Introducing High School Students to the field of Civil Engineering: The ASCE/MESA Summer Institute

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Since 1996, the Department of Civil Engineering and the Mathematics, Engineering, Science Achievement (MESA) Program of the School of Engineering & Technology at California State University, Los Angeles conducted a two-day Saturday Academy "style" program designed to create a "pipeline" to direct college-bound high school students into civil engineering-related careers. Funded by the American Society of Civil Engineers (ASCE) Committee on Equal Opportunity Programs, the program has proved to be successful by serving to (1) expose students to science and engineering in a college-related environment (2) introduce it's student participants to the study and career of civil engineering and (3) involve engineering faculty, students and professionals in a worthwhile community-based program.

The program took place on two-consecutive Saturdays on the California State University , Los Angeles (Cal State L.A.) in late August for a total of 12 hours (6 hours each Saturday). The program was free to all participants and in 1997 a stipend of $25.00 was given to students that attended both days and completed all assigned work. The following is a description of how the program was developed and implemented.

INTRODUCTION

Studies show that the engineering profession does not receive the attention of minority students as often as other professions. The portion of minority students entering engineering schools is at an increasing low 11.5 percent nationwide[1]. Often times some of the primary reasons for this decline in minority representation is due to a lack of exposure and knowledge to the various disciplines and opportunities related to engineering. Effort has been directed toward solving this problem on both the federal and state level. Model programs have been created to specifically deal with the problem as early as the primary levels of education. Programs most notable for their commitment to increase minority representation in engineering are: the National Action Council for Minorities in Engineering (NACME), the National Association of Minority Engineering Program Administrators (NAMEPA) and the Mathematics, Engineering, Science Achievement (MESA) program.

At the undergraduate level, Minority Engineering Programs (MEP's) are offered at 110 of the more than 300 schools of engineering nationwide. MEP's are designed to increase the number of underrepresented minority students who choose engineering and graduate in engineering. At the undergraduate and pre-college level, the MESA Program is one of the country's oldest and best-known programs that produces highly trained technological professionals to enter the workforce and assume leading positions in industry. MESA has been profiled in **Science** magazine as one of the top programs in the nation that is successfully producing science professionals of color[2]. The 27-year old program serves educationally disadvantaged students and, to the extent possible by law, emphasizes participation by students from groups with low eligibility rates for four-year college. MESA works with over 21,000 students throughout California from elementary through university levels. MESA is funded by the state legislature, corporate contributions, and various grants. It is a program of the University of California. MESA is an academically-based program that provides a rigorous, all-sided learning environment. This includes MESA classes, academic advising, peer group learning, career exploration, parent involvement and other services for students from elementary through college level.

BACKGROUND

Founded in 1947, Cal State L.A. is one of 20 campuses comprising the California State University System. Cal State L.A. is a comprehensive university dedicated primarily to undergraduate education and offering more than 50 undergraduate and graduate degree programs in academic and professional fields. With a student population that is 10 percent African-American, 48 percent Hispanic-American, 24 percent Asian-American, and 17 percent Caucasian and "other," Cal State L.A. is perhaps the most ethnically and culturally diverse university in the nation. Unique in California, Cal State L.A. is the only federally designated "Minority Institution" (MI) in the State which has an engineering program and the only California university that is eligible for membership in the Hispanic Association of Colleges and Universities (HACU) as an Hispanic Serving Institution (HSI).

The School of Engineering and Technology is one of six Schools within the University. The School serves approximately 1,200 of Cal State L.A.'s more than 20,000-plus students. The School is

organized into four departments: Civil Engineering, Electrical and Computer Engineering, Mechanical Engineering, and Technology. The School's three engineering programs receive the highest award granted by the Accreditation Board for Engineering and Technology (ABET). Taught by an excellent faculty of 50 full-time members, several of whom have achieved international reputations through their widely-adopted textbooks, Cal State L.A. engineering majors pursue a curriculum that strikes a balance between theoretical programs and practical, technology-oriented programs.

