

AC 2009-2270: AN ACADEMIC SCHOLARSHIP PROGRAM FOR TRANSFER STUDENTS IN ENGINEERING AND COMPUTER SCIENCE: A FIVE-YEAR SUMMARY

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An Academic Scholarship Program for Transfer Students in Engineering and Computer Science: A Five Year Summary

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Abstract

Each year the Ira A. Fulton School of Engineering accepts 300 transfer students, most of whom come from local community colleges (CCs). These students face a big adjustment when transferring to the largest student enrollment campus in the nation. Traditionally, little has been done to assist transfer students with the transfer process and to help them be retained after they have matriculated to a university such as Arizona State University (ASU). In addition to adjusting to another academic system, most transfer students work, some close to full-time. Also many transfer students are females or underrepresented minority students. These particular transfer students may face additional barriers when transferring to a larger institution.

This academic scholarship program for transfer students was sponsored by the National Science Foundation (NSF) through the CSEMS program (Proposal # 0324212). This successful program ran from 2003-2008 with 76 students and over a 92% retention and graduation rate in engineering and computer science. This paper will give summary statistics for the program including demographics, retention and graduation rates, and the percentage of transfer students who have gone on to graduate school. Diversity was an emphasis and 67% of the students in the program were either female or an underrepresented minority. Based on surveys of the students, the program highlights will be described. The program featured academic workshops and assignments in addition to scholarships. The workshops and assignments were all designed to help the students become a more complete engineer as well as to inform them of the opportunities available for research, internships, graduate school, and jobs after graduation. The students received instruction on resumes, interviews, recommendation letters, portfolios, and consulting. In addition, students learned about graduate school from panels of graduate students and engineers from industry with graduate degrees.

The paper will also discuss the primary lessons learned over 5 years and areas that could be improved. In particular, we will note how the women fared in this program. The program is being continued with an S-STEM NSF grant.

I. Background

Arizona State University (ASU) is now the largest single university in the United States with over 67,000 students on four campuses and also has the largest single campus, its Tempe campus, with over 53,000 students. Tempe is a neighbor city to Phoenix, the fourth largest city in the United States. The University is set in a valley of high tech manufacturers and over 4 million people. Also set in this valley is one of the nation's largest community college district system, the Maricopa County Community College

District (MCCCD) with over 200,000 students and including 10 independent colleges. For some time, each year 300-400 students have transferred into ASU's Ira A. Fulton School of Engineering, most of them from the MCCCD. Although the students were welcome and new transfers were invited to a university orientation, there was no special welcome for them in the School of Engineering.

The Ira A. Fulton School of Engineering at ASU includes engineering, computer science, and construction. In this paper the term "engineering" shall generally include both engineering and computer science. The computer science department includes both Computer Science with a Bachelor of Science degree, and Computer Systems Engineering with a Bachelor of Science in Engineering degree.

A general myth prevailed among some ASU faculty that Community College transfer students were those who hadn't been able to qualify academically for ASU out of high school. With that thought, the students were tolerated, but not particularly welcomed. Although there are some students who are not academically qualified to attend a four-year university right out of high school, the majority of the transfer students chose to go to a community college due to lower tuition, close proximity to their home, the uncertainty of a major, free parking, smaller classes, and friendly faculty, or other reasons. Many community college students only decide on engineering as a major after they have attended a community college. Our studies have shown that this may be true for up to 40 or 50% of the ASU engineering transfer students.

The first upper division Academic Scholarship Program directed by the author was begun in the fall of 2002 with a four-year \$400,000 National Science Foundation CSEMS (grant 0123146). This program provided an annual academic scholarship of \$3,125 which covered the ASU tuition at that time. The Collaborative Interdisciplinary Research Community (CIRC) program began with 22 students in the Fall of 2003, 11 of these being transfer students. Five of these transfer students graduated the first year and one withdrew from ASU after one semester. In the fall of 2003, a second \$400,000 CSEMS National Science Foundation (grant 0324212) enabled a second upper division academic scholarship program to begin with the same requirements and program as CIRC, except the second program was for transfer students. The continuing five transfer students from the CIRC program were joined by 22 additional transfer students. This second program was called the Collaborative Interdisciplinary Research Community/Maricopa Engineering Transfer Scholars (CIRC/METS). As we have now begun to work with Arizona community colleges outside of Maricopa County, the METS now stands for "Motivated Engineering Transfer Students". The scholarships for the transfer students were also \$3,125 per academic year.¹

