community, and identity; and, if students were in the College of Engineering, their perceptions of engineering and perceptions of diversity in the engineering career. Students also reported demographic information. One week later, engineering students received *The Immortal Life of Henrietta Lacks* to be read over the summer as part of the Common Reading Experience (CRE). Upon arriving on campus, engineering students were assigned a discussion session to participate in during the first month of school. Over 99% of those students completed the program by participating in a discussion session. After the discussion sessions were completed, both engineering and non-engineering students received a post-CRE survey, once again gauging their sense of belonging, community, and engineering identity; and, if they were engineering students, perceptions of the engineering career and perceptions of diversity in engineering. They also completed a program evaluation of the CRE.

## **Survey Instrument**

Ultimately, the purpose of this study was to determine if the CRE was achieving goals 1 and 2 in the short-term:

1. Students build and develop a sense of community (including a sense of belonging and engineering identity)
2. Students broaden their thinking about the skills (both technical and non-technical) that they need to be a successful engineer in the 21st century

Embedded in each of these goals is an intention to increase students' value of diversity in engineering, therefore, that factor was also an area of focus.

To accomplish this, an assessment instrument was developed containing items organized in five constructs: sense of belonging, sense of community, engineering student identity (pertaining to goal 1) and student perceptions of the engineering career and of diversity in engineering (pertaining to goal 2).

1. **Sense of Belonging:** The items in this construct contain the relevant items from the Sense of Belonging instrument used to assess youth development programs, which is used to gauge whether students feel “welcome, comfortable, and accepted.” (Anderson-Butcher & Conroy, 2002)
2. **Sense of Community:** The items in this construct are a subset of the Collegiate Psychological Sense of Community (CPSC). (Lounsbury & DeNeui, 1996)
3. **Engineering Student Identity:** The items in this construct are a subset of the Centrality and Group Identification constructs in the Academic Pathways Study survey, used to investigate the relationship between gender and identity in engineering students. (Chachra et al., 2008)
4. **Perceptions of Engineering:** The items in this construct are also from the Academic Pathways Study survey, from the Private Regard and Public Regard constructs, aimed at measuring if students have positive perceptions of the engineering career and if they believe others also perceive it positively. (Chachra et al., 2008)

5. **Perceptions of Diversity in Engineering:** These items were developed by the research team, aimed at investigating if students believe that diversity, equity and inclusion are important to engineers and the engineering field.

Students rated their agreement with each item (Table 1) on the Likert scale, where 5 = strongly agree and 1 = strongly disagree.

**Table 1.** Items in the survey instrument.

<b>Construct</b>	<b>Item</b>
Sense of Belonging	I feel comfortable in the College of Engineering.
	The leaders at the College of Engineering make me feel wanted and accepted.
	I am committed to the College of Engineering.
Sense of Community	I feel there is a real sense of community at this university.
	I feel that I am supported in the College of Engineering.
	I feel that I really belong at this university.
	I feel there is a strong feeling of togetherness at the College of Engineering.
	I really enjoy going to school at this university.
	I feel very attached to this college.
Engineering Student Identity	In general, being an engineering student is an important part of my self-image.
	Being an engineering student is important to my sense of what kind of person I am.
	Being an engineering student is an important reflection of who I am.
	I am happy that I am going to be an engineer.
	I am proud to be an engineer.
Perceptions of Engineering	I feel that engineers have made major accomplishments and advancements.
	I feel that the engineering community has made valuable contributions to the society.
	Engineers are respected by the broader society.
	In general, other professionals view engineers in a positive manner.
	Society views engineers as an asset.
Perceptions of Diversity in Engineering	Engineers value diverse perspectives.
	Engineers are skilled at interacting and communicating with different types of people.
	Engineers consider different cultures in addressing technical challenges.
	Engineers need to work in diverse teams to produce the best work possible.

