

## **Facilitating a Student-Led, Large-Scale Engineering Bridge Camp: Twelve Years of Tips from the Trenches**

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Adrienne Steele has 20 years experience in STEM education. Currently, Adrienne works at Louisiana State University as the Assistant Director of Student Programs and Outreach in the Chevron Center for Engineering Education. Her current responsibilities include managing a large peer mentoring program, facilitating all aspects of a first year student bridge camp, assisting faculty members with outreach activities and grant proposals, and working with other student leadership programs in the College of Engineering. Previously, she coordinated the Scope-On-A-Rope (SOAR) Outreach Program in the Department of Biological Sciences, where she worked for 10 years and led 175 workshops for K-12 teachers. Prior to her positions at LSU, Adrienne was the Science Education Curator at the Louisiana Art and Science Museum in Baton Rouge. Adrienne has a Master of Science degree in zoology, and an Education Specialist Certification in science education.

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## Introduction and Program History

The transition from high school to college can be difficult for many students, causing many to drop out of school. The first discussions of retention in higher education go back to the 1930s, but early research on this topic was focused mainly on why students fail instead of why they succeed [1]. Vincent Tinto is credited with bringing this subject to the forefront and examining other non-academic factors as to why students drop out of college [2]. Using this data, many universities and colleges have implemented programs to assist students and improve retention, such as bridge camps, specialized introductory courses, tutoring and learning centers, and mentoring programs, to name a few [3]. Universities first started offering bridge camps over three decades ago. Since then, many universities and colleges continue to offer a variety of these camps, which can range from a few days to several weeks, sometimes aimed at specific populations of students from underrepresented groups or those with the highest likelihood of dropping out [3-6]. This complete, evidence-based practice paper will share results and lessons learned from the past twelve years of a bridge camp for first year students at LSU College of Engineering, Encounter Engineering (E<sup>2</sup>).

LSU is a land-, sea-, and space-grant university with about 25,000 undergraduate students, over 5,000 of whom have declared majors in the College of Engineering, making it the largest college at the university. Prior to introducing the bridge camp in 2007, the college's six-year graduate rate was 15% lower than the university as a whole, with the biggest drop in retention occurring between the first and second year (30%). The E<sup>2</sup> bridge camp was one of several initiatives implemented as part of the NSF-funded STEP project targeting first-year students to increase engineering student persistence to rates closer to those of the university as a whole [7]. The goals of this camp were to give students hands-on experience with the engineering design process; introduce them to campus resources; and connect them with faculty, staff, and peers.

The principle investigators of the STEP grant decided that the best way to increase retention at the college level was to make the bridge camp open to all first-year students. The camp usually takes place about a week before the fall semester begins and lasts for 5-7 days. Starting with forty-five participants and 5 student mentors in 2007, E<sup>2</sup> has grown to host 200-300 students each year with 70-90 mentors (Table I). For the past five years, the number of participants has fluctuated with the changes in the incoming class of students; one quarter to one third of all incoming engineering students typically register for this program. The number of mentors has likewise increased over time with student leaders becoming more and more responsible for the content of the camp. [Note: The program was canceled in 2016 due to the 100-year flood that occurred in Baton Rouge. Registration was kept low prior to the flood that year, because the engineering building was in the middle of a \$108 million renovation and expansion.]

The STEP 1a grant to LSU ended in 2011, and most of the programs developed from this award, including the bridge camp, were institutionalized in the College of Engineering. This program is currently sustained through participant fees, as well as support from the college and industry

donors. There is a full-time staff member who oversees all aspects of camp planning and execution, and who also serves as the advisor for the peer mentor student organization.

Table I  
Number of E<sup>2</sup> Participants and Mentors for Each Year of the Program

Year	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17	'18
<b>Participants</b>	45	84	106	125	140	149	201	231	341	464	306	196
<b>Mentors</b>	5	15	35	41	48	58	71	84	89	59	93	74

### Program Structure and Activities

#### *Registration*

Students self-select to participate in E<sup>2</sup>, although in many cases, the parents are the ones who make the decision to register their child for the program. The camp is advertised at all orientation sessions, in the LSU parent newsletter, in direct emails to prospective and declared students with majors in engineering or undecided, in a letter from the Dean, and in various social media outlets. Online registration begins in the spring, and students are accepted on a first-come-first-serve basis, based on maximum size requirements. In recent years, the camp did not reach maximum capacity, so a waitlist was not necessary.

