MEP Summer Bridge Program: A Model Curriculum Project

Maria A. Reyes, Maria Amparo Gotes,
Dr. Barry McNeill, Dr. Mary R. Anderson-Rowland

Arizona State University

ABSTRACT

Arizona State University's (ASU) Office of Minority Engineering Programs (OMEP) has hosted the Minority Engineering Program (MEP) Summer Bridge Program (SBP) for the past three years. The purpose of the program is to promote greater awareness of and to recruit potential candidates to the College of Engineering and Applied Sciences (CEAS) at ASU. The program content and curriculum are designed to prepare underrepresented ethnic minority students for success in the CEAS at ASU. The program focuses on community building and utilizes undergraduate student role models, while the curriculum focuses on engineering design, technical communications, and includes a very unique design project. Academic scholarships are awarded to all participants based on a team design project competition.

The design project is a group project that the students complete by the tenth day of the program. The project consists of three elements: web page, design notebook, and an oral team presentation. This unique design project consists of a web-based newspaper that the teams "publish". The newspaper has certain requirements and specifications, but also allows for creativity on the student's part. The purpose of the newspaper is to document the team's experience and activities during the MEP Summer Bridge Program. The intent of the newspaper is to have the students document their processes and experiences in the SBP and to have the teams create a newspaper that promotes the Program to future students, to funding agencies, and to the community.

The purpose of this paper is to describe the three elements of the design project in detail, focusing on the web-based newspaper. In addition, the purpose is to provide web site addresses for viewing the "published" newspapers and to assist in modeling this project for other programs.

INTRODUCTION

Arizona State University (ASU) has, for the previous three summers, hosted the Minority Engineering Program (MEP) Summer Bridge Program (SBP). The program is open to underrepresented ethnic minority high school graduates who have been admitted to the College of Engineering and Applied Sciences (CEAS) for the fall semester. The purpose of the program is to promote greater awareness of and to recruit potential candidates to the CEAS at ASU. The SBP is a two-week residential program funded through a collaborative effort of the Western Alliance to Expand Student Opportunities (WAESO), a federally funded agency; the McDonnell Douglas Foundation; the College of Engineering and Applied Sciences (CEAS) Dean's Office; and the NSF Foundation Coalition. Participants are provided with room and board, classroom materials, and academic scholarships.

The program focuses on community building and utilizes undergraduate student role models, while the curriculum focuses on engineering design, technical communication, and includes a very unique design project. The program content and curriculum are designed to prepare the students for success in the CEAS's engineering program. This overall objective is accomplished by implementing five curriculum goals, which are:

1. Build community among the participants and current engineering students.
2. Introduce participants to computing at ASU.
3. Introduce participants to engineering and more specifically incorporate:
   - engineering documentation and design projects
   - team building and team competition
   - use of computer software such as Microsoft Word, Excel and PowerPoint
   - E-mail, Internet, and web page design tools
   - problem solving skills
   - research activities
4. Help students believe that they can be successful engineering students at ASU.
5. Address issues relevant to freshman students such as the function of the registrar's office, financial aid, and academic advisement.

The design project includes engineering documentation, in both written and electronic form, and an oral presentation. This paper will discuss in some detail the curriculum, with special attention to the design project, and will end with a brief discussion of the results of this program on the matriculated students.

A DESRIPTION OF THE CURRICULUM

The academic area is focused on all the elements involved in the engineering design and technical communication process. The goal is to teach students about engineering design projects and what they entail while preparing them for their course work in engineering and the applied science curriculum. This is accomplished by incorporating a design project that includes project management, time management, and team building aspects. The project requires the students to use Microsoft WORD, EXCEL and PowerPoint, e-mail, the Internet, and web page design tools such as UNIX, HTML, GIF, JPEG, and Frames.

The design project is the culmination of the program with student written, electronic, poster, and oral presentations. Most of these elements are fundamental skills required in the curriculum of ECE 100: Introduction to Engineering Design, the first core course required of all engineering students. The catalog description of the course is the following: Introduction to engineering design philosophy and methodology: computer modeling of systems, processes, and components; design for customer satisfaction, profitability, quality and manufacturing; economic analysis; flow charting; sketching CAD; and teaming. A term design project is included.