Although items were drawn from three previously-validated surveys, these survey constructs have not yet been validated and will be as part of future work. For the non-engineering student

survey, students only responded to items pertaining to sense of belonging, sense of community, and engineering student identity; any item regarding “engineering” was changed to “my major” and College of Engineering was changed to “my school/college.”

## Participants

The surveys were distributed to 2,900 incoming first-year students (1,450 in engineering and 1,450 in non-engineering majors). 731 engineering students submitted complete responses to the pre-CRE survey, while 1,128 engineering students submitted complete responses to the post-CRE survey. 731 non-engineering students completed the pre-CRE survey fully, while 343 non-engineering students completed the post-CRE survey. The post-CRE survey participation was likely lower for non-engineering students because it was not linked to a specific event, whereas the engineering students completed their post-CRE survey soon after participating in the CRE discussion. Table 2 shows the number of participants for each survey, organized by racial/ethnic identity and gender identity.

**Table 2.** Number of survey participants.

		<i>Engineering Students</i>		<i>Non-Engineering Students</i>	
		<i>Pre-CRE Survey</i>	<i>Post-CRE Survey</i>	<i>Pre-CRE Survey</i>	<i>Post-CRE Survey</i>
<b>All students</b>		<b>731</b>	<b>1128</b>	<b>731</b>	<b>343</b>
<i>Gender Identity</i>	Female students	236	342	475	242
	Male students	475	721	239	91
	Non-binary students	4	3	2	1
	Prefer to not answer or no response	16	62	15	9
<i>Race/Ethnicity</i>	Caucasian students	423	635	459	222
	Asian/Asian-American students	168	251	139	67
	Hispanic students	39	43	25	13
	African/African-American students	13	26	39	7
	Hawaiian or Pacific Islander students	1	2	0	0
	American Indian or Alaskan Native students	2	1	0	0
	Multiple races and/or ethnicities	64	95	55	26
	Prefer to not answer or no response	21	75	17	8

Students who reported non-binary gender identity, Hawaiian or Pacific Islander students, and American Indian or Alaskan Native students were excluded from statistical analysis due to small population sizes.

## Results and Analysis

**How do engineering students' sense of belonging, sense of community, engineering student identity and perceptions of engineering and diversity change throughout the Common Reading Experience?**

When comparing the pre- and post-CRE surveys for all engineering students, the one significant change was in perceptions of engineering, which decreased (Table 3); In other words, between the summer before starting college and arrival on campus, students did not feel a significantly stronger sense of belonging, sense of community, engineering student identity, or have stronger perceptions of diversity in engineering.

**Table 3.** Comparing pre- and post-CRE survey responses for all engineering students.

	<i>Pre</i>	<i>Post</i>	<i>P-Value</i>
Sense of Belonging	4.25	4.30	0.09
Sense of Community	4.23	4.20	0.31
Engineering Student Identity	4.26	4.21	0.09
Perceptions	4.57*	4.52*	0.01
Diversity	4.14	4.14	0.91

\* signifies statistical significance at p=0.05.

**What differences exist in these measures between students of different gender identities?**

Male engineering students reported a significant increase in sense of belonging from the pre- to post-CRE survey. Female engineering students reported a significant decrease in perceptions of engineering (Table 4). No other significant changes were observed when comparing the measures across gender identity.

**Table 4.** Comparing pre- and post-CRE survey responses for male and female engineering students.

	<i>Male Students</i>			<i>Female Students</i>		
	<i>Pre</i>	<i>Post</i>	<i>P-Value</i>	<i>Pre</i>	<i>Post</i>	<i>P-Value</i>
Sense of Belonging	4.29*	4.36*	0.03	4.19	4.2	0.92
Sense of Community	4.24	4.24	0.96	4.22	4.15	0.18
Engineering Student Identity	4.3	4.23	0.07	4.19	4.17	0.56
Perceptions	4.58	4.53	0.1	4.57*	4.5*	0.04
Diversity	4.11	4.14	0.47	4.21	4.17	0.42

\* signifies statistical significance at p=0.05.