The E<sup>2</sup> Camp currently costs \$350 with a \$50 non-refundable application fee. The fee is based on budgeting calculations; the aim is to break even and does not change much from year to year. The fees are charged directly to the students' university billing statement, which means that they can apply scholarship funding and/or loans to cover the cost. Due to the program's success and industry involvement, several companies have donated funds to help pay for different aspects of the camp. For example, a large petrochemical company has made a sizeable donation for the past four years to provide fee waivers for students with financial need. Each year, 30-40 students are able to attend E<sup>2</sup> for only the price of the application fee (\$50).

#### *Teams and Mentors*

Once registration is finalized, participants are placed into teams of 4-5. Team assignment is based on several factors, such as declared major and entering math course. Each team is led by a mentor, called a team leader, who is ideally in the same major as the participants. With the camp growing larger, it became necessary to place 10-15 teams into one of 6 groups. Each group is led by 2-3 mentors known as group leaders. Group leaders are mentors who have worked the camp at least once before. They need to have a good understanding of the camp structure, and they are given greater responsibilities. Team leaders attend activities with their participants all week, while group leaders assist in supervising team leaders and locate missing participants, among other duties. Figure 1 shows the hierarchy of camp positions—all of the leader positions are filled

by current undergraduate students except for the program director, who is a full-time staff member.

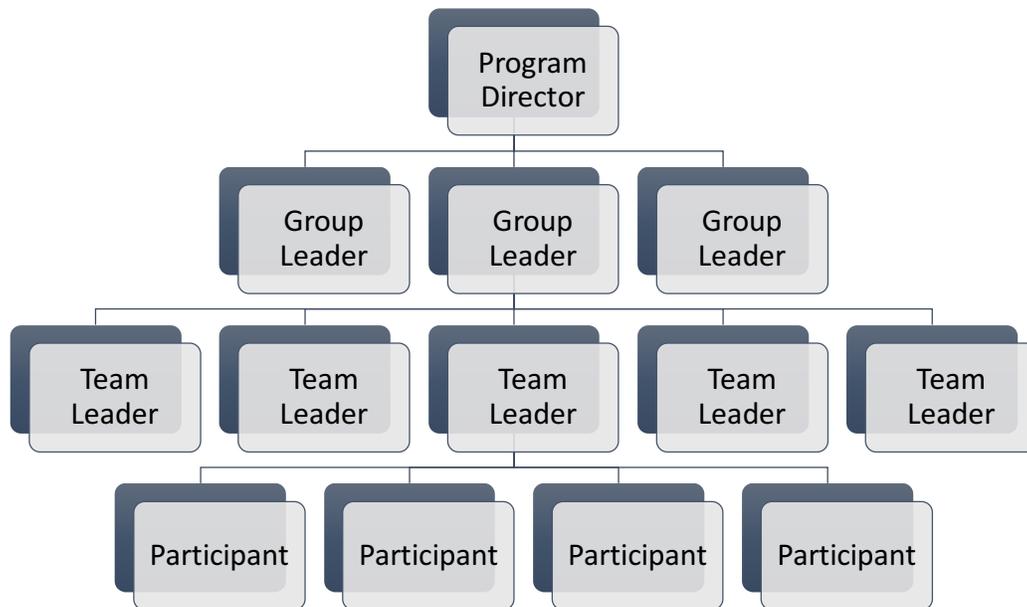


Figure 1. Hierarchy of E<sup>2</sup> camp participants, student leader positions, and program director

In addition to serving as team and group leaders, mentors also deliver program content (program leaders), develop and lead the design projects (design leaders), and assist with facilitating and organizing the camp (logistics leaders). This requires the hiring and training of many students, but year after year, participants say that getting to know their team leader and other upperclassmen is what they appreciate the most about this program. Managing as many as 95 student leaders can be overwhelming, but the hierarchical nature of their positions, along with mandatory leadership training and team building activities, makes a huge impact.

