Evaluating A Collaborative Program To Increase The Enrollment And Retention Of Community College Transfer Students

Mary R. Anderson-Rowland¹, Debra L. Banks ², Donna M. Zerby ³, and Elizabeth A. Chain⁴

Abstract - In 2003, NSF awarded a joint two-year grant to Arizona State University’s Ira A. Fulton School of Engineering (FSE) and the Maricopa County Community College District (MCCCD). The purpose of the grant project was to create an interest in engineering at the community college level, to encourage and support potential engineering students (particularly women and minorities) in community colleges, to mentor and support community college transfer students enrolled in FSE programs, and to build a collaborative model between FSE and MCCCD that would become institutionalized within both institutions. This paper evaluates the Maricopa Engineering Transition Scholars (METS) project’s events and student outcomes after one and a half years of activity. The paper provides descriptions of METS events and METS supporting events and the FSE-METS Center by the number of students attending. It also analyzes students’ desires and outcomes by quantitative and qualitative analyses from surveys, interviews, and student enrollment, retention, and graduation data. The METS events outcomes suggest that there is a high-level of interest in engineering among community college students, especially with women and minorities. The student outcome data on enrollments and retention and graduation are still debatable given that this project needs one more year of data analysis.

Index Terms – Community College, Transfer Student, Transfer Student Retention, University/Community College Collaboration.

INTRODUCTION

The United States critically needs more scientists, engineers, and technologists. The interest in engineering by entering college freshmen continues to be near a 25 year low. [1] Labor market research shows that foreign professionals admitted under the H-1B visa program are increasingly filling new jobs requiring a technical education.[2] In addition, women, minorities, and persons with disabilities comprise 70% of the U.S. workforce, but only 30% in science and technology areas.[3] We are not using our nation’s people resources well to fill the ever-growing number of science and technology jobs that power the knowledge economy.

However, there are a large number of students attending community colleges. There is a significant transfer gap between the number of students who enter two-year colleges with the intention of transferring to four-year institutions and the number who actually do.[4] If this gap can be reduced there is great potential for promoting economically disadvantaged and underrepresented students’ access to and the achievement of the baccalaureate degree. [4] In 1999-2000 approximately 42 percent of all U.S. undergraduates were enrolled in two-year colleges, including a large percentage of those underrepresented and women in science, engineering, and technology careers.[5] Moreover, more than half of the community college students are among the first in their families to attend college, and 10% of doctoral recipients in math and science started their educational careers in a community college.[6]

Arizona State University (ASU), with over 45,000 students on the Tempe campus, shares the Phoenix metropolitan area with the Maricopa County Community College District (MCCCD) consisting of ten colleges and over 200,000 students. In the state of Arizona transfer agreements have existed for many years between the community colleges in the state and its three state universities, including ASU. Also, for years transfer student services and programs have existed at ASU. However, very few community college students transferring into engineering took part in those programs, reportedly because they were not particularly helpful in deciding a major and learning about what it takes to be successful in an engineering major.

Research suggests that students experience significant post-transfer adjustment difficulties during their first term of enrollment at new institutions. [7,8] Other research suggests

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The METS events titled, Be An Engineer, are held on each of engineering programs became part of this coalition. Mesa, and South Mountain) that have strong mathematics and transfer to ASU and the FSE. In particular, five MCCCD transition for the MCCCD engineering student who chooses to transfer students each fall, the need for collaboration between FSE and the community colleges finally became clear. [13] After working together for over a year and a half, the FSE and MCCCD representatives collaborated on a proposal to the National Science Foundation (NSF) to strive for a seamless transition for the MCCCD engineering student who chooses to transfer to ASU and the FSE. In particular, five MCCCD colleges (Chandler/Gilbert, Estrella Mountain, Glendale, Mesa, and South Mountain) that have strong mathematics and engineering programs became part of this coalition.

In 2003, NSF awarded a joint two-year grant to ASU and MCCCD. The purpose of the project was to create an interest in engineering at the community college level, to encourage and support potential engineering students (particularly women and minorities) in community colleges, to mentor and support community college transfer students enrolled in FSE programs, and to build a collaborative model between FSE and MCCCD that would become institutionalized within both institutions. The project was entitled Maricopa Engineering Transition Scholars (METS).