The curriculum was designed under the supervision of Dr. Barry McNeill, Assistant Professor, Department of Mechanical and Aerospace Engineering. The curriculum team was comprised of

four undergraduate engineering students[1], Dr. McNeill, and the program director. The four students had responsibility for a portion of the curriculum, which included HTML/UNIX, Microsoft Office, Team Building, and the Design Project. The curriculum began with fundamental elements of team building, introduction to e-mail, and evolved to specific programming functions. The curriculum team determined that the students would complete a design project devoted to the development of a web page with engineering documentation, a design notebook, and an oral presentation.

THE DESIGN PROJECT

As discussed earlier the basic curriculum was comprised of many individual and team activities. The desire was to have an activity that pulled all these separate activities together, something to act as an integrating umbrella. This desire lead to the creation of the team design project, with the following goals:

1. allow the students to learn how to work under high stress situations, as is done in preparation for finals week,
2. attract possible funding agencies, future students, and to inform the faculty and staff about the program through the documentation of the student's activities,
3. allow the students to document and capture their experiences over the two-week period,
4. allow the students to put into practice what they had learned during the program about teamwork, web page design, and MS Office,
5. allow the students to learn how to work in an engineering program as it refers to following specifications and, at the same time, use their knowledge and creativity to solve problems,
6. allow the students to learn about the engineering documentation process in a planned and stepwise manner.

The design project has always involved the creation of the documentation that completely describes the various individual and team assignments that were undertaken during the program. During the first two summers of the program the project consisted of the creation of individual and team design notebooks, the creation of personal Web pages, and the presentation of a final team oral report[2]. During the third summer the personal Web page was replaced with the creation of a web based team newspaper.

The Newspaper – a New Design Project

During the planning for the Summer '98 curriculum, the development team reviewed the previous two summers efforts and felt that the second Design Project goal, i.e., advertising the program, had not been satisfied very well, if at all. The design notebooks the students created certainly documented their activities, but the general sense was that the notebooks were not complete and did not demonstrate the knowledge of the desired organizing skills. The Design Project was not producing material that could be used effectively in advertising the program. After some thought, it was decided that one of the reasons for this problem was the students' complete unfamiliarity with the idea of what a design notebook was. Complicating this was the

two-week time period of the program, which did not allow enough time to bring the participants up to speed on how to create a good design notebook.

With this in mind, the curriculum team decided that the project should include the publishing of a Web Based Newspaper reporting on the two-week program. There were several reasons the newspaper idea was appealing. First, the students were all familiar with what a newspaper is and does and thus when told they had to publish a newspaper we were not asking them to create something they had never seen before. Second, a good newspaper actually has all the important fundamental aspects of a well-designed design notebook. A newspaper has a variety of specialized sections, as does a notebook; a newspaper has an index to the sections, as does a notebook, and all articles in the newspaper have a byline, as does all work in a notebook. Third, the newspaper offered the students a good opportunity to be creative in how the newspaper was organized, what sections were included, and how the work would be connected together (i.e., how items were hyper linked). Fourth, the web-based newspaper addressed the second goal, which was to develop a tool to help promote the program. Finally, it was easy to develop a set of specifications for the web-based newspaper and the rest of the design project.

Design Project Specifications

The specifications for the electronic newspaper were very detailed, while still leaving a certain amount of flexibility for the participants to interject their creativity into the project. The newspaper had to be named and identify who was on the team that produced it. To further identify these "editors", each member was required to write a biography and include it in the newspaper. The newspaper also had to contain a list of the daily activities that each member completed individually and as a team. Another section of the newspaper had to contain reflections by the team and team members about the program and activities. It was also expected that the participants would include an article describing the Minority Engineering Program.