Comparing male and female engineering students' responses in the pre-CRE survey, male students reported a significantly higher sense of belonging and engineering student identity than female students. Female students reported a higher perception of diversity's role in engineering. In the post-CRE survey, male students continued to have a higher sense of belonging than female students, and also reported a higher sense of community (Table A1 in the Appendix).



From this data, it can be concluded that the CRE meets goal 1 (students building a sense of belonging and community) for male students, in that they experience an increase in sense of belonging and community after they participate in the CRE, although female students are not impacted in this area. Additional factors beyond the CRE may influence these measures: for example, the generally male-dominated culture of the engineering profession likely contributes to male students starting with stronger measures (senses of belonging and engineering student identity) and subsequently seeing greater gains.

In considering goal 2 (valuing engineering and diversity), the CRE appears to have no short-term impact for male students, and a limited or possibly negative impact for female students, given that female students experience a negative change in their perceptions of the engineering career over the short-term. However, goal 2 may also be impacted by many other factors beyond the CRE. For example, during the same time period of the CRE, students start many rigorous first-year STEM courses and may be questioning their place in the engineering field which could result in negative changes in this measure.

**What differences exist in these measures between students of different races and/or ethnicities?**

Next, we analyzed differences between these same five measures for students of different racial or ethnic identities. Caucasian students were the only racial group to experience a significant change in their engineering student identity and perceptions of engineering, which decreased. Students reporting multiple races/ethnicities were the only racial group to experience a significant change in sense of belonging, which increased. There was no difference across student racial identity for sense of community or perceptions of diversity (Table 5).

**Table 5.** Comparing pre- and post-CRE survey responses for engineering students of various racial/ethnic identities.

	<i>Caucasian</i>			<i>Asian/Asian-American</i>			<i>Hispanic</i>			<i>African/African-American</i>			<i>Multiple Races/Ethnicities</i>		
	<i>Pre</i>	<i>Post</i>	<i>P-Value</i>	<i>Pre</i>	<i>Post</i>	<i>P-Value</i>	<i>Pre</i>	<i>Post</i>	<i>P-Value</i>	<i>Pre</i>	<i>Post</i>	<i>P-Value</i>	<i>Pre</i>	<i>Post</i>	<i>P-Value</i>
Sense of Belonging	4.2	4.3	0.38	4.2	4.3	0.24	4.3	4.4	0.21	4.4	4.2	0.43	4.2*	4.4*	0.02
Sense of Community	4.3	4.2	0.19	4.2	4.2	0.94	4.3	4.3	0.74	4.2	4.1	0.59	4.2	4.3	0.24
Engineering Student Identity	4.3*	4.2*	0.01	4.2	4.2	0.55	4.3	4.4	0.35	4.4	4.2	0.45	4.2	4.4	0.07
Perceptions	4.6*	4.5*	0.009	4.5	4.5	0.3	4.6	4.6	0.6	4.6	4.5	0.72	4.5	4.6	0.16
Diversity	4.1	4.1	0.2	4.2	4.2	0.65	4.5	4.3	0.12	4.1	4.1	0.84	4.1	4.1	0.96

\* signifies statistical significance at p=0.05.

Comparing across racial/ethnic groups for the pre-CRE survey, Hispanic students reported a significantly higher perception of the importance of diversity to engineering as compared with other groups (Table A2 in Appendix). For the post-CRE survey, Hispanic students reported a significantly higher engineering student as compared with other groups (Table A3 in Appendix).

The data presented here indicates that the CRE does not significantly affect most students of underrepresented racial or ethnic groups, with the exception of students with multiple racial/ethnic identities reporting stronger sense of belonging after participating in the CRE.

***How do non-engineering students' sense of belonging, sense of community, and identity as a student in their program change as they begin college?***

Non-engineering students experienced a significant decrease in all three constructs (Table 6).

