



ChemE Camp: A Two-Day Workshop to Increase Student Preparedness for Their Sophomore Year in Chemical Engineering (Work in Progress)

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Abstract

Traditionally, the drop-out rate for students majoring in chemical engineering is the highest during the sophomore year. This can often be attributed to numerous factors including student interest in the major, student preparedness, knowledge of what chemical engineering is, and overall technical ability. To address this, the AIChE student chapter at Louisiana State University has developed a two-day series of professional development, academic, and team-building workshops hosted by upperclassmen students and sponsored by local industrial partners to better prepare rising freshmen for their sophomore year in chemical engineering. Having completed many of their required pre-requisites, prospective students are about to embark upon their first core courses in the chemical engineering discipline in addition to starting to apply for internship and co-op opportunities. The camp first introduces students to the department through facilities tours and engagement with faculty and upperclassmen. During these faculty engagement sessions the students have an opportunity to meet their courses' instructors, who offer tips for success and answer questions before any coursework begins. Upperclassmen serve as student mentors during the camp, offering informal advice and support. The camp also serves as a point of contact between students and local industry representatives recruiting intern and co-op candidates. These local industry representatives offer valuable career-formation advice to the students by hosting resume review and mock interview sessions. Lastly, the camp builds relationships and camaraderie among the rising freshmen. The students are divided into teams and required to complete a small research project in chemical engineering science or design. In completing this small project together, students grow more comfortable working in a collaborative team environment while gaining familiarity with chemical engineering fundamentals such as process safety. The relationships formed during the camp aim to give sophomore students a supportive network of classmates, student mentors, faculty members, and industry professionals in order to promote retention and student success in the chemical engineering curriculum. Here, we present our findings from the first two years of offering this camp including very preliminary data correlating camp participation with student performance in their sophomore year courses and overall retention in the major. While preliminary in nature, the data collected thus far indicates that students who participate in the camp feel better prepared for their sophomore year which has led to enhanced course performance, greater involvement in the department, and a higher success rate in obtaining summer internships.

Introduction

The transition from the freshman year to the sophomore year can be fairly challenging for young chemical engineering students. The sophomore year is when most chemical engineering students begin taking their core courses as opposed to the freshman year when most students are enrolled in fundamental courses like physics and chemistry. While freshmen tend to focus on the social aspects of moving away from home and living on a large college campus, sophomore students begin to worry about building their resumes to enhancing their chances for obtaining their first summer internship or co-op. In recent years the AIChE student chapter and their faculty advisor at Louisiana State University (LSU) have been tracking student performance in two core courses

