

An Electronic Forum and Workshop for Design and Manufacturing Education

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Abstract

In this paper we discuss the development of an Internet-based Electronic Forum and Workshop for Design and Manufacturing Education. The system will utilize the world wide web and multimedia resources to organize and focus the growing body of research data, information and materials created by educators and industry professionals. The wide spread availability of the WWW and new technologies for collaboration and electronically-mediated interaction will provide new opportunities for expanding interaction among the community of design and manufacturing educators, industry and our students.

1 Introduction

Engineering educators face a set of challenges that parallel those confronting industry and business: retaining competence (competitiveness) within our disciplines, incorporating new technology in our courses while anticipating and responding to the needs of industry with new materials in the same manner and timeframe as industry must respond to their customers for goods and services. Just as industry has adopted a collaborative model to adequately respond to the challenges of business, so must we as educators find fitting means to address the needs of our customers and absorb the expanding knowledge created by our various disciplines.

Traditional mechanisms such as workshops and conferences have served well when we had the time and resources to meet and exchange information. But today we find less time to attend appropriate meetings, and our conferences, workshops and forum are more internationally distributed as engineering education becomes a competitive goal for many newly industrialized economies. One result is that faculty have even less chance of participating as the costs and time commitment increase and the participants are scattered globally across many meetings instead

only one or two. Somehow we must expand the opportunities we have for interacting with more of our colleagues, while reducing the costs associated with the historical mode we have adopted.

Furthermore, so much of the educational materials and resources we are creating in response to the demands articulated by industry, our students and society also require a substantial investment of our time and financials. We need to pool our efforts, to work collaboratively in that same manner as we teach our student engineers they must work when employed by companies developing products and providing services to their customers.

2 The Internet as Infrastructure for Educators

One means of supporting this effort is the Internet and the WWW (world wide web). The project we report on in this paper, which was recently funded by the National Science Foundation, is to create an electronic infrastructure to support design and manufacturing educators. This framework will provide a mechanism by which the many computer-based resources already created can become accessible to an expanded, global community. It will be a place where developers of new educational materials, case studies, databases and applicable knowledge resources may immediately obtain feedback on new contributions and education methodologies. A network-centric approach will help ensure that those materials are more widely accessible and interactive aspects of the forum and workshop system will provide opportunities to investigate innovative means for expanded dialogue and interaction among engineering and business professionals, faculty and students. We call the collection of computer-based information resources and the dynamic involvement of faculty, students and industry the Electronic Forum and Workshop for Design and Manufacturing Education.

The Forum will also be a place where faculty, students and industry can organize and coordinate a wide variety of collaborative activities, develop and exchange course materials, and share resources and information that will enrich the engineering educational experience. The electronically publishable results of the many TRP/MET¹ partnerships will provide initial content and motivation for organizing electronic workshops. These resources will be expanded and encompass a broad spectrum of completed works from those involved and interested in manufacturing education.

The design, development and conduct of an electronic community provide a unique research opportunity for faculty and students, and a major objective is to ensure that knowledge about development and conduct of electronic forums is broadly available to individuals or groups wishing to establish similar kinds of communication infrastructures. Although the Electronic Forum and Workshop will be developed for initial use by the engineering community concerned with design and manufacturing education issues, the software, data structures, tools and operational guidelines for operation of the system will be designed in a content-neutral manner. By changing appropriate configuration parameters, other disciplines and groups will be able to deploy an instance of the Electronic Forum and Workshop Framework to support their unique

¹ Technology Reinvestment Program/ Manufacturing Engineering Training

network-mediated dialogue and seminars and create specialized databases and rich subject-specific resources for sharing and exchanging within their community of interest.

3 Objectives of the Forum and Workshop

Organizing and constructing a repository of information and resources for design and manufacturing educators will provide the core around which the long term, and what we believe will be the most influential, goal of the project will be undertaken: creating a forum, a public meeting place for open and on-going discussions of issues important to those involved in education and employment of manufacturing and design engineers. Research we are conducting in parallel with the construction of the Forum and Workshop will help us gain a better understanding of how these technologies can be used most effectively to expand and extend collaborative efforts of faculty, industry and students. Our mission is to create an infrastructure for collaboration. We have identified three primary objectives for the Forum and Workshop:

3.1 Capture, organize and distribute the results of the Technology Reinvestment Program.

Through the Manufacturing Engineering Training (MET) program, the Technology Reinvestment Program (TRP) has provided funding to several partnerships of educational institutions to improve undergraduate Design and Manufacturing education. Many innovative approaches to teaching design and manufacturing were implemented at the partner schools, and opportunities for dialogue among the education and industrial communities was greatly expanded. At the conclusion of most projects, substantial efforts was made by each partnership to broadly distribute the results of their work. Unfortunately, there has been no concerted effort to organize across the many contributions resulting from the TRP/MET nor to expand the dialogues established among educators and industrial partners within the various activities. Furthermore, there are many other organizations and research groups involved in the improvement of the educational experiences and foundations of manufacturing education at the undergraduate and graduate levels. These also need to be identified and linked to effectively share knowledge, expertise and experience.