**Table 6.** Comparing pre- and post-CRE survey responses for all non-engineering students.

	<i>Pre</i>	<i>Post</i>	<i>P-Value</i>
Sense of Belonging	4.25*	4.13*	0.002
Sense of Community	4.26*	4.02*	<0.001
Identity as a Student in their Program	4.26*	4.12*	0.001

\* signifies statistical significance at p=0.05.

Male non-engineering students reported a significant decrease in sense of community. Female non-engineering students reported a significant decrease across all three measures (Table 7).

**Table 7.** Comparing pre- and post-CRE survey responses for non-engineering male and female students.

	<i>Male Students</i>			<i>Female Students</i>		
	<i>Pre</i>	<i>Post</i>	<i>P-Value</i>	<i>Pre</i>	<i>Post</i>	<i>P-Value</i>
Sense of Belonging	4.28	4.16	0.1	4.25*	4.11*	0.005
Sense of Community	4.28*	4.14*	0.06	4.26*	3.97*	<0.001
Identity as a Student in their Program	4.23	4.14	0.26	4.29*	4.12*	0.001

\* signifies statistical significance at p=0.05.

There were no significant differences between male and female students in the pre-CRE survey. In the post-CRE survey, male students reported a higher sense of community than female students (Table A4 in Appendix).

This data implies that non-engineering students generally do not benefit in these measures upon starting college; female students, particularly, feel less like they belong, have a community, or identify as a student in their program after they start classes. Although male students have a stronger sense of community than female students after starting college, they still experienced a decrease in that measure upon starting school.

Non-engineering Caucasian, Asian/Asian-American, Hispanic and African/African-American students all experienced a significant decrease in sense of community between the pre and post survey. Caucasian students also experienced a significant decrease in their identity as a student in their program, and African/African-American students experience a significant decrease in their sense of belonging (Table 8).

**Table 8.** Comparing pre- and post-CRE survey responses for non-engineering students of various racial/ethnic identities.

	<i>Caucasian</i>			<i>Asian/Asian-American</i>			<i>Hispanic</i>			<i>African/African-American</i>			<i>Multiple Races/Ethnicities</i>		
	<i>Pre</i>	<i>Post</i>	<i>P-Value</i>	<i>Pre</i>	<i>Post</i>	<i>P-Value</i>	<i>Pre</i>	<i>Post</i>	<i>P-Value</i>	<i>Pre</i>	<i>Post</i>	<i>P-Value</i>	<i>Pre</i>	<i>Post</i>	<i>P-Value</i>
Sense of Belonging	4.28	4.21	0.16	4.16	4.03	0.12	4.16	4.03	0.12	4.15*	3.25*	0.04	4.3	4.12	0.25
Sense of Community	4.3*	4.11*	<0.001	4.13*	3.94*	0.04	4.13*	3.94*	0.04	4.1*	3.1*	0.048	4.28	4.04	0.14
Identity as a Student in their Program	4.27*	4.15*	0.02	4.21	4.1	0.19	4.21	4.1	0.19	4.28	4.06	0.34	4.33	4.23	0.49

\* signifies statistical significance at p=0.05.

When comparing non-engineering students across racial/ethnic groups for the pre-CRE survey, a significant difference occurred in students' sense of community (Table A5 in Appendix). For the post-CRE survey, a significant difference occurred in students' sense of belonging and sense of community (Table A6 in Appendix).

***How do engineering and non-engineering students compare in how their sense of belonging, sense of community, and identity change as they begin college?***

Although there were no differences between engineering and non-engineering students in the pre-CRE survey, engineering students reported a higher sense of belonging and sense of community in the post survey (Table 9).

