
AC 2011-1790: WHAT HAPPENS AFTER A SUMMER BRIDGE PROGRAM: THE DPO SCHOLARS PROGRAM

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Kyle P. Foster, a native of Detroit, Michigan, graduated from Michigan State University in 1997 with a B.S. in mechanical engineering. Upon graduation, he accepted a position in the Chrysler Institute of Engineering (CIE) program at Chrysler Corporation. While in the program, he earned an advanced degree in engineering from the University of Detroit Mercy. After completing two years in the CIE program, Foster spent the next nine years as a product development engineer at Chrysler. He joined the staff of the Diversity Programs Office in February 2009. He hopes to impact the lives of future engineers by passing on all that he has learned.

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What Happens After a Summer Bridge Program: The DPO Scholars Program

Introduction

The current state of retention as it relates to underrepresented minorities (URM) and at-risk students in science, technology, engineering and mathematics (STEM) majors is well documented.¹⁻³ Failure to retain these students in STEM will have far-reaching, negative implications for the U.S. economy and for the U.S. in general.⁴ We will need a diverse group of people to tackle the diverse issues confronting us.

Statistically, students who matriculate to an engineering undergraduate program from an economically disadvantaged background are substantially less likely to graduate than other students. Locally, an integral part of the land grant mission of Michigan State University has historically be to serving the needs of all segments of the Michigan population. For these two key reasons - one rooted in current need and one rooted in historic mission - we have operated a summer bridge experience for students from economically disadvantaged, inner city areas of Detroit over the last several years. Our summer bridge program has been supported with funding from corporate sources and from the NSF-funded Michigan Louis Stokes Alliance for Minority Participation (**MI-LSAMP**).

Students largely from the Detroit inner city are recruited to take part in an experience that includes academic pre-classes as well as social network building - all aimed at preparing students for their first year of university life. This bridge program is targeted at students ready to matriculate to a university; most in our program matriculate to Michigan State University (**MSU**) to pursue an engineering degree. The current capacity of our summer bridge program is 30 students.

There are many successful summer bridge programs that are similar to ours, and we learned substantially from earlier efforts of others to establish such summer bridge programs; e.g., the Meyerhoff program at UMBC⁵.

A fundamental issue facing all institutions with such summer bridge programs is the follow up *after* the summer bridge; what happens to the bridge students in their subsequent first year of university studies?

Our experience indicates that bridge students need a follow on program that reinforces the lessons embedded in the summer bridge and extends those lessons to develop good student and professional habits of mind during students' first year. Our data reflects this same issue as we struggle to *retain* URM students in Engineering. Since Fall Semester 2002 of new freshmen declaring Engineering as a major:

- 6% placed into Intermediate Algebra. Of that 6%, 73% were URM students.

- 8% placed into College Algebra or Trigonometry. Of that 8%, 45% were URM students.
- 39% placed into Calculus. Of that 39%, 5% were URM students.

It has been determined from analysis of years of internal student retention data for MSU that initial placement into math courses are an accurate predictor for success in Engineering; those students who place into Calculus or higher are more likely to graduate with an Engineering degree. This shows that a disproportionate number of URM students come to their first year at MSU underprepared for the level of mathematics correlated with success in undergraduate engineering studies.

At MSU we have developed a follow-on first year program for our summer bridge students: the Diversity Programs Office Scholars Program (**DPO-SP**). DPO-SP is funded internally by MSU, corporate foundation grants and MI-LSAMP funding. DPO-SP is designed to provide a structured, *mandatory* academic mentoring, and social support system establishment for students coming from an under-prepared/economically disadvantaged background.

In this report, we describe our initial experience with the DPO-SP program. We include analysis of data for Fall, 2009-Spring, 2010 (cohort 1), including participation in the program (attendance at events and meetings) versus academic performance as well as attitude survey data we use to determine degree of linkage to the program.

DPO-SP Overview

The DPO-SP is provided by the Diversity Programs Office (DPO) and is in collaboration with the Louis Stokes Alliance for Minority Participation (LSAMP). The goal of the program is to retain at-risk students in Engineering specifically and STEM related majors generally. First, the following is background information on both the DPO and LSAMP.

Diversity Programs Office

Dr. George Vandusen, Associate Dean for undergraduate studies, originally established the MSU Engineering Diversity Programs Office as the Engineering Equal Opportunity Program (EEOP) in the late 1960's. Dr. Vandusen organized a small group of motivated engineering faculty members who made personal financial contributions to create a scholarship fund for a black male community college student, who expressed an interest in attaining an engineering degree. They also provided academic assistance and mentoring, to support him in completing degree requirements.