The Technology Reinvestment Program participants and their repository of accomplished work can become the basis for this new kind of organization. The Electronic Forum and Workshop will not only encourage and facilitate the continued interaction of the TRP/MET participants, but will also attract new members and stimulate a much greater interaction among the broad community of educators, researchers, students and industries concerned with design and manufacturing education.

3.2 Develop a better understanding of how the Internet can be used to facilitate interaction among educators, students and industrial firms.

The Forum can become a focal point for collaborative educational activities among universities and industrial partners. While the interaction of industry and universities has been positive, one of the difficulties has been the synchronous nature of the interactions; most were at planned meetings on the university campus, although some partnerships did visit industrial partner sites.

Often business commitments and scheduling conflicts prevented the kind of extended participation which would most benefit students. These interactions with manufacturing partners were successful, but we believe there is a much greater potential for interaction if industry and universities were able to adopt an asynchronous approach that does not require co-located meetings and travel. The Internet is the infrastructure for these kinds of interactions and the Electronic Forum and Workshop will provide the suite of facilities to accomplish a substantially broadened contact and exchange among engineering educators, students and manufacturing organizations.

For example, one of the problems confronting engineering educators is obtaining realistic data about product design and manufacturing. If a professor in an engineering college wanted to add a benchmarking module to a class in product design, they could search the web site databases to discover other faculty-developed classroom/laboratory course content relating to benchmarking. This would help the students understand the purpose and methodology of benchmarking. Using other Internet tools, they could solicit case studies and examples from several companies in order to compare and contrast benchmarking activities within different organizations.

We recognize that there are proprietary and competitive issues that might limit the type and amount of information that firms could provide. However, the opportunity to draw upon actual industrial problems and their resolution will certainly help bring a more realistic, and timely, depiction of engineering problems and their real world resolution to students and faculty.

3.3 Improve curriculum development and delivery for undergraduate and graduate levels.

The Forum will be a place where faculty, students and industry can organize and coordinate a wide range of activities. Opportunities we foresee as a result of web-mediated interaction include formation of special interest groups, on-line conferences, peer-reviewed white papers, focused group discussions, and shared student projects among different schools. In direct support of curriculum development we anticipate the creation of course content databases, a catalogue of design and manufacturing case studies, and other resources that will enhance the timely development and delivery of engineering related materials.

A major objective is to ensure that knowledge about development and conduct of electronic forums is broadly available to individuals or groups wishing to establish similar kinds of communications infrastructures. We will use the online mechanisms of the Forum to capture and document the issues and dynamics reflecting the evolution of the Forum concept as we move through the design, development, deployment and operational stages of the project. All software designed for the Forum project as well as configuration guidelines for constructing identical structures-- what we might call a forum-shell-- will also be provided in an online manner throughout the three year project.

At the University of Washington, we intend to use the forum-shell as a coordinating, reporting and documenting mechanism for undergraduate engineering design and manufacturing-related classes. Student teams are almost always required to create design documents and other artifacts as their projects progress through the semester. In this case, an instance of the Electronic Forum

will be the mechanism for capturing and organizing the team project deliverables. Students (and faculty) will populate a forum shell with assignments, course notes, design documents, databases, and other items created during the class project. The instructors will also use the Forum as the basis for periodic evaluation of the student team efforts. Since the projects will be online and accessible from any point on the Internet, we intend to involve senior engineering executives in the review and evaluation of student projects. We believe that the involvement of industry will create a substantially richer reflection of the challenges the students will confront as practicing engineers.

4 Organization and Management

Faculty, students and industrial partners that it will serve will guide the planning and development of the Electronic Forum and Workshop for Design and Manufacturing Education. It is critical, therefore, that guidance from those constituencies is solicited in the early stages of development. A Planning Workshop will meet at the University of Washington in Seattle, Washington in April of 1998 to help define the mechanisms needed to electronically organize and access materials and other items created as a consequence of the TRP/MET funded efforts.

The objective of the Planning Workshop is to bring together a core group of 15-18 representatives of the major TRP/MET partnerships that have an interest in continuing the interaction and exchange of data, course materials and results obtained during the TRP efforts. The Planning Workshop will also involve groups that have already undertaken activities similar in concept to the project proposed here. While a primary concern of the workshop will be integrating the results of the TRP/MET projects, the participants will also be charged with identifying innovative and effective Internet-based activities that can facilitate an expanded interaction of the academic and industrial design and manufacturing communities. Furthermore, the Planning Workshop participants will collaboratively establish the long term structure and parameters of the Electronic Forum and Workshop for Design and Manufacturing Education and the metrics for its on-going qualitative and quantitative evaluation and assessment.

5 Current Status

The Electronic Forum and Workshop is still in the initial planning stages, since funds from the National Science Foundation were only recently awarded. We have, however, acquired a large server computer system that will be devoted to the project, and several prototype services are under development to demonstrate state of the market web technologies (streaming audio and video). An initial prototype web site for the Electronic Forum and Workshop is scheduled to be operational by February 1998.

The current URL for the Electronic Forum and Workshop is <http://weber.u.washington.edu/dmef/>. We encourage ASEE members to review the work we have accomplished thus far, and to participate in the online discussion groups that have been established.

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