All E<sup>2</sup> student leaders are recruited from an engineering student organization, Society of Peer Mentors (SPM) at LSU. In order to join SPM, students must go through an application process; participate in an interview; and attend two leadership workshops in the spring semester, one of them an overnight retreat. These workshops focus on leadership skills, problem solving, and conflict resolution, with several team building activities to build community within the group. As an official campus organization, SPM has elected officers who lead monthly meetings and plan events and fundraisers. SPM members also participate in over 100 hours of K-12 outreach in the surrounding community each year, and about a dozen mentors are hired each year to assist middle and high school robotics teams. In 2019, there are 168 members of SPM, about half of whom will serve as leaders for E<sup>2</sup>. Any active member can apply to work E<sup>2</sup>, and the majority of students who become mentors attended E<sup>2</sup> as an incoming student and look forward to serving as a camp leader the following year. More details about the peer mentoring program at LSU can be found in references [8-10].

### *Activities*

Although  $E^2$  has changed in length over the years, it is currently a six-day program that begins 10 days before the start of the fall semester. Participants who are living on campus are able to move in a few days early, which has been a big motivator for students. (In fact, lower attendance in 2018 was likely due to residential life changing move-in day to right before camp, allowing students to move into their campus housing a full week before classes began, three days earlier than in past years.) Check in occurs in the afternoon of the first day, giving students time to move in that morning, if applicable. This is followed by a large welcome session to which all family members are invited. At the end of this welcome, parents are dismissed, and participants then meet their fellow team members and team leader over dinner.

For the rest of the week, activities begin around 8:00am and extend through the afternoon, with occasional evenings. A sample schedule of activities is shown in Table II. Participants rotate through several sessions over the first two full days of camp to assist in building team camaraderie and to set the expectations for the week. These activities include team building activities at the university's recreation center, introduction to their design projects and time to start working on them, a session teaching proper business etiquette (which is helpful when preparing for the industry luncheon on the last day), and time management tips to have a successful first semester at LSU. All of these aforementioned activities are student-designed and led. Because they attend four hours of math refresher classes with faculty members from the mathematics department, students are placed into teams with other participants in the same entering math course. These math instructors focus on getting students familiar with the online math software and go over some important concepts that they may have forgotten since high school. Other sessions include learning about all the engineering majors offered at LSU and ways to enhance their college career (such as study abroad, internships, and minors), lunch with faculty and staff, a presentation on how to design a research poster, a student organization showcase, and culminating in a luncheon with industry representatives.

The students spend most of the remaining time on engineering design projects. Teams get to choose from eight different projects that are inspired by different engineering disciplines, but are tied to a common theme. Last year's theme was an amusement park renovation, and example projects included designing a safe roller coaster car (mechanical and biological), providing power to the park using electrical circuits (electrical and computer), planning the park layout (civil and industrial), and developing a chemically powered boat ride (chemical and mechanical). Each team also creates a poster to illustrate their design process. There is a design competition on the penultimate day, and the top posters are selected to be printed. The top designs and posters are displayed at the industry luncheon on the last day.

These incoming students are new to the university, and many are away from home for the first time.  $E^2$  does not count for a grade, nor do the participants get course credit. All of these factors can be a challenge since there is nothing forcing them to show up early every morning. Encouraging participation is one of the main jobs of the student leaders, which is why it is so important to have trained student leaders. Participants are also required to sign an agreement when they register stating that failure to show up to activities results in them being removed from the program—they cannot just pick the fun stuff and skip the sessions that do not interest them.

Table II  
Sample Schedule of Camp Activities

	<b>Fri</b>	<b>Sat</b>	<b>Sun</b>	<b>Mon</b>	<b>Tues</b>	<b>Wed</b>	
8:00am	Move In	Team Building, Design Project, Business Etiquette, etc. (Rotation 1)	Rotation 3	Math Refresher & Study Tips	Math Refresher, Finish Design Projects & Posters	Enhancing your College Career	
9:00am							
10:00am							
11:00am						Industry Lunch	
12:00pm		Lunch	Lunch	Lunch with College Faculty/Staff	Lunch		
1:00pm		Rotation 2	Rotation 4	Degree Discovery	Design Competition & Resume Help	Student Orgs	Closing Ceremony
2:00pm							
3:00pm						Snow Balls/Free Time	Poster Presentation
4:00pm		Check In					
5:00pm	Welcome Presentation	Engineering Mini Challenges	FREE	FREE	FREE		
6:00pm							
7:00pm	Welcome Dinner	Dinner	FREE	FREE	FREE		
8:00pm							

