

## **Strategies and Support Systems for an Outreach and Recruiting Engineering and Computer Science Residential Summer Camp**

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### **Abstract**

This paper will describe a successful model for a residential summer camp program that introduces and exposes middle school and early high school students to a variety of different engineering disciplines through university lectures, corporate field trips, and hands-on student engineering projects. This summer camp program has been operating at its full capacity for 8 years and over 800 students have participated in this program. This paper will give an overview of the history and motivation of the camps, the structure of the camp activities, the preparations required on a yearly basis, the support needed from the university and industry, the types of results we have received from running these camps, and future directions for this type of outreach activity.

### **History**

The University of Texas at Arlington (UTA) is diverse school with over 24,000 students. The College of Engineering of UTA supports eight different engineering disciplines along with numerous centers and laboratories performing research in areas as varied as intelligent homes, nanofabrication, road construction techniques, and implantable fibers to promote nerve growth. UTA graduates hundreds of engineers at all levels from bachelors through doctoral each year and our alumni work in jobs ranging from constructing the Dallas Hi-Five to scheduling tasks for the Mars Rovers.

With an engineering infrastructure such as this, it was a natural fit in 1998 to write a grant to fund the start of an engineering summer camp designed to introduce and expose middle school and early high school students to a variety of different engineering disciplines in order to influence the choices they might make in the future. It was a further goal of the camp to especially focus on populations, which are historically underrepresented in engineering including minorities and girls. The desire was to

motivate students to prepare for and enter engineering by showing them engineering in action and having them participate in engineering activities.

A secondary goal of the camp was also to influence teachers since they are such a crucial factor in students' decisions about education. The camp invites classroom teachers to attend and participate in the camps along with the students thus allowing them to enjoy learning the material with the students. The teachers then take the material and knowledge back to their classrooms for the benefit of future students.

Since the beginning of the camps in 1998, approximately 800 students have participated in one or more camps. Former camp alumni have become students at UTA in engineering and have gone on to other universities in engineering disciplines. While not all students become engineers, the overwhelming response of the campers is that UTA Engineering and Computer Science Summer Camp is fun, enriching and challenging learning experience for them.

### **Structure of the camp**

The University of Texas at Arlington (UTA) Engineering and Computer Science Summer Camps are one week, residential camps. Approximately 50 campers participate per week and generally three camps are held each year sequentially in June. One camp week targets incoming 9<sup>th</sup> and 10<sup>th</sup> graders (Bridge to Engineering camp) and the other two weeks target 7<sup>th</sup> and 8<sup>th</sup> graders (Gateway to Engineering camps). Campers apply to the camps either on-line or by mail starting in late January. Camp applications include material for the student to submit as well as teacher recommendations and transcripts. The assessment process for applications is discussed later in this paper.

Students selected to participate in the camps must fill out additional material such as release forms for photography and permission to travel from the UTA campus for field trips. The cost to the camper of a week of Engineering and Computer Science Summer Camp for 2006 is \$300.

The camps begin on Sunday evening with a presentation to campers and parents about the camp schedules, plans and rules. Students are then checked into the dorm where they will stay for the week and meet their suitemates. Usually, by the time this process is complete for all 50 campers, it is time for lights out in order to get an early start on Monday.

A typical camp day begins when students leave the dorms at about 7:20a.m. heading to the university cafeteria for breakfast. The first lecture of the day begins by 9:00am. Generally two days of the camp begin with field trips to engineering locations and there is usually one afternoon field trip as well. Recent summer camp field trip destinations have included a GM assembly line making Escalades, UTA's Automation and Robotics Research Institute, Sabre Industries (we got to see the Travelocity gnome), L3 Link Communications testing F-16 flight simulators and Bass Performance Hall in Fort Worth. The lectures are given in university classrooms by professors and graduate teaching assistants on topics from each of our engineering disciplines plus chemistry, physics, and safety issues (usually the first lecture). Most of these "lectures" involve hands-on or group activities, which involve the students actively in the subjects. Students attend lectures or field trips in the morning, break at around noon for lunch, then spend the afternoon in other lectures or field trips until the dinner break.

In the evenings, the students work on team projects. Depending on the topic, the team may have between 2 and 4 students on it. Students are allowed to pick a project they are interested in and then become part of a team for that project. Teams are randomly selected groupings. There are typically five projects for campers to choose from; one each in aerospace, civil, computer science, electrical and mechanical engineering. The teams are responsible not only for building the project but also for preparing a technical report on their project, developing a presentation about their project, and then presenting the project and presentation to the other campers on the final camp day. The campers get lectures on how to develop their technical reports and presentations.

