AC 2010-686: MOTIVATED ENGINEERING TRANSFERS – STEM TALENT EXPANSION PROGRAM (METSTEP)

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Motivated Engineering Transfers – STEM Talent Expansion Program (METSTEP)

Abstract

The **Motivated Engineering Transfers – STEM Talent Expansion Program (METSTEP)** is a partnership between Arizona State University's (ASU's) Ira A. Fulton Schools of Engineering (lead institution) and non-metropolitan Arizona Community Colleges (CCs) designed to significantly increase the number of CC transfer students (especially women and underrepresented minority students) that graduate with engineering and computer science – hereafter referred to as engineering – BS/E and graduate degrees. The targeted students are enrolled in pre-calculus/calculus, engineering, biology, chemistry, physics, and geology courses at Arizona's CCs and their local high school (HSs). The partner CCs (Arizona Western, Central Arizona, Cochise, Eastern Arizona, and Mohave) have been selected because (1) they possess a significant pool of untapped engineering talent (a high percentage of women and underrepresented minorities) and (2) they have enthusiastically embraced the vision to reach out to students to attract them to exciting engineering careers. This project develops a supply-chain of high quality engineering students by 1) supporting the CCs' HS student outreach activities, 2) supporting the CC engineering courses by providing materials, tutoring, local engineering speakers, and tuition scholarships, 3) conducting "Be an Engineer" events on the CC campuses to CC students and local HS students and their parents, 4) following up with classes/workshops/seminars - exploiting time-tested techniques, assignments, as well as one-on-one and group mentoring - for all participants either via live teleconference or webcast, 5) providing an engaged community of mentors (with extensive experience and commitment) for all students, as well as remote tutoring and mentoring via phone, email, or Blackboard, 6) hosting an Orientation at ASU specifically for engineering transfer students, 7) managing a Fulton Transfer Center where engineering transfer students and their CC cohorts can study together and get the support needed to survive, and 8) working with (especially new) transfer students for success and learning through a (time-tested) "career shaping" academic scholarship workshop program. This project is funded through a grant from NSF's STEP Program (#0856834).

I. Introduction

Computer science, engineering, and mathematics (CSEM) are essential to the continued scientific advancement and technological development of the United States. Recent government studies have concluded that the future economic well being of our nation will be largely dependent on the training of students in these disciplines [1]-[5]. S&E occupations are projected to grow by 26% from 2004 to 2014, while employment in all occupations is projected to grow 13% over the same period [6]. In spite of this, there is an alarming lack of mathematical and scientific achievement by American students at all educational levels, particularly among students from minority groups [5]. As a nation, it is clear that we must increase our efforts to attract and retain students in these critical subjects. If we fail to do this, we place the economic health of the United States at risk [1]-[5]. The problems of recruiting and retaining students in

science, engineering, and mathematics (SEM) are especially difficult among women, persons with disabilities, and low income and ethnic minority students: many of whom are in community colleges (CCs). Once these students enroll in challenging academic programs, they often face financial problems that seriously impede their academic success [5].

We at the Ira A. Fulton Schools of Engineering at Arizona State University (ASU) are in a unique position to address these challenges by working with CCs across the state to increase the number of graduating engineers. ASU is a Research I School. In 2007, it had a total undergraduate (UG) enrollment of 53,298 (28,077 FTE) - 10,706 undergraduates received Bachelor's degrees. In 2008, ASU reached 67,000 – making it the largest university in the nation. The Tempe campus is the largest single campus in the nation with over 53,000 students. The Ira A. Fulton Schools of Engineering, on the Tempe campus, has 4,000 undergraduates (2,822 FTE) and graduates around 760 engineers and computer scientists per year. Fulton has 2,300 graduate students. Over 20% (20.9%) of the UG students are underrepresented minority students and 18.5% are female [7]. Arizona is also the home of one of the largest CC systems in the nation. Maricopa County Community College District (MCCCD) has more than 250,000 students attending its ten independent colleges each year taking credit and non-credit courses. Housed near ASU, 56% of MCCCD students are women and 42% are non-Anglo [8]. In addition, Arizona has ten *non-metropolitan* community colleges across the state. Articulation agreements are in place with all Arizonan CCs and the three state universities (including ASU). Arizona is one of the fastest growing states (an increase of 20.2% from April 1, 2000 to July 1, 2006, while the US population grew 6.4% during that same time) and Hispanics are the fastest growing population segment (Arizona is 30% Hispanic, while the nation is only 15%). The ASU campus is flat and due to the warm weather is a top choice for persons with disabilities. In addition, ASU is surrounded by many high tech companies making it easy for students to intern while in school and to find jobs after graduation. The ASU President has recently tasked his staff with doubling the number of ASU transfer students from the current 5,000/year to 10,000/year in the next 5 years. Efforts are being made at the university level to allow CC students to transfer to ASU after completing pre-engineering courses and to complete their Associate of Science (AS) degree while at ASU, but the AS degree would be credited to the CC. Our engineering project is in line with these ASU efforts. These facts make our project an excellent, important program to increase the number of students in the CCs (especially women and minority students) who choose a career of engineering or computer science (hereafter referred to as engineering), transfer to the university, and earn an engineering degree.