A literature review on engineering and computer science community college transfer students was conducted in a previous paper.²

II. The CIRC/METS Students

The CIRC/METS Scholarships were advertised on the School website. Emails were sent to potentially qualified women and underrepresented minority transfer students to especially invite them to apply. Scholarships were made known to students at six of the MCCC schools through liaisons. The application for the academic scholarship program, now on-line, consisted of demographic information, a personal statement, transcripts, and two letters of recommendation (at least one must be from a professor). Qualifications included being a U.S. citizen or permanent resident, being a transfer student of at least junior standing, and having a GPA of at least a 3.0. In addition the student must have unmet financial need as shown by a FAFSA. For continued enrollment the student must keep at least a 3.0 GPA, have continued unmet financial need, attend the seminars, and complete the assignments. In most cases all students, who submitted a complete application and who were qualified, received a scholarship. The number admitted each year was capped by the money available for new scholarships and filled on a first come, first served basis. If there were too many applicants, the statement of purpose was the main criteria used for selection as judged by the school's scholarship director and the CIRC/METS PI.

Over the five years of the project 76 students took part in the program. The program had an emphasis on women and underrepresented minority students and fifty (65.8%) of the students were either female or underrepresented minority or both. Table 1 shows the breakdown. The percentage of women in the program was 38.2% while the percentage of women undergraduate students in the School of Engineering is less than 17%. The percentage of underrepresented minority students in the program was 39.5% while the percentage of underrepresented minority students in the School of Engineering is now 19%. Among the underrepresented minority students, 21 were Hispanic, 6 were African American, and 3 were Native American.

	Underrepresented Minority	Non-Minority	Total
Women	9	20	29 (38.2%)
Men	21	26	47 (61.8%)
Total	30 (39.5%)	46 (60.5%)	76 (100.0%)

Table 1. Gender and Minority Status of Students in Program

Twenty-two of these students are still in school. Twenty of them are continuing in engineering and many are in the current CIRC/METS program which is being continued under NSF S-STEM funding (grant 0728695). Two have transferred to other majors: one to mathematics and one to psychology.

Through a survey of the 24 students in the fifth year of the CIRC/METS program, we learned that 15 had gone to a community college (CC) because it was less expensive than a college or university, 7 attended the CC because it was close to home, 4 thought the education was as good or better at the CC, and only 3 did not have a high school diploma or did poorly in high school. Other reasons given for attending a CC includes smaller classes, more interaction with instructors, a need to improve their English, and that they

had taken classes at a CC while in high school.² Students were asked to check all reasons that applied.

The first semester experiences of these transfer students summarized in a previous paper are given here for completeness in Table 2.² Nine women and 15 men took this survey. The students were told to check all that applied. In looking at the table there are no obvious categories in which women had more problems than men transfer students. In fact, the percentage of women having a negative transfer experience is often half that of the men. The only experiences in which women reported more problems than men (percentage-wise) are being lonely and having no easy classes left to take. A slightly higher percentage of the women reported having a friend/mentor who helped them. All of the women reported having some problems in the transfer experience.