This early initiative formed the structural foundation of the DPO: an active learning community, co-enrollment for students in engineering courses, team building, group study, advising, counseling, scholarships, internships, freshman orientation, and mentoring. These key features supported the mission of the DPO to recruit, retain, and and mentor to graduation in engineering programs of historically underrepresented minorities. Throughout ensuing years, the program

has served thousands of minority students, thus, exemplifying the impact that a sustained, proactive approach has on increasing the number of minorities, who are systematically engaged to pursue and receive degrees in engineering.

Concerns however persist about declining numbers of students earning engineering degrees, and the lack of diversity within the workforce³, as contrasted by census data⁶ that forecasts demographic increases within ethnic minority groups that are changing the “face” of America as we know it today.

Currently, the focus on underrepresented minorities and women is necessary because these groups have a history of being significantly underrepresented in STEM. As such, this supports a critical continuing need for the DPO, and for the MSU College of Engineering to continue to be committed to the issue.

Michigan Louis Stokes Alliance for Minority Participation

The NSF-funded MI-LSAMP was initiated in November 2005. The MI-LSAMP partners represent the diversity of public doctoral research extensive institutions in the nation. The MI-LSAMP universities are:

University of Michigan,
Michigan State University University,
Wayne State University University, and
Western Michigan University.

The overall goal of the MI-LSAMP is to significantly increase the number of URM students earning baccalaureate degrees in STEM fields from the participating universities, and further to prepare them for entry into graduate programs or the professional workplace.

To accomplish its goal, the MI-LSAMP uses the following approaches.

Pre-First Year Programs

Funding from the grant has allowed the four MI-LSAMP institutions to host Pre-First Year programs. MI-LSAMP also sponsors an All Students Day Program for participants from all four campuses to meet, network and receive additional preparation for their first year of college.

Transfer Admission Project

The Alliance institutions participate or plan to participate with the Atlanta University Center Dual Degree in Engineering Program (DDEP). This program, offers undergraduate students at Morehouse College, Spelman College and Clark Atlanta University the opportunity to earn a baccalaureate degree in science or mathematics and a baccalaureate degree in engineering after nominally 5 years of study.

Undergraduate Research Consortium

Participation in research is a proven way to enhance the quality of undergraduate education and encourage students to pursue careers in Science, Technology, Engineering and Mathematics (STEM) fields^{7, 8}. Nationally, the numbers of undergraduate students participating in research has been relatively small and most efforts selectively engage upper level undergraduates⁹. With growing concerns about the declining number of students earning STEM degrees and the lack of diversity of the STEM workforce³, there is increased emphasis on expanding research opportunities for undergraduate students, in particular those from underrepresented groups (i.e. ethnic minorities and women)¹⁰. Universities in Michigan have a long tradition of providing undergraduate students with significant research experiences, including programs that engage first and second year students, URMs and women.

While successful, these efforts have been of limited scope and have not been coordinated. In addition, the models have not been widely disseminated and there have not been coordinated pipeline programs to identify students and encourage their consideration of advanced studies - including research skills. The MI-LSAMP institutions will collaborate with established leaders in the education of undergraduate students through engagement in research to establish the MI-LSAMP Undergraduate Research Consortium (URC).

The principal goals of this virtual center will be to provide significant numbers of first and second year URM students with authentic research experiences, integrate research activities and findings into core STEM curricula, and enhance the research capacity, infrastructure, and culture of affiliate institutions that have traditionally focused on undergraduate education. Two-year community colleges have been added in the second phase of the grant because they account for approximately a third of the total enrollment in STEM fields in the state, enroll significant numbers of URM students and these community colleges represent a rich pool from which to attract students into the MI-LSAMP.

The URC will:

- Provide grants to teaching and research faculty to encourage the involvement of URM undergraduate students in research.
- Provide research stipends to URM undergraduate students to enable them to conduct research at institutions around the state.
- Sponsor a consortium-wide Undergraduate Research Symposium to allow students and faculty from LSAMP partner and affiliate institutions to share research accomplishments, learn about graduate school opportunities, and hear researchers discuss their work.
- Provide supplementary grants for innovative curriculum and course development to incorporate research activities into STEM courses at the community college and university levels. These grants could be used to develop software, supplementary lab materials, and other materials shared among partner institutions and broadly disseminated.

- Share best practices for engaging undergraduates in research early in their academic careers with campuses around the state and more broadly and provide consulting services to campuses interested in establishing, expanding, or enhancing their capabilities to engage first and second year students in research.