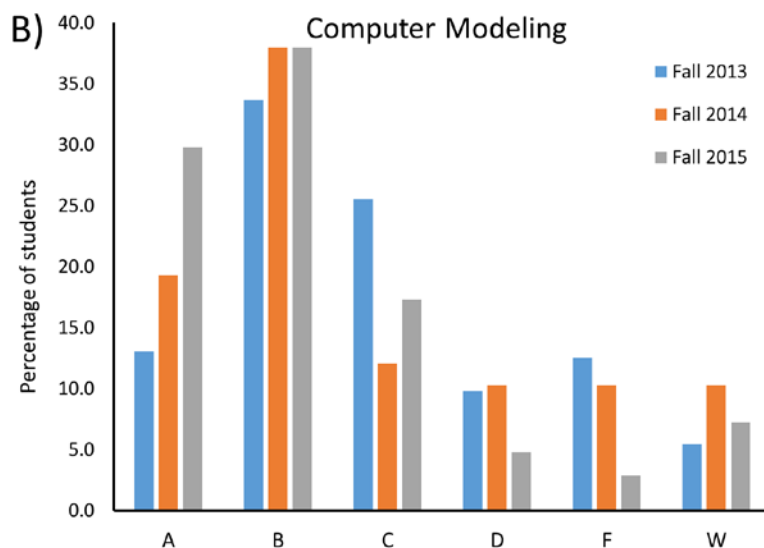
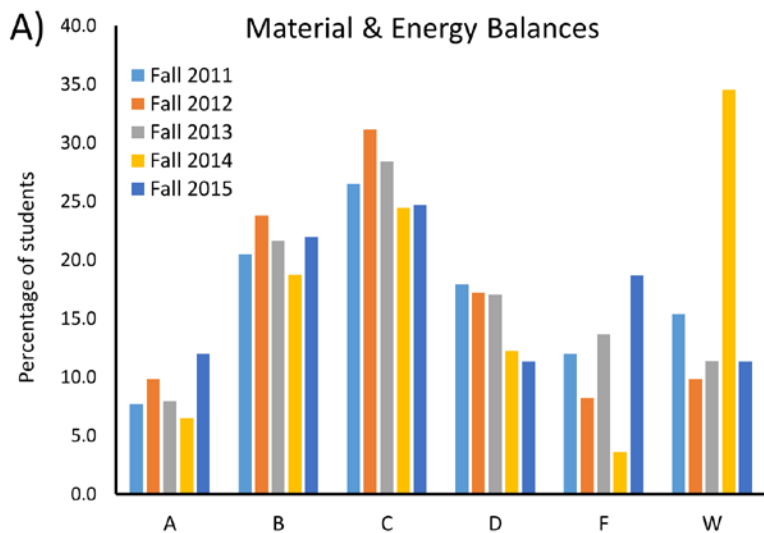


Figure 1. Sophomore course statistics. Grade distributions for students enrolled in the (A) Material & Energy Balance course and (B) Computer Modeling course in the fall semester. The modeling course was started in the fall 2013 semester which is why the data only goes back that far. Statistics for the fall semester of each academic school is denoted by the different color bars following the legend.

has significantly increased in size from 117 in the Fall of 2011 to 155 in the Fall of 2015, which unfortunately reduces the amount of individual attention each student can receive from the course instructor. Student performance in the Computer Modeling course tended to be more favorable than in the MEB course (Figure 1B); however approximately 30% of the class still earns a grade of D or lower.

Informal discussion with the sophomore members of AIChE indicated that many students believe their poor performance in both courses was due to a number of factors including (i) not being

that the majority of sophomores are enrolled in during the fall semester (Figure 1). These two courses are the three credit Material & Energy Balance (MEB) course and the two credit Computer Modeling course. For the sake of simplifying the analysis, we are not including the statistics for any spring offerings of these two courses; however the grade distribution in both classes resemble what is presented in Figure 1. The MEB course offered at LSU is similar in content and course objectives to most peer institutions and is often viewed as the most challenging course in the sophomore curriculum. The Computer Modeling course is unique to LSU as it mainly focuses on learning two computer languages (MATLAB and Visual Basic) and providing a basis for the Numerical Methods course offered during the spring semester of the sophomore year. As can be observed from Figure 1A, the performance of students in the MEB course follows a general bell curve; however the percentage of students with a failing grade or a grade of W (which means the student withdrew from the course) has increased in recent years.

Additionally, the total number of students enrolled in the course

adequately prepared for the course, (ii) not knowing anyone to work/study with, (iii) the size of the course, and (iv) not getting the chance to meet with/get to know the course instructor. Additionally, these students mentioned how difficult it was to obtain summer internships and how they felt completely unprepared for their first career fair with many students not even knowing how to put together a resume or act during the interview process. While individual performance and aptitude can ultimately determine a student's success, many of these aforementioned challenges can be addressed by providing the students with more information and an opportunity to interact with fellow students, faculty, and representatives from local industry. While several different approaches were discussed, we ultimately decided to hold a two day 'camp' where the students could enhance their personal, professional, and academic development. The idea for the camp actually came from a discussion between the LSU and Texas A&M University AIChE student chapter presidents at the 2014 regional meeting. We discovered that Texas A&M had been holding a sophomore camp the weekend prior to the start of the fall semester to provide a bridge for rising sophomores. Based on these success at Texas A&M, we then went about designing and implementing our own version of the sophomore camp at our institution. While the literature describes many summer camps offered by chemical engineering departments, they are almost exclusively designed towards recruiting high school students. A brief survey of the literature indicated no such competing camps for college students already enrolled in chemical engineering. As such, the work presented in this paper highlights our ongoing efforts to better prepare rising sophomore students majoring in chemical engineering. Our intent is to summarize what we have found that works with the students, what we have learned during the two years of offering the camp, and provide a general overview of topics covered.