**Table 9.** Comparing survey responses for engineering and non-engineering students.

	<i>Pre Survey</i>			<i>Post Survey</i>		
	<i>Engin</i>	<i>Non</i>	<i>P-Value</i>	<i>Engin</i>	<i>Non</i>	<i>P-Value</i>
Sense of Belonging	4.25	4.25	0.95	4.3*	4.13*	<0.001
Sense of Community	4.23	4.26	0.27	4.2*	4.02*	<0.001
Identity as a Student in their Program	4.26	4.26	0.77	4.13	4.21	0.06

\* signifies statistical significance at p=0.05.

This implies that engineering and non-engineering students feel the same before starting college, in terms of their sense of belonging, sense of community, and identity as a student in their program. However, once they start college, non-engineering students experience a significant decrease in these measures that engineering students do not.

Female non-engineering students had a higher sense of identity than female engineering students in the pre-CRE survey, but this difference was not observed in the post-CRE survey. Female engineering students had a higher sense of community in the post survey (Table A7 in Appendix). In comparing male engineering and male non-engineering students, the only significant difference was that male engineering students had a higher sense of belonging in the post survey (Table A8 in Appendix).

When comparing engineering and non-engineering students within each racial/ethnic group, no differences existed in the pre-CRE survey (Tables A9-A13 in Appendix). In the post survey, Caucasian and Asian/Asian-American engineering students reported a higher sense of community than non-engineering students. Also in the post survey, engineering students who identified as Asian/Asian-American, African/African-American, or as multiple racial/ethnic identities reported a higher sense of belonging.

In comparing these results, engineering students' lack of change is encouraging. Non-engineering students experienced a significant *decrease* in their sense of belonging, sense of community, and identity as a student in their program when arriving to campus. The changes were more notable when analyzing the data specifically for female students and underrepresented minority groups. Although engineering students did not experience an *increase*, they did not experience as many negative changes as their non-engineering peers. It is possible that the CRE (along with other incoming student experiences) may be *preventing* engineering students from experiencing a decline in these measures. Thus, it appears that arriving on campus and participating in the CRE is a positive experience for female and other underrepresented engineering students, given that they report significantly higher than non-engineering students in multiple measures in the post-CRE survey.

## Conclusions and Implications

When considering the analysis of the engineering student data alone, it could appear that the Common Reading Experience does not significantly impact students in a positive way. From the summer before starting college to shortly after beginning their first semester, engineering students did not indicate a stronger sense of belonging, stronger sense of community, stronger engineering student identity, or have more positive perceptions of the engineering field or diversity within engineering.

However, when comparing the non-engineering and engineering student data, it does appear that the Common Reading Experience may benefit students. Students generally reported the same values for sense of belonging, sense of community, and identity prior to starting college, regardless of their major. However, shortly after beginning their first semester, engineering students did not experience as many negative changes as their non-engineering peers, implying that there are factors within students' college/school of choice that significantly impact their experience. Therefore, it is clear that the Common Reading Experience (likely in conjunction with other College of Engineering initiatives) plays a role in helping students maintain their sense of belonging, sense of community, and identity as an engineer, particularly for female and other underrepresented students.

While this work indicates that efforts, such as the Common Reading Experience, can help *prevent* engineering students from experiencing decreases in these measures, there is more work to be done to identify efforts that will *increase* these measures for students upon starting college. Future work might also include a longitudinal assessment, an evaluation of additional programs and initiatives that impact students over the same short-term period, and a look at what factors contribute to the decreases observed among all students during arrival on campus. Currently, this work is being continued through student focus groups (separately with male non-URM students,

with female students, and with underrepresented students) to determine how the Common Reading Experience could be evolved to further increase the impact upon first-year students.