Student participation in the URC activities will be apportioned annually based on graduation rates at the end of each academic year.

Engineering and Science Summer Academy

As a component of the MI-LSAMP Pre-First Year initiative and through funding from the 3M Foundation, Alcoa Corporation and the DTE Energy Foundation, the Engineering and Science Summer Academy (ESSA) bridge program was created (during the first year of the program, it was referred to as the Engineering Summer Academy or ESA). This program is a six-week, residential, academic intensive program designed to acclimate incoming freshmen with both the academic and environmental aspects to post secondary education. Participants attend daily classes in Math, Writing, Chemistry and an Engineering Seminar course to expose students to post graduation and professional opportunities. These courses were selected for the following reasons:

- Both Math and Chemistry are required courses for admissions to the College of Engineering. Both courses are condensed versions of the Chemistry 1 (CEM 141) and either Intermediate Algebra/College Algebra (MTH 1825/103) or Calculus (MTH 132) courses offered at MSU.
- The Writing course is taught by an instructor who teaches a similar course and is necessary because STEM students have sometimes shown the tendency to not “enjoy” writing courses due to their “gray” nature. Writing courses ask students for their opinion and their responses are neither correct nor incorrect. STEM based courses typically provide a formula to find the correct answer.
- The Seminar course gets students interacting with faculty, graduate students and exposed to their discipline early on.

Participants also attend presentations from representatives in all engineering disciplines within the College of Engineering as well as participate in living learning programs and activities designed to get students acquainted with the environmental and social aspects to college. Additionally, in collaboration with the other LSAMP institutions, ESSA students participate in the Summer Corporate Tour that takes students on a 3-4 day bus tour of several companies on site visits and the All Student Day that culminates the week of the Summer Corporate Tour and reconvenes the students at one of the campuses of the partner institutions for additional training, preparation and networking with staff from their home institution.

The DPO Scholars Program

ESSA has been held every summer beginning in 2007. Through the first two iterations of the program, it was realized that a student participating in a summer bridge program and then being “thrown into the fire” simply was not enough. Those same students needed a programmatic and systemic environment that began with the summer bridge program and continued through their first full academic year and on through admissions to the College of Engineering. It was this revelation that was the genesis of the Diversity Programs Office Scholars Program (DPO-SP).

Program Structure

Based on retention data, we determined that the URM students most at risk in Engineering were the following two groups:

- Students admitted to MSU who declared Engineering and placed into Intermediate Algebra (Math 1825), College Algebra (Math 103) or Trigonometry (Math 114), or
- Students admitted to MSU through the College Achievement Admission Program (CAAP) managed by the MSU Office of Supportive Services (OSS)

OSS is a multifaceted holistic retention initiative designed to address the needs of CAAP students; first generation and low income students, and students who meet other participant criteria. Through the collaborative efforts of faculty and staff, the Supportive Services personnel implement an intensive and comprehensive university-wide service. Students have access to program services from the time they enter the university, through graduation and placement into graduate school. The primary goal of OSS is to assist in the increase of retention rates, facilitate academic successes and enhance graduation rates among program participants. This is accomplished by offering a variety of services, which foster student academic achievement, self-confidence and leadership.

The DPO-SP program has the following requirements:

- Participation in the Engineering and Science Summer Academy (ESSA).
- Participation in the Leaders Encouraging Academic Development (LEAD) mentoring program.
- Course schedule building by the DPO during 1st full academic year.
- Enrollment in Science, Technology, Engineering, and Mathematics (STEM) sections of math courses. These courses are done in collaboration with the Charles Drew Science Scholars program in the College of Natural Science. Classes meet for a total of seven hours per week versus three hours per week in non-STEM sections.
- Nightly recitation sessions, Monday – Thursday; 7 pm-9:30 pm. Sessions are staffed by Academic Assistants who facilitate the sessions and assist with the learning process.
- Bi-weekly meetings with DPO staff. During these meetings, students must complete a meeting-tracking form designed to uncover issues and challenges students may be facing and update staff on how students are progressing in their courses.

- Enrollment in EGR160 and course evaluation upon completion. EGR160 Course Objectives: To strengthen and enhance students' communication, teamwork, and leadership skills through exposure to faculty and resources.

Students who successfully complete the DPO-SP program receive:

- \$1,000 scholarship awarded after successfully completing the program.
- Placement in a Research Assistantship the summer after their first year (MI-LSAMP funded Summer Undergraduate Research Academy [SURA]).
- Selection into new Engineering, professional organizations.

