

An Interactive CD ROM to Sensitize Engineering Students to Diversity Issues

Stephanie Blaisdell
Constantine Andreyev
Russell Jones

Arizona State University
Tempe, Arizona 85287-5506

INTRODUCTION

Only 44% of the students majoring in engineering their freshman year remain in engineering their senior year¹. Research indicates that women and minority students are more likely to attrit from engineering than men and majority students². It has been documented that one of the most salient retention issues for women and minority students is the academic climate within engineering, including sexist or racist attitudes on the part of faculty and peers³. In an effort to improve and enrich the learning experience, to increase the efficiency and quality of performance of the engineering student work teams, and to increase student retention (especially among female and minority students), the "Diversity in Engineering Student Work Teams" interactive CD ROM program was developed.

The CD ROM project is a joint effort between the Foundation Coalition and Arizona State University's Women in Applied Science and Engineering (WISE) Program. The National Science Foundation-funded Foundation Coalition, now in Year 6, links seven higher education institutions: ASU, Rose-Hulman Institute of Technology, Texas A & M University, Texas A & M - Kingsville, the University of Massachusetts-Dartmouth, the University of Wisconsin-Madison, and The University of Alabama in an effort to improve engineering education. The Coalition's mission is to construct improved curricula and learning environments, to attract and retain a more demographically diverse student body, and to graduate a new generation of engineers who can more effectively solve societal problems that demand: life-long learning, teamwork, communication skills, appropriate application of math and science, integration of knowledge, and flexibility and competence in using modern technology. The Foundation Coalition commissioned the WISE Program to develop the CD ROM program in order to contribute to these efforts.

The CD ROM program is designed to assist first-year engineering students with overcoming some of the potential difficulties that may arise in their engineering work teams by (i) heightening awareness of issues of diversity, (ii) changing attitudes and

stereotype information and (iii) increasing teamwork skills. The topic of diversity is potentially a very sensitive one as it deals with attitudes and value systems. Therefore, the instruction is delivered subtly, emphasizing experiential activities, and presented in a manner considered appropriate and appealing (i.e. "cool") to the audience.

The program does this by introducing some of the potential difficulties of working in teams with diverse members, giving numerous scenarios played out in the form of video sequences (short skits) in which the learner, at various points in the sequence, has to select an appropriate response based on judgment and is then given feedback directly following the response or at the end of the entire sequence. If the responses to the situations are inappropriate, the learner is given the opportunity to go through the sequence again. A User's Manual will accompany the program, with additional activities and tips for the instructor.

PREPARATION

In preparation for the creation of this program, the authors have researched the literature on the subject (especially Myra and David Sadker's work and Bernice Sandler's research), studied similar materials created by and used in academia and industry (e.g., UC Davis video "Equity in Engineering"; Purdue University's "Classroom Climate Workshops: Gender Equity Video and Facilitation Guide"), participated in on-line forums on the subject, attended relevant conferences, took part in industry diversity training seminars and workshops, and conducted an anonymous Internet-based survey of freshman engineering students at Arizona State University.

Once a draft of each module was developed, focus groups of engineering students provided feedback for refining the content and presentation. In fall, 1998, the CD ROM will be piloted and assessed in the first-year Foundation Coalition classroom at ASU, described further in the next section.

AUDIENCE DESCRIPTION

The CD ROM program will initially be used by freshman engineering students in the Foundation Coalition program in the College of Engineering at ASU. These students, recipients of an integrated engineering curriculum devised by the National Foundation Coalition and emphasizing the team approach to study, are taught all courses together in one large group for which special classrooms have been designated and equipped with computers and Internet access. The professors of these engineering students meet regularly to monitor improvements for the smooth integration of all courses, such as the English Composition course, into the engineering curriculum. These professors have expressed enthusiasm about the program and will incorporate the delivery of the CD ROM into the course syllabus, giving 20-30 minutes weekly which is the time needed to complete each module with discussion.

During the 1997-98 year, the class consisted of nearly 70 students, of which over 83% were males. Over 85% were white, only 4% were African American, 5% were Hispanic, 1.5% were Native Americans and 0% were foreign students. After feedback from the pilot group, the program will be further refined and disseminated to other Foundation Coalition programs, and then to other engineering programs.