First Semester Transfer Experiences	Total	%	Men	Women
Parking was difficult	18	75.0	12 (80%)	6 (67%)
Did not know where resources were	13	54.2	10 (67%)	3 (33%)
Classes were faster paced	12	50.0	10 (67%)	3 (33%)
Hard to get to know professors	12	50.0	10 (67%)	3 (33%)
Classes were harder than expected	11	45.8	8 (53%)	3 (33%)
Lonely	9	37.5	5 (33%)	4 (44%)
Lost	9	37.5	6 (40%)	3 (33%)
Hard to get into study groups	9	37.5	6 (40%)	3 (33%)
Did not spend much time on campus	9	37.5	6 (40%)	3 (33%)
Felt like a freshman all over again	9	37.5	7 (47%)	2 (22%)
Overwhelmed with classes and logistics	7	29.2	5 (33%)	2 (22%)
Worked too much to do well academically	6	25.0	4 (27%)	2 (22%)
No easy classes left to take	4	16.7	2 (13%)	2 (22%)
Had a friend/mentor who helped me	4	16.7	2 (13%)	2 (22%)
No problems	3	12.5	3 (20%)	0 (0%)

Table 2. First Semester Transfer Experiences by Total and by Gender²

Although three men marked that they had no problems, they also marked several of the negative experiences listed. Three students listed additional problems: missing a lot of school due to religious holidays, taking too many credits the first semester, and being ignorant of using blackboard since no announcement was made that class material was posted there.² It is the author’s opinion that “no easy classes left to take” was actually a larger factor than the transfer students admitted. Transfer students take their English, general studies, and some electives at the CC. By the time they transferred, most of the classes left were upper level mathematics, science, computer science, and engineering classes, all demanding classes which required more study time than most of the classes taken at the CC. This study of the transfer students showed no discrimination toward the women students.

To help the transfer students in their transition to the university, a Motivated Engineering Transfer Student (METS) program, supported by NSF (grants 0315817 and 0836050), exists and supports a METS Center where the transfer students can study, use computers with free printing, socialize, and eat.³ The METS Center provides informal counseling at all times since three successful engineering transfer students help run the Center along with a METS Center Director. The students in these positions are given tasks that help

them to increase their professional development. The Center also provides mentoring and workshops. Some of the students who enter the CIRC/METS program had CSEMS scholarships at their CC. We work with the MCCCCD colleges and, if at all possible, support their transferring CSEMS scholars.^{4,5,6}

III. The CIRC/METS Seminars and Assignments

During the first year of the CIRC program, a series of seminars were begun for the CIRC students. During the first year of the CIRC/METS program, we attempted to have the CIRC students meet during one hour and the CIRC/METS students meet during another hour. However since students' schedule are so varied, after the first year we no longer tried to keep the students apart. Each of the six meetings were held several times (3 or 4) during the same week so the students could attend during at least one of the times.^{7,8}

The syllabus for the last semester of the CIRC/METS Program is given in Table 3. Each meeting began with student introductions. Each student gave their name, major, year in school, and an answer to the icebreaker question for the meeting. In the first meeting of each semester the students were interested in learning what the other students did during the summer or winter break. Other icebreaker questions ask about the best thing that happened to them during the last week. The students were also asked to comment on how the semester is going. Often students will mention a certain difficult class and other students will join in and say that that class was also difficult for them. Sometimes hints are given on how to do better in the class or study groups might form among the scholarship students. The students often comment that this is a very valuable part of the program. It is comforting to a student to know that other students also found the class difficult, but survived.

The students were given assignments throughout each semester. The assignments were designed to help the student become a better scholar, be more informed about engineering, and to consider graduate school. A student assistant is hired part-time to keep track of the attendance and the assignments. If the assignment is not complete the student assistant emails the student with a listing of the corrections that need to be made. This position is also one of development for the student as they learn how to critique assignments and to write pleasant and encouraging emails. The scholars are asked to email a copy of their official class schedule at the beginning of each semester. These are reviewed and at the first meeting each semester a discussion is held about reasonable class loads and workloads. A general rule given to the students is that if they are working 20 hours per week or more, then they should not take more than 12 semester credit hours. A major reason that some new transfer students do not do well their first semester is that they have too large an academic load given the number of their work hours.