	Day 1	Day 2
9:00	Welcome Presentation	Scheduling Advice
9:30	AIChE Overview	Unit Operations Project
10:00	Team Building Activities	
10:30		
11:00	Class Preview: Chemical Engineering Fundamentals: Material & Energy Balances	Class Preview: Introduction to Computer Modeling and Simulation of Chemical Engineering Systems
11:30		
12:00	Lunch + Learn: What do ChemEs Do at Work?	Lunch + Learn: Importance of Co-Ops and Internships
12:30		
1:00	Chemical Engineering Building Tour	Resume Reviews + Mock Interviews
1:30	Workshops	
2:00		
2:30		
3:00		
3:30		
4:00	Wrap-Up Unit Operations Project	
4:30		Break
5:00		
5:30	Challenge Course	
		Dinner + Presentations

Table 1. Summary of activities for the 2015 AIChE ChemE Camp

Camp design

So far, the AIChE sophomore camp has been offered two times, during the fall of 2014 and the fall of 2015. The camp was designed to occur after campus move-in, but before the semester officially started. The 2014 iteration of the camp occurred from Friday to Sunday afternoon, while the 2015 iteration was adjusted to take place on Thursday and Friday. The reason for the change in date was due to several reasons including increased student retention for the duration of the camp and increased involvement from the department faculty and local industry. All camp events took place on Louisiana State University's campus in spaces that could be reserved by student organizations free of charge. The overall design of the camp was to aid in students' personal, professional, and academic development. A summary of the camp activities from the 2015 iteration of the camp are listed in Table 1. The following sub-sections deal with the objectives and activities offered during the 2015 camp. For the sake of brevity the activities from the 2014 offering are not included in this discussion as they are similar to the 2015 offering.

Personal development

A common trend noticed by both the faculty and the AIChE leadership is that many rising sophomores majoring in chemical engineering have not yet gotten a chance to meet or get to know one another. This is due to the fact that most students do not enroll in a chemical engineering course until the second semester of their freshman year. However, this course (CHE 1100) is a one credit seminar course with approximately 170-200 students that limits the interactions between the students. As such, students are strongly encouraged to get to know each other for the duration of the camp through a variety of team-building activities. On the morning of the first day, students participated in several icebreaker activities to learn everyone's names, interests, and backgrounds. At the end of the first day, these students were given the option to participate in a Ropes Course at the LSU Recreation Center (Figure 2A). The goal of the ropes course was to give the students an opportunity to get outside of their comfort zone and support one another in completing a challenge. After becoming more comfortable with one another, the students were broken up into small teams of 3-4 students at the beginning of the second day and tasked with completing an informal Unit Operations research project. Each team was given the name of a typical unit operation (e.g., heat exchanger, distillation column, CSTR) and asked to report on three different themes: (1) how does it work, (2) what is its traditional use, and (3) what are the process safety considerations. Students were then given the opportunity to give a brief presentation to the group on their findings (Figure 2B). The goal of this exercise was three-fold. First, it served to introduce the students to unit operations they would undoubtedly hear about in their future classes (especially the impending Material and Energy Balance course). Second, the students were able to make connections between their introductory sciences courses from their freshman year curriculum and these process units, effectively bridging the mental gap between their prior coursework and their future chemical engineering courses. Third, the team exercise was representative of the type of group work and oral presentations required in several chemical engineering courses. By forming these relationships among the participating students, they could begin their sophomore year knowing their classmates and identify potential study partners. In addition to these activities, students were exposed to several personal development workshops led by chemical engineering upperclassman, faculty members, and administrators. Topics included (1) AIChE activities (e.g. the ChemE car team and attending conferences), (2) SChE (the online safety training certification program offered by AIChE), (3) the Distinguished Communicators program offered at LSU, (4) STEM outreach opportunities, (5) planning for