II. Background

Although some 300 or more students had been transferring into the Fulton Schools of Engineering each year, little was being done to actually encourage and to help new engineering transfer students. A University Orientation Day is held for new transfer students in general, but the orientation does not include a tour of the engineering buildings. An evening reception for engineering transfer students had been held in the evening each semester. It was hoped that transfer students could meet with an advisor in their major at this time, but the attendance was quite modest. It seemed appropriate that a partnership with the community colleges would be in the best interest of all parties to help inform, encourage, and support pre-engineering or computer science students who would or are attending a community college with the desire to get a degree at a four year school. During 2002, the first author made contact with a representative from the

MCCCD office, who then assisted with identifying contacts for five of the MCCCD schools. It was important to have the appropriate campus liaison or representative as someone who was supportive of a partnership and either had authority or access to the authority to have it happen. Research/grants staff also needed to be included from both MCCCD and ASU. Even though the MCCCD colleges are independent, in matters of partnerships and grants, the district is the final authority for the colleges. The first matter that needed attention was to have an understanding that the university wanted to help the CCs with their recruitment and retention of pre-engineering and computer science students and to assist their students with transfer only after they could go no further in their engineering studies at the CC.

Representatives from ASU and MCCCD worked together for several months writing a grant for the National Science Foundation. The primary objective of the project was to work together on a program to encourage more potential and actual CC students to consider engineering. The first author had discovered through her research that of the engineering transfer students in Fulton, many of them had gone to a CC with no particular major in mind and had decided on engineering or computer science after they had matriculated at a CC. The representatives had many discussions, wrote carefully with several rewrites, explained the project well, matched a proper budget with the project, worked closely with grant personnel at both institutions, and understood the difference between a partnership and a sub-award. The grant proposal was written such that ASU controlled 50% of the budget and MCCCD controlled 50% of the budget for a true partnership. The proposal was submitted and funded by the National Science Foundation (NSF) (#0315817). Initially each institution had their own director, a METS (Maricopa Engineering Transition Scholars) Center was established and staffed at ASU, and "Be An Engineer" events were held at each CC reaching about 300 students per semester. ASU provided student panels and arranged a panel of industry representatives to talk to the students. Women and underrepresented minority students were especially encouraged to consider engineering. The "Be An Engineer" event usually included engineering demonstrations, advisors and financial aid representatives from ASU, as well as faculty and staff members. The hosting CC took care of the advertisement and serving of refreshments as an incentive for students to attend. Some CC math and science instructors gave their students extra credit if they attended the event. The events usually had a good attendance (30-100 students), but more needed to be done. The METS Center ran an Orientation Program each semester for potential transfer students including a tour of a lab and engineering facilities. In the fall of 2003, ASU also received funding an S-STEM grant from NSF (#0324212) which provided $3,125 academic year scholarships to transfer students. These students also met in a workshop six times a semester with a program and assignments to help their understanding of engineering, their retention and graduation, and their going right on to graduate school. This grant ran through the 2008-09 academic year and is continuing to the present under an NSF S-STEM grant (# 0836050) for transfer students.

