Industrial Partnership for the Enhancement of Engineering Technology Education

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Abstract

Preparing and increasing the number of technology students in order to meet demands in the 21st century through industry-based case studies curriculum development approach is one of the goals of a two-year National Science Foundation, NSF, grant titled "Tennessee Exemplary Faculty for Advanced Technology Education, TEFATE." A coalition of five teams, each is hosted by a two-year technical college and includes university, high school, and industry partners. In addition to the PI and industry partners, each team includes faculty with specialties in engineering, computer, math, basic science, English, and business. Throughout the grant period, the team members attended various workshops, seminars, and discussion groups emphasizing the importance of industry-based case study approach in technology education. Industrial site visits and internships were also used to familiarize the faculty with the technical need of major area industries as well as to identify potential problems for technical case studies. The grant has resulted in twenty five cases that were prepared and now are being tested by the participating as well as other institutions. These cases provide the student with exciting work-based problems using up-to-date applications, as well as build the foundation knowledge in technology, mathematics, science, and communication. The grant has paved the way to a three-year extension by NSF titled "South East Advanced Technological Education Consortium." The author is a member of the TEFATE teams and his experience is described here.

I. Introduction

The fast introduction of new technology in the workplace has greatly affected the daily operation of most industrial institutions. Automation, telecommunication, and computer applications have resulted in higher efficiency, reliability, and/or lower production cost. In face of this fact, however, companies currently encounter a new challenge: stay technologically current or risk falling behind the competition! A recent study by The US Department of Commerce indicated the following: firms that do not use advanced technology are less productive, pay lower wages, and offer less job security than similar firms that do. On the other hand, the implementation of new technology is often slowed down by the unavailability of skilled workers. This was expressed in letters of support by various officials form major area companies such as BellSouth, Xerox, Time-Warner Cable, Eastman Chemical, NORTEL, Phillips Consumer Electronics, Fujitsu Business Communication Systems, MCI, Technology 2020, Genesis Communication, and The Bevill Center for Advanced Manufacturing Technology.

Therefore, it is essential, particularly in small or medium size companies, that entry-level technical employees possess the required skills in order to be productive as soon as they join the

workforce. Moreover, almost all companies are now faced with the burden of continually training their employees in order to keep up with the rapidly changing technology and the need for qualified technical personnel will continually grow.

One of the fastest growing and rapidly changing technical fields is the telecommunication industry. This includes the software/hardware involved in the sending, transmitting, and receiving voice, data, and video information. New applications, such as e-mail, the Internet, and microcomputer applications, are becoming essential for everyday's business needs even in small companies. Yet, higher education has not being able to address the growing demands for technologists and engineers in this ever-growing field; in part because education, by nature, is a slow changing environment. As a consequence, We often find that the faculty technical knowledge and the course contents lag behind emerging technologies.

II. Proposed Solution

In order to address the increasing demand for a skilled workforce by the telecommunication industry, "a process was needed for the development and dissemination of a technology-based communications education curriculum which is both readily accessible and responsive to innovation and industry needs." As a result, a coalition of five tow-year technical colleges in Tennessee with representatives from four-year universities, secondary schools, business and industry, and government institutions in Tennessee, Kentucky, Georgia, and Alabama was formed in order to plan a solution. A grant proposal, titled "Tennessee Exemplary Faculty for Advanced Technology Education," was prepared, submitted, and ultimately funded by NSF for two years at a budget of $449,594. The primary objective of which is: developing a group of faculty who will provide leadership in curriculum development in emerging technology fields, such as telecommunication, by:

1. Understanding curriculum development techniques and practices.
2. Gaining an appreciation and understanding of the telecommunication industry and how this technology is used throughout area industry.
3. Developing an understanding of the cross-disciplinary needs through successful team strategies.

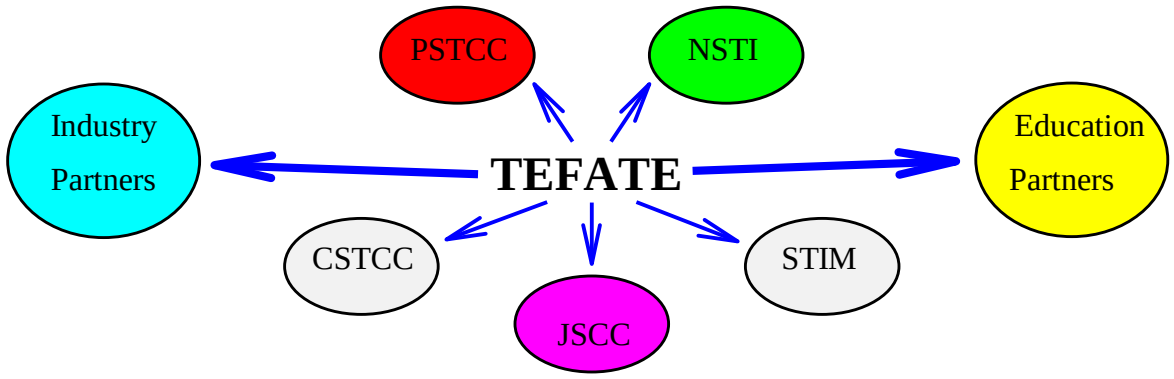
Activities to accomplish this objective will provide faculty with experience in interdisciplinary team building, leadership, and cooperative learning while exposing them to telecommunication technologies. This will result in implementing a new curriculum that is responsive and accessible to industrial requirements and demands.

