Development of Engineering On-line Courses:
Faculty and Student Support

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Abstract

The College of Engineering and Applied Sciences (CEAS) at Arizona State University has embarked on a variety of initiatives to provide on-line engineering courses to several audiences. This paper will describe these various efforts and our special attempts to provide direct support to our faculty and students to maximize success in these courses. It will also present some lessons we have learned to date.

I.   Introduction

While the support and encouragement of various administration offices and department leadership is absolutely necessary for on-line course development and offerings, we strongly believe significant direct assistance to faculty and students is critical to any success we may achieve in this growing area of interest. As with most large research universities it seems (after exploring programmatic efforts in this area at over ten of them), ASU is providing varying levels of assistance at both the university and college level.

II.   Beginning the Journey

Our College of Engineering and Applied Sciences primarily began its efforts into on-line education in fairly typical academic fashion – by appointing a faculty and staff committee to review this area and provide recommendations to the Dean on whether to pursue such activities and (if, yes) how to do so. Early in its work, the group expanded beyond CEAS to include interested parties outside of engineering – including the College of Business, College of Extended Education – Distance Learning Technology Group (DLT) and Information Technology (IT). The committee worked through 1996-97 and submitted its report in July 1997 providing a comprehensive assessment of our situation, a series of recommendations and budget needs to meet them.[1]

As a result of this and other efforts, our Provost, Milton Glick has provided substantial funding to DLT to support faculty and course development. He, of course, also funds the central Information Technology.

III.   Providing Faculty and Student Support Services

We currently have three major entities at ASU to assist faculty in on-line course development:

Distance Learning Technology Group in the College of Extended Education

Instructional Support Unit within Information Technology

College of Engineering – Center for Professional Development and Center for Innovation in Engineering Education

The largest unit – Distance Learning Technology - assists faculty from all parts of the university wanting to do on-line courses primarily for off-campus students. They have a team of instructional designers and web experts familiar with a large variety of software tools. They meet individually with faculty and tailor their service to his or her other needs – extensive in some cases, minor in others, depending on the instructor's previous experience. CourseInfo is the primary software tool now used but others can also be used if the instructor prefers to do so. In the spring of 1999, twenty-six different on-line courses are scheduled from five different ASU colleges – ten in Engineering – including two that are offered in three, one-credit modules. More details are available at their web site:

http://asuonline.asu.edu

A Student Guide outlining all hardware and software requirements, support information and student resources are also available at this Web site. On-line registration is also provided. Extensive interaction by email with students has readily solved most of their operational issues and concerns.

DLT has also set up a faculty advisory group consisting of representatives from all interested colleges at ASU. It meets regularly to exchange ideas and formulate campus-wide under assistance efforts. To date they have offered brown bag, noon hour seminars by faculty currently doing on-line instruction to exchange ideas and experiences and obtain feedback on assistance needed. They have also cooperated in offering workshops by local staff experts or by experienced professors from other campuses – such as Professor Mack Daily as discussed later.

Our central IT Instruction Support unit has a growing staff of instructional and computer system designers to assist faculty in developing primarily on-line enhanced courses for on-campus students. They began to conduct workshops on a regular basis in spring 1999 with multiple offerings on Blackboard CourseInfo - a three-hour session limited to 15 participants. The format being used explores the software from a student's perspective for the first hour, how faculty can create and manage a class site for the second hour and the third hour is devoted to lab time to develop the class site with tutoring assistance from the staff. Some results should be available for reporting at the June conference.

The Center for Innovation in Engineering Education (CIEE) and the Center for Professional Development (CPD) try to coordinate activities within Engineering for on-line efforts. CIEE publishes a regular newsletter distributed to all faculty, conducts workshops and regular seminar series, obtains trial use software and added a full time instructional designer (Kerri Barlow) with multimedia experience in the fall of 1998. This spring 1999 workshops include:

Setting Course Objectives and Outcomes
CourseInfo
Course Assessment

Each CIEE workshop lasts approximately two hours and is open to all interested faculty and staff. CIEE also leads our participation in the Foundation Coalition project and provides many other programs and services. It will be "morphed" (their term) next year into a university-wide resource know as the Southwest Center for Educational Research and Development in Science, Mathematics, Engineering and Technology including the Colleges of Engineering and Applied Sciences, Liberal Arts and Sciences and Education. Its director is Professor Don Evans and more details are available at their web site:

www.eas.asu.edu/~asufc/ciee/#center

The Center for Professional Development coordinates outreach and continuing education for CEAS. This includes live short courses, seminars, conferences, closed-circuit microwave TV network credit classes, web classes and leads our participation in the JACME^{2}T Project. In the spring of 1999 it organized (with CIEE and DLT) a series of workshops for faculty led by Professor Mack Daily from the University of Missouri – Rolla. He has developed two graduate level classes offered completely on the Web and has offered them in multiple sessions to over 200 students. A doctoral student there conducted an extensive assessment comparing Web and in class students and found no significant differences in learning. Students had a positive overall feeling about course effectiveness.[2] He has spent over 1000 hours doing all the course development work primarily on his own. He recommended that we:

-Should answer email each day
-Recognize that students like bulletin boards updated daily
-Should return graded assignments within one week

He also observed that students like the CD-ROM and notes he uses to support the Web instruction and especially value the flexibility (any place any time).