In recent years, the School has demonstrated its commitment to excellence through its highly successful Solar Eagle projects. Designed and fabricated by outstanding teams of Cal State L.A. engineering students, Solar Eagle I and Solar Eagle II placed fourth and third, respectively, of the thirty-two entries in the GM and DOE Sunrayce competitions of 1990 and 1993, ahead of such powerhouses as MIT and Stanford. Solar Eagle III outperformed all competitors and attained #1 in Sunrayce 1997.

The School's MESA Engineering Program and MESA Pre-College program provide academic enrichment and career awareness activities to 350 undergraduate students and over 600 disadvantaged students at ten high schools, seven middle schools and one elementary school in three School Districts. The Cal State L.A. MESA Engineering Program has been highly successful in assisting students to graduate and move on to engineering careers. The Cal State L.A. MESA Pre-College Center has been highly successful in preparing and motivating students for engineering study.

The School's Dean, Dr. Raymond B. Landis, is a nationally recognized leader in minority engineering education. He founded the first Minority Engineering Program (MEP) in California at CSU Northridge in 1973 and served as its director for ten years. In 1983, he led the effort to establish MEPs in other California engineering schools. Currently, 20 California universities operate MEPs based on his "community building / collaborative learning" model. Dean Landis is widely published and a frequent consultant to universities on minority engineering education. He edited the definitive document on minority engineering student retention, the National Action Council for Minorities in Engineering (NACME) Handbook on Improving the Retention and Graduation of Minorities in Engineering. Since coming to Cal State L.A. in 1985, he has worked to develop the University's MEP into one of the finest programs of its type in the nation.

ASCE

Founded in 1852, ASCE is the oldest national engineering society in the United States. It is devoted to the advancement of civil engineering knowledge and enhancement of the professional status of the civil engineer. It seeks these objectives by publishing articles on engineering matters (professional papers), holding frequent meetings to discuss engineering problems, publishing the monthly **Civil Engineering** and otherwise providing for cross-communication throughout the United States and abroad[3].

PROGRAM DESCRIPTION

ASCE/MESA Summer Institute is a two-day Saturday Academy for high school students designed to introduce college-bound underrepresented students into civil engineering -related careers. The mission of the institute is two-fold, (1) to expose students to science and engineering in a college-related environment (2) and introduce students to the study of civil engineering.

STUDENT RECRUITMENT AND SELECTION:

The Cal State LA MESA Center, serves approximately 350 students from 10 senior high schools in the Los Angeles and Pasadena areas. Applications were available through the MESA Advisor -- a math or science teacher that works directly with the MESA students on a weekly basis. For students who could not contact the advisor, applications were available at the MESA office. Applicants had to demonstrate an interest in the field of civil engineering, have at least a 3.0 G.P.A. and be currently enrolled or have taken Geometry.

YEAR 1:

In the first year of the program we endeavored to expose 25 student participants to the eight civil engineering specializations offered by the civil engineering department at Cal State L.A. These fields are: coastal, surveying, environmental, structural, geotechnical, hydrology, transportation, and bridge building. A civil engineering faculty member was selected to give a one hour presentation on his concentration. The MEP Associate Director presented a motivational-style workshop and undergraduate civil engineering students gave presentations on civil engineering student projects. A civil engineer from industry spoke about his career in water resources.

During year 1 the program followed a traditional lecture format. The following is a schedule for both days of the institute.

ASCE/MESA Summer Institute 1996
Program AGENDA

DAY ONE: Saturday, July 20, 1996

9:30 Introduction - Dr.Young Kim, Milton Randle & Dominique McMillan

10:00 Coastal Engineering - Dr. Kim

11:00 Environmental Engineering - Dr. Greene

12:00 LUNCH

1:00 Drafting, Autocad, Surveying - Dr. Purasinghe

2:00 Water Resources, Hydraulic Engineering - Dr. Jeng

3:00 Geotechnical Engineering - Dr. Barsam
4:00 Conclude
DAY TWO: Saturday, July 27, 1996

9:30 Introduction - "College- How to Be A More Successful You" - Jacqueline Slaughter

10:00 Structural Engineering - Dr. Bhaumik

11:00 Bridge Building - Dr. Taly

12:00 LUNCH

1:00 Student Engineering Projects

2:00 Transportation - Dr. Hashemian

3:00 Industry Perspectives

4:00 Conclude

At the end of the first day, the students were given a take-home assignment to complete and return on the second day. The assignment was to write a one-paged typed essay about the different civil engineering specialization's. The purpose of the assignment was for the students to discuss what they learned on the first day and to describe how civil engineering is involved in every day life. The best two essays were selected and awarded a Hewlett Packard calculator that was donated from the MESA Engineering Program.