A secondary objective of the grant is the compilation and dissemination of a defined curriculum development for telecommunication technology education and gained information about industrial experiences. This will allow the student to link his/her learning experience to future workplace. The curriculum framework developed by the teams will include outcomes and competencies that address the changing needs of the workplace and will be valuable for building new programs or reforming existing programs. Industrial site visits and internships will provide the faculty with experience in the real workplace environments that will ultimately result in

building relevant learning experiences for technology students. Finally, the participation of industry representatives on each team, in addition to site visits and internships, will establish a continuous dialogue and interaction between education and industry even after the project funding has ended. This will also enable faculty to better understand emerging technology.

Strategies to achieve these objectives include:

1. The organization of five development teams which include a two-year college faculty from technology, English, science and mathematics, a secondary school faculty, a university technology faculty, and an industry partner (Fig. 1). In addition, the project has a director, evaluators, five principal investigators at the two-year colleges, and a five-member advisory committee that will provide advice and guidance to the management team and will become a vehicle for disseminating the project outcomes.
2. Professional development activities to focus on team strategies and curriculum development.
3. Technical workshops conducted by industry partners and experts in various educational fields.
4. Industry site visits.
5. Faculty internships in industry.
6. Development and dissemination of a curriculum framework, a guidebook for faculty internships, and a set of case studies to be used in the classroom.



TN Two Year Colleges
PSTCC - Pellissippi State
NSTI - Nashville State
CSTCC - Chattanooga State
JSCC - Jackson State
STIM - State Tech Memphis

Business Partners
Sprint
Oak Ridge National Lab
MCI Telecommunication
NORTEL
TVA
FED EX
Time-Warner Cable
Technology 2020
Alumax
Colombia/Healthcare
Cinetel

Education Partners
Middle Tennessee State University
East Tennessee State University
University of Memphis
Murray State University
Alabama A&M
Southern College of Tech.
Memphis City Schools
Jackson-Madison County Schools
Farragut High School
Red Bank High School
Hillwood High School

Figure 1. TEFATE Teams and Their Partners.

III. Summary of Activities

Several major activities throughout the grant period (September 1996-1998) were accomplished. Year one activities were focused on leadership, team building, learning the technology, defining core components of telecommunication technology curriculum, and piloting the internship experience. Year two activities were focused on the curriculum development process, planning for the internship experiences, the internship work experience, and developing core components and a curriculum framework for a telecommunication technology program.

1. Industry Site Visits

Teams visited various industrial sites where telecommunication applications are used. These visits helped the teams gain an understanding of how their various disciplines are integrated into the workplace. An industry visit questionnaire was developed to assure completeness and coherence of relevant data gathered form each site visit. Some site visits were made a team or two and some by members of several teams. Visits were made to the following industry sites:

- **Sprint** – one of the largest providers of local and wireless telephone as well as telecommunication services.
- **Cinetel** – is the home of HGTV and provides production services in post, field, studio, graphics, animation, and music composition.
- **DTI** – a manufacturing company that designs and constructs digital telephony switches.
- **Genesis** – a company that refurbishes Mitel communication equipment used in hotels and hospitals.
- **NORTEL** – a leading global provider of digital network services.
- **MCI** – one of the largest providers of telecommunication services.
- **TVA** – the nation's largest electricity producer and is a regional economic developer.
- **Saturn Corporation** – a GM company that produces the Saturn automobile.
- **Tech 2020** – a telecommunication solution provider that helps business, industry, and government meet their customers needs.
- **Oak Ridge National laboratory** – the largest multi-program DOE laboratory.
- **Virginia Tech.** – a pioneer in educational curriculum development and delivery techniques.
- **Alumax** – a fully integrated aluminum producer and a fortune 200 company with worldwide facilities.
- **Dupont** – with about 175 manufacturing and processing facilities in 70 countries, is one of the oldest continuously operating industrial enterprises in the world.
- **Olan Mills** – the world's leading producer of family portraits.
- **Willis Corroon** – a worldwide knowledge-based company providing specialized consulting services.
- **National Bank of Commerce** – ranked one of the highest performance banking institutions in the US.
- **Cable 19 TV (Memphis)** – offers a variety of courses to high school students and carries the Discovery Channel.