Results: 2009 Cohort

As shown in Figure 1, the students who participated in the program are being retained as engineering students as of their third semester at a higher percentage than those engineering students who did not participate in the program or those engineering students who began their college careers at similar levels of math readiness.

As shown in Figure 2, program participants' cumulative GPA is almost a half point higher than their predicted GPA. The Predicted GPA is assigned by the university upon a students' admission and is based on a number of factors including academic performance during high school, standardized test scores and school district.

As shown in Figure 3, those participants who participated in 80%-90% of the mandatory nightly recitation sessions earned a much higher GPA than those who participated in less than 80% of the nightly recitation sessions.

During Spring semester 2010, when participants were not compliant with program requirements based on their belief that they "had it" after performing well their first semester and hence did not meet with DPO staff bi-weekly as mandated, their GPA's fell substantially when compared to Fall semester 2009. This data is depicted in Figures 4 and 5.

In summary:

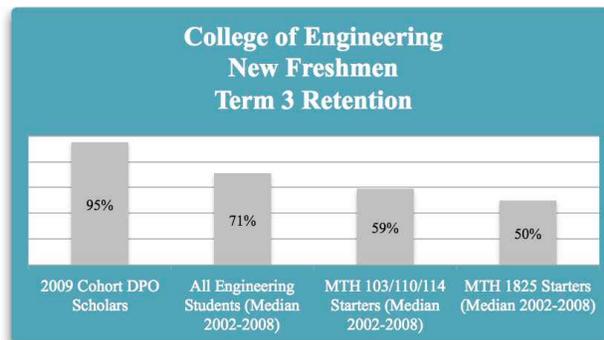


Figure 1: 2009 Cohort Three Term Retention

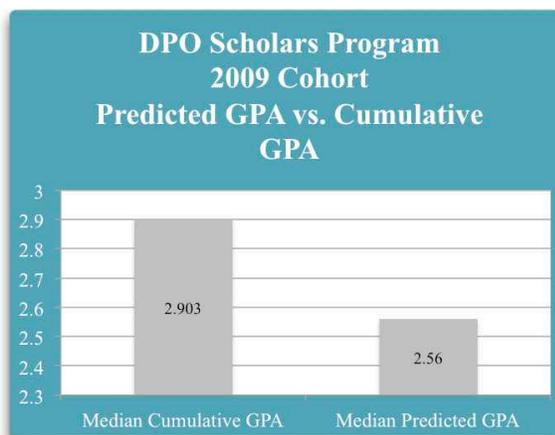


Figure 2: 2009 Cohort Predicted vs Actual GPA

- 95% of the DPO Scholars in our first cohort have been retained in engineering through their first year. Historically, large numbers of engineering students are lost during this period.
- DPO Scholars, Cohort 1 are performing better than expected (2.903 median cumulative GPA vs. 2.56 predicted GPA). Predicted GPA is assigned by the university when a student is admitted and is based on the school district they hail from, their academic performance during high school and standardized test results.
- Students attending 80-90% of recitations obtained a median cumulative GPA of 3.45.

Conclusion

The results half way through the first year of the program are encouraging. While we are dealing with a sample set from the target population, we are anxiously awaiting grade results from a complete academic year, evaluation and assessment and the prospect that, with additional funding, we will be able to increase program capacity and, therefore, provide a larger data set from which we can determine program effectiveness. What we do know is that what we have done in the past has not worked and from our preliminary results, the DPO-SP has the potential to positively impact retention.

Recommendations

Institutionalization is critically important for the sustainability of this program. Currently, the majority of the dollars that