graduate school, (6) an overview of electives and concentrations offered within the chemical engineering department, (7) a time management course, and (8) how to give and receive feedback. The students were allowed to pick and choose which workshops to attend during a three and a half hour block of time on the first day of the camp, effectively allowing them to tailor their camp experience to maximize interest and involvement.



Figure 2. Images from the student activities during the ChemE Camp. (A) Students get a quick safety lesson before participating in the challenge course. (B) One group of students presents their findings for the Unit Operations project to their fellow classmates. (C) Students participate in mock interviews with representatives from local industry. (D) ChemE Camp 2015 student participants.

Professional development

Many rising sophomore students are unfamiliar with the types of employment opportunities offered to undergraduate students including summer internships and co-ops. Most students are aware that they need work experience to obtain a job when they graduate, but are unsure as to how to go about obtaining one. As such, an objective of the camp was to provide students with training and contacts to assist in landing their first position. During each day of the camp, a “Lunch-n-Learn” was hosted by a corporate sponsor. On day 1 Maverick Technologies talked about process controls and automation, while on day 2 Lubrizol spoke to the students about specialty chemicals. Lunch-n-learn sponsors were also asked to present on topics such as “What chemical engineers do” or “The importance of internships and co-ops”. In addition to giving the

students valuable insights on these topics from an industry recruitment team's perspective, the hosts were asked to discuss their own experiences and career opportunities within their company. Many of the visiting industrial representatives were alumni from LSU and could share unique insight on their path from student to practicing engineer. During both sessions, the recruiters remained after their presentations to network individually with the camp attendees and provide further insight and guidance. During the second day of the camp, students were asked to dress up in formal attire and provide resumes for mock interviews with five different companies: Dow, DuPont, Conoco Phillips, Prosys, and Lubrizol. Each student's resume was reviewed on an individual basis by chemical engineering upperclassman prior to the mock interview session to provide initial insight and direction. LSU student leaders offered practical advice from their own learnings from the LSU Career Center. During the mock interview session, representatives from the five companies asked students questions they would typically ask potential candidates for internship, co-op, or full-time positions (Figure 2C). After the interview, the corporate recruiters provided the students with valuable feedback on how to improve their resume, how to present themselves professionally, and how to adapt their responses to corporate review procedures such as STAR (Situation, Task, Action, Result). Each student had the opportunity to conduct a mock interview with two different companies. After the mock interview session concluded, the industrial representatives held an open panel discussion to answer any additional career-related questions. Afterwards, an informal, general networking session was held for all students and recruiters.

Academic development

As stated above, many rising sophomores are very concerned about their first chemical engineering courses; thus, the objective of the academic aspect of the camp was to give them a chance to learn more about the courses, ask any questions they may have, and lessen any fears about taking their first chemical engineering courses. During each day of the camp, the students attended an information session about their two upcoming chemical engineering courses conducted by the faculty members who were teaching the courses. The two classes offered to rising sophomores are Material and Energy Balances (CHE 2171) and Computer Modeling (CHE 2162). During these sessions, the course instructors discussed the course objectives, expectations, topics to be covered, and the outline of the course. By learning about their courses and meeting their professors in an informal environment, students could begin their coursework with more confidence and accurate expectations, aiding their overall performance in these courses. During the morning of the second day of camp, the chemical engineering upperclassman held an informal Q&A session regarding course scheduling to give the rising sophomores feedback and suggest a plan for the academic trajectory for the remainder of their college career. By developing this plan, camp attendees could begin to anticipate coursework necessary for potential double-majors, minors, popular electives, and potential problem areas. Moreover, students were given the chance to discuss the prospect of taking a semester or a year off school to enroll in potential co-ops and how that would affect their academic progress. This informal advising session was essential to avoid possible mistakes made by students unfamiliar with the degree requirements for chemical engineering at LSU. These mistakes can result from students neglecting to enroll in required courses (especially pre-requisites for upper-level classes) or withdrawing from core courses mid-semester, both of which can delay a student's graduation date by up to a year, as some courses are offered only in the fall or spring. This problem tends to occur in greater numbers in the freshman and sophomore year. As such, the objective of this