Each semester begins with the presentation of the Guaranteed 4.0 Program created by Donna O. Johnson.⁹ This program and the student reactions to it have been described in previous papers.^{7,8} Since the program asks the students to do activities that they have not done before, often an initial reaction is that it takes too much time. The students are encouraged to try the complete system for at least three weeks (to make it a habit) before

MEETING DATE/TIME	MEETING TOPICS	ASSIGNMENT/DUE DATE
Meeting #1 – ECA 228 Thurs., Jan. 17, 12:40-2:30pm 1:40-2:30pm 2:40-3:30pm Fri., Jan. 18, 12:40-2:30pm 1:40-2:30pm	A) Icebreaker – How did the summer go? B) Guaranteed 4.0 Plan	1) Email a copy of your official spring class schedule 2) Email a copy of your full weekly time management schedule including BPR, BPN, BPC, POH, and HW time for each class. The completed Check List must accompany the schedule. 3) Complete a Time Estimate Chart that matches your time management schedule by category (Sleep, Eat, Class, etc.). Example is on back side of first page of the 4.0 Handout. Email. Due by Jan. 31
Meeting #2 – ECA 228 Thursday, Feb. 7, 12:40 Fri, Feb. 8, 12:40, 1:40	A) Icebreaker – How is the 4.0 Plan going? B) How to Catch Up when you get behind on the Plan C) Professor of Engineering	1) Answer the 7 questions to check if you are “On Plan” shown on p. 92 of the 4.0 Handout. Answer more than just yes or no. Give an explanation if the answer is not “yes.” 2) Complete a chart showing how much time you have scheduled for BPR, BPN, BPC, HW, and POH for each of your classes. Due by Feb. 22 3) Write a summary of today’s talk and include five new things that you learned. 4) Watch for and select one assignment that you have done either this semester or last semester which displays some of your best work that you would want to show to a perspective employer or graduate school admissions committee. Due by Feb. 22
Meeting #3- ECA 228 Thursday, Feb. 21, 12:40 Fri., Feb. 22, 12:40, 1:40	A) Icebreaker – How is studying going? / What do you need to know? B) Engineers from Industry	1) Work on “The Plan” and straight A’s 2) Turn in an updated resume with the resume Check List 3) Write a summary of today’s meeting including five new things you learned. 4a) If you are in graduate school, list 5 things that you are now doing that you like in graduate school and 5 things in graduate school that you would like to change. If you are not in graduate school then do 4b) and 5). 4b) If you are not already in graduate school, make a list of the top 3 schools that you would want to go to if you were to continue on to graduate school. 5) is on next page. 5) Do research on these 3 schools and for each school give 3 reasons why it would be a good place for you to go and 3 reasons why it might not be a good place for you to go to graduate school. Due March 21
Meeting #4 – ECA 228 Thursday, March 20, 12:40 Fri., March 21, 12:40, 1:40	A) Icebreaker – What is the best thing that happened to you this week? B) Financial Advice for Engineering Students by Financial Consultants	1) Write a summary of the presentation today including five new things that you learned about saving, investing, and finances. Due April 4
Meeting #5 ECA 228 Thursday, April 3, 12:40 Or Friday, April 4 , 12:40, 1:40	A) Icebreaker –Semester Successes B) Graduate Student Panel	1) Write a summary of today’s presentation and include five good reasons to go full-time to graduate school right after the Bachelor’s degree and five (good) reasons not to go to graduate school full-time right after the BS/E. 2) Turn in completed portfolio for the semester Due April 17, 18
Meeting # 6 ECA 228 Thurs., April 17, 12:40 or Friday, April 18, 12:40, 1:40	Networking Meeting End of Semester Review	Evaluation at meeting No Homework! ☺ Portfolios Due Study for Finals!

Students are allowed one excused absence which must be made-up at a later date.
(Homework is still due on time)

Table 3. CIRC and CIRC/METS Scholars – Spring 08 Program

they turn the system down. During the 4.0 presentation, students who are using the system are encouraged to share their experiences with the 4.0 Plan and how it has helped them. The students are required to make a detailed time management weekly schedule including all of the parts of the 4.0 Plan accounting for the 168 hours in the week. If students have completed two semesters at ASU with a GPA of 3.5 or better, then they are still required to do the time management assignments, but they are not required to have their detailed schedule follow the 4.0 Plan. The Director assumes that if the student has a 3.5 GPA or better, then the student knows how to learn the material, but if their GPA is not at least 3.5, then they can do better. The students need to have a 3.0 GPA to stay in the program, a further encouragement to have at least a 3.0 GPA which will allow them to be accepted into graduate school. The students are given a Check List for the Detailed Time Management Schedule.³ Before the Check List existed, the director would go through several rounds with many of the students before the Schedule satisfied the 4.0 Plan requirements. With the Check List the scholar is empowered and a student assistant can check for correctness.