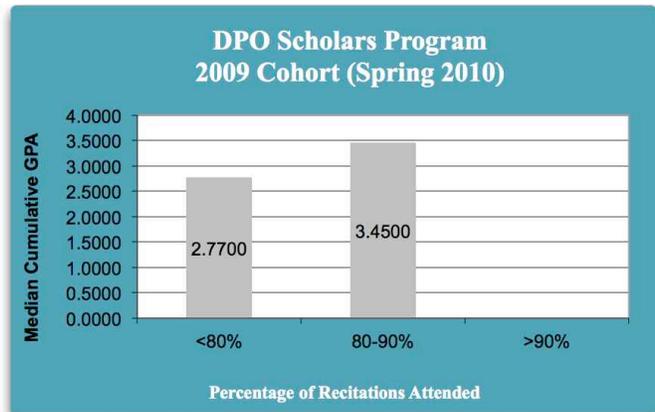


Figure 3: 2009 Cohort GPA versus Percent Program Recitation Attendance

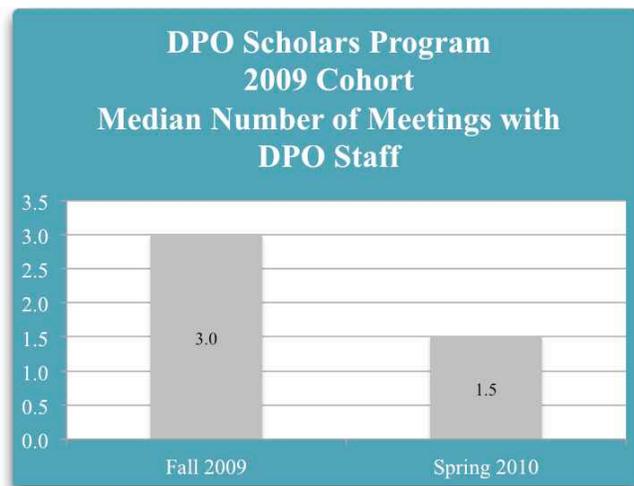


Figure 4: 2009 Cohort Meetings with Staff for Fall 2009 and Spring 2010

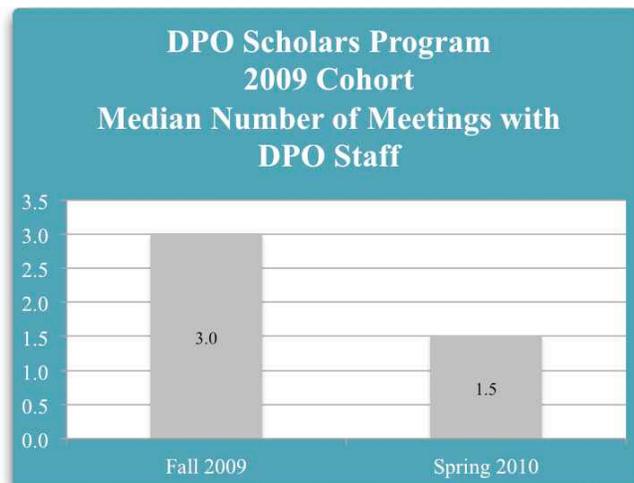


Figure 5: 2009 GPA results for Fall 2009 and Spring 2010, and possible link to number of meeting (Figure 4)

support the program are supplied by corporate foundation and governmental grants (NSF). To the extent that we are able to include the program in College and University budgets, we will be able to expand it to include ALL at-risk students declaring engineering and not just a small sample of this target audience.

Next Steps

We are most encouraged by our results presented above. The next steps that we have charted for the development of the DPO-SP are as follows:

- Evaluate and assess first year of program and make changes, if necessary, based on results.
- Securing funding to ensure program will occur over the next five years.
- Convince University to allow participants to re-take math placement exam at the end of ESSA for a more accurate placement in fall semester math course.
- Securing funding to increase capacity of participants.
- Move towards program institutionalization.

Acknowledgments

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Citations

1. Committee on Science Engineering and Public Policy, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*. 2007, Committee on Science Engineering and Public Policy.
2. Maton, K.I. and F.A. Hrabowski III, *Increasing the Number of African American PhDs in the Sciences and Engineering: A Strengths-Based Approach*. 2004, University of Maryland Baltimore County.
3. National Science Foundation, *Science and Engineering Indicators, 2002*. 2002, National Science Foundation.
4. Hersh, R.H., *Declining by Degrees: Higher Education at Risk*. 2005, New York City, NY: Palgrave Macmillan.
5. Maton, K.I., F.A. Hrabowski III, and C.L. Schmitt, *African American college students excelling in the sciences: College and postcollege outcomes in the Meyerhoff Scholars Program*. *Journal of Research in Science Teaching*, 2000. **37**(7): p. 629-654.
6. United States Bureau of Census, *United States Census 2000*. 2000, Government Printing Office.
7. Hathaway, R.S., B.A. Nagda, and S.R. Gregerman, *The Relationship of Undergraduate Research Participation to Graduate and Professional Education Pursuit: An Empirical Study*. *Journal of Student Development*, 2002. **43**(5): p. 14-31.
8. Zydney, A.L., et al., *Impact of Undergraduate Research Experience in Engineering*. *Journal of Engineering Education Research*, 2002. **91**: p. 151-158.
9. National Science Foundation, *Exploring the Concept of Undergraduate Research Centers: A Report of the NSF Workshop*.
10. Greater Expectations National Panel, *Greater Expectations: A New Vision for Learning as a Nation Goes to College*. 2002, American Association of Colleges and Universities.