Improving Technical Literacy in the General Student Population

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Abstract

This paper addresses some of the challenges of teaching engineering courses to non-engineering majors at California State University, Northridge. One of these courses is Introduction to Computer-Aided Graphics Tools offered by Manufacturing Systems Engineering and Management department (MSEM). This course was designed to enable computer illiterate students to achieve success in the use of a CAD software package. The course is unique for several reasons: 1) it is the first course that an Engineering department at CSUN has ever offered for non-majors, 2) it is the first computer graphics course taught by an engineering department at CSUN that was approved as a general education breadth course, and 3) it is the first freshman-level General Education course taught by the MSEM department faculty. The challenges we faced in teaching this type of course to non-technical students are many and varied. In this paper, we focus on a subset of ideas and methods that we used to develop this course. One of the ideas, for instance, is to raise the level of technical literacy in the general student population on campus. This includes a substantial number of students with substantial math deficiencies. The ideas that we have developed in this course can be expanded to enhance technical literacy. This has led us to develop other General Education breadth courses that will be discussed in the paper in more detail.

Introduction

To increase the technical literacy among the general student population at California State University, Northridge, the Manufacturing Systems Engineering & Management department began offering a new course, Computer-Aided Graphic Tools (MSE 105), in the Fall 1999 semester. MSE 105 is now being offered in its eighth semester as a general education course for non-engineering majors. This course falls within the General Education program, which requires students to complete a broad program of study in humanities, arts, and sciences in order to earn a bachelors degree. MSE 105 fulfills a portion of the Applied Arts and Sciences requirement within general education. The course teaches students how to use AutoCAD as a drawing tool.

This paper describes the rational for the development of this course, the course structure, the general student population served by the course, the lessons learned by engineering faculty as a result of offering the course and finally the future plans for other GE courses.

Rational

It is widely accepted that increasing the technical literacy among all students is critical as our society becomes increasingly dependent upon science and technology. A technically illiterate population is not capable of understanding and making the informed decisions necessary to maintain our quality of life. The overall decline in B.S. degrees in engineering during the period 1996-2000 as documented by the Engineering Workforce Commission of American Association of Professional Societies highlights this problem[1]. Policy makers often lack understanding of technical issues due to a lack of training in technical fields. For example, the majority of the Washington State legislature is degreed in liberal arts, business and economics yet they are expected to make policy decisions on technical issues[2]. In California, government officials mandated that 10% of all new automobile sales would have to be zero emission vehicles without taking into account that a viable technology for achieving this goal does not exist.

The college of Engineering and Computer Science at CSUN tends to be focused on the education of technical students without considering the importance of its role in providing technical literacy to non-majors. This tendency may be seen at many other institutions nationally. If we are to address the need for technical literacy in the general population, then Engineering schools must break this trend and reach out to other disciplines on campus. IEEE and ASME have pre-college education initiatives aimed at technological literacy of pre-college educators[3]. These efforts must be complimented at the university level for the general student population. Engineering educators can play a key role in supporting and encouraging universities to offer an array of courses addressing general engineering and technology courses to non-major students. This idea was reinforced by the keynote speaker at the 2002 ASEE annual conference.

Development of the Course

MSE 105 teaches students how to use AutoCAD as a graphic tool within their academic discipline. Students are given instruction in two and three-dimensional drawing techniques without requiring a strong math background. The course covers orthogonal projections, isometric views, wire frame models, surface models, and solid models. These concepts are taught using a series of in class exercises through which the students gain competency at using the program as a tool. Students are not expected to have a background in math beyond basic mathematics and the software program is used without relying on numerical parameters to build their models. The course culminates in a solid model project which allows students to pick the topic to be modeled. Students are encouraged to pick a project theme that is relevant to their major field of study.