Each semester the scholarship students are also required to turn in an updated resume. The students are given a Career Handbook developed by Career Services and a Resume Check List. The Check List was developed by the program director based on the instructions given by Career Services. A Career Service representative collaborated with the Director for a more refined version.⁹

The students are required to give a summary of the guest speaker's presentation and to include five new things they learned. This encourages the students to pay closer attention to the material being delivered. Other assignments are about graduate school such as:

- Research and find three graduate schools that you would want to go to if you were to continue on to graduate school, giving three reasons why each would be a good school for you and three reasons why it would not be.
- Give five good reasons to go to graduate school full-time right after the baccalaureate degrees and five reasons not to do this.

Some students used these exercises very seriously and did an extensive study in order to determine which graduate school they would attend. Some of the other speakers and topics covered in the seminars include:

- Librarian for engineering on how to research data bases.
- Financial consultants on how engineering students should begin to invest their money
- Representative from the Institute of Sustainability and how engineering intersects with sustainability
- Industry representative who informed the students on how they could become quality auditors on either a part-time or full-time basis

The two most popular types of meetings were speakers from industry and the graduate school panel. The engineering speakers from industry were selected from all majors and from those who had a Master's or PhD degree. Engineering students, in general, believe that graduate school is only for those who want to go into an academic career. Many of the students had never thought about graduate school. Since most transfer students had

gone to a community college to save money, and all of the students qualified for this academic scholarship program because they had unmet financial need, most of the students wanted to get their engineering degree and get a job to be able to pay off debts and not to incur any additional debt. However, since a goal of this program was to have the students go on to graduate school full-time right after graduation with the baccalaureate, the students were told about the advantages and rewards of graduate school throughout the program. The industry speakers with graduate degrees would describe what they were able to do in industry because of their graduate degree. Since engineering is such a broad degree, these industry speakers also gave the students an idea of the type of work they were doing and also gave tips and advice about a career in industry in engineering.

The graduate school panels were always very well received. Three or four current graduate students would answer some general questions posed by the CIRC/METS Director. These questions included:

- Why did you choose to go to graduate school?
- Why did you decide to go to this graduate school?
- How far are you in your graduate program and what degree are you pursuing?
- How are you financing your graduate program?
- What do you plan to do after you get your degree?
- How would you compare graduate classes with undergraduate classes?

After these general questions, the program students would ask the graduate students questions about graduate school, processes, preparation, finances, and their research projects.

At first graduate students for the panel were recruited from the various engineering department. Undergraduate students in the CIRC or CIRC/METS program who graduated were encouraged to go right on to graduate school with the offer of the continuation of the program scholarship for up to two years. All graduate students in the programs, whether a transfer student or not, received their scholarship through the CIRC program, now with \$4,000 scholarships per year. After a couple of years of the grants, there were graduate students in the CIRC program who served on the graduate school panel. These panelists were very credible since they could tell the students that they, too, had come up through the program and some of had also been transfer students. The CIRC/METS students were quite surprised to learn that graduate level courses, in general, are not harder, just different. The CIRC/METS students learn that there are less busy work assignments and you are also studying courses in which you are interested. The graduate panelists also told the undergraduates that they did not have to be a genius to go to graduate school – if they were a good student (getting a 3.0 GPA or better) then they could make it in graduate school.