The METS grant ran from 7/1/03 to 6/30/07. The program was continued through the 2007-08 academic year with support from local industry and the Fulton Schools of Engineering. During time MCCCD decided that they wanted to go their own way with future funding with an emphasis on recruitment. More about the programs run during these years can be found in references [9]-[17]. During the spring of 2008, ASU submitted another proposal to NSF in their Innovations in Engineering Education, Curriculum, and Infrastructure (IEECI) program for funding for one year to run an exploratory program on working with non-metropolitan CCs. This proposal was funded (#0836050). The purpose of this project was to research what could

be done to get more engineering and computer science graduates by working with non-metropolitan CCs. Specifically, we wanted to know what could be done to inform and to encourage high school students about engineering when the high school is located close to a community college, but not to a four-year college or university. By partnering with the local CC, which is the most likely place that most of the high school students would go if they went to college, we could help to get more students interested in engineering. We also wanted to determine how we could encourage the CC students taking pre-engineering courses, and to continue to hold Transfer Information Days and run the ASU METS Center as "home base" for transfer students after they have transferred. ASU worked with three CCs: Arizona Western, Arizona Central, and Cochise College. While Arizona Central is only an hour away from ASU, Arizona Western and Cochise College are about four hours away. This longer distance makes it difficult to bring student role models and industry models since the trip takes most of a day. Also, the main class days for the ASU and CC students are the same – Monday through Thursday, making it difficult for ASU students to travel to the CCs and to speak in their classes. Liaisons were established in each of the three CCs and visits were made to each of the non-metropolitan CCs and to some of their local high schools. More about the exploratory project can be found in reference [18]. This year of exploration gave enough evidence that we knew that we wanted to continue efforts with these three schools and to add two more non-metropolitan CCs. We were able to do this with funding through a grant from NSF's STEP Program (#0856834). The five-year program, with an emphasis on women and underrepresented minority students, was funded on September 1, 2009.

III. Overview of METSTEP Project

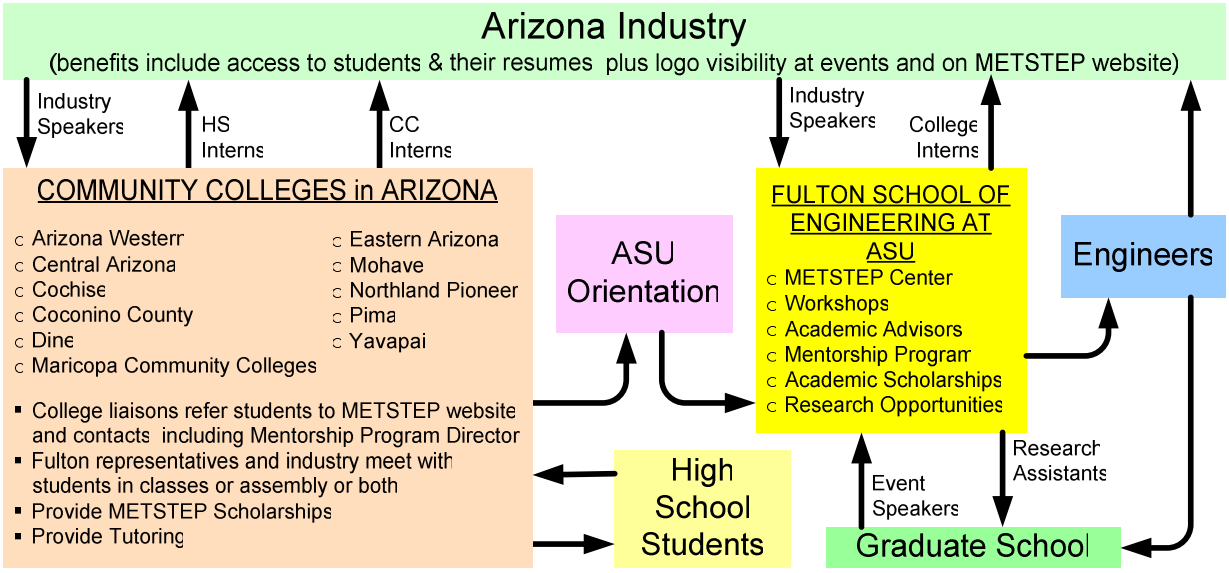
One objective of the Ira A. Fulton Schools of Engineering's *Motivated Engineering Transfers-STEM Talent Expansion Program (METSTEP)* is to inform, support, encourage and motivate students (especially women and underrepresented students) at four levels: 1) as high school students and their parents local to a CC; 2) as CC students in engineering or math/science classes, particularly in the non-metropolitan Phoenix area, 3) as engineering transfers to the Ira A. Fulton Schools of Engineering at ASU and 4) as successful engineers graduating to industry or onto graduate school. The main goal of this project is to significantly increase the number of CC transfer students receiving engineering degrees from ASU and successfully transitioning into the STEM workforce or on to graduate school. While focus will be placed on recruitment from five non-metropolitan partnering CCs – situated 60-200 miles from ASU- the project will also assist students from many other Arizona CCs. This project will determine the effectiveness of working with community colleges in non-metropolitan areas across the state of Arizona by leveraging high school and community outreach activities with these colleges and implementing new retention strategies for local community colleges.