His Web site can be seen at:

www.umr.edu/~daily/

The CPD Web site can be seen at:

www.eas.asu.edu/cpd

It is too early for us to report results of our on-line classes but we do have plans outlined for major efforts in assessment by CIEE staff.

IV.   Our First On-line Engineering Class

Our first effort in engineering to develop an on-line course (on Rapid Prototyping) was by Professor Mark Henderson. He was provided with some summer salary through JACME^{2}T (Joint Arizona Consortium – Manufacturing and Engineering Education for Tomorrow) – a NSF administered TRP (Technology Redeployment Program) Grant (#3518). With contacts through our ATLAS Project – a joint European – USA student exchange and distance learning programs we also offered it to students on a pilot basis in other states and countries. He also spent part of his sabbatical to refine the course. He used a variety of different software tools and did most of the development and preparation on his own – as primarily a learning experience. He did use our DLT group to set-up its offering through our normal ASU processes which handle on-line registration, provide direct support and use personal protected access. Most credit course development is being done through the statewide ME program now but JACME^{2}T as a consortia of the three state universities and five major industries (AlliedSignal, Boeing, IBM, Motorola and Raytheon) expect to continue developing non-credit on line courses.

More information about JACME^{2}T can be seen at: www.eas.asu.edu/jacmet

More information about Project Atlas can be seen at: http://www.dipoli.hut.fi/org/ATLAS/

V.   Statewide Master's Program

As outlined in their promotional brochure,[3] -Arizona's three state universities, Arizona State University, Northern Arizona University and the University of Arizona, are collaborating to offer a new tri-university degree program: the Master of Engineering.

The Master of Engineering is a graduate degree program that is intended to meet the educational needs of Arizona's practicing engineers. With input from industry professionals, the three universities expect to develop courses that address the enhancement and/or development of skills, knowledge, and understanding that are critical to today's practicing engineers. These courses will be offered through a variety of distance-delivery methods and in flexible formats. Students enrolled in the program will be able to take advantage of course offerings at any of the three universities. These offerings reflect the diversity of strengths across the state.

The Master of Engineering offers the practicing engineer the opportunity to design, in conjunction with an advisory committee, a program of study that can reflect the increasingly interdisciplinary nature of engineering practice.

Working closely with an advisory committee, a program of study will be developed early in a student's academic career that can include courses taken from any of the three state institutions. Designed as a terminal master's degree program, the Master of Engineering requires the completion of 30 hours of course work. Within this 30 hours of coursework, students must complete a minimum of three hours in applied engineering mathematics as well as three hours of engineering management/business. Up to six hours of credit from a

practice-oriented project may be applied to the program of study. A final examination is also required.

The JACME^{2}T Policy Board is serving as the initial Industrial Advisory Board for this degree program.

Our Dean of Engineering provided approximately $60,000 + to support faculty to develop courses for the statewide master's program in the summer of 1998 and will do so again in 1999.

More information can be obtained at their Web site:

http://triuniv.engr.arizona.edu

VI.   Some Other Related University Activities

Another university initiative provides funds from the Provost's office to explore potentially expandable (and largely self-supporting) projects. A group from CEAS, Liberal Arts and Science, Education, Extended Education and Public Programs submitted a comprehensive proposal for a "Multidisciplinary Initiative on Distance Learning (MIDL): Multidisciplinary Research on the Next Generation Multimedia Technologies for Interactive Distributed Learning." It was funded for three years (1997-2000) and is led by Professor Andreas Spanias. It primarily funds graduate students to work with faculty on a variety of projects. Some activities in their second year report[4] included seminars on:

- Internet and Higher Education – Silicon and Fiber Replacing Bricks and Mortar by Professor Burks Oakley from the University of Illinois – Urbana-Champaign

- Applications of JAVA and HTML in Courses

- Visual Computing and Communications for Distance Learning

Other seminars, projects, publications and activities have also resulted. Further information is available on their web site at:

www.eas.asu.edu/~midle

VII.   Some Lessons Learned

So what does all this "activity" mean? Perhaps it would be helpful to share some of what we have learned so as to possibly help others. In no particular order of importance they include:

- While sometimes overlapping, it is better to have several loosely coordinated efforts with many champions rather than a bureaucratic system and "czar" centrally directing such program efforts.

- It takes considerable time and effort to develop on-line courses. A model of "one month summer salary" seems to be a bare minimum. Faculty also vary widely in their computer skills and this can impact greatly the time and effort needed.

- Faculty should "share" in the ownership of courses with the university. Royalties is a promising alternative. However, with constantly advancing technologies, the "shelf-life" of almost all engineering on-line courses would appear to be so short as to limit long-term use. (We are still in the process of developing policies for this area.)

- The size of the market for credit courses and degrees is still far from determined. It is doubtful that all 300+ US engineering colleges need to be doing this.

- Whether students can learn "better" on-line (certainly some do) is yet to be demonstrated.

- Whether on-line courses are truly cost effective (in engineering anyway) has yet to be determined – especially if total costs are included.

However, it seems reasonably clear that this is going to be a major part of future distance education offerings and we hope to play an appropriate role in this area.

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