Throughout the program representatives from Career Services, either at the university or the school level, came to the seminars and presented on resumes, interviewing, negotiating, portfolios, cover letters, working career fairs, networking, and other related topics. The students were told how to sign up with Career Services and were encouraged to do so right away so they could receive information on companies looking for interns as

well as graduates. The information on portfolios was especially new for the students and to encourage them to start a portfolio at the end of each semester the students are required to turn in all of their assignments as a portfolio. Included in the assignments are ones which ask for the student to select a new artifact for their portfolio.

Refreshments are served at each of the six meetings to help make the students feel special. The main food switches between pizza and subs, but they are accompanied by fruit, cookies, chips with hot salsa, water and soda, and sometimes cake, doughnuts, or ice cream bars.

IV. Internships, Research Positions, and Recommendation Letters

The CIRC/METS students are all encouraged to do an internship and a research position while undergraduate students. The students are encouraged to use internships for hands-on experience, assessment of what type of industry they would like to work in, and also to observe what engineers are doing at each of the levels of a Bachelor's degree, a Master's degree, and a PhD degree. Many engineers have decided that they want to get a graduate degree after they see the difference in the level, challenge, and independence of work done by engineers with a graduate degree. The students are encouraged to sign up immediately with Career Services (both at university and school level, who work together). An updated resume is required with the registration so that companies wishing to hire an intern or permanent placement engineer can view the resumes of the students in the pool. Students who are registered with Career Services receive notices of companies who will be visiting the campus and doing interviewing. The CIRC/METS PI also keeps the students informed of internship opportunities that she comes in contact with. Additionally, sometimes the industry speakers will take resumes or encourage the student to apply to their company on-line, but they will watch out for the application. Most of the CIRC/METS scholars have done an internship or are working part-time for an engineering company while attending school.

The students are also encouraged to try a Research Experience for Undergraduates (REU) program sponsored by NSF. The REU programs are offered at universities across the nation and have an emphasis of encouraging underrepresented minority students and women. The CIRC/METS PI sends out email notices to all of the transfer students encouraging them to apply to programs that they find of interest. The School of Engineering sponsors a Fulton Undergraduate Research Institute (FURI) to which students can write proposals with a professor for research funding. The selected student is paid by the hour and the professor receives a small stipend from FURI. One of the fall assignments for the CIRC/METS students is to get on the website of professors with whom they might like to do research and to learn about what they do. The student is then to make an appointment and visit the professor about their research and to inquire if the professor has any openings on the research team. If not and the student is very interested in the research, the student is encouraged to volunteer for a few hours a week in the lab. At the same time, the student can ask the professor if they could do research with them through a FURI grant. Underrepresented minority students are also encouraged to apply for WAESO research positions funded by NSF for a student to work with a professor. If

a student volunteers in a lab for a few hours per week, they are very likely to be hired to do research when the next grant comes in.

All but 3 of the 21 students surveyed at the end of the program had held an internship or a research position or both. A third of the students had done at least one research project. In most cases, after the student has done a research project they want to go on to graduate school so they can do more research. In a few cases the student did not enjoy the research and decided that they may get a Master's degree, but they would not go the research route.

Since the CIRC/METS students do apply for research and internship positions, as well as graduate school, the Director is asked to write many recommendation letters. In order to be able to handle all of these letters and also to be able to write the best recommendation letter for a student, she requires three pieces of information in addition to the information of the purpose of the letter, to whom it is to be sent, and by when it needs to be sent:

- Updated resume
- Draft of the recommendation letter the student would like written for them
- Completed Recommendation Letter Check List¹⁰

By having the student write their own recommendation letter, they can emphasize the attributes they wish a particular person to write about them. The Recommendation Letter Check List reminds the students of various attributes that they might have and reminds the student to back up that attribute with an example. Of course, the Director revises the letters appropriately, but many students are able to write excellent letters with examples.

V. Program Evaluations

The program has been evaluated continuously.^{2,6,7,8} At the end of each seminar, each student is required to turn in an evaluation of the meeting. The students answer the questions on a brightly colored half sheet form:

- What was the most important thing you learned today?
- What did you enjoy most about the meeting today?
- What do you need to know more about?
- Suggestions for future meetings?
- Comments, food suggestions

Circle a rating of the meeting:

1 = Excellent 2 = Very good 3 = OK 4 = Poor 5 = Very Poor

The comments given by each student are all summarized in a handout that is given to the students at the next meeting. The questions from the evaluation sheet are usually answered in the handout or discussed at the next meeting. The evaluation handout is also given to the special speaker as feedback on their presentation along with a thank you for their time and effort.

