National Information and Materials Resources for Manufacturing and Engineering Technology Education

Monica Pfarr
National Center for Manufacturing Education (NCME)
Sinclair Community College
University of Dayton
Dayton, Ohio

Jack Waintraub
New Jersey Center for Advanced Technological Education (NJCATE)
Middlesex County College
Edison, New Jersey

Elaine Craft
South Carolina Advanced Technological Education Center (SC ATE)
Florence-Darlington College
Florence-Darlington, South Carolina

Abstract

Two-year college educators have shown strong interest in upgrading content and pedagogy for their curricula and individual courses. This paper describes several methods of providing these educators with information and materials resources from which to obtain useful approaches and specific teaching materials. The use of these resources avoids much of the initial effort in creating revised curricula and informs the educators about novel materials available from other sources. The primary focus of this paper is on the products and services of three national resource centers for advanced technological education funded by the National Science Foundation who have developed information clearinghouses.

Need for National Resource Centers in Engineering Technology Education

It is imperative for educators in engineering technology and engineering to stay current in their fields and to implement novel pedagogies that have been proven to enhance student learning. The future of our country depends heavily on the availability of highly skilled professionals, technicians, and production associates who are able to respond to rapidly changing technology, ever increasing customer expectations, and fierce global competition.

Many resources exist to assist engineering technology educators in creating effective curricula, courses, and learning activities. However, it is difficult for educators to become knowledgeable about what is available, how to access it, and how to put it into action in their own programs. Many fine projects funded by the National Science Foundation and others have produced

exemplary materials, but they have difficulty disseminating them to potential users around the country.

To ensure that the innovations in the forefront of engineering technology are more widely known and adopted, the National Science Foundation has funded three national resource centers: the Manufacturing Education Resource Center (MERC); the National Engineering Technology Education Clearinghouse (NETEC); and the South Carolina Advanced Technological Education Center (SC ATE)[1]. These centers provide an extensive body of engineering technology education-related materials through a variety of services. This paper will introduce these three resource centers.

Overview of the Manufacturing Education Resource Center (MERC)

The Manufacturing Education Resource Center (MERC) was initiated by the National Center for Manufacturing Education (NCME) in July 2003 with funding from the Advanced Technological Education program of the National Science Foundation, building on eight years of successful innovation in instructional materials development. The NCME is located in Dayton, Ohio and administered jointly by Sinclair Community College and the University of Dayton. MERC is dedicated to identifying, evaluating, collecting, and disseminating exemplary materials in manufacturing education.

Services Provided by MERC

The resource center offers a variety of services to manufacturing educators, including:

- An extensive, Internet-based clearinghouse database of information pertinent to manufacturing education obtained from numerous sources such as NSF centers and projects, other academic institutions, industry, and vendors of equipment and software
- Database search capability
- Preparation of custom searches to provide electronic compilations of materials on a specific subject
- Consulting on implementing novel curriculum materials and pedagogies in manufacturing education
- Internet-based symposia on selected topics highlighting emerging technologies

Instructional materials in the database are categorized, making key word searches simpler. The primary classifications of materials included in the clearinghouse are:

1. Manufacturing processes
2. Materials technology
3. Automation systems
4. Quality management
5. Design for manufacturing
6. Production and inventory control
7. Manufacturing of electronic products
8. Manufacturing enterprise management

9. Manufacturing information systems
10. Technical mathematics
11. Technical science
12. Plant engineering and facilities management
13. Safety, industrial hygiene and environmental management
14. Manufacturing curriculum, instructional design and novel pedagogies

In addition, the materials are classified according to type and format such as instructional module, learning object, CD-ROM, video, PowerPoint slides, etc.

MERC is offering a series of web seminars on emerging manufacturing topics beginning in early 2005. Recognized experts in selected fields will lead the seminars and provide plenary presentations that give overviews of the state of the art and future potential for the technology being discussed. Interactions among the participants and with the featured speaker will be a part of each web seminar.

MERC, through NCME and its partners, provides a broad spectrum of workshops and customized educational services for both academic institutions and industry clients. Mentoring is available for improving manufacturing programs as well as implementing manufacturing related programs within an institution.

Overview of National Engineering Technology Education Clearinghouse (NETEC)

The National Engineering Technology Education Clearinghouse (NETEC) was initiated by the New Jersey Center for Advanced Technological Education (NJCATE) in June 2003 with funding from the Advanced Technological Education program of the National Science Foundation, building on eight years of serving as a catalyst and resource for technological education. NJCATE is located in Edison, New Jersey and operated by Middlesex County College.

Services Provided by NETEC

NETEC has two primary components: an online digital library for rapid, accessible dissemination of print and electronic resources, and in-person assistance delivered via individual mentoring and group professional development. The combination of electronic, on-demand information, discussion, and links to resources, with the opportunity for in-person assistance, either through meetings or individually, encourages individuals and institutions to participate more fully in the improvement of engineering technology education.

Via the NETEC electronic database, users are able to access a rich array of curricula and materials developed. Resources include:

- Bibliographies
- Curriculum materials, syllabi
- Evaluation studies
- Feasibility studies
- Strategies and programs for recruitment and retention of students, with an emphasis on students from underrepresented populations
- Instructional materials, teaching guides

- Manuals, resource guides
- Conference papers, position papers, monographs, etc.
- Research/technical reports
- Technical and employability skills standards
- Degree and certificate program listings, articulation data

Some of the materials are directly available at the NETEC site. In some cases, links are provided to the projects themselves, and in other cases, materials may be purchased for a fee. The method of distribution is determined through negotiation with the creators.