The following are two responses completed by the students of the 1996 program.

- "Everything about the program was good, but I think it would be better if we could do experiments and go to labs relating to civil engineering".

- "The length of the lectures could be cut down. I would like more hands on experience, more time in general , more than two days would be better".

After reviewing the evaluations it was decided that for Year 2 the program would involve less lecturing and more hands-on problem solving. This would provide a collaborative learning process designed to parallel the working environment that students would encounter in college engineering labs and in the "real world" of engineering.

Year 2:

With a more hands-on rather than a lecture driven program to engage students in the real work of civil engineers, it was decided that the program could accommodate an additional 10 students for a total participation of 35. In addition, we decided focus on fewer disciplines. The three components that were introduced are: computers, structures and water resources.

On Day One, the students received a one-hour lecture on Computer Aided Drafting followed by a lab which required them to complete a fairly challenging programming problem. After lunch MESA Engineering Program students gave a tour of the campus, dormitories and engineering labs. This interaction made it possible for the college students to discuss with the high school students what it is like to be a college student and some of the issues they are now facing as young adults. Following the tours, three professional engineers spoke about their careers. The individuals were from three different fields: transportation, environmental and construction. The diversity of the different specializations proved to be more interesting, thus encouraging the students to ask many thought provoking questions.

Day Two activities included breaking various forms of materials in the Strength & Materials Lab, performing different experiments in the Wind Tunnel Lab and introducing the students to the World Wide Web , requiring them to search for a civil engineering job on the Internet.

The following is a schedule of the program for the second year.

ASCE/MESA Summer Institute 1997
Program Agenda

DAY ONE: Saturday, August 16, 1997

9:00 Introduction of Program, Dominique McMillan

9:30 CAD Lecture - Dr. Purasinghe

10:30 CAD Lab

12:00 LUNCH

12:40 Tour of Campus & Dorms

1:30 Students Speakers & Lab Tours

2:00 Industry Panel

2:45 Review Take Home Assignment

3:00 Conclude

DAY TWO: Saturday August 23, 1997

9:00 Problem Solving Activity

9:30 Bridge Building Lecture

10:30 Bridge Building Lab

11:30 LUNCH

12:30 Water Resources Lab & Lecture

1:30 Internet Activity

2:45 Evaluation & Distribution of Stipends

3:00 Conclude

Year 2 evaluations proved that by decreasing the amount of lectures and providing a more hands-on approach a much more interesting and exciting program for the students took place. The following are two student responses for the 1997 program.

-"What I liked best about the program was it gave me a better understanding of the field of engineering in general and it has influenced me to look into civil engineering as a career choice".

-"What I least liked about the program was the time. I would have enjoyed the program more if it was longer. I really enjoyed doing the experiments".

CONCLUSION

After having completed two years of the program, the administrative staff is confident that the program will be successful overtime in influencing students to choose civil engineering as a field of study. Like any other study it takes time to draw conclusions on the effect the Institute has had on the students. However, the evaluations and responses provide insight on how the students viewed the experience overall. The most notable of the responses is that the students were excited to find out what civil engineers do and how civil engineering effects our everyday lives. The students also consistently commented on the fact that the program should be longer and it would be interesting to learn about other engineering disciplines.

The program has been approved for another year and the staff is looking forward to incorporating new programs to make the institute even more interesting. In addition, proposals are being written to supplement the allocated budget to increase the length of time of the institute.

References:

[1] Engineering and Technology Degrees, 1997: Engineering Workforce Commission of the American Association of Engineering Societies, Inc.

[2] Science Magazine: Volume 258 15, November 1996.

[3] American Society of Civil Engineers Brochure, New York, NY

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