

Improving Student Learning and Retention in Technology Programs Using Industry-Based Case Studies

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Abstract

The main objectives of the three-year NSF-funded grant entitled “The South East Advanced Technological Education Consortium, SEATEC,” are to train faculty to identify and address the technical needs of area industry, upgrade curriculum to meet these needs, produce industry-based case study models that apply active collaborative learning, improve student oral and written communication skills, and ultimately produce better prepared graduates that will meet challenges in today’s global economy. This paper describes some of the activities of the SEATEC