RESPONDING TO EXPECTATIONS OF NON-TECHNICAL STUDENTS

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It is widely accepted that increasing the technical literacy among all students is critical as our society becomes increasingly dependent upon science and technology. Therefore, a number of engineering departments at some universities offer courses specifically addressing the needs of the non-engineering students. A general education course, Introduction to Computer-Aided Graphics Tools, has been offered by the Manufacturing Systems Engineering and Management department (MSEM) at California State University, Northridge (CSUN) since Fall 1998. This course was designed to enable computer illiterate students to achieve success in the use of a CAD software package. The students enrolled in this class who form the general population of the CSUN campus usually come from a wide range of academic majors. In this paper, we intend to address the conceptions and expectations of non-engineering students who enrolled in this class. Students were surveyed to determine their opinions regarding science and engineering. The survey was intended to analyze their opinions regarding the importance of technological literacy, their perceived technical literacy after taking the course, their satisfaction with the course, applicability of the course material to their major field of study, their comfort level taking an "engineering" course, whether their expectations of the course content were met, why they took the course in the first place, and would they take another course in the discipline. The input from the non-engineering students forms a useful basis for curriculum development; the results of the study can be used for other engineering educators to develop specific details of instructional programs.

Introduction

Based on the findings of the National Science Foundation study on technical literacy of non-technical majors[1], it is now widely accepted that technical literacy among all students is a critical role of engineering educators in our society[2, 3]. It is believed engineering colleges have a vital role to develop curriculum which meets the expectations of non-technical students. In order to enhance a curriculum reflecting the expectations of these students, it is necessary to respond to expectations of non-technical students. A survey was conducted to allow faculty to determine students' expectations and how well they were met by a general education course centered about a computer aided design software program. Krupczak and Green[4] used similar study to determine the perspective of non-technical students on technical literacy. They found a clear definition of technical literacy was stated by their students. This included the ability to interact with technical systems and repair them when they fail. Students in their study specifically site the ability to interact with computers, cars, and other technically advanced devices. Although there is a diverse

definition of technical literacy, this paper focuses on the computer literacy aspect of technical literacy.

A general education course, Introduction to Computer-Aided Graphics Tools, has been offered by the Manufacturing Systems Engineering and Management department (MSEM) at California State University, Northridge since Fall 1998 semester. This course, which is currently in its tenth semester of being successfully offered, now services approximately 400 students per year. The number of students enrolling in this course has steadily increased since its inception. The course, which is designated as MSE 105, addresses the application of computer-aided design for non-technical majors. The course meets university general education requirements in the area of Applied Arts and Science. Students learn to use the AutoCAD software package to create two and three-dimensional drawings. The course culminates in a final project that requires students to produce a three-dimensional object, of their choosing, which is related to their major field of study. The final projects are posted on a course website gallery after each semester. Students are not expected to have a math background beyond basic mathematics. This requires faculty to teach students to build models without relying on complex mathematical parameters.

Student Demographics

Students enrolled in the class came from a broad range of majors including: radio TV & film, graphic design, music, art, math, urban studies, journalism, biology, psychology, chemistry, political science, business, child development, theater, health science, interior design, criminology, sociology, English, history, and speech communication. About half of the students were first year freshmen and the balance was from the sophomore through senior years.

Survey Methodology

MSE 105 students were anonymously surveyed at the end of the semester to determine their perceptions of the course with respect to types of technical literacy they would like to achieve relative to science and engineering. The survey was intended to analyze their opinions regarding the importance of technological literacy, their perceived technical literacy after taking the course, their satisfaction with the course, applicability of the course material to their major field of study, their comfort level taking an "engineering" course, whether their expectations of the course content were met, why they took the course in the first place, and would they take another course in the same discipline.

Questions included inquiries about the student majors, the ability of the course to meet their expectations, applicability of the course content to their major, their background, and their perceptions regarding technological literacy. Students were asked to respond by selecting from a set of multiple-choice responses. A sample of the survey questions and responses appears in Table 1.

Table 1. Survey Questions and Responses.

Questions	Responses
1. I feel that having technological literacy is important.	a. Yes, very much so. b. Yes, somewhat so. c. I'm not sure. d. No, somewhat not. e. No, not at all.
2. To what extent have your expectations been met in this course relative to learning AutoCAD?	a. All of my expectations have been exceeded. b. All of my expectations have been met. c. Most of my expectations have been met. d. Some of my expectations have been met. e. None of my expectations have been met.
3. Do you see the applicability of the material presented in this course to your major?	a. Yes, very much so. b. Yes, somewhat so. c. I'm not sure. d. No, somewhat not. e. No, not at all.
4. Before taking this course were you concerned about?	a. Taking a course in engineering. b. Too much math in the course. c. I had no concerns.
5. Would you take another course in this discipline?	a. Yes b. No c. I'm undecided at this time.
6. Do you feel that your technological literacy has been improved by taking this course?	a. Yes, very much so. b. Yes, somewhat so. c. I'm not sure. d. No, somewhat not.
7. After taking this course I will recommend this course to my friends.	a. Yes, very much so. b. Yes, somewhat so. c. I'm not sure. d. No, somewhat not. e. No, not at all.
8. Why did you take this course?	a. To meet section E General Education requirement. b. To learn more about computers. c. For fun while learning a CAD package. d. Other

Results

The information used in this research was collected from 162 students out of a total enrolment of 218 students in six sections. Opinions of students in this survey were anonymous. A discussion of the student responses to the questions listed in Table 1 follows.