This effort will help build a strategic supply-chain or local pathway that produces a diverse engineering workforce for our local companies, as well as the nation, by effectively strengthening the important links in the pathway. The following diagram in Figure 1 shows the left-to-right progression of a student from high school (K-12 outreach activities), through their local community college (Intro to Engineering), to an Engineering Transfer Student Day at ASU, and as a student in the Fulton Schools of Engineering where there is a METS Center for them, and finally as a graduate who goes into industry or continues in graduate school before going

into industry or academia. Throughout this pathway, Arizona's industry is supportive, varying their activity along the pathway: they donate their time to talk to high school and community college students about engineering, share information about their internships to CC and university students, and then actively recruit the graduating engineering students to work for them. This industry has also donated funds to ASU to continue a viable transfer program. This industry is very supportive of growing Arizona's diverse population of students to attend Arizona engineering programs, and then offering them careers at their Arizona companies.

Figure 1: METSTEP Program – Building Arizona's Engineering Workforce Pathway

Recruiting *Arizona* students (especially undecided majors women and minority students) into *Arizona* engineering programs retaining them through graduation and then offering them careers with *Arizona* engineering firms



Community colleges, both in the Maricopa County Community College District (metropolitan Phoenix area) and across the state of Arizona (*non-metropolitan* areas), are the perfect institutions for Arizona's diverse students to attend; students at the community colleges are more often first generation college students, who do not know what they want to major in, and who come from the local communities. Before this program, there had been little or no collaboration between a university and the rural CCs in Arizona. At ASU, engineering transfer students have a place (the METS Center) to call home, especially while they get acclimated to the campus and its resources. More than 150 students use the METS Center each semester.

Newly-established partnerships with faculty liaisons in the five non-metropolitan college campuses are driving the project. Many of the communities across the state of Arizona have a high proportion of Hispanics and are in or near Indian reservations, therefore providing CCs with the opportunity to recruit from a diverse community of students. Intelligent and motivated, these students enter our supply-chain initiative in this project *first* with information about engineering provided in their high schools through hands-on activities. If a college is not yet linked to a high school, we hope to facilitate the implementation of the MESA Program, which is an already-existing high school program conducted and distributed by the Fulton Schools. The high school