Since 2004 several papers have been presented and archived in the journal proceedings of the American Society of Engineering annual conferences and the WEPAN/NAMEPA joint conferences. The first paper about the METS Pilot Program describes the formation and early work of the collaboration. The paper included the challenges, accomplishments, and future needs of each academic institution. [14] The second paper discussed findings from key stakeholders and quantitative and qualitative measures of effectiveness that are being used for the project. [15] And, two papers described the METS Center at FSE-ASU as it has been a place for transfer students to meet and study and to receive support from nearby staff and mentors. [16,17] It should be noted that such centers are advocated by the National Resource Center for The First-Year Experience and Students in Transition. [9]

This paper evaluates the program events and student outcomes after one and a half years of activity. The paper provides descriptions of METS events and METS supporting events and the FSE-METS Center by the number of students attending. It also analyzes students’ desires and outcomes by quantitative and qualitative analyses from surveys, interviews, and student enrollment, retention, and graduation data.

**METS EVENTS**

The METS events titled, Be An Engineer, are held on each of the targeted MCCCD campuses and the ASU Tempe campus each semester. The purpose of these events is to interest community college students in pursuing a career in engineering. Students in community colleges’ mathematics, science, or engineering classes are especially targeted.

In the 2003 Fall Semester, Be An Engineer events were held at Glendale Community College and Chandler/Gilbert Community College with a total of 120 students attending these events. After that first semester, Be An Engineer events were held on each of the five community college campuses each semester (attendance rates for Spring 2004 were 420 students and Fall 2004 380 students). The events are somewhat unique on each campus with combinations of panel speakers, demonstrations, and resource tables including admissions, financial aid, and course taking advice.

Be An Engineer events were held in the METS Center on the ASU campus. Students who had registered for Be An Engineer events on the MCCCD campuses were notified by email of the ASU events. Also for some meetings, telephone calls were made especially inviting women and underrepresented minority students to attend the events. These events have proved to be particularly helpful in having potential transfer students interact with FSE faculty since it is difficult to get faculty to commit to three or four hours in order to participate in a Be An Engineer on a community college campus. As of Fall 2004 over 146 students have attended the ASU events that include an informational welcome session, laboratory tours, and special sessions such as time management and a luncheon with academic advisors.

**SUPPORTING METS EVENTS AND THE FSE-METS CENTER**

There are two categories of events that support and add value to the METS efforts.

One category of events is sponsored by the MCCCD METS’ campuses. These events include high school recruitment fairs, a GED challenge project for the economically disadvantaged, Chemistry or Mathematics Days, classroom visits, new students’ orientations, goal-setting workshops, and industry tours (e.g., Lockheed and others). It is estimated that since Fall 2003 over 1,746 students have taken part in one or more of these events.

The second category of events focus on the retention and graduation of FSE community college transfer students. These events are two-fold. First, from continued NSF sponsorship (CIRC/METS, CSEMS project) the METS Center at ASU-FSE offers not only funding for select community college transfer students (average 24 per semester) but also seminars on time management, expectations from industrial employers, and information about graduate school [18]. For new transfers who do not have CIRC/METS funding, there are staff who advise and support transitioning students by offering workshops on time management, course selection, and mentoring (pairing new students with CIRC/METS students). In this approach, since Fall 2003 the FSE METS Center has interacted with over 112 transfer students.
ANALYTIC DESIGN OF THE EVALUATION

The analytic framework used to evaluate the METS program addresses student interest, intended outcomes for student enrollment, retention/graduation, and partial evidence affecting student enrollment. Multi-method data gathered were from student surveys at Be an Engineer events, the ASU student database warehouse, and interviews with potentially interested community college students and the engineering advisors at FSE. The questions in this report were:

- For community college students considering an engineering degree: 1) What was the general profile of the students attending the Be an Engineer events? 2) What barriers were cited in obtaining an engineering bachelor’s degree? 3) What revenue support streams were identified to reach the goal of degree attainment? 3) What did students have to say about becoming an engineer?
- For measuring the project’s effectiveness: 1) What have been the enrollments rates for MCCCDD students compared to an expected five-year index? 2) What has been the relative retention/graduation success of FSE-MCCCD enrollees based on a three-year index? 3) What do FSE advisors have to say about community college transfer students? The aforementioned indices act as benchmarks by which subsequent years of activities can be compared against (see Table I).