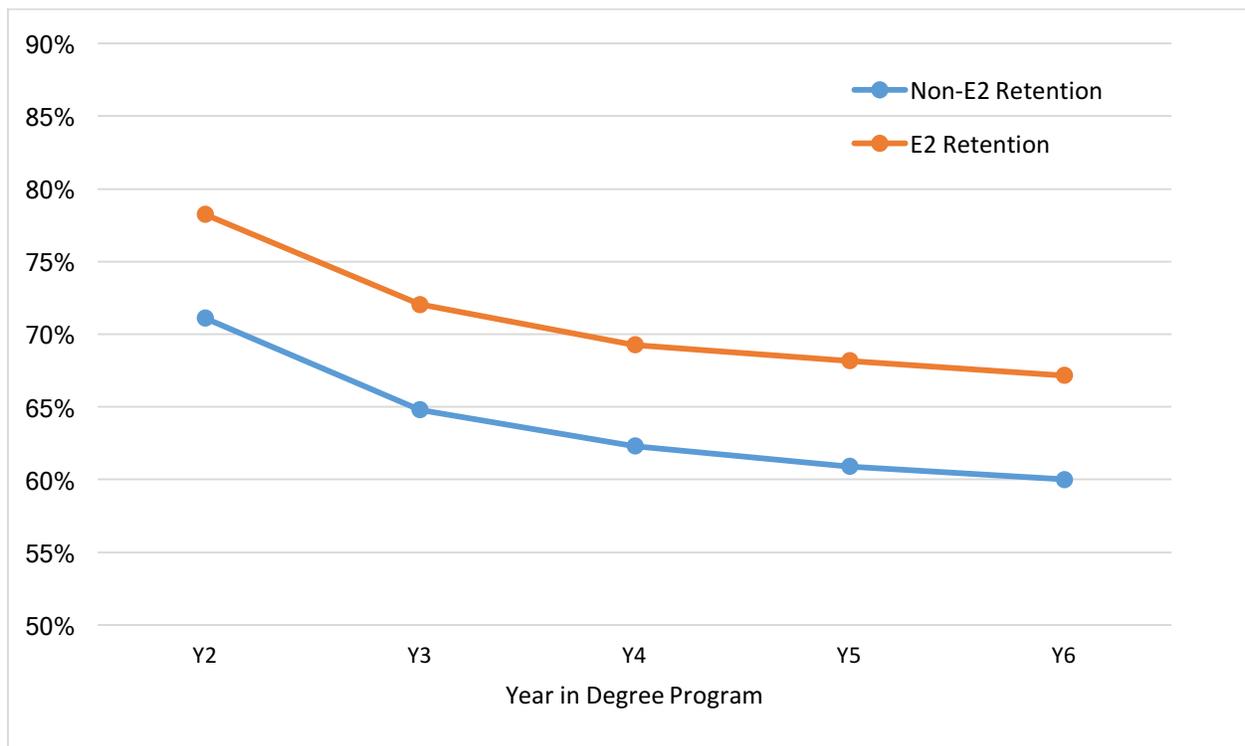
*Industry Partnerships*

In addition to supporting the program monetarily, many local engineering industries send representatives to attend the luncheon. Typically, 50-60 engineers participate in each year to network with these students, and one is selected to be a guest speaker. This is a great opportunity for any company who wants to get their name on the radars of students at the beginning of their college careers, and it benefits the students who need to practice selling themselves to industry representatives and who may not know much about what engineers do day-to-day. Since this program has existed for a dozen years, there are many SPM alumni who look forward to coming back to this event each year. Graduating mentors fill out an exit survey, and their new contact information is collected, so they can be added to the invitation list for the following year.

## Results

Performance in math courses and retention between years one and two are of particular importance in the LSU College of Engineering and are a main focus as an area for improvement. Retention rates for camp participants have been analyzed to examine overall impact. Participants are given pre- and post-assessments and program evaluation surveys; mentors are also surveyed and can volunteer to participate in focus groups. There are also many other indicators of success, such as the increase in students applying to become mentors after attending the camp, industry participation and the return of program alumni, and anecdotes from personal conversations.