advising session was to create better informed students who could reach their desired graduation dates without unnecessary setbacks.

Camp recruitment

A key feature that contributed to the general success of the camp was the intense recruiting efforts put forth by the AIChE student leaders. This required a two-tiered approach with recruiting efforts focused on enrollment of camp attendees but also with industrial representatives to participate in the activities described above. Fortunately, the AIChE student chapter at LSU is packed with great student leaders who jumped at the chance to get involved in a camp to help out their fellow sophomores. These student leaders consisted of current chemical engineering juniors, seniors, and fifth-year seniors who offered to volunteer to make the camp a success. Once the 'backbone' of the camp was assembled, we then went about garnering support from local industrial representatives. The AIChE student chapter at LSU has several on-going relationships with local industry in the Baton Rouge area due to interactions and recruitment events held during the academic year. As such, we were able to recruit an outstanding list of industrial partners to help make the camp a success. These industrial partners were contacted and asked to host a Lunch-n-Learn, a Mock Interview or simply provide any financial support for the camp. All companies involved in the camp donated \$100-\$150 to offset camp costs. These companies were incentivized by the recruitment opportunity in addition to their names being mentioned as participating sponsors in the student's camp booklets of the AIChE Sophomore Camp. Finally, camp attendees (then freshmen at LSU) were recruited by a number of methods. Informal information sessions were held in the freshman engineering residential halls specifically targeting students intending to enroll in sophomore chemical engineering courses. The AIChE freshmen class representative (an officer position within the AIChE student chapter) frequently advertised the sophomore camp to his/her classmates via e-mail and word of mouth. Other student leaders made public announcements in the freshman year chemical engineering seminar class. We launched a website to streamline the registration process for both camp attendees and corporate sponsors and provide everyone with general camp information. Due to the generous support of our industrial sponsors, students were only required to pay \$15 to attend the camp. This was done to cover the cost of printing all camp materials and incentivize the students to attend both days of the camp. To ease the financial burden on the students, this \$15 cost also covered the student's yearly AIChE dues for their sophomore year. The recruitment efforts were a preliminary success with 24 students participating in the camp in 2014 (~17% of the rising sophomores) and 19 students participating in the 2015 camp (~13% of the rising sophomores). Additionally, we received support from 8 companies in 2014 and 6 companies in 2015.

Preliminary metrics of camp success

Currently, success in the AIChE Sophomore Camp is defined as perceived student personal development, academic success, and career preparedness. Admittedly, one area that is currently lacking in the analysis of the camp's success is precise quantitative metrics. After the 2014 offering of the camp, many of the student attendees spoke informally about how much they enjoyed the camp and how they felt better prepared for their sophomore courses; however, no surveys or data were collected from the 2014 offering of the camp study due to it being a pilot study. In the preparation of this paper, it was determined to start tracking camp participants and evaluate the positive or negative effect of the camp on student's career trajectory.