<table>
<thead>
<tr>
<th>Indices</th>
<th>How Applied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enrollment:</td>
<td>First, MCCCD enrolling transfers are compared against the 5-yr average.</td>
</tr>
<tr>
<td>Five-year averaging of</td>
<td>The same model is used for a comparison of MCCD METS and non-METS colleges.</td>
</tr>
<tr>
<td>academic years from 1998-99</td>
<td></td>
</tr>
<tr>
<td>to 2002-03 by non-minority</td>
<td></td>
</tr>
<tr>
<td>males and combined</td>
<td></td>
</tr>
<tr>
<td>females/ minorities.</td>
<td></td>
</tr>
<tr>
<td>Retention and Graduation:</td>
<td>For all MCCCD students from 1996 to 2006.</td>
</tr>
<tr>
<td>Three-year averaging from</td>
<td></td>
</tr>
<tr>
<td>1996 to 1998 and based on</td>
<td></td>
</tr>
<tr>
<td>percentages of those still</td>
<td></td>
</tr>
<tr>
<td>enrolled or graduated</td>
<td></td>
</tr>
<tr>
<td>compare to original enrollees.</td>
<td></td>
</tr>
</tbody>
</table>

FINDINGS OF THE SECOND-YEAR EVALUATION

I. Prospective Students
Over 600 unduplicated individual students have attended Be an Engineer events on their local designated METS campuses and at the ASU main campus. Students attending these events are requested to complete a demographic survey. About 474 students submitted usable demographic surveys.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Non-Minority</th>
<th>Minority</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>179</td>
<td>148</td>
<td>327 (69.0%)</td>
</tr>
<tr>
<td>Females</td>
<td>64</td>
<td>83</td>
<td>147 (31.0%)</td>
</tr>
<tr>
<td></td>
<td>243 (51.3%)</td>
<td>231 (48.7%)</td>
<td>474</td>
</tr>
</tbody>
</table>

The survey posed a number of questions, but the two most relevant questions for this paper were barriers of attaining a bachelor’s degree in engineering and supporting oneself to attain that degree.

The barriers concerning baccalaureate degree attainment in engineering for all categories of students transferring from the community college to a four-year institution are displayed and ranked by the top three concerns in Table IV. The primary barrier for all groups was finance. This is not surprising, since lower tuition is one of the primary reasons that students choose to attend community colleges. It is also interesting to note that only non-minority females did not list their mathematics skills as a major barrier. Perhaps these are women who have been encouraged to study engineering because of their good mathematics skills.
Interviews with the FSE advisors confirmed that transfer choices focus on securing loans and working off-campus. Rather than jobs that could help them pay-off their loans. Future contacts in their study field. In addition, students are off-campus at minimum-waged jobs that provide them with no students create an unrealistic situation when they are working part-time. However, there is a concern that the community college students balance their studies with full- or college student is 29 years old and more than 80% of community college students balance their studies with full- or part-time work. [20] However, there is a concern that the transfer students can get caught in a debt cycle trying to obtain a Bachelor’s degree. That is, the ranked number “1” and “2” probation results are consistent with what we already know about community college transfer students. The average age of the community college student is 29 years old and more than 80% of community college students balance their studies with full- or part-time work. [20] However, there is a concern that the transfer students can get caught in a debt cycle trying to obtain an engineering degree. That is, the ranked number “1” and “2” choices focus on securing loans and working off-campus.

Table V displays the top ranked responses by categories of students on how they would support themselves in attaining a Bachelor’s degree. Again these results are consistent with what we already know about community college transfer students. The average age of the community college student is 29 years old and more than 80% of community college students balance their studies with full- or part-time work. [20] However, there is a concern that the transfer students can get caught in a debt cycle trying to obtain an engineering degree. That is, the ranked number “1” and “2” choices focus on securing loans and working off-campus. Interviews with the FSE advisors confirmed that transfer students create an unrealistic situation when they are working off-campus at minimum-waged jobs that provide them with no future contacts in their study field. In addition, students are working in minimum-waged jobs just to pay their current due rather than jobs that could help them pay-off their loans.

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**TABLE IV**

<table>
<thead>
<tr>
<th>What Would Prevent You From Obtaining a Bachelor’s Degree?</th>
<th>Male Non Minority</th>
<th>Male Minority</th>
<th>Female Non Minority</th>
<th>Female Minority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language Problems</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math Problems</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finances</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family Obligations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From the first 200 submissions of the demographic surveys we randomly chose 30 women and minority students, interested in becoming an engineer to interview about why they were interested in becoming an engineer and the barriers involved in pursuing their career interests. Only 20 could be reached for phone interviews. The following are comments from three female and three males made about selecting engineering as a career and career obstacles. The codes are W=women, M=Male, nm=non-minority, and m=minority.