A recent paper by LSU faculty and staff [11], found  $E^2$  participation to have a significant impact on retention in engineering between the first and second year, although this trend was not seen in years 3-6. By comparing demographic and academic preparation variables, it was shown that students who attended  $E^2$  were representative of the student population as a whole; this is important to note since the participants self-select for the camp. Since this camp has reached over a thousand students since its inception, and since the highest drop in student retention is seen between the first and second year, this finding is encouraging. Comparison of retention and graduation rates for  $E^2$  participants and non-participants are shown in Figures 2 and 3.  $E^2$  participants have 7% higher retention in engineering majors than their peers, and they graduate in engineering at 8-13.5% higher rates.



*Figure 2.* Retention in engineering majors for  $E^2$  participants ( $n=1002$ ) compared to non-participants ( $n=8526$ ) for cohort years 2009-2015

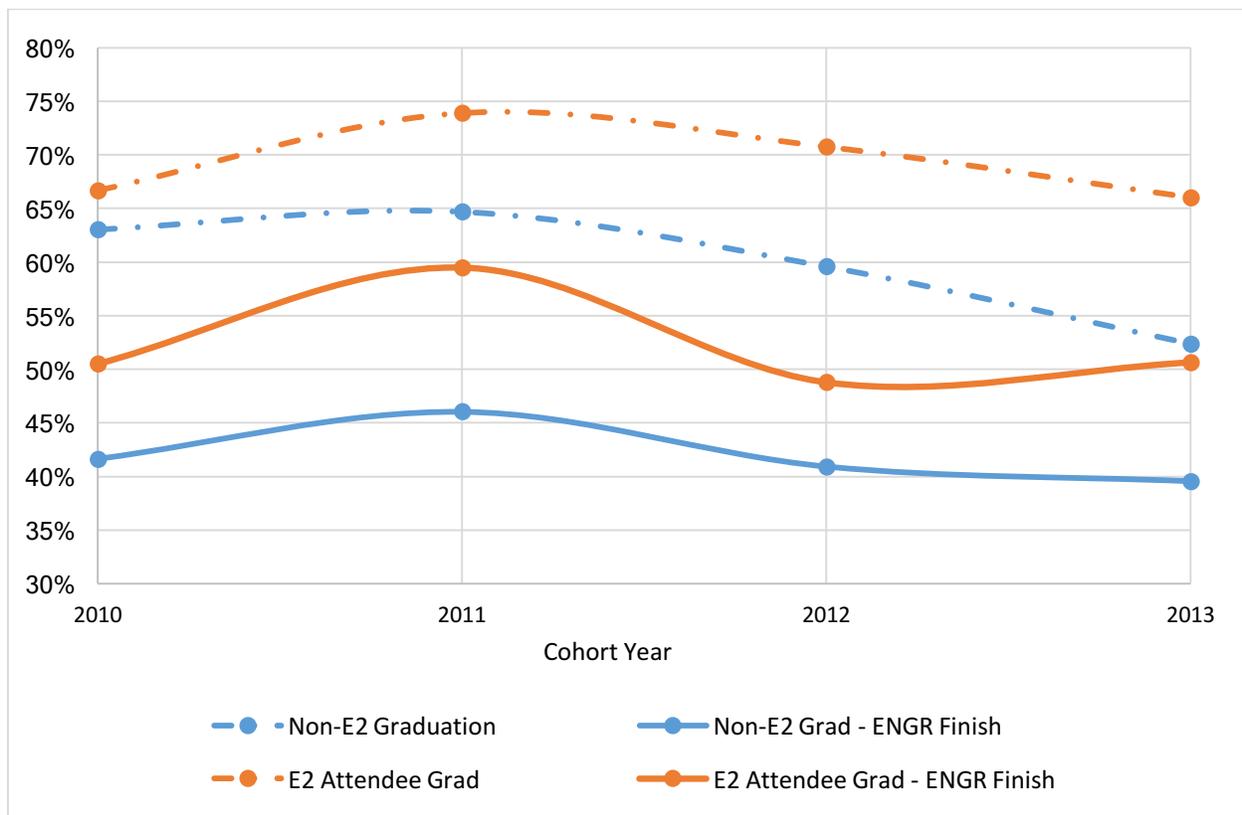


Figure 3. Graduation rates at LSU (any major) and in engineering for E<sup>2</sup> participants (n=394 LSU; n=295 ENG) compared to non-participants (n=3280 LSU; n=2305 ENG)