The participants were required to learn more about the CEAS and the university in an effort to assist the participants in their search for resources. In addition, the participants needed to research and document their findings about their chosen field of study. In a separate article they had to report about the community building that occurred among them and how they thought it might assist them in their future studies. It was also suggested that each team include optional sections and/or materials that the team felt appropriate for the Newspaper (e.g., comics, want ads, etc.). As is the case in any quality newspaper, it was expected that the author/photographer of each story or picture be included through the use of bylines or photo credits.

Design Project Decisions (Creativity)

Each team had a number of decisions to make throughout the development of the newspaper. The team had to decide: what the newspaper would look like as it was viewed on the web, how the material would be organized (e.g., by date, topic, person, activity, etc.), how the audience would navigate through the paper, and what special sections, if any, would be included. The team also had to decide what hardware/software to use. Finally, the team had to decide how to design the newspaper so that it would be easy to find articles or information on specific topics.

Web Based Newspapers URL

The web site for the eleven "newspapers" that were published from the MEP Summer Bridge Program '98 can be found at www.eas.asu.edu/~omep. The key words to follow are *Summer Programs*, and *Student Newspapers.*

Design Project Design Notebook

The existence of the web-based newspaper did not eliminate the need to organize all the work done. Thus each team was expected to generate a team design notebook. The goal of the team notebook was to completely document the process that each team and individual used as they developed the team newspaper.

Since participants had a number of individual and team assignments that would be completed through the program, in order to keep the assignments organized, the students had to place them in their Team Notebook. The notebook was different from the newspaper since the newspaper only "published" some of this material. Some specifications were given about the notebook including a title page that gives the team name, the team member's names, the program title (i.e., MEP Summer Bridge Program 1998), the team logo, and the team picture. Also, for organization purposes, the notebook had to contain a table of contents, a tabbed section for any work completed by the team, and a tabbed section for each team member. Finally, it was also required that teams include a table of contents at the front of each tabbed section indicating page number of each new piece of work in that section.

Design Project Oral Report

The third and last part of this project was to give a ten-minute oral presentation utilizing Power Point visual aids developed by each team. The specifications for the oral presentation were less restrictive than for the design notebook. The most important requirements were that each team member take part in the presentation, that a Power Point visual presentation be included, and that the teams could not exceed the time limit of ten minutes. In addition, it was required that every participant be in attendance for all presentations regardless of their presentation time, otherwise the team would be disqualified. The teams had to choose one topic from three options for their presentations. The topics were: to describe the newspaper design, to explain the process used to develop the newspaper design, or to present their experiences during the program.

How Well Did the Design Project Work?

The three elements of the design project were the elements of the competition for academic scholarships. A panel of industry representatives and a senior CEAS student judged the design projects. Overall, it was the judges' opinion that the projects were very creative and met most of the specifications. The judges also indicated that they were impressed that the students could have learned and accomplished so much in such a short period of time.

The projects did meet most of the established goals. The students needed good time management skills to complete the project just as they would need such skills in the upcoming semester. Overall, the project allowed the students to document their experiences of the two-

week period, both electronically and in the design notebook. All of the elements of the design project required the students to implement what they had learned during the program; including their teamwork, computer, and organizational skills. The design project also required them to make use of their creativity, engineering documentation, and problem solving skills. Finally, the web based newspapers provided the MEP with the best possible promotional and descriptive material about the program from the best possible source, the actual participants.

PROGRAM IMPACT

In terms of recruiting, the effects of the program have shown overwhelming success. The overall minority student freshman enrollment in the CEAS at ASU has increased by 25.8% since the program was implemented in 1996. Over the last three years, 122 of the 125 students who have participated in the Program have enrolled in the CEAS in the fall semester following the program. We believe that this increase can be attributed in part to the program, since the participants already feel part of the CEAS and part of the community before they start classes.

As a retention tool, the program also shows a very marked success[3]. The one-year retention rate of the Summer '96 and Summer '97 MEP SBP participants within the university is 88.4% and 81.6% respectively. The one-year retention rate of the same students within the CEAS is 79.1% and 76.3% respectively. The comparable retention rates for all minority in CEAS who returned to the university is 80.7% and 75.0%, while the comparable retention rate for all minority students in the CEAS who returned to the College is 69.3% for F96 and 66.9% for F97 respectively.