Personal					
Due to the ChemE Camp, I was able to:	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Meet fellow classmates	4	2	-	-	-
Meet upperclassmen in CHE	2	4	-	-	-
Increase confidence in choice of major	5	1	-	-	-
Begin relationships that developed in the fall semester	3	2	1	-	-
Form study groups	1	4	1	-	-
	Yes	No			
Are you an active member of AICHE?	5	1			

Academic					
Due to the ChemE Camp, I was able to:	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Meet my professors for the fall semester	3	3	-	-	-
Feel more comfortable on the first day of class	5	1	-	-	-
Better understand the courses I would be taking	4	2	-	-	-
Gain familiarity with the CHE department	2	4	-	-	-
Learn about courses I will take in the future	2	3	1	-	-
Develop a plan for the remainder of my college career	4	2	-	-	-

Professional					
Due to the ChemE Camp, I was able to:	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Learn about the chemical industry	2	4	-	-	-
Learn about internship + co-op opportunities available to me	3	3	-	-	-
Improve my resume	2	2	2	-	-
Improve my interviewing skills	1	2	3	-	-
Learn about what Chemical Engineers do	2	2	1	1	-
Network with campus recruiters	1	5	-	-	-
	Yes	No			
Did ChemE camp prepare you for the career fair?	5	1			
Have you obtained an internship or co-op position?	-	6			

Table 2. Summary of survey results from ChemE Camp 2015 attendees.

To accomplish this goal, all camp attendees were asked to participate in an online survey to determine how the Sophomore Camp affected their personal, professional, and academic development. The results of these surveys are binned into the three main development objectives

of the camp (personal, professional, and academic) and are included in Table 2. For the most part, the students responses collected thus far have been overwhelmingly positive. Many of the students claim to have felt better prepared for the courses and what needs to be done in order to obtain the first summer internship or co-op position. ChemE Camp attendees also felt much more comfortable about their future as chemical engineers and were able to meet study partners for the MEB and Computer Modeling courses. One statistic which strongly indicates the success of the camp is a distinct absence of negative (disagree or strongly disagree) responses for all but one of the questions posed in the survey. This indicates that the current list of topics and student activities are apparently meeting the objectives of enhancing the students' personal, professional, and academic development.

While these very preliminary findings are positive, we acknowledge that our quantitative metrics are at this point incomplete, which is why this paper is being submitted as a "work in progress". At the time of submission, the number of responses was low, with only 6 out of 19 students reported at this time. This can be attributed to the fact that the survey was sent out after the fall 2015 semester and that no incentives were provided to increase student participation. As the camp is still in its nascent form, we are still learning about not only how to administer the camp, but also how to assess its overall effectiveness. As such, we fully intend to perform more in-depth analysis before and after the 2016 offering of the camp. This includes administering surveys before the camp begins, after the end of the camps, and at the end of the fall 2016 and spring 2017 semesters. To increase student participation in subsequent offerings, we are considering some type of financial incentive (e.g., a raffle for a \$25 amazon gift card or covering the students' AIChE due for the subsequent year). Additionally, we intend to gather more personal information about the students from all camp offerings and track their progress through the chemical engineering curriculum. Specifically, we will investigate student performance in the sophomore classes (e.g., grades in CHE 2171 and CHE 2162) and the withdraw rate of students from these classes. We will also track student performance in some of the upper level courses to determine if there is a trend between students who participated in the camp and those that did not. These statistics will be compared to the grades and withdraw rate from the remaining students who did not participate in the camp. This metric will provide a more detailed analysis of camp success. This metric was not included in this paper, or compared to overall student performance shown in Figure 1, due the fact that student performance was not assessed in the pilot survey discussed above. A similar comparative analysis between camp attendees and the chemical engineering student body will also be performed in subsequent offerings for obtaining summer internships and/or co-ops to track professional success. Ultimately, our intent is to develop more quantitative metrics of camp success to share with the students and the industrial partners to demonstrate how our two day camp can substantially make a difference on the undergraduate chemical engineering students.