In the course of the week we also take time to relax at UTA's bowling and billiards room and to have an evening of sports and games. Every day the students have about 90 minutes for each meal and are allowed to sit where they like within the camp's area of the cafeteria. The cafeteria provides students with a choice of food at each meal and camp counselors do monitor the campers eating habits so that no one eats cookies all week, for example.

The students move between classrooms and activities in an organized fashion to facilitate keeping track of all 50 at once. The campers assess each activity during the day and turn in these assessments daily. The students receive notebooks at the beginning of the camp and they use these notebooks to keep track of notes, activities, schedules, handouts and other information during the week. These notebooks are theirs to keep after camp.

The final day of the camp is for team presentations during the morning and afternoon, a late afternoon movie for the campers (while judges are choosing the winning presentations), a dinner with their parents who have come to pick them up, and a closing presentation with an overview of the week for the parents, presentations from the winning teams and camp awards. Each camper also receives a certificate and a camp T-shirt.

### **Management of the camps**

The UTA Engineering and Computer Science Summer Camps require significant preparation and planning, as one would expect. The camps require certain yearly tasks, a temporary staff, support from the college and from local industry and then specific management activities throughout the duration of the camps themselves.

The yearly camp preparations usually start immediately after the completion of a year's camp. These early activities include reservations of rooms for lectures and classes the following summer, a lessons learned review of the just past camps, and tentative housing plans for the following summer. The room and housing reservations must be done early due to the number of other summer activities that occur at UTA. The lessons learned includes feedback from camp staff, budget review, and planning for changes that will be needed. The next burst of activity begins in late December / early January when the new current year camp application is posted online and mailed to teachers and schools. Costs goals and budgets are also reviewed at this time. Through the early spring, applications come in for campers and also for teacher participants. Review and selection of participants occurs in an ongoing fashion throughout the spring. Mid to late spring is the time that UTA student counselors and mentors are interviewed and hired,

field trips are explored and arranged, faculty and graduate student presenters are arranged and scheduled, and material for campers (ex. T-shirts), and camp projects (ex. glue and CD-RWs), are ordered and procured.

One unique characteristic of the UTA Engineering and Computer Science Summer Camps is the UTA engineering students (both undergraduate and graduate) who work in the camps as counselors and project mentors. UTA students are selected by interview and application. Students may be hired as counselors, mentors, camp coordinators, or for special purposes such as camp photographer. The counselors are the UTA students who live in the dorms with the campers for the week. Typically there are three counselors for a group of 50 students. The camp coordinator role is the lead UTA student who is the central point of contact for campers and counselors. The camp coordinator stays with the campers in the dorm, has the authority to make decisions, has the discretion to defer a decision to the camp director (such as issues of rule breaking), and reports directly to the camp director (Dr. Tiernan) and assistant director. The UTA student mentor role is to guide camper teams in developing and completing their engineering projects in the evenings. Usually a UTA student will be a counselor for one week of camp and then serve as a mentor in one or both of the other camp weeks. All UTA students are paid for these jobs in the camp. The camp director (Dr. Tiernan) hires the students and develops the work schedules for the camps.

UTA students who serve as counselors or mentors in the camp not only receive pay but also have unique opportunities as a result of the camp. UTA students in one engineering discipline will have the opportunity to meet professors in other fields and learn more about those other disciplines. UTA students have the chance to manage activities and develop the skills of working with others. The UTA students also get a chance to exercise some authority and to explore the limits of their authority in a safe and controlled setting. Lastly and most importantly, the UTA students serve as role models for the campers making engineering studies real to the campers in a different way than faculty and field trips can do. For this year, one of the two camp coordinators will be a young lady in electrical engineering at UTA who attended UTA summer camps when she was in middle school.

During the weeks of camp, other management issues come to the fore. One the first evening of the camp, the parents and campers together see a presentation about the camp and the expectations for them. This includes a clear set of rules and clear consequences. By giving this presentation up front to campers and parents together, we lay the groundwork for the week's behavior and we enlist the parents in support of that expectation. The presentation also introduces the UTA student counselors and explains their role to the campers and parents. It is important that the UTA counselors and mentors understand their roles and responsibilities. The camp director and assistant director must be the check and balance in the first 36 hours as counselors learn their new job on the job. Usually after 36 hours the counselor has developed an interaction style with the campers that will last for the rest of the week.