*What sparked your interest in engineering? And, besides financial reasons, what would prevent you from furthering your education?*

[Wm age 23] I have always been interested in math, science and problem solving. While in high school, I had a math teacher who encouraged me to pursue the field of engineering. I am more interested in the area of aerospace. . . . Nothing except for my kids and family obligations.

[Wm age 20] My interest developed from my personal interest in engineering. I remember the first time I was exposed to using the computers as a kid I enjoyed the hands on technology. . . . Nothing.

[Wm age 30] I was influenced by television news’ programs on alternative fuel. I wanted to be part of an engineering process involved with this major project. I have received a lot of encouragement from my math teacher along with the Department of Energy at the Pacific Northwest Lab. I learned a lot about the field of engineering through the work I did. I like the salary that engineers make as well as their involvement in helping solve every day problems. . . . My family obligation is the only obstacle.

[Mm age 27] I have always been interested in electrical engineering. I remember a part of my childhood spent in taking things apart because I was curious about how thinks work. I would say my interest was sparked by my own personal interest. . . . Nothing except my family.

[Mm age 18] I have always been interested in the concepts of math and I want to make a career of it in the field of engineering. I am more interested in the job itself not so much the people. . . . I would have to say both financial and time are my biggest problems. The more money I have the more I would stay in school.

[Mm age 20] While in high school I participated in a few of ASU’s summer programs. One of these programs got me involved with the Society of Hispanic Professional Engineers. In participating in these summer programs, I was encouraged to pursue my interests in creating new things and working in the field of engineering. I received a lot of support and motivation from people. . . . A large problem I face is financial.

It is evident from these testimonies that the women and minorities are very committed to becoming engineers. However, a combination of finances and family obligations will be major obstacles for them to attain an engineering degree.

II. FSE-ASU Enrollment Findings

At first glance trend enrollment numbers for FSE do not look encouraging for any entering Fall undergraduate cohorts after 2001 (Table VI). The enrollment numbers are being affected by policies made by the FSE in 2002 to reduce the number of undergraduates and increase the numbers of Master’s level and Ph.D. students. For example, the Department of Computer Science and Computer Systems Engineering has changed from

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**TABLE V**

<table>
<thead>
<tr>
<th>How Will You Support Yourself in Attaining a Bachelor’s Degree?</th>
<th>Male Non Minority</th>
<th>Male Minority</th>
<th>Female Non Minority</th>
<th>Female Minority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work on campus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work off Campus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financial Aid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GI Bill</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Scholarship</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Family help</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

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S3G-18

Session S3G
accepting incoming freshmen students as regular majors to 
pre-professional students. Students will be declared as regular 
majors after certain core courses have been taken and an 
appropriate GPA has been achieved. The other engineering 
departments are following suit. Since it will not be as simple 
to be accepted into a department as a transfer student, we will 
need to watch and see what effects these new admission 
standards will produce. However after three years of declining 
freshmen classes, the School has decided that there should be 
no further declines.

However, the percentage of new transfer students from 
MCCCD in the Fall 2004 semester dramatically rose to its 
prior level in 2001. For the future, we will need to continue 
collecting the same data to ascertain if this is a data-blip or if it 
is the effect of METS efforts and/ or other factors.

### Table VI

<table>
<thead>
<tr>
<th>Year</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Transfers</td>
<td>351</td>
<td>364</td>
<td>408</td>
<td>383</td>
<td>351</td>
<td>325</td>
</tr>
<tr>
<td>Males non-Minority</td>
<td>174</td>
<td>144</td>
<td>151</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Females &amp; Minorities</td>
<td>86</td>
<td>94</td>
<td>79</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-METS Index</td>
<td>03-04</td>
<td>04-05</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males non-Minority</td>
<td>72</td>
<td>52</td>
<td>63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Females &amp; Minorities</td>
<td>40</td>
<td>30</td>
<td>36</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total MCCCD</td>
<td>Index</td>
<td>03-04</td>
<td>04-05</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males non-Minority</td>
<td>246</td>
<td>196</td>
<td>214</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Females &amp; Minorities</td>
<td>126</td>
<td>124</td>
<td>115</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### III. FSE Retention and Graduation Findings

Table VIII displays by percentages those still enrolled and 
those graduated in engineering programs compared to the 
number of entrants for each cohort year. The index is based on 
a three-year averaging from 1996 to 1998. It would appear that 
the percentages of retention and graduation rates are slightly 
increasing, but we will need to wait until we have more data to 
declare any trend.