The future of the ChemE camp

The positive feedback received from the 2015 ChemE Camp attendees will be used to attract prospective participants for the 2016 ChemE Camp. This feedback will also be used to make improvements on the design and layout of the camp. One area we intend to improve upon in subsequent camp offerings is the total enrollment of rising sophomores in the camp. After two years, our enrollment has been ~10-17% of rising sophomores per year, which is only a small percentage of the incoming students. Ideally, we would like to increase our enrollment numbers

to ~25% of the rising sophomores. The rationale for this number is that we want to maintain a relatively small camp size to continue to afford a more personalized experience for the attendees, while providing more students with the advanced training and preparation offered by the camp. As more data is collected and we obtain more precise metrics of camp success, we will consider the option of holding more than one summer camp to accommodate a greater number of students; however this would depend on not only student interest but also the support from our industrial partners. By enhancing the recruitment strategies and incentives used for the 2015 ChemE Camp, we hypothesize that more students can be informed about the camp by sharing info-graphics of the camp's benefits via the various social media accounts managed by the LSU AIChE student chapter including Facebook, Instagram, and Twitter. Additionally, our intent is to increase the number of informational emails sent to all freshmen students who have declared chemical engineering as their major using the departmental listserv and via the AIChE freshman class representative. Our aim is to ensure our target audience is both reached and well-informed of the ChemE Camp's goals and expected outcomes. Moreover, we suspect that timing is essential to elicit more corporate sponsors. As such, our current student leaders will reach out to local industry representatives earlier in the year (e.g., 2-3 months before the camp) to increase the number of participating companies. Furthermore, recruiting more students and providing more quantitative metrics to distribute to our industry partners will further incentivize their participation.

We have also identified some areas that can be improved in the design of the camp activities. For example, while the students enjoyed working in smaller groups for the Unit Operations Projects, some students expressed that the project was too open-ended. For the 2016 ChemE Camp, we will modify this activity with more specific directions, goals, and presentation expectations. Additionally, informal student feedback indicated that while the workshop sessions were informative, there were too many offered to efficiently execute. As such, we intend to reduce the number of workshops based on camp attendee and student leader feedback to select which workshops have the greatest impact on the rising sophomores. We also believe we can increase the quality of the workshops by relying less on the student leaders and more on the chemical engineering faculty and LSU officials. Most notably, we intend to ask representative from the LSU Career Center to host a formal resume building and interviewing tips workshop during the first day of camp prior to the mock interview session. We anticipate that this would more adequately prepare the students for their mock interviews before receiving feedback from the industrial representatives. Another suggestion we are exploring is incorporating a tour at one of the local chemical facilities to give students a firsthand experience of what chemical engineers do after graduation. Additionally, based on student feedback from the camp and the LSU students, the freshman seminar course (CHE 1100) is currently undergoing a redesign to focus more on student development and to include select aspects from the ChemE Camp (e.g., how to prepare for a career fair, how to prepare for an interview, what kind of jobs can chemical engineers get, etc.). While these changes to CHE 1100 cannot encompass the personalized opportunities and training offered by the ChemE camp due to high enrollment numbers (~200 students), it does provide students with another resource for personal, professional, and academic development. In fact, during the spring 2016 semester the AIChE faculty advisor and student leaders gave a one hour seminar on AIChE and the sophomore camp to encourage student enrollment.

Finally, we acknowledge that the development of a more robust procedure of obtaining quantitative metrics on student outcomes and feedback is essential for the continued success of the ChemE Camp. The 2016 offering of the ChemE Camp will include a brief pre-camp survey in addition to a more detailed survey given at the end of the two-day camp. This will provide immediate feedback on what activities should be retained, improved, or abandoned in subsequent iterations. Additionally, we intend to collect more data on student progress using very brief update surveys at the beginning, middle, and end of their sophomore year. These surveys will be designed to address the three core objectives of the camp (personal, professional, and academic development) by obtaining data related to course performance, retention in the major, number of job interviews, and number of job offers given (accepted and declined). These metrics will be compared between camp attendees and the remaining student in chemical engineering to provide a more detailed metric of camp success. Tracking the students' progress more frequently will enable us to get a more comprehensive understanding of the participants' outcomes relative to their fellow classmates. Ultimately, our intent is to continue to offer and improve the ChemE Camp every fall semester to provide our students with another resource to help them not only survive their sophomore year, but thrive in it.

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