The General Student Population

The course targeted students in non-technical majors. Tables 1 and 2 illustrate Fall and Spring enrollments since the course inception in Fall 1999. Each student's major was obtained from the class rosters. One can see a diverse student population enrolling in the class that ranges from

Table 1. Majors enrolled in MSE105 by Fall Semester

Fall 1999	Fall 2000	Fall 2001	Fall 2002
Undecided	Undecided	Undecided	Undecided
Radio,TV &Film	Radio,TV &Film	Radio,TV &Film	Radio,TV &Film
Art	Art	Art	Art
Biology	Biology	Biology	Biology
Graphic Design	Graphic Design	Graphic Design	Graphic Design
Music	Music	Music	Music
Math	Math	Journalism	Journalism
Comp Sci	Comp Sci	Psychology	Psychology
Journalism	Journalism	Speech Comm.	Speech Comm.
Urban Study	Psychology	Interior Design	Comp Sci
Psychology	Speech Comm.	Criminology	Political Science
Speech Comm.	Political Science	Business	Theater
Special Interdisc.	Child	Chemistry	Business
Political Science	Development	Sociology	History
	Theater		Chemistry
	Health Sci.		Physics
	Interior Design		English
	Criminology		Sociology
	Business		
Total enrollment: 88	Total enrollment: 116	Total enrollment: 142	Total enrollment: 218

science to non-science based majors. Data are intentionally divided into Fall and Spring semester to reflect a campus wide trend in general education enrollments. Lower division courses typically have higher enrollments in the Fall semester and lower enrollments in the subsequent Spring semester. Total Fall and Spring enrollments have consistently increased each year indicating a general enthusiasm among the non-major student population for a technology-based course. One can observe that the majors taking the course are retained in subsequent semester. For example Radio, T.V. & Film students make up a consistently strong percentage of the course enrollment every semester. Student feedback has indicated that they are enjoying the course and recommending it to others.

Lessons Learned

The success of reaching out to the broader campus community with MSE 105 has led the department to develop three other general education courses; MSE106 Introduction to CAD Motion, MSE 302 Women in Mathematics, Science and Engineering, and MSE 303 Innovation, Invention, and Technology. These courses have been designed to further broaden the students understanding of the importance of technology in our society without requiring them to have a high level of technical skill.

Table 2. Majors enrolled in MSE105 by Spring Semester

Spring 2000	Spring 2001	Spring 2002
Undecided	Undecided	Undecided
Radio,TV &Film	Radio,TV &Film	Radio,TV &Film
Art	Art	Art
Graphic Design	Biology	Biology
Music	Graphic Design	Graphic Design
Math	Music	Comp Sci
Comp Sci	Comp Sci	Journalism
Psychology	Journalism	Psychology
Political Science	Speech Comm.	Health Sci.
Criminology	Political Science	Interior Design
Business	Theater	Business
Sociology	Criminology	History
Anthropology	Business	English
Chemistry	Chemistry	
	Philosophy	
	English	
	Linguistics	
Total enrollment: 56	Total enrollment: 57	Total enrollment: 88

The MSE 105 course was originally proposed as a means to involve the general student population in the MSEM department. The course is taught primarily by part time faculty and therefore does not negatively impact the teaching load of full time faculty. As engineering faculty we have become more aware of the need to battle technical illiteracy. We have also become aware that this type of course, in fact, serves a dual purpose at CSUN. The result of attracting non-engineering students to the department has been an increase in resources available to the department. This has helped us to deal with the nation wide downturn in engineering enrollments. Similarly, this approach may be used at other institutions to enhance the technical literacy among the general student population with the added benefit of increased resources.

Future Plans

Assessment of the MSE 105 courses will be performed by asking students about their experience in the course, their perceived technical literacy, their educational preparation in math and science, their comfort in communicating with engineers, their satisfaction with the course, applicability of the course material to their major field of study, their comfort level taking an "engineering" course, and why they took the course in the first place. The results of this assessment should be available for the purpose of improving the quality of the general education courses offered by the MSEM department.

References

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Biographies

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