The industrial partners were as follows: Sprint and Tech 2020, PSTCC team; Nortel, NTSI team; TVA, CSTCC team; Alumax, JSCC team; and MCI and Time-Warner Cable, STIM.

2. Faculty Internship in Industry

The mission of the TEFATE internship program was to assist in faculty development and to prepare the faculty to utilize team-oriented and cross-disciplinary approach to curriculum development and delivery. In this manner, faculty internships served both the academic and the business communities by producing students that are better prepared for today's industrial challenges. First year pilot internships allowed the project staff to identify successful techniques in developing and managing internship activities as well as challenges. Over twenty four company-sponsored internships were conducted over the two year grant period. A comprehensive document outlining the internship process and benefits, suggested before, during, and after internships activities, and ways to assess internships is available from the South East Advanced Technological Education Consortium, SEATEC, website: http://nsti.tec.tn.us/SEATEC. For his internship, the author worked with engineers from Square D, Power Logic Group in LaVergne, Tennessee.

3. Curriculum Development Workshops

The TEFATE team members attended a variety of workshops, training sessions, and discussion groups. The workshops were focused on team building, leadership training, critical thinking, case study development and implementation, curriculum development, and using cooperative learning in technology education. The training sessions were primarily focused on learning various software and hardware applications in course delivery both in the classroom and over the Internet. The use of new teaching tools (software and hardware) and new teaching techniques was also discussed.

4. Defining Competencies

As an activity of the TEFATE project, a comprehensive DACUM (Develop a Curriculum) study was conducted in order to develop a list of core tasks and skills for Network Specialist / Telecommunications Technicians. Two DACUM facilitators, Lisa Bogaty and Le Duckwoth, who were also team members gathered data from business partners and through focus groups held on each of the five colleges. The result from each study was a DACUM chart that includes a matrix of duties and tasks and the required knowledge/skills, tools/equipment/supplies, and worker traits/ behaviors. Three new DACUM facilitators, including the author, were also trained and certified by this process. The results were analyzed and compared with the tasks for the network specialist job identified by the Northwest Center for Emerging Technologies Regional ATE consortium. The result of the two studies was a developed extensive list of tasks from all data sources. The list can be obtained from the SEATEC website: http://nsti.tec.tn.us/SEATEC.

5. Case Studies

The participating faculty have recognized in the early stage of this project that a novel method of teaching technical contents in the classroom was needed. The use of case study and cooperative learning style were identified as new and useful ways to teach and supplement technology education. After attending various workshops, brainstorming sessions, and focus groups, it was clear that each case study should have five components:

- A set, to get the reader's attention.
- A background narrative, to provide a historical and real world workplace context.
- A problem, which can be small and very specific or large and general.
- Questions, to provoke critical thinking and guide the analysis.
- Finally, an instructor's guide, to provide comprehensive support including instructional strategies, possible solutions, alternative problems, and any other related materials .

Twenty five case studies were developed by the five teams and they are now being edited, reviewed, revised, and tested at all participation institutions as well as others. These cases can be obtained from the SEATEC website: http://nsti.tec.tn.us/SEATEC.

6. Project Assessment

Internal and external evaluation of the project clearly indicated that the TEFATE project provided significant and meaningful opportunities for faculty development. Several major outcomes have resulted. These include: twenty five work-based case studies, an extensive DACUM chart for network/telecommunication specialists, and the Internship Guidelines.

IV. The Next Step

A three year NSF proposal titled "The South-East Advanced Technological Education Consortium" was prepared, submitted, and funded (about $1.6 million) by NSF. The SEATEC project goals are:

1. To provide national leadership for the development and implementation of case-based instruction for technological education.
2. To provide opportunities for continuous and appropriate professional development of participating faculty.
3. To assess the effectiveness of the case study approach to teaching technology-related material in classroom.
4. To nationally disseminate information related to SEATEC activities, materials, and results, including outcomes of the use of case studies in field-test setting.

V. Summary

Industry/business partnership with higher education institutions will benefit both systems by training faculty to identify technical needs, upgrading curriculum to meet those needs,

producing work-based real problems that use cooperative learning and team building concepts, improve student verbal and written communication sills, and ultimately producing better prepared graduates that will meet today's emerging technological challenges.

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