Ambassadors Connecting with Engineering (ACE) Academy: Providing Opportunities to Engage a Diverse Group of Talented Students

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ABSTRACT

The Ambassadors Connecting with Engineering (ACE) Academy is possible as a result of the partnership between The University of Iowa College of Engineering and ALCOA. ACE Academy is a week-long residential camp that focuses on engaging a diverse group of talented high school students in the areas of math and science while specifically encouraging those who are traditionally underrepresented in the field of engineering. A focus of the academy is to enrich the field of engineering by encouraging bright young students to consider the applications of their math and science skills, and to make a positive impact on the workforce in the Quad-Cities and Iowa City. The classroom experiences provide interesting and high-level reasoning activities that are not offered in a traditional classroom setting. The program is run by math and science teachers, and is integrated with presentations and classroom experiences taught by professors in The University of Iowa College of Engineering. The students fill out a pre-session and post-session survey that is used to assess the effectiveness of the program.

Background

The ACE Academy is in its third year and is primarily funded through a grant from ALCOA, a world-renowned manufacturing company. ALCOA is a company focused on excellence in their workforce, and like The University of Iowa, is determined to encourage young people to pursue engineering degrees, especially those students who are underrepresented in the field, specifically women and minority students of color. Students are asked to pay only a $150 enrollment fee which is waived if the student

qualifies for free or reduced lunch. This allows the program to be relatively inexpensive and provides opportunities for students to attend who otherwise may not have been able to. The program has focused on local students from the Quad-City and Iowa City areas in order to provide exposure to ALCOA, and The University of Iowa College of Engineering. In the past, the program has included a middle school non-residential component. In 2003, however, the program has focused on 9-11 grade high school students. The academy ranges from 21-26 students each year and is staffed by 2 lead teachers from local high school science departments, 2 teaching assistants and 2 live-in resident assistants who are current undergraduate engineering students at The University of Iowa. The program is coordinated by staff in the Student Development Center in the College of Engineering, and representatives from ALCOA.

Objectives

Upon completion of the academy, we expect that our students will:

- Become more interested in math and science
- Learn how math and science concepts are used in various careers
- Become familiar with a university campus
- Share experiences with teachers and classmates upon returning from ACE Academy
- Serve as leaders in their schools' math and science clubs and organizations.
- Form positive connections with engineering students, faculty, and staff
- Further their education after high school graduation
- Consider working for ALCOA and other local companies in their future

Program Structure

Students are nominated to the program by their math and science teachers, and must exhibit interest and potential in those areas. The application process also requires students to write a personal statement about why they would like to attend. This allows the selection team an opportunity to view both academic and non-cognitive variables that could be indications of success in engineering. The academy runs for one-week, typically during the month of June, and the students stay in one of the residence halls on The University of Iowa campus. This allows students to get a “taste” of campus and residence hall life with other students that share their interest in engineering. Throughout the program, students are given projects to work on that help them develop

their problem-solving skills, and display real-world applications for math and science. For example, in one project (see attached description) the students were required to construct a car that would keep an egg safe from breaking after hitting a wall, using only limited materials such as paper and paper clips. Imagining that if that egg were a human being, the students can begin to understand how engineering can help to save lives, along with its many other applications. Each day, the students listen to presentations from staff and faculty in the College of Engineering, allowing them to ask questions from experts in fields such as industrial and biomedical engineering. In the evenings, students are provided fun events to attend, such as a Star-gazing party and a rocket-launch, as well as relaxing movie nights. In 2003, the graduation ceremony was held at the ALCOA Learning Center in Bettendorf, Iowa. The students' diplomas were signed by President David Skorton, and presented by the Dean of the College of Engineering, Dr. Barry Butler.