students and their parents will be invited to engineering events at the local community college, co-sponsored by ASU. *Secondly,* after the CCs' recruitment efforts, these students again need to hear about engineering from a career standpoint at events and in classrooms at their CC campuses. The high school students will have the option of having an ASU student mentor to answer questions about engineering and campus life. These students will also be invited to all such future events at the local CC. Through these activities we will also reach undecided community college students who have not yet considered engineering. Encouragement is needed for each cohort of students to continue in engineering and to transfer to the university after completing their courses at the community college. As part of this project, twenty $1,000 academic year scholarships will be available to students with unmet financial need at the CCs to encourage students who are studying for an engineering career. In addition, small tuition scholarships ($120-$168) will be available to encourage CC students to take Introduction to Engineering courses. Follow-up seminars for the CC students will be provided either by live broadcast or webcast, by a community of mentors for potential transfer students, as well as remote tutoring through phone, email, or Blackboard. The community of mentors will connect the CC students with peers, with current university-level transfer students, with CC liaisons, and with ASU professors. *Thirdly,* during the transfer process, the Fulton Schools will conduct two separate events: a Transfer Day and a Welcome Day, to help new transfer students familiarize themselves with the campus and its resources. *Finally,* the Fulton Schools will provide the transfer students with support through the use of a METS Center geared specifically for transfer students to study together and to reconnect with their college cohorts. Workshops at the METS Center will help students quickly identify the resources they need to complete their higher-level engineering course loads successfully, teach them a learning system to help them with a faster pace of classes, become interns at local technical companies, prepare for rewarding careers in STEM fields, and, finally, graduate with either a Bachelor's or graduate degree as well-prepared engineers for Arizona's growing community of technology-based companies, national laboratories, or academia. This project will provide 15 $4,000 scholarships to transfers from the partner institutions with unmet financial need and an additional 50 $300 scholarships to transfer students with or without unmet financial need. The students who are awarded these scholarships will attend six seminars during the semester to further assist them do well as an engineering student. The existing CIRC/METS program provides 30 $4,000 scholarships yearly for ASU engineering transfer students who are citizens or permanent residents with unmet financial need, and have at least a 3.0 gpa. The students on a scholarship from the METSTEP grant will meet with the CIRC/METS students, so we fully expect the students coming through this project to do as well as the CIRC/METS students have in the past.

IV. The Community College Partners

Approximately 90% of the CC transfers in engineering and computer science come from six schools, all inside Maricopa County where ASU resides. Only about 30 students/year come from

the ten non-metropolitan CCs outside of Maricopa County. Each of the five partnering CCs is eager to develop and/or to improve their engineering program. Table I, below, which lists the enrollment figures for each CC, demonstrates the opportunity presented by this project to encourage a large stream of students to become aware of, consider, and pursue engineering.

	Students Total/ FTE	% Minority	% Female	AA/AS Degrees/Yr	STEM Students	STEM Students (% female/minority)				Pre-Eng	Transfers /Yr Ave*	Transfers /2007
						Females	NA	H	AA			
Arizona Western	6,613/ 3,378	63.0	57.0	314/27	2,828	57.2	1.7	49.9	2.6	Yes	6.67	2
Central	6,049/ 3,812	36.1	56.4	84/18	2,469	60.5	4.7	18.8	9.6	Reestablishing	5.3	2
Cochise	13,620/ 6708	42.0	63.7	101/20	1,628	58.7	1	27.6	6.4	Math/ Science AA	3.0	4
Eastern	8,909/ 3,088	27.7	59.2	230/6	3,460	54.3	10.7	18.3	2.9	Yes (4 yrs.)	1.0	4
Mohave	5,474/ 3,143	18.0	66.0	66/4	1,441	16	1	2	0	CIS Conc.	1.3	0
Totals	40,565/ 20,129			795/75	10,191						17.3	12

Table 1. Student Enrollment and Degrees Awarded at Partnering METSTEP Community Colleges
NA = Native American, H = Hispanic, AA = African American, (*Average 04-06)

These colleges lie one to four hours from ASU and several have more than one campus. The total enrollment at these five schools is over 40,000. The total enrollment in their STEM courses is over 10,000. Our project will specifically target students taking STEM courses (pre-calculus and above). The project will also help these CCs grow their math and science departments, as well as foster pre-engineering programs. The number of current transfers from these colleges is small so the potential is large. (Note: Fulton Schools has more total engineering transfer students than any other Arizona engineering program.)

In addition, we will continue to encourage, transition, and support transfer students from the MCCCD. MCCCD has some 14,000 are taking math and science classes. The semester orientations for CC students will also include new transfer students from MCCCD. Most students receiving the CIRC/METS scholarships are CC transfers from Glendale Community College, Chandler-Gilbert Community College, and Mesa Community College from the MCCCD. Transfer students from METSTEP CCs will be given preference on scholarships provided by the STEP program.

Each college has established a program or an idea that needs the support of this partnership to provide the pathway for its student output. The long-term goal is to be able to determine the merits of the various programs and then to leverage these best practices to the other partnering colleges. In addition, we expect that as these CCs are given a boost in their pre-engineering programs, they will gain impetus of their own and have well functioning pre-engineering programs.