Importance of technological literacy

Question number 1 dealt with the students' perception of the importance of technological literacy. Students responding that they felt that technological literacy was either very important or somewhat important were 89%. This shows that the overwhelming majority of students recognize the importance of technical literacy.

Meeting Student Expectations

Question 2 reveled the degree to which students' expectations had been met by the course. Students' expectations were defined as learning the AutoCAD software package and being able to apply it within their field of study. These expectations are outlined in the course syllabus as a course goal. The response of 20% of the students polled indicated that their expectations where exceeded, 30% answered that all of their expectations had been met, and 33% said that most of their expectations were met. Only 3% indicated that none of their expectations were met. The overall response indicates that the course, as currently offered, meets the expectations of 83% of the students surveyed.

Applicability of the course material

Question 3 questioned the applicability of the course material to the students major. The responses indicated that 45% of the students felt that the course work was either somewhat or very applicable to their major field of study. This number is slightly less than half of those surveyed. In light of the varied fields of major study it is not felt that this represents a significant problem in the course curriculum for two reasons. First, about half of these students are freshmen who unsure of the application of the technology represented by AutoCAD in their field of study (28% responded that they were unsure of the application of the course material in their field). Second, it is believed that with slight modification of the course assignments to make them more relevant to different majors that this response may be altered towards a more positive outcome.

Comfort Level

Question 4 was included to give an indication of the students' comfort level in taking a course that was offered by an engineering department. The student response shows that 59% had no concern, 25% had concerns about the math required, and 16% were concerned with taking a course in engineering. This question was included to try to gauge the effectiveness of the departments advertising effort to present the course to the general student population in a friendly environment. It is believed the creation of an open environment is necessary to facilitate engineering colleges' efforts at addressing the need for technological literacy. The advertising effort was undertaken because we believe non-technical majors are often intimidated by their

perceptions of the engineering discipline. These results indicate that our efforts have been successful.

Follow up course

Question 5 asked if students would take another course in this discipline. The survey showed that 42% of the students would take a second course in the same discipline. There are two ways of looking at student responses to this question. First, even though the majority of students indicate that they feel technological literacy is very important and that MSE 105 met their expectations with respect to technological literacy, most would not take a second course in the same discipline. The second interpretation is that 42% is not actually a low percentage. In fact, it actually shows significant interest among the students surveyed when taking into account the fact that a second course in the same discipline would not count towards any general education or other degree requirement. However current enrollment figures indicate that only 5% of the students have taken a follow up course. The reason for the discrepancy between the number of students who indicated they would take a follow up course and the actual number who have taken a follow up course cannot be determined. This is because a mechanism for tracking students after they have left the initial course does not exist.

Improvement of technological literacy

Question 6 addresses the improvement of technological literacy as a result of taking this course. Survey results show that 83% of the students responded that they felt their level of technological literacy has been improved. This indicates that the department goal of enabling computer illiterate students to achieve success in the use of a CAD software package has been achieved.

Student Satisfaction

Question 7 asked students if they would recommend the course to their friends. Survey results showed that 63% of the students would recommend the course to friends and that 25% were unsure. It is believed that this is a good indication that student satisfaction is relatively high. It is believed that this level of satisfaction is not due to grade inflation because grade distributions in this course are typically Gaussian. Students wishing to attain high grades must invest a significant amount of time and effort to master the software program. The final project requires students to create three dimensional objects with materials and lighting incorporated into the drawing. Achievement of this level of competency in using the AutoCAD program is not a trivial task for either non-technical majors or engineering students.

Reasons for taking the course

Question 8 touches on the reasons for students taking the course. Survey results indicated that 52% of the students took the course for General Education credit, 32% took the course for fun while learning AutoCAD. This question indicates that most students take the course as a means of meeting a degree requirement. The interesting thing to note is that question 5 showed that once students took one course in the department that 42% would enroll in a second class in the

same discipline as discussed earlier. Once students are exposed to one course they can be motivated to take other courses for personal benefit rather than degree requirement.

Summary

We believe that computer literacy is a necessary foundation to non-technical major's achievement of technical literacy. We have chosen to use a course centered on the AutoCAD program because of its usefulness in fields outside of engineering to compliment the creative skills of non-technical majors. To enhance the ability of engineering educators to improve technological literacy, they should make an effort to incorporate the perspectives of the general student population into the formulation of course curriculum. This ensures that we respond to the needs of the non-technical student population in our society. An appropriate vehicle for incorporating the perspectives is the use of student surveys. This is necessary because this type of curriculum does not benefit from the type of guidance provided for the engineering curriculum, such as ABET, professional societies, alumni advisory boards and industry feedback. It is believed that further work in developing a national model addressing the technological literacy needs of non-technical students would greatly enhance the ability of engineering educators in their effort to meet these needs.

References

1. National Science Foundation, "Shaping the Future: New Expectations for Undergraduate Education in Science, Mathematics, Engineering, and Technology", NSF 96-139, October 1996.
2. Norton, M.G., and Bahr, D.F., An upper division General education course on materials for non-engineering students, Session 2356, ASEE proceedings, Montreal, Canada, 2002.
3. Gorham, Douglas, Promoting Engineering, Science and Technological Literacy: Pre-College Educator Resources. Session 1532, ASEE proceedings, Montreal, Canada, 2002.
4. Krupczak, J.J. and Green, C., The Perspective of Non-Engineers on Technological Literacy, Session 1387, ASEE proceedings, Charlotte, NC, 1999.

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