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## Appendix

### Comparing responses for engineering students

**Table A1.** Comparing survey responses between male and female engineering students.

	<i>Pre-CRE Survey</i>			<i>Post-CRE Survey</i>		
	<i>Male</i>	<i>Female</i>	<i>P-Value</i>	<i>Male</i>	<i>Female</i>	<i>P-Value</i>
Sense of Belonging	4.29*	4.19*	0.03	4.36*	4.2*	<0.001
Sense of Community	4.24	4.22	0.54	4.24*	4.15*	0.03
Engineering Student Identity	4.3*	4.19*	0.03	4.23	4.17	0.14
Perceptions	4.58	4.57	0.95	4.53	4.5	0.32
Diversity	4.11*	4.21*	0.04	4.14	4.17	0.42

\* signifies statistical significance at  $p=0.05$ .

**Table A2.** Comparing pre-CRE survey responses for engineering students of each racial/ethnic group.

	Caucasian	Asian/Asian-American	Hispanic	African/African-American	Multiple	P-Value
Sense of Belonging	4.27	4.23	4.25	4.35	4.21	0.81
Sense of Community	4.26	4.20	4.29	4.17	4.21	0.63
Engineering Student Identity	4.28	4.24	4.31	4.40	4.19	0.58
Perceptions	4.60	4.54	4.55	4.54	4.54	0.55
Diversity	4.10*	4.20*	4.48*	4.13*	4.14*	0.003

\* signifies statistical significance at  $p=0.05$ .

**Table A3.** Comparing post-CRE survey responses for engineering students of each racial/ethnic group.

	Caucasian	Asian/Asian-American	Hispanic	African/African-American	Multiple	P-Value
Sense of Belonging	4.30	4.30	4.41	4.20	4.42	0.19
Sense of Community	4.21	4.19	4.33	4.05	4.31	0.2
Engineering Student Identity	4.19*	4.20*	4.43*	4.20*	4.36*	0.03
Perceptions	4.53	4.50	4.61	4.48	4.63	0.09
Diversity	4.14	4.17	4.30	4.08	4.13	0.52

\* signifies statistical significance at  $p=0.05$ .

## Comparing responses for non-engineering students

**Table A4.** Comparing survey responses between male and female non-engineering students.

	<i>Pre-CRE Survey</i>			<i>Post-CRE Survey</i>		
	<i>Male</i>	<i>Female</i>	<i>P-Value</i>	<i>Male</i>	<i>Female</i>	<i>P-Value</i>
Sense of Belonging	4.28	4.25	0.48	4.16	4.11	0.5
Sense of Community	4.28	4.26	0.71	4.14*	3.97*	0.04
Identity as a Student in their Program	4.23	4.29	0.23	4.14	4.12	0.8

\* signifies statistical significance at p=0.05.

**Table A5.** Comparing pre-CRE survey responses for non-engineering students of each racial/ethnic group.

	<i>Caucasian</i>	<i>Asian/Asian-American</i>	<i>Hispanic</i>	<i>African/African-American</i>	<i>Multiple</i>	<i>P-Value</i>
Sense of Belonging	4.28	4.16	4.38	4.15	4.30	0.12
Sense of Community	4.30*	4.13*	4.41*	4.10*	4.28*	0.004
Identity as a Student in their Program	4.27	4.21	4.33	4.28	4.33	0.74

\* signifies statistical significance at p=0.05.

**Table A6.** Comparing post-CRE survey responses for non-engineering students of each racial/ethnic group.

	<i>Caucasian</i>	<i>Asian/Asian-American</i>	<i>Hispanic</i>	<i>African/African-American</i>	<i>Multiple</i>	<i>P-Value</i>
Sense of Belonging	4.21*	4.03*	3.73*	3.25*	4.12*	<0.001
Sense of Community	4.11*	3.94*	3.68*	3.10*	4.04*	<0.001
Identity as a Student in their Program	4.15	4.10	3.98	4.06	4.23	0.81

\* signifies statistical significance at p=0.05.