The 21 students who completed a program evaluation in Spring 2008 at the end of the program gave typical evaluations to those throughout the program and are summarized in Table 4. A fifth column was given in the survey, but no students checked “Strongly Disagree.”

The students were also asked to identify which CIRC/METS program components were helpful to them. The following is a sample of the responses:

- It has helped maintain a good relationship with my teachers through the 4.0 Plan. Improve my grades slowly, but surely: each semester they are going up. Also, it has helped me determine that I would like to go to graduate school. Just have to work hard.
- Networking because of all the helpful emails from the Director.

For the following statements, check the areas that Corresponds to how strongly you disagree or agree with each item.	Disagree	Neutral	Agree	Strongly Agree
Participating in the CIRC/METS program has made me think about attending graduate school.	0	1	7	13
Participating in the CIRC/METS program has helped or made me decide to attend graduate school.	1	2	8	10
I enjoyed learning about graduate school options.	0	0	6	15
Participating in the CIRC/METS program has made me think about research	0	1	11	9
Being a CIRC/METS Scholar helped me learn about research.	0	1	10	10
Being a CIRC/METS Scholar has helped me network better.	0	4	10	7
Being a CIRC/METS Scholar has helped me become good at exploring options.	0	2	11	8
Being involved in the CIRC/METS program has increased my knowledge of engineering careers.	0	0	11	10
Participating in the CIRC/METS program has made me think about a career in Research.	2	7	9	3
Designing my portfolio has contributed to my self-awareness.	1	6	9	5
Participating in the CIRC/METS program has helped me understand how Engineers have contributed to solving problems in the world.	0	3	10	8
I am confident in my overall communication skills	0	3	15	3
Participation in CIRC/METS has helped me with my study skills.	1	2	10	8

Table 4. Student evaluation of CIRC/METS Program for Spring 2008.

- Skills learned, industry speakers, networking.
- The financial aid workshop and the experiences of current graduate students.
- The speakers from industry; the graduate school panel, the advice and stories of other engineering students.
- 4.0 Plan, meetings, METS Center
- Learning about graduate school convinced me to go
- Bi-weekly meetings and information that is provided by the Director
- Financing, graduate school
- Meetings, lectures, graduate students’ feedback

- Talking about graduate school – clears up confusion
- Not to be lazy, but all of them. Money, workshop, and networking
- Lunch, knowledge of opportunities on campus
- All the meeting speakers! BPN (bullet point notes from 4.0 Plan)
- The meetings – suggestions, advice, tips, etc.

The students were asked if the CIRC/METS Scholars program helped improve their grades. All of the students answered “yes”. The students were then asked to what percentage (estimate) did they use the 4.0 Plan or equivalent (0 = not at all, 100 = did all of the Plan). See Table 5. The Plan is quite comprehensive and includes getting 8 hours of sleep per night as well as visiting each professor once a week.

Percentage of 4.0 Plan used	<50%	50-60%	70%+	No response
# of Students	3	3	12	3

Table 5. Use of 4.0 Plan by CURC/METS Students

The students were also asked to predict their GPA for the semester. Twelve of the students (not the same 12 that used the 4.0 Plan at over 70%) predicted a GPA of 3.5 or better. Eight of these students were correct in their prediction. In comparing the actual GPA with the predicted GPA, 13 of the students over estimated their GPA and 8 of the students underestimated their semester GPA. The average actual GPA of the 8 who underestimated their GPA was 3.8 with 3.52 as the lowest of these grades.