Participants complete a pre-assessment at the welcome dinner and a follow-up post-assessment at the closing event. Assessments are matched using student ID numbers, keeping their identities anonymous. Data from the past two years (2017-2018) indicate that participants chose to enroll in E<sup>2</sup> to meet other students (74%) and to be better prepared for their classes (80%). When asked on the post-survey if the camp delivered on these goals, 95% and 79% selected these same options. The largest increases from pre- to post-survey were that participants now know at least one faculty member in the college, they have friends in the same major, and they understand the engineering design process. An electronic post-survey was emailed to all 2017 E<sup>2</sup> participants several months after the program to see what aspects of camp were the most helpful to them as they completed their first semester. Forty-five students completed this post-survey (15% response rate). 87% of the 2017 survey participants reported to have stayed in touch with their teammates, 44% continued to contact their team leader, 23% changed their major (many did so because of what they learned during E<sup>2</sup>), and 67% indicated that the math sessions helped to prepare them for their first math course. The math sessions are not usually rated highly on the post-assessment given at the end of the camp, but the benefits of attending these sessions become more apparent once the semester has started and they have gotten their first test results. Mentors also complete a post-survey and participate in focus groups to assist with the planning for the

following year's camp. Their input is highly valued and used to create new sessions and modify others each year.

### Lessons Learned

The first step in hosting a large, successful bridge camp is to have staff members and other resources allocated to the program. Support from NSF was critical in starting a program of this nature, but it was important to get administrative support in order to institutionalize the program. Support staff were originally paid from the grant, but the college created a new position to keep the program going long-term. The current E<sup>2</sup> director has other job duties, but the camp and the peer mentor program make up 50% of her responsibilities (25% for each program). Fortunately, the current staff member spent two years assisting the previous camp director with this program, and experienced students also have assisted in easing the transition between staff. It is also imperative to partner with other campus programs, units, and resources to ensure that the program is successful. Some changes made by campus residential life in 2018 possibly had a negative impact on the camp's enrollment and participation due to competing activities. Communication for planning 2019's camp began immediately after the 2018 program to attempt to better coordinate these activities for the benefit of all students.

Since camp participation is not mandatory and there are many other distractions for a first-year student, signed program contracts have been helpful. Both the student and parent sign this agreement indicating that campers must participate in all activities or face expulsion from the camp. This helps to set the stage from the very beginning that we expect students to take the program seriously, as students will only benefit if they attend for the whole week. Parent/guardian contact information is also collected on the registration form, and they are copied on all camp correspondence. The need for this was determined several years ago when it was discovered that students were missing important information by not checking their emails. Parents are encouraged to attend the welcome presentation, but they are not invited to attend any other camp events, nor are they provided the students' complete schedule. This is to aid in their child's transition to college and life away from home.

Further, instituting a \$50 application fee helps to ensure a student is financially invested in attending the bridge camp. This prevents too many students from signing up when they are not sure they can make it and then canceling their registration at a later date, which is logistically problematic. Additionally, even students receiving financial fee waivers pay this application fee. This is to ensure their participation in the program, since in the past, students who went for free tended to be more likely not to show up.

The E<sup>2</sup> Camp would not be successful without the dozens of dedicated student leaders who facilitate it. Building a community of student leaders is essential through membership in a student organization, attending leadership workshops, and participating in team building activities. For example, the program was turned over to inexperienced staff members one year, and any current engineering student could apply to be a camp leader. The student leaders were not a cohesive group, and many of them did not have any prior camp or leadership experience. This change resulted in an increase of negative evaluations for that year's camp. Thankfully,

these issues were rectified quickly, resulting in a much more successful program in the years that followed.

The student leaders also need ownership of the program. It is not enough to survey them and lead focus groups; staff have to actually listen to their opinions and suggestions and act on them. The camp has evolved every year based on both participant and mentor feedback. The post-survey sent to 2017 participants after their first semester asked what they did not get from E<sup>2</sup> that would have helped them. The most common response was that they wanted more help with time management and how to handle the challenging course load. The following year, a new session was created by two upperclassmen called “How to College” to address this need.

The last recommendation is to let students give the presentations and lead the activities. First-year students want to hear from other students who have recently gone through the transition from high school to college and who would have the most current and relevant tips on how to succeed. The “How to College” session was one of the highest ranked activities in last year’s camp, along with the design project. This also gives upperclassmen applicable leadership and communication skills that they will bring with them into the engineering workforce upon graduation.

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