PROGRAM CONTENT

The program begins with the program's moderator providing an explanation of diversity and a brief introduction to the purpose of the CD ROM, as well as an introduction to the program's mechanics (i.e. description of buttons, print and help functions). The moderator, a young white male, is intended to reflect the majority of the audience and therefore facilitate a connection between the program and themselves. The next sequence, an introduction to diversity, is the "sales pitch," the motivator which should help the learner feel as though the program is credible and worthwhile. Ann Livermore, Vice President of Customer Support for Hewlett Packard; Craig Barrett, CEO of Intel Corporation; and the Dean of the College of Engineering & Applied Sciences at Arizona State University, Peter Crouch; make brief video appearances emphasizing the importance of diversity skills and the CD ROM program.

After completing the introductory phase, the learner will enter an "academic realm", consisting of six modules. Each module has a specific instructional objective, and focuses on one or more diversity issues. Diversity issues include valuing differences relative to gender, ethnicity, culture, age, physical ability, and more. Table 1 indicates the settings, or modules, and each diversity issue addressed:

The academic modules portray situations, through video segments, in which diversity issues come to play in the classroom or laboratory setting as the various members of the engineering student teams interact. At certain "forks in the road" the learner is asked for a response based on his/her judgment. Feedback for incorrect and correct answers is provided either after each response or following the entire video sequence. Then, the learner will have the option of going through the experiential video sequence again to try a different option. The learner can obtain a printout of the decision path taken at any time.

After completing the seven academic-situation modules, the student continues on into a "corporate realm" as an engineering intern. As in academia, the corporate world will engage the learner in a number of experiential learning situations. Following the corporate experience modules, the learner will be return to academia for one additional module, hopefully with added insight of the real world which will assist him or her in succeeding in the interpersonal aspects of engineering work team activities in the classroom.

Following each video sequence are questions and statements prompting introspection and serving as primers for discussion in a small group or classroom setting. The program can

be self-paced or part of a regular lecture schedule. The latter is ideal, as it allows more classroom interaction since students will be working in the same module at the same time.

TABLE 1
Diversity Issues Per Module

#	Module Setting	Race	Gender	Physical Ability	Age	Cross-cultural	Sexual Orientation	General
1	"Sales Pitch"							
2	Student Orientation							
3	Engineering Lab							
4	English Composition							
5	Student Union							
6	Simulation Lab							
7	Systems Design							
8	Physics Lab							
9	Internship Interview							
10	Internship							
	TOTAL	4	8	2	1	6	1	2

MEDIUM SELECTED

This highly interactive, multimedia computer-based instruction program was developed using MacroMedia Director 6 and is self-contained as it is launched with a stand-alone executable file (i.e. learner does not need to have MacroMedia Director installed on the computer to run the program). The program will be delivered on CD-ROM for IBM PC, IBM-compatible and Power Macintosh computers with CD-ROM drives, and through the Internet via CD-ROM-directed links. MacroMedia Director was selected for its flexibility and capabilities to incorporate multi-channels of various media simultaneously. This is most suitable for the many video sequences contained in the program and the feedback to be provided to the learner.

ASSESSMENT

As described in the Preparation section, throughout the development of the CD ROM formative assessment has been conducted. Summative assessment will take place during the piloting of the project in the Foundation Coalition classroom. Pre and post surveys on the students' perceptions of diversity issues will be conducted to measure the impact on the CD ROM and accompanied activities and discussions throughout the fall semester. Foundation Coalition first-year faculty will also provide feedback as to the effectiveness

of the program by observing the program's impact on classroom and team interactions. Although the CD ROM will be in a fixed form, hot links from the CD ROM to a dynamic web site will allow for continual modifications and updates to the program.

DISSEMINATION

Upon completion of the pilot project, the CD ROM will be made available to the other Foundation Coalition institutions. It is projected that the CD ROM program will be available to all U.S. engineering schools by spring, 1999. A small fee will be charged for the program to cover the cost of production and shipping.

CONCLUSION

The CD ROM program is designed to heighten sensitivity to diversity issues, allowing students to identify such issues when they arise in team work and other situations. The program is also intended to provide students with suggestions on how to navigate through common diversity issues that arise in team settings. Such skills are highly sought after in today's global economy. Further, it is believed that this CD ROM program will improve retention of women and minority students by improving the academic climate in the engineering classrooms in which it is utilized.

REFERENCES

1. Astin, A., "Engineering outcomes", *ASEE Prism*, September, 1996 27-30.
2. Ibid.
3. Brainard, S.G. "Nuts and Bolts of Retention Programs", *Conference Proceedings, Women in Engineering Conference: A National Initiative*, Washington D.C., June, 1990, 215-220.