Arizona Western College is a Hispanic-serving institution with an on-going pre-engineering program.. Although no "official" ASU engineering delegation had visited AZ Western before the exploratory project, in the past ASU student members of the Society of Hispanic Professional Engineers have spent part of their winter break speaking at nearby Yuma High School about engineering career opportunities. AZ Western has an active collaboration with the nearby Yuma and GM Proving Grounds and Marine Corps Air Station, as well as support from an Engineering Advisory Committee.

Central Arizona College (CAC), with two campuses, is also a Hispanic-serving institution. CAC regrets having closed their engineering program nine years ago and has reactivated the program. During the last two years the college has hired a new faculty member to lead the engineering program. Courses being taught now include a one-credit "Survey of Engineering Professions", a three credit "Intro to Engineering" and a three credit "Engineering Design" course. The school has had several successful events by inviting HS students and their parents to an Engineering Open House on their campus. An advantage of working with CAC is their less than one hour proximity to ASU.

Recent progress at Cochise Community College (CCC) in developing an engineering program fits in well with the timing of the exploratory grant and the METSTEP project. CCC has recently established a Running Start Academy for local HS juniors to start acquiring an associate's degree in engineering. The HS students can take classes at CCC during both their junior and senior years in HS and continue on to CCC the following year to complete an Associate's of Science degree in Pre-Engineering. CCC is also working with Project Lead the Way curriculum and accepts the courses for college-level credit. More work needs to be done to

have the courses articulated so universities can readily accept them for transfer as intro level engineering courses.

Eastern Arizona College (EAC) is a minority serving college 160 miles from ASU. EAC is the oldest CC in the state of Arizona and most of the students come from small, impoverished towns located on the White Mountain Apache, the San Carlos Apache, and the Navajo Indian Reservations or bordering communities. About one-third of the EAC students are from underrepresented groups. A Pre-Engineering Program was begun seven years ago. The school offers the array of usual lower division engineering courses. Due to the mathematics preparation of the incoming students, most are limited at first to the Introduction to Engineering course. EAC is also working with high school students, encouraging them to dual enroll, and have an annual "Engineering Day" for HS students and Parents. They welcome this partnership and its timing.

Mohave Community College (MCC) is also about 200 miles from ASU. The college offers higher level math and science courses for students desiring transfer to state universities on a pre-engineering track. The school is in the process of including computer science courses to further enhance that track. This partnership should be able to assist students living in rural Mohave County with their focus on engineering.

V. Program Scholarships

Five types of scholarship will be given in this program. Fifteen $4,000 academic year scholarships will be available at ASU for transfer students with unmet financial need as determined by FAFSA. These students must also be full-time students, be US citizens or permanent residents, and have at least a 3.0 gpa. Students from the five CCs in this project will be targeted for these scholarships. Fifty $300 semester scholarships will be available for transfer students in Fulton with no unmet financial need or if they do not qualify for the $4,000 scholarship, if they enroll in a one-credit Success Seminar and complete the assignments. In addition, each CC has scholarship money in their own budget for $1,000 annual scholarships for five students who are pre-engineering and $3,000 for $120-$168 tuition scholarships for students to attend Introduction to Engineering courses to interest them in engineering. The above is the scholarship money for year one. There is scholarship money for each of the five years of the project with the amount of scholarship money available decreasing somewhat. However, it is probable that not all of the scholarship money will be awarded during the first two years and will carry over to the last three years. An additional twenty $1,000 scholarships for students still at the CC will be available through ASU for the CCs who have a particularly high number of eligible applicants for the $1,000 scholarships.

VI. Accomplishments and Conclusions

Through the year of the exploratory METS project and the first semester of the METSTEP project we have been able to come to some consensus on some best practices. In visiting the non-metropolitan colleges, our audiences vary greatly and the presentations need to vary as well. One of the audiences is high school students. We have met with them at the community college (high school students taking calculus at the CC) and in a group in their high school. Having adults talking to a group of students at the high school did not go well for several reasons. The meeting was in a corner of the library and the acoustics were not good. Having student role

models closer to the high school age are generally more effective than adult speakers. Many of the students in the audience were headed to a hands-on technical certification and were not interested in engineering. A more effective way to interest high school students about engineering is to have college engineering students talk with students in AP calculus and AP physics classes. The students in these classes are generally college-bound and are already in a possible pre-engineering track even though they may not know much about engineering. The best type of college role model to a Hispanic-serving institution is to have a Hispanic student who used to go to that high school and who is now a successful engineering student talk about what engineers do in positive terms and with excitement. It is also very important to point out how engineers solve problems to help people. Having the high school students guess what some of the major inventions of the twentieth century were can help them understand some of the important ways engineers have influenced daily life.