Assessment

Students are given pre-session and post-session surveys in order to assess the effectiveness of the program, as well as allow them the opportunity to provide feedback to the coordinator(s). Students overwhelmingly report positive experiences with the program, and often ask for it to be longer. One 2003 ACE Academy student said, "I had so much fun and gained so much college-life experience. I am so glad I was a part of this camp because it really helped me decided that biomedical engineering is almost for certain what I would like to major in…I had no idea what to expect, but I was pleasantly surprised by the end and actually wouldn't have minded another week! Everything from rockets to web pages to crashing cars, all of it was an enjoyable experience!" All the feedback provided by the students and staff is taken into consideration each year in order to continuously improve the program. Some of the long-term effects of the camp are only beginning to come into focus. The University of Iowa College of Engineering reported a number of new engineering students were former ACE Academy students.

Benefits

As mentioned earlier, some of the benefits to the students are that they are able to see practical and exciting real-life applications of the study of math and science. They are also able to experience life as a The University of Iowa student through their residence

hall experiences and the relationships they form with current undergraduate engineering students. Lastly, it provides them with the opportunity to meet professional engineers, scientists, and professors of engineering.

Other benefits are to the field of engineering. By encouraging a diverse group of students to pursue engineering degrees and careers, it will provide positive change to the local workforce and community. The University of Iowa College of Engineering and ALCOA may also see the benefits in terms of their enrollment numbers and applications.

Conclusion

The Ambassadors Connecting with Engineering Academy provides opportunity—for students, for faculty, for companies, and for the community. The importance of young people learning how to solve-problems for our society cannot be measured with any assessment instrument. Diversity allows for problems to be looked at from a variety of viewpoints. A combined focus of diversity and problem-solving can only help with the challenges that we, as a nation, indeed as a global community, will face in the future.

Ambassadors Connecting with Engineering *(ACE)* Summer Camp
June 15th-20th, 2003

Sunday, June 15th, 2003

Travel to The University of Iowa

By 6:30 p.m. Leave the Quad-Cities (Northpark Mall, JC Penny)
7:30 p.m Check-in to Currier Residence Hall
8:30 p.m. Welcome and Whitey's Ice Cream Sundaes (North Lounge, Currier Hall)

Monday, June 16th, 2003

Getting Your Feet Wet **(Engineering Basics)**

7:30 - 8:30 Breakfast
8:30 - 9:30 Toilet Paper Ice Breaker & Introduction to ACE
9:30 - 10:00 *What is Engineering?*
10:00 - 10:15 Engineering Match Game
10:15 - 12:15 Engineering Campus Tours and Presentations
12:15 - 1:15 Lunch
1:30 - 3:00 Paper Car Crash - *Design Challenge!!*
3:00 - 3:15 Conclusion and discussion
3:30 - 5:15 Webpage basics & Create Webpages
5:15 - 6:00 Supper
7:00 - 10:30 Evening Activities: Scavenger Hunt and Games Night (Currier Game Area)

Tuesday, June 17th, 2003

The Sky is the Limit **(Rockets)**

7:30 - 8:30 Breakfast
8:30 - 9:30 Aeronautical Engineering - TOP GUN Contest
9:30- 11:00 Aerospace Engineering - Rocket Science and Fizzy Tablet Take-off
11:00 - 11:30 Conclusion and Discussion
11:30 - 12:30 Lunch
12:40 – 1:30 Polymerization and Drug Delivery with Dr. Jessop – Iowa Advanced Technologies Lab (meet outside of room 350)
1:40 - 4:00 Design Engineering 101 - Rocket Blueprint and Construction
Paper Car Crash Test Run
4:00 - 5:00 Webpage Work Time, 1245 SC
5:00 - 6:00 Supper
6:00 – 7:00 Webpage Work Time, 1245 SC
7:15 - 9:00 Evening Activities (Video "Engineering the Impossible" and snacks)
9:00 – 9:30 Drive to Observatory for Star Party
9:30 - 11:30 STAR PARTY at Palisades Observatory (rain or cloud date Wednesday)