In terms of academic performance, the program has also proved that it helps its participants to earn a higher GPA than those CEAS minority freshman students that did not participate in the program as shown in Table 1. The most striking difference occurred in the Fall of 1998 where the bridge students were almost 0.4 GPA points above other minority students.

Average First Semester GPA	Fall 1996	Fall 1997	Fall 1998
MEP SBP Students	2.63 (43)	2.43 (35)	2.59 (41)
All Other Minority Students in CEAS	2.47 (79)	2.43 (100)	2.20 (109)
Table 1: Comparison of Average First Semester GPA for minority freshman students with those that were in the MEP SBP.			

Most importantly, the expectation of the MEP SBP curriculum and design project was to give the participants a "head start" in the ECE 100 curriculum. The web-based newspaper was implemented as part of the program curriculum in an effort to promote student comfort level in working with technology and sharing their experience with their community. The design project was developed to prepare students for the "term design project" and "teaming" elements that are a part of ECE 100. An analysis of the average grades received by all CEAS students who took ECE 100 during their first semester at ASU shows that the MEP SBP students outperform the remaining minority students in CEAS (see Table 2). In essence, the MEP SBP students, in each year, bridge the gap between high school and the University and perform at the level of all CEAS

students in ECE 100. The design project and curriculum preparedness that are done in the SBP contribute to this success.

Average Grade Received in ECE	Fall 1996		Fall 1997		Fall 1998	
MEP SBP Students	3.10	(25)	3.00	(11)	3.10	(13)
All Other Minority Students in CEAS	2.3	(12)	2.57	(26)	2.66	(26)
All Students in CEAS	2.95	(151)	3.04	(142)	3.09	(201)

Table 2: A comparison of the average ECE 100 grade received for MEP SBP, all minority and all CEAS students who took ECE 100 during their first semester at ASU.

SUMMARY

The MEP Summer Bridge Program prepares the participants for the CEAS experience by simulating the very rigorous environment in which CEAS students are immersed during their first academic year. By simulating this environment, the students learn ahead of time that through dedication, persistence, and teamwork they can achieve academic success.

The content and curriculum of the program are the key factors to its success. The program content focuses on engineering design, technical communication, team building, and computer skills. Additionally, students are immersed in a situation which builds community and provides the opportunity for development of informal role modeling by current CEAS students, who act as instructors to the current SBP participants. During the two weeks, the participants are given the opportunity to practice what they have learned through the completion of the interdisciplinary team based design project. This newspaper project was judged to be very successful and will be used in future MEP Summer Bridge Programs.

REFERENCES
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BIOGRAPHICAL INFORMATION

MARIA A. REYES is a graduate of the Minority Engineering Program (MEP) at ASU, where she obtained a BSE in Civil Engineering and is pursuing a Masters in Geo-environmental Engineering. She spent two years serving as a project engineer for a private engineering consulting firm. Her current assignment as Program Coordinator for the MEP has given her the opportunity to interact with students and offer assistance from a mentor's prospective.

MARIA AMPARO GOTES is a graduate of the CEAS at ASU, where she obtained a BSE in Biomedical Engineering and is pursuing an International Business Certificate. As an assistant Program Coordinator for the MEP

at ASU, she assists in the planning and coordination of events designed to recruit and retain CEAS students as well as in the implementation of programs and research.

BARRY MCNEILL is an Assistant Professor in Mechanical and Aerospace Engineering at Arizona State University. He earned all his degrees from Stanford University (BS Chem E and MS & PhD ME). He helped develop and deliver a new first year and a new third year engineering design core course. He has given numerous workshops on course/curriculum development and teaming and has co authored several papers on assessment.

MARY R. ANDERSON-ROWLAND is the Associate Dean of Student Affairs and Special Programs in the College of Engineering and Applied Sciences at Arizona State University. She earned her Ph.D. from the University of Iowa. She is the director of a successful Graduate Career Change Program in Industrial Engineering and a frequent speaker on career opportunities for women in engineering.