### Table VIII

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>50%</td>
<td>53%</td>
<td>58%</td>
<td>57%</td>
<td>60%</td>
<td>72%</td>
<td>89%</td>
</tr>
</tbody>
</table>

In February 2004, a 45-minute focus group was held with 
25 FSE academic advisors and counseling affiliates. [15] The 
objective of this interview was to identify and clarify issues 
regarding community college transfer students with the FSE 
programs. All of the reported issues cited here pertain to 
barriers that may prevent succeeding in attaining a 
baccalaureate degree in engineering.

Do you see a difference when you are advising first-time 
community college transfer students compared to first-time 
freshmen or sophomore, junior, or senior students?

In my experience working with first-time freshmen and first-time 
community college transfer students, we still go through common 
issues: program requirements, residency, and time management even 
though the community college student has already experienced 
college level coursework. In many cases they do have special needs... 
the big need is always "I have to go work and go to school"... and 
there are always time management issues with that.

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Do you find that community college students are interested in working on campus as opposed to off-campus?

In my experience, students are looking for something that will pay a good amount of money. On-campus jobs do not traditionally fall into that category... only a small percentage of community college students ask for work study. Most of the students arrive already employed in the job or have in mind of looking for a job that is closer to home than to ASU.

Sometimes they are working in industry related to engineering but most are working in a related engineering area and are making just above minimum wage. I don't think it is a good thing that a student has to work and go to school. For those students that tell us that they're working and they are going to go full-time, I think that it is a little scary. But, maybe some of them are use to doing it at a community college. We tell them that it is not a good idea.

Do you investigate how community college transfer students succeed?

I have not looked at every student record but I can tell you that a lot of the [withdrawal] petitions we get, one of the major reasons given to take a class for the third time is “I was working too many hours and now, I cut back". [Thus, they meet]... the minimal requirement but . . . are still not ... completely in the top groups. Some of them have to have a bad semester to understand that they can't do both, some of them will tell us immediately, "Oh, I am going to cut my hours. I was planning to do that."

It is apparent, that work issues play a large role in the success of the community college transfer student. In addition, the counselors stated that the community college transfer students compared to undergraduates, who started as first-time freshmen, and transfer students from other universities have a greater tendency to swirl - - that is taking classes at community colleges or other colleges after enrolling in the FSE. This irregular course-taking pattern is part of their need to work cycle and both are attributable to the lack of success of the community college transfer student in attaining an engineering degree.

**CONCLUSIONS**

In a year and a half of the METS Project, an evaluation of the events and attendance show that the project is getting the word out on engineering careers to community college students. Also, by using female and minority role models in the METS events, the community college females and minority students are encouraged and stimulated in thinking that they can become engineers too. Of course some students attend several METS events before they are convinced that this is the career path that they wish to take. The evaluations of the individual events have received favorable comments, mostly “excellent” and “very good” ratings.

The students who use the METS Center report that the METS program is very helpful to their academic program. Both the program and center attendance is evaluated by formative and summative approaches using attendance and rating sheets.[17] The overall ratings for the Center and its programs are mostly “excellent” and “very good.” A new learning system based on Donna Johnson’s “Guaranteed 4.0” was presented to a group of transfer students who began their studies at Fulton in spring 2005. [21] It will be interesting to follow these students and see if this learning system helps them to continue their studies in the Fulton School of Engineering and to graduate with a Bachelor’s degree in engineering. This system will be introduced to additional transfer students this next academic year.

Collaboration is difficult due to the independence of each institution in the MCCCD. Collaboration is still a work in progress.[15] Both the MCCCD and the FSE recognize that this program has merit and should be institutionalized. The details have not yet been finalized.

Total enrollments at each community college, as well as the number of students identified as “engineering,” are being analyzed to see if there are any trends that would shed light on the impact of this project as we continue to track transfer students to the Fulton School.

Last, we are concerned about the 2001-02 decision to reduce the enrollments in the undergraduate programs at the FSE. Even though the School is not seeking further declines, the “pre-professional” status for most students may reduce enrollments further. As previously stated, we will have to wait and see how community college transfer students’ enrollments will be affected by this decision to diminish the supply chain. Equally, we are concerned about how diminishing the supply chain will affect the economic status of the Arizona resident who should be allowed to compete for technical and engineering jobs during and after degree attainment rather than filling those positions with non-residents or H-1B foreign professionals.

**REFERENCES**