## Comparing engineering and non-engineering students

**Table A7.** Comparing survey responses for female engineering and non-engineering students.

	<i>Pre Survey</i>			<i>Post Survey</i>		
	<i>Engin</i>	<i>Non</i>	<i>P-Value</i>	<i>Engin</i>	<i>Non</i>	<i>P-Value</i>
Sense of Belonging	4.19	4.25	0.19	4.2	4.11	0.09
Sense of Community	4.22	4.26	0.26	4.15*	3.97*	0.002
Identity as a Student in their Program	4.19*	4.28*	0.04	4.17	4.12	0.38

\* signifies statistical significance at p=0.05.



**Table A8.** Comparing survey responses for male engineering and non-engineering students.

	<i>Pre Survey</i>			<i>Post Survey</i>		
	<i>Engin</i>	<i>Non</i>	<i>P-Value</i>	<i>Engin</i>	<i>Non</i>	<i>P-Value</i>
Sense of Belonging	4.29	4.28	0.9	4.36*	4.16*	0.005
Sense of Community	4.24	4.28	0.38	4.24	4.14	0.15
Identity as a Student in their Program	4.3	4.23	0.18	4.23	4.14	0.26

\* signifies statistical significance at p=0.05.

**Table A9.** Comparing non-engineering and engineering Caucasian students.

	<i>Pre</i>			<i>Post</i>		
	<i>Engin</i>	<i>Non</i>	<i>P-Value</i>	<i>Engin</i>	<i>Non</i>	<i>P-Value</i>
Sense of Belonging	4.27	4.28	0.86	4.3	4.21	0.052
Sense of Community	4.26	4.3	0.18	4.21*	4.11*	0.03
Identity as a Student in their Program	4.28	4.27	0.8	4.19	4.15	0.41

\* signifies statistical significance at p=0.05.

**Table A10.** Comparing non-engineering and engineering Asian/Asian-American students.

	<i>Pre</i>			<i>Post</i>		
	<i>Engin</i>	<i>Non</i>	<i>P-Value</i>	<i>Engin</i>	<i>Non</i>	<i>P-Value</i>
Sense of Belonging	4.23	4.16	0.27	4.3*	4.03*	0.002
Sense of Community	4.2	4.13	0.34	4.19*	3.94*	0.01
Identity as a Student in their Program	4.24	4.21	0.73	4.2	4.1	0.26

\* signifies statistical significance at p=0.05.

**Table A11.** Comparing non-engineering and engineering Hispanic students.

	<i>Pre</i>			<i>Post</i>		
	<i>Engin</i>	<i>Non</i>	<i>P-Value</i>	<i>Engin</i>	<i>Non</i>	<i>P-Value</i>
Sense of Belonging	4.25	4.38	0.38	4.41	3.73	0.06
Sense of Community	4.29	4.41	0.35	4.33	3.68	0.08
Identity as a Student in their Program	4.31	4.33	0.92	4.43	3.98	0.17

\* signifies statistical significance at p=0.05.

**Table A12.** Comparing non-engineering and engineering African/African-American students.

	<i>Pre</i>			<i>Post</i>		
	<i>Engin</i>	<i>Non</i>	<i>P-Value</i>	<i>Engin</i>	<i>Non</i>	<i>P-Value</i>
Sense of Belonging	4.25	4.15	0.28	4.21*	3.25*	0.03
Sense of Community	4.17	4.1	0.75	4.05	3.1	0.06
Identity as a Student in their Program	4.4	4.28	0.66	4.2	4.06	0.52

\* signifies statistical significance at p=0.05.

**Table A13.** Comparing non-engineering and engineering students with multiple racial/ethnic identities.

	<i>Pre</i>			<i>Post</i>		
	<i>Engin</i>	<i>Non</i>	<i>P-Value</i>	<i>Engin</i>	<i>Non</i>	<i>P-Value</i>
Sense of Belonging	4.21	4.3	0.39	4.42*	4.12*	0.04
Sense of Community	4.21	4.29	0.45	4.31	4.04	0.09
Identity	4.19	4.33	0.17	4.36	4.23	0.35

\* signifies statistical significance at  $p=0.05$ .