Clearinghouse users are also provided with links to a wealth of other ATE and engineering technology education resources.

The NETEC forum is a place where all NETEC users may come together and become a true virtual community. Discussions in the forum are opportunities for the ET community to communicate, collaborate, or simply exchange ideas. All discussions will be moderated by ET experts, who can help to steer the conversations in productive directions, as well as guard the forum against spam and other abuse.

The NETEC careers section allows registered users to submit job and/or internship opportunities, skill sets, etc. Users may then search these listings to find opportunities that suit them. All postings are removed after 30 days, ensuring that the opportunities are up-to-date and current.

NETEC will host workshops and institutes nationally at NJCATE and partner sites on specific topics of interest and will match institutions and individuals with experts and mentors who can assist with adaptation of program innovations.

Overview of the National Resource Center for Engineering Technology Education (SC ATE)

The South Carolina Advanced Technological Education Center **(**SC ATE) is now serving as a National Resource Center for Engineering Technology (ET) education with funding from the National Science Foundation. SC ATE is located in South Carolina and is building upon years of service to the two-year college community.

Services provided by SC ATE

The SC ATE Center of Excellence and National Resource Center for Engineering Technology Education offers many resources that are available to assist colleges with the improvement of associate degree engineering technology programs. Resources include curriculum products, recruitment strategies, a workplace research model, peer mentoring for project or curriculum implementation, assistance with soliciting grants, and project evaluation. A project website also posts an up-to-date listing of professional development events being provided by other ATE-funded projects. These activities are generally subsidized by the grantee and thus are very affordable.

SC ATE has taken a research-based, faculty-lead approach to curriculum development. The result is the Technology Gateway, a pre-engineering technology curriculum, and an ET Core curriculum, a general education/introduction-to-technology curriculum for all engineering technology majors. By embedding improved teaching methodologies and retention strategies into the structure and delivery of the SC ATE curriculum, retention rates have improved. Special training is available for ATE teaching teams to prepare these instructors to deliver the SC ATE curriculum components.

SC ATE has published research on student retention in engineering technology. *Monograph: Recruitment & Retention of Engineering Technology Students* (2000) is available on the SC ATE website. In addition, two special recruitment strategies have been developed, one through the ATE Scholars initiative and the other is the ET Career Ambassador program.

The SC ATE designed workplace research activity helps instructors, particularly those from general education, understand what students really need to know and be able to do in the workplace. The activity is designed to be done by interdisciplinary teams and is useful for helping instructors prioritize instruction. Faculty report that after completing this research activity, they can focus on the more valuable skills and knowledge and spend less time on content that is not critical for student success.

Colleges wanting to adapt and implement any component of the work done by SC ATE can take advantage of peer mentoring at every level: college president-to-college president, chief academic officer-to-chief academic officer, or faculty-to-faculty. In addition, the SC ATE staff will provide guidance in soliciting grants from the ATE program (for adaptation and implementation of SC ATE models) and can even provide assistance with project evaluation.

Conclusion

The National Science Foundation's national resource centers exist to help others in finding resources that can significantly impact the improvement of engineering technology education. From clearinghouses of materials to mentoring and assistance, the national resource centers are dedicated to serving the two-year college community. Please visit our websites for additional information, www.ncmeresource.org, www.neteconline.org, and www.scate.org .

Endnotes

[1] MERC, NETEC and SC ATE are in part supported by the National Science Foundation. Any opinions, findings, and conclusions or recommendations expressed in this paper are those of the author and do not necessarily reflect the views of the National Science Foundation.

MONICA A. PFARR is the director of the National Center for Manufacturing Education in Dayton, Ohio, jointly administered by Sinclair Community College and the University of Dayton. She earned a Bachelor of Science in Industrial Engineering from Ohio State University and a Master of Science in Administration from Central Michigan University. She is a Certified Quality Engineer and a member of ASEE. Her 12 years of industrial experience include several positions in industrial engineering and production supervision with General Motors Corporation.

JACK L. WAINTRAUB is Professor and Chairman of the Electrical Engineering Technology Department at Middlesex County College, Edison, NJ. He currently also serves as the Executive Director of NJCATE—a National Center for Advanced Technological Education. He holds a Master of Science in Electrical Engineering from Rutgers University and is a licensed Professional Engineer. He is also the author of several textbooks in Electrical

Engineering Technology. In the past, he was a member of the Education Activities Board of IEEE and served as a Program Director at the NSF during 1993-1994 in the Division of Undergraduate Education. He served as a member of the TAC/ABET Executive Committee. Professor Waintraub is the 2002 recipient of the Fredrick J. Berger Award for Excellence in Engineering Technology Education. He is a senior member of IEEE and a member of ASEE.

ELAINE L. CRAFT is Director of the SC ATE Center for Excellence and National Resource Center for Engineering Technology Education with offices at Florence-Darlington Technical College, P.O. Box 100548, Florence, SC 29501. She holds a Bachelor of Science degree in Chemical Engineering and Master of Science degree in Business Administration and is a member of ASEE.