Wednesday, June 18th, 2003

How Do I Get There From Here? **(Campus Day and Rocket Launch)**

7:30 - 8:30 Breakfast
8:30 - 9:15 Paper Car Crash Challenge!
9:30 - 10:00 *How to Prepare for College*

10:00 - 11:00 University of Iowa Campus Tour
11:00 - 12:15 Lunch (at Hillcrest)
12:30 - 1:30 Dr. Wilder's Wacky World of Biomedical Engineering
1:30 - 3:30 Biomedical Engineering - *Egg-cellent Summer Slam*
3:30 - 5:00 Webpage
5:00 - 6:00 Supper
6:30 – 9:00 Rocket LAUNCH @ soccer fields!
1) Air Rocket Practice Launch
2) Group Picture
3) Launch Solid Fuel Rockets
9:00- 11:30 Evening Activities: Movie Night (Currier MPR)- ***Star party cloud date***

Thursday, June 19th, 2002

Searching For Clues **(Robotics)**

7:30 - 8:30 Breakfast
8:30 - 9:00 Rocket Launch Conclusion
9:00 - 12:00 Robotic Stations!
1) Dr. Gary Fischer Mechanical Robots & Programming
2) Car Simulation – Cognitive Systems Lab
3) Robotic Design in College; Dr. Dan Thedens
12:00 - 1:00 Lunch
1:30 - 2:00 Robotics Basics and Lego Building
2:00 - 3:00 Structural Design
3:00 - 4:00 Webpages - LAST DAY
4:00 – 4:45 Group Sharing of Webpages
4:45 – 5:00 Walk to dorms, Load up the vans
5:30 – 6:00 Behind the Dome IMAX tour
6:00 – 7:00 **IMAX Theatre – "The Magic of Flight"**
7:00 – 8:00 Supper in Cedar Rapids (boxed dinners from food service)
8:00 – 9:30 Evening Activities **– (Science Station)**
9:30 – 10:00 Travel back to Campus

Friday, June 20th, 2002

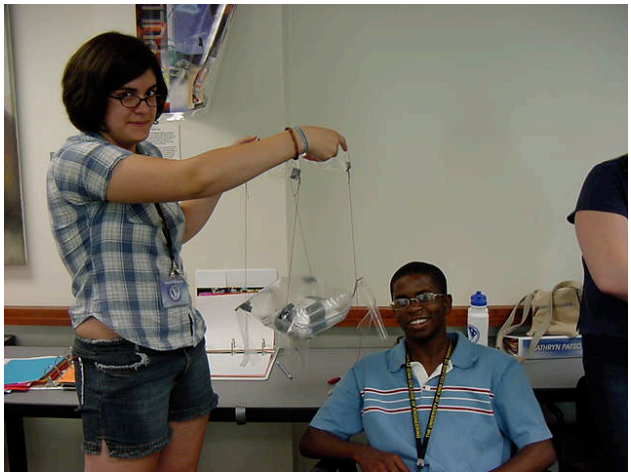
The Sky's the Limit! **(Graduation DAY!)**

7:30 - 8:30 Breakfast
8:30 - 8:45 Pack up vans and check out of residence halls
8:45 - 9:45 Campus Gift Shop (Iowa City parents pickup student's bags)
9:45 - 10:45 Travel to Davenport
11:00 - 12:00 ALCOA Tour (Belin Center ACE kids accompanying)
12:00 - 1:00 LUNCH at the ALCOA Learning Center and fill out post survey
1:00 - 2:00 Metallurgy Magic!
2:00 - 3:00 Students share what they learned or enjoyed about the ACE experience
Graduation and Awards Ceremony

ACE ACADEMY 2003

Dr. Julie Jessop describes polymerization in the Unit Operations Laboratory.

Tiah Carlough and Samantha Goldstein attempt to drive while distracted in the Cognitive Systems Laboratory.



Kirsten Reimann and Jonathan Welburn show off their egg protection device.

Dr. David Wilder uses dolls to illustrate the functions of the human spine.