Some of the audiences are mixed with high school students and their parents, as well as regular CC students, who may or may not have chosen engineering or computer science as their major. The presentation in this case needs to be quite broad and also needs to include what engineers do and the variety of careers that engineers can choose from. It is good to mention that although engineering is a challenging major, the benefits in salary and challenges and rewards are well worth it. Again, this group, women especially, are usually interested in how they can help people in the career that they choose. A good topic to mention are the grand challenges that engineers face today in helping people from pollution to cheap, clean power.

The toughest audience may be the older students who are attending the CC while working full-time and supporting a family. They do not see themselves ever moving to live near a four-year college or university so they can obtain an engineering degree. There are not many options for on–line engineering degrees at this time.

A visit to a community college before presentations are made is a good idea for the presenters to better understand the college setting and the type of students they will encounter. An excellent venue for working with CC students, who are taking pre-engineering courses, is for the instructor(s) to have the students available for two hours for an engineering presentation. The favorite part of the presentation for the CC students was to have a student who had gone to their CC and who is now an engineering student at ASU give them tips on transferring their credits and how life is at ASU. One particular presenting student had done the first semester of his senior design project, so the CC students in an “Engineering Design” class had several questions about how the “design” part worked in the project. Included in each presentation should again be a general broad view of what engineers do, including specific examples. It is also helpful if the presenters can answer general questions on financial aid and advising, or at least give the student the name and contact information of the ASU academic advisor in the major in which he or she is interested.

This discussion begs the question: “What if you can’t get an alumni, any other student, or an industry representative to go on an information trip to a CC due to the extensive time required?” This is an important question when a CC is about four hours from ASU. There are two solutions. One is to bring the CC students to ASU and the second is to use teleconferences or webcasts. Very successful trips have been made by a group of CC students travelling in vans to ASU for a half-day program. If a student can come early or stay later than the planned program for an appointment to meet with an academic advisor, then the visit is enhanced. The ASU program

includes introductions and short presentations from advisor, financial aid, scholarships, internship program, and career services representatives. A panel of transfer students speaks to the students. Preferably at least one of the students is from the visiting CC. The students share various aspects of college life including student organizations, student projects such as the concrete canoe or electric car, internships, and research. The CC students are given a short tour of a lab and/or of engineering buildings. The students are given a presentation on the "Guaranteed 4.0 Plan" which gives the students study skills that they can begin using before they come to the Fulton Schools. During one successful visit, the CC students were asked to join a CIRC and CIRC/METS meeting to listen to an engineer from industry speak. The meeting was appreciated by the CC students both for learning more about engineering from an industry representative and for being able to network with ASU engineering and computer science students.

The other way to bring role models to the rural CC student is to use live videoconferencing or webcasts. The Fulton Schools of Engineering and the CCs in this project all have teleconferencing capabilities already on their campuses. A problem is that these rooms are being well-used, some already to capacity. This spring semester we plan to begin to teleconference at least one of each of the six Thursday workshops to be held for the CIRC and CIRC/METS scholars. For those CCs where there is an open conference room at one of these times, the CC students will be able to interact and ask questions during the meeting. For those CCs who do not have a conference or class room available, the meetings will be saved on a webcast at the same time and this webcast will be shipped to the CC so it can be played in a classroom or other appropriate setting. While not as ideal as the live teleconferencing, with webcasts at least the rural CC students will be able to view appropriate role models among students and working engineers.

In order to measure what we will be able to accomplish in this project, it is important that we gather baseline statistics at the beginning of the project while they are easy to obtain. The ultimate success of this project will be measured in the increased number of engineering and computer science degrees, Bachelor's or Associate Degrees, for pre-engineering/computer science. However, along the way we want to measure which activities has been the most productive and efficient in increasing the number of students who choose engineering or computer science.

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