The students were also asked if the CIRC/METS program had helped ensure their graduation. Almost all of the students answered “yes.” Following are some of the comments made by the students relative to the grades, graduation, and graduate school:

- Never had thought about grad school before (full-time single mom supporting herself)
- The CIRC/METS program has made me think more about the advantage of going to graduate school right after the completion of my Bachelor’s
- CIRC/METS promotes more responsibility in my schooling and overall planning and organization
- I already knew I wanted to do research prior to this program, but this program has enforced my decision
- CIRC/METS has helped me to have a good attitude and never give up school, including grad school
- The financial part helped me to pay for academic expenses.
- It informed me how to research and choose graduate school options
- Helped get better grades and made me consider grad school
- By listening to graduate school panels, I took the decision of attending graduate school. I have already applied to the Bs/MS integrated program here
- The transition from community college would have made it really hard to succeed without the CIRC/METS program. The CIRC/METS program helped me to learn what to look for and expect of graduate school
- Exposure to the benefits of graduate school

- I will be attending graduate school
- The program activities to familiarize me with grad school has encouraged me
- Financially help me to go to ASU. Learned how to approach graduate school (research, options, funding, etc.)
- Financial help (a little), more the program – awareness of underlying needs, what I need to do to ensure my success
- The money has helped me to be able to focus on school, thus improve grades. Meeting other students in graduate school has helped me realize I can do it.

Twenty-two of the CIRC/METS students are still in school, 20 of them in engineering. Through spring 2008, the retention and graduation in engineering and computer science of CIRC/METS students is 92% in engineering and nearly 95% at ASU. If we compare these rates to the retention and graduation rates of upper-division students who transferred into engineering and computer science, the average retention rate in engineering for the Fall cohorts of 2002, 2003, and 2004 was 61%. Of the 50 CIRC/METS students who have graduated, 13 (26%) have gone on to graduate school full-time or have already completed a Master's degree and an additional 8 have started graduate school part-time. Since the national average of engineering students going right on to graduate school is about 18% for all students, the 26% is remarkable considering that most of these students have been fighting unmet financial need all the way through their college years. An astonishing 42% have attended graduate school. Several of the students have been accepted into BS/MS programs available in their department which allows 9 hours of approved credit to double count for both the BSE and the MS degrees. At least 5 of the graduated students are now in PhD programs. The above numbers are conservative since some of the CIRC/METS students may have gone on to graduate school unknown to the Director.

VI. Lessons Learned

Several lessons have been learned through the years of this program. The basic programming is sound and appreciated and helpful to the students. The students respect the program Director and use her often for advice about dealing with professors, internship or job offers, or other issues related to academics. The assignments need to be changed a bit more for the students in their second or third year in the program. Having students participate in summer NSF REUs and then reporting back to the rest of the students has increased the interest in these programs even more. Since many of the CIRC/METS students are women or underrepresented minority students, they are in demand to fulfill the diversity goal of the REUs.

Starting in Fall 08, the seminars were made as an optional one hour of academic credit per semester for the scholars. The course does not count in their program of study, but does count in their GPA. Having the students sign up for credit (which most of them did) helped the incentive for the students to turn in their assignments on time. Since the CIRC/METS scholarship is not renewed unless the scholar attended the meetings and turned in all of the assignments, the Director has spent many extra hours encouraging students to finish their assignments and then checking these late assignments. Since

turning in the assignments is a requirement for a grade in the seminar, the assignments took on a higher priority for the students, which is very good. At the end of the first semester of the credit experiment only a few students were a bit tardy with the assignments.

VII. Conclusions and Future Plans

The CIRC/METS program has been a great success. The retention and graduation of the transfer students has been very high – 92% and the percentage of transfer students going on to graduate school is much higher than the national average of all students. It is very important to be able to interact early with the new transfer student their first semester at the university to make sure that they have not set themselves up for failure by taking too many credit hours while working over 20 hours per week.

The CIRC/METS program continues with NSF S-STEM support (grant 0836050), so the continuing students, from the first CIRC/METS program when it ended, are now being supported in a second CIRC/METS program with \$4,000 scholarships per year. When a CIRC/METS student graduates and continues full-time in graduate school in engineering or computer science at ASU, the student is supported by a second CIRC program supported by the NSF S-STEM program.

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