For purposes of communication, photographs of student activities are posted daily on the camp website. Campers must call home every day before going to bed. The camp also has a cell phone that is carried by the camp coordinator who is always with the students. This gives parents peace of mind that they can have rapid contact with their child if needed.

On those infrequent occasions when major rule breaking or problems have occurred, the camp director, not a UTA student, deals with students and parents. The camp director is the final decision maker for campers and counselors during the camp week and has the authority to send a camper home or to dismiss a counselor if necessary.

## **Support**

### **Support from the college**

The UTA Engineering and Computer Science Summer Camps require significant support from the College of Engineering (CoE) to insure its success. The College's most significant contributions are funding and administrative support. The CoE provides the administrative support staff for the Summer Camps. This provides a single point of contact for everything from housing contracts to UTA counselor payroll to receipt of student applications and camp fees. The CoE support staff handle residence hall contracts, dining service contracts, insurance issues, release forms, ordering of T-shirts, materials and supplies, reservation of lecture space, transportation arrangements for field trips, and all the myriad details that such a complex undertaking entails. The College of Engineering staff also provides website support, publicity, and fund-raising for the camps. The CoE provides funding to pay a stipend to faculty and graduate student presenters who participate in the camps. An Associate Dean of the College of Engineering provides direction for camp goals and objectives.

### **Support from the industry**

As the largest engineering campus in North Texas, UTA College of Engineering has excellent relationships with many industries. The Engineering and Computer Science Summer Camps provide many opportunities for partnerships with our local industry. The largest form of support is direct camp sponsorship through donations. The camp sponsor companies are thanked during opening and closing presentations, are listed on the camp banner posted on the engineering building and are listed on the Camp T-shirt as a thank you for their support. Local industry also provides various locations for field trips for the campers and supplies volunteers who come and assist the UTA mentors with the evening team projects. Some corporations provide camper scholarships often in conjunction with a school they have adopted to insure all students have the chance to attend the camp regardless of financial limits. Local industry representatives are invited to come to the final camp day and observe student presentations as a way to connect them to the camp they support. We also hold a sponsor reception with camper participants to give the sponsors an overview of the camps that occurred and to thank them again for supporting the future of engineering.

## **Results and future directions**

Follow up that was conducted in the first years of the camp showed a positive change in attitude toward engineering in the campers from prior to the camp to after the camp. We have had an average of 30% female participants over the years of the camp and an

approximate 30% minority participation as well. The camp receives students from all across the state and from the region as well.

In 2005, a survey was done of the parents of camp participants from the summers of 1998 and 1999. Of those responding, 100% of camp attendees were currently attending college, 50% were majoring in engineering-related programs, and 72% said that the camp experience had an influence on their selection of a major course of study. Parent comments included:

“It was an outstanding opportunity and program to familiarize students with different facets of engineering. He still talks about what he learned at camp.”

“Has been considering biomedical engineering since attending camp.”

“Helped her focus on different kinds of engineering. Inspired her brother to attend camp. Thanks for making camp so enjoyable and keeping learning fun while maintaining and developing self-discipline.”

The summer camp program has created partnerships with a number of schools that send students to the camp every year because of the positive experiences their students have reported. We have also developed teacher-student pipelines where teacher participants are more likely to suggest the summer camp to their students than prior to their camp experience. Anecdotally, UTA CoE has already graduated at least one prior camp participant and other camp alumni, such as the camp coordinator, are current students in engineering at UTA.

In the future, the College of Engineering is looking at additional camp formats to add to the residential camp to increase the number of students reached by these efforts. In particular we would like to offer a college-focused camp for high school juniors and seniors that incorporates aspects of engineering and college planning activities.

We believe that the UTA Engineering and Computer Science Summer Camp program is a benefit to the community, to engineering education, and to UTA. It addresses a critical need in our country to encourage more students to enter engineering and it supports the goals of increasing the representation of women and minorities in engineering. We are happy to share our approach as one tool of many to bring more students into engineering.

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Dr. Tiernan is Senior Lecturer in Computer Science and Engineering (CSE) at U. Texas at Arlington, and serves as Undergraduate Advisor and Director of Outreach for the CSE Department as well as Director of the UTA Engineering and Computer Science Summer Camp Program. She coordinates the Infinity Project, the Engineering Freshman Interest Group (FIG), and RoPro, a high school robotics competition. Dr. Tiernan holds a B. A. in computer science from University of Tennessee, and an M.S.C.S. from the UT Dallas and a Ph.D. in Computer Science from UT Arlington. She is faculty advisor for the Society of Women Engineers and the Game Developer's Club.

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