

METS Pilot Program: A Community College/University Collaboration to Recruit Underrepresented Minority Students into Engineering

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Abstract

Maricopa Engineering Transition Scholars (METS), funded by NSF, is a collaborative project between Arizona State University and five Maricopa Community Colleges. The project aims to increase the recruitment and retention from untapped labor pools in community colleges into university engineering programs.

This paper describes the formation and early work of a two-year pilot collaboration between Arizona State University and Maricopa Community Colleges to build a seamless system that interests, enrolls, retains, and graduates women and underrepresented minorities in engineering degree programs.

Key Words: Collaboration, Community College, Integrated Programs, Recruitment, Retention, Transfer Student, Transition Student, Underrepresented Minorities, Women

I. Introduction

The United States critically needs more scientists, engineers, and technologists. That need shows in the increasing number of jobs requiring technical education, industry's reliance on foreign technical professionals admitted under the H-1B visa program, and that one-quarter of today's science and technology workforce is age 50 or older.¹ Yet the only labor pool deep enough to supply adequate applicants is going largely untapped. Women, minorities, and persons with disabilities together comprise 70 % of the U.S. workforce. But white males hold nearly 70 % of American science, engineering, and technology jobs. It is a mirror image that bodes ill for the nation's capacity to fill the ever-growing number of science and technology jobs that power the knowledge economy.²

Emerging trends are not promising. Demographers forecast rising minority populations in the United States for decades to come. In fact, the U.S. Census Bureau predicts that by 2050 the "minority" populations will grow so large that the traditional designations of minority and majority will be rendered meaningless.³ Short of relying on foreign workers, women and underrepresented (URM) populations are the nation's only source of an expanded technology workforce, and they are not being successfully recruited and retained.

One solution is collaborations between universities and community colleges. For example, public community colleges enroll about 10% more URM students than public universities.⁴ The literature search revealed that there are many models of successful collaborations between universities and community colleges, but only a few involve engineering sciences. The theory of collaborations resides in symbiotic relationships addressing: 1) alignment between partners in purpose and benefits for the students being served, 2) resources and costs to initiate and to sustain the relationship, and 3) economic benefits to the targeted community (i.e., engineering).^{5,6,7}

II. Background on the Maricopa Engineering Transition Scholars (METS) Collaboration

The Maricopa Engineering Transition Scholars (METS) Project, funded by the National Science Foundation, goals are to pilot a program that transitions women and minority community college students to university engineering programs and to recruit, retain and graduate these students once they enroll in such programs. This project responds to a principal recommendation of the Congressional Commission on the Advancement of Women and Minorities in Science, Engineering, and Technology Development to focus intervention efforts to target women and underrepresented minorities.²

The METS is a two-year pilot collaboration between the Fulton School of Engineering of Arizona State University (ASU) and five colleges in the Maricopa Community College District (MCCD). ASU, a Research I institution, and MCCD rank among the highest enrolled institutions within the United States. ASU has nearly 50,000 students on their main campus and MCCD enrolls over 200,000 students each year. Five MCCD colleges are major participants in the METS project: Chandler-Gilbert, Estrella Mountain, Glendale, Mesa, and South Mountain. The targeted women and underrepresented populations are those students enrolled at the five MCCD colleges in engineering, chemistry, biology, physics, calculus/ pre-calculus, and geology courses. The primary objectives of the METS project are:

- 1) To increase by 30% the number of women and underrepresented students from the target schools who enroll in the ASU engineering programs. Average indices (using the years 1996 – 1998) of entrants by gender and ethnicity/race are being established to measure the recruitment effects of the METS program.
- 2) To graduate 75 % or more of the transfer students as engineering or computer science majors in the ASU engineering programs. Average indices (using the years 1996 – 1998) of entrants by gender and ethnicity/race are being established to measure the retention effects of the METS program.

ASU and the MCCD have worked together on various aspects of their education systems for many years. This effort resulted in an equivalency guide which lists courses taught in all of the MCCD colleges and their transfer equivalency at ASU, the University of Arizona, and Northern Arizona University. In addition, community college and university faculty teach at each others institutions. Also, several MCCD and ASU engineering faculty gatherings have been held at ASU and at MCCD. However among the discussions, there has never been any formal agreement about working together to recruit and to retain women and underrepresented minority engineering students.

In late 2001 and early 2002 the first attempt was made by leaders in the Fulton School of Engineering to present a proposal for joint recruitment and retention efforts with MCCD. Unfortunately, MCCD leaders were asked late in the game to join in the effort. They did so, but expressed the desire that next time they be brought in as partners from the beginning. This proposal was not funded.

In May 2002, Anderson-Rowland, ASU's Associate Dean of Student Affairs of the Fulton School of Engineering, initiated conversations with Vanis, Director, Maricopa Center for Workforce Development, to make another attempt at a collaborative program. Many meetings were held between the two institutions. From May until January 2003, when a grant proposal for the Maricopa Engineering Transition Scholars (METS) was submitted, the major concerns were:

- How can we make this effort a true collaboration?
- Who are the right personnel to involve in the project?
- What are the proper activities for the project?

For the first question, each partner (ASU and MCCD) needed to be assured that they would have an active and equal voice in collaboration. A major decision was to split the project budget so that each institution could decide how to allocate their half of the project award.

The second question culminated to the decision that the METS team would consist of the project's two top administrators from ASU and MCCD and two full-time co-directors, one at each institution, with the understanding that the administrators and directors would work together on the METS programs as informed by the project evaluator's evidence for decision-making. In addition, an advisory council would advise the management team about present and future collaboration efforts.

For the third question about activities, descriptions and intent of the program are provided in subsequent sections of this report. However, for the METS project to succeed, staff (including ASU academic advisors) and faculty of ASU and MCCD must be supported by an institutionalized system of communication and collaboration. To ensure continued strong collaboration the METS project proposed to develop this system as follows:

1. Annual meeting of advisement staffs.
2. Bi-annual meeting of Fulton and MCCD STEM (Science, Technology, Engineering and Mathematics) faculties.
3. Stimulate ongoing collaborations.
4. Create quarterly METS e-news brief for faculty.
5. Develop awareness of METS among senior administrators at all campuses.

III. The Pilot Project between ASU and MCCD

ASU and MCCD are ideally positioned to pilot a model collaboration by enrollment and campus resources. Data from 1997 to Fall 2003 show that about 65% of the over 400 transfer students enrolling in undergraduate engineering programs each year come from MCCD colleges.

Both MCCD and ASU have decades of experience in serving underrepresented students and are currently engaged in leveraging those experiences through joint projects such as this one, the CIRC METS (funded by NSF), and projects funded by other agencies.⁸

Within the last decade, the Maricopa Community Colleges have received funding from a number of agencies to promote awareness in STEM education and careers. Selected awards have been made to:

- 2002, Estrella Mountain received a one-year and a three-year grant to establish the NASA Center for Success in Math and Science to expand outreach services to the middle school level. The purpose of both grants is to recruit and to retain underrepresented minorities in STEM disciplines. The Center forges a continuous pipeline for Hispanic and other underserved youth to ensure their persistence through high school and on to college or advanced degrees.
- 2001, Estrella Mountain was awarded a five year grant, the largest Title V grant awarded to any two-year college.
- 1996 MCCD was awarded an NSF grant to change women's images of science and engineering.
- 1994, MCCD was awarded a \$14M Urban Systemic Initiatives in Science, Mathematics, and Technology Education grant for systemic reform of science instruction, implementation of the interactive mathematics program, and ongoing work in the CSEMS program.

In addition, the participating five MCCD colleges (of the ten MCCD colleges total) all have academic advisors to assist students with career choice and transition to four-year colleges and universities. In addition, the colleges offer unique and different activities to promote student interest in STEM careers.

Each of the five community colleges in the METS project has programs of awareness about engineering or programs that can encourage mathematics and science:

- Chandler-Gilbert offers COOL Engineering Links, the Engineering Learning Community, and ASU Transfer Tuesday.
- Estrella Mountain focuses on Student Success and Life Skills workshops.
- Glendale has the STEM Organization, Technical Career Programs, and the ACE Plus Program.
- Mesa offers the AWARE and Student Technology Assistance programs.
- South Mountain also has COOL Engineering Links, as well as a number of other programs designed to interest and to engage students in engineering and science.

At ASU, the Office of Student Affairs (OSA) and the Student Outreach and Retention Programs (SORP) in the Fulton School are the university's principal actors in drawing underrepresented students into engineering programs and encouraging them to graduate.⁹ In the last ten years these offices have launched a number of highly successful programs resulting in:

- The underrepresented minority population in the Fulton School has more than doubled since 1991.
- The Fulton women's enrollment has increased by more than 50% since 1993.

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- Overall one-year retention in the college has increased by more than 10%.
- One-year retention in the college by women and minority students has increased by more than 20% for each group.

OSA programs include WISE Investments¹⁰ and the Inclusive Learning Communities Program.¹¹ WISE Investments is an innovative collaboration that introduces middle school and high school math and science teachers, guidance counselors, and middle/high school female students to the world of engineering and technology. The WISE Investments mission is to encourage more females in middle and high school to pursue engineering and related careers. Some of these students first enroll at a community college and later transfer to ASU in engineering. The Inclusive Learning Communities Program offers career mentoring to all Fulton students, including transfer students. The OSA also coordinates an orientation track for new Fulton freshmen students each fall and in Fall 2004 will add a special session for new transfer students.

SORP includes the Center for Outreach & Recruitment (COR) and the Center for Engineering Diversity and Retention (CEDAR). The major goal of the COR is to recruit the best and brightest students through outreach initiatives such as the Office of Recruitment and the Arizona Mathematics, Engineering, Science Achievement (MESA) program. The CEDAR comprises the Minority Engineering Program (MEP), Women in Science and Engineering (WISE),¹² and other diversity and retention programs such as the Coalition of Engineering Minority Societies and Society of Women Engineers (CEMSWE).¹³

IV. What Needs Work at ASU and MCCD?

The missing pieces in MCCD and ASU collaborative efforts are: 1) working together to interest community college students in engineering, 2) a transition from the community colleges to the university that is smoothly geared to the particular concerns of women and minorities and 3) programs at the university that are specifically tailored to the needs of transferring female and minority students. The team leaders know that 2) and 3) are the weak links in recruitment and retention, because the students have said so in surveys, interviews, and round table discussions with faculty and staff. Specifically, transfer students reported that they need support systems to address these concerns:

- Transferring to ASU is like being a freshman again; students feel alone and isolated.
- To students accustomed to classes of 20 to 30 learners, ASU's large lecture classes are intimidating.
- While general university orientation is useful, engineering transfer students want a specialized Fulton School orientation.
- Transfer students do not know where to find resources for academic and career support.
- Shyness stops many from joining study groups and student organizations (or they feel shut out because groups have already formed among students who already know each other).
- Classes move much faster at the university.
- The first transfer semester is the hardest.¹⁴

The METS project is designed to address these concerns. The METS activities include elements that have proved successful in previous ASU/MCCD programs to recruit and retain students, along with innovations suggested by student feedback and elements especially relevant to transfer students. In Year 1, METS project activities will focus on faculty collaboration and awareness and support activities on the MCCD college campuses. The METS co-Directors are responsible for “Be An Engineer” events at each of the community colleges in cooperation with a liaison from that college. These events have been piloted and are going well. At ASU, a bridge program for Fall 2004 and an academic success workshop in Fall 2004 will be piloted for new women and underrepresented transfer students. In Year 2, the activities on the MCCD campuses will be refined. As the students transition to Fulton, an improved bridge program and a one-hour required academic success class will be held along with additional retention activities.

Table 1.
Challenges, Accomplishments, Future Needs by Institution

ACADEMIC INSTITUTION	CHALLENGE(S)	ACCOMPLISHMENT(S)	FUTURE NEED(S)
Community College	Promoting and holding METS events to interest students in engineering with opportunities for students to interact individually with METS faculty and staff	<p>Held 3 independent “Be an Engineer” events at GCC, CGCC, & EMC in which 79 students expressed an interest in engineering as a career field in Fall 2003</p> <p>“Be an Engineer” event held at each of 5 CC campuses during Spr. 2004</p> <p>METS module development has secured an instructional designer to work with METS Team to complete 2 modules for Spring 2004 METS events</p>	<p>Create a regular schedule so students, faculty, and staff expect Be an Engineer events at the 5 participating community colleges to occur</p> <p>Promote schedule of Be an Engineer events at the 5 participating community colleges</p> <p>Create an effective system to follow-up with students attending METS events to mentor transfer students and future transfer students</p>
University	Promoting and holding METS events to connect transition students with METS Program, resources, and METS Center to assist them with challenges of a 4 year engineering program	<p>Held 5 workshops on college survival strategies, including seasoned transitioned-students for networking and peer mentoring for new transfer students</p> <p>Held METS event to connect 47 transition students in engineering with NEW METS Center to connect with other transfer students and METS co-Directors</p> <p>Held two mentor training sessions</p>	<p>Create regular METS events to connect students with METS co-Directors, faculty, and staff</p> <p>Promote schedule of METS events held at university at community colleges and at university</p> <p>Create an effective system to follow-up with students attending METS events to mentor transfer students and future transfer students</p> <p>Strengthen mentor program with transitioning students</p>

It is a unique challenge to work with students at both academic institutions since the student needs and structure of the two schools is different. The METS collaboration requires both ASU and MCCD to see the student needs from the other institution's perspective to maintain a collaborative working relationship. This is a difficult task and requires a good management plan. A management plan which gives ASU and MCCD equivalent organizational structure is key to accomplishing program tasks and encouraging the METS team to work closely together.

As the METS team gains support for the program, the addition of more faculty and staff increases the complexity of the METS team and its ability to make program decisions. It is a challenge for both institutions to work collaboratively, since faculty and staff from each institution is experienced at planning and facilitating events for students at their own institution. The METS program requires planning and facilitation which integrates best practices from both institutions to meet goals and needs for students from both institutions. This type of "integration" for transfer students is viewed differently by the faculty, staff, and the students who attend these events. In trying to plan and to facilitate integrated events, there seems to be miscommunication which leads to frustration, poor working relationships, and lack of support for the program.

A major challenge for the METS team is that while the Fulton School is one organization, the five community colleges are separate entities, each with their own government and culture. Community college programs need to be tailored for each campus.

V. Conclusion: Lessons Learned Thus Far

A goal stated in the project proposal was that METS would be run as a flexible project that rapidly adapts to student and faculty feedback. Since this project is a pilot research program, we wanted the program to be dynamic and flexible with special attention paid to feedback from the transition students in the program as to what is working, what is not, and what activities should be added to the program. This information is acquired through individual conversations, workshops, on-going evaluation of the workshops, and focus groups. In addition, the staff and faculty working with the project report their observations to the METS management team. We now know that there is a need for flexibility in the administration of the programs as the team is put in place and as the five colleges learn to work with each other.

Communication is a challenge in beginning a new project where the team is located in several different locations. It is hard work. It has been difficult establishing the proper lines of communication in order to keep the project a true collaborative. Certainly, it is easier at times for any party to make decisions by themselves and make sure they get done, without deliberation and consensus from the other party. However, we are dedicated to persevering as a collaborative and have already seen changes and progress.

A collaborative program in which the METS team gains support from faculty, staff, and students at both institutions is a challenging process. The collaborative process requires strong management leadership, effective communication, and commitment from both institutions which

is an investment of their time and resources. Initial difficulties with communication and responsibilities should now be smoothed with a full staff. Regular management meetings will now be held and the management function of the project should show great improvement. As regular management meetings are held, long-term program goals will be developed, and with perseverance, the METS program will continue to pilot the development of a community college/university collaborative system which benefits transition students.

At the same time, the project evaluator is interviewing all of the management team of eleven: PIs, co-Directors, the five community college liaisons, and one additional person each from ASU and MCCC. Advisors from both institutions have also been interviewed. The insight gained by the evaluator as to what is working and what is not working is fed back to the management team. The broad conclusions to date are that the events are a success, but the communication still needs improvement for the collaboration to be at its best.

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Biographical Information

MARY R. ANDERSON-ROWLAND, PhD, is the Associate Dean of Student Affairs in the Fulton School of Engineering at ASU. She was selected for the National Engineering Award in 2003, the highest honor given by the AAES. In 2002 she was named the Distinguished Engineering Educator by the Society of Women Engineers. Other diversity awards include the YWCA Tribute to Women 2001 Award (Scientist/Researcher). An ASEE Fellow, she is a frequent speaker on the career opportunities in engineering, especially for women and minority students.

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DEBRA L. BANKS, PhD, is the Director of Evaluation for the Center for Research on Education in Science, Mathematics, Engineering and Technology (CRESMET) at ASU. At the post-secondary level she taught the Biological Sciences for 12 years. For the past 14 years, she has been/is principal staff or a co-PI in selected projects funded by the National Science Foundation, Ford Foundation, California Association for Community Colleges and the California Legislature, and the Virginia Community College System.

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BASSAM MATER, a project co-PI and PI for MCCCCD, is the community college liaison at the lead MCCCCD institution, Chandler-Gilbert, where he is Professor of Engineering Science/Mathematics. He is an electrical engineering with 12 years of industry and college experience. From 1991-97 he served in engineering capacities with Intel. He was named Motorola Educator of the Year in 1999 and received a National Institute for Staff and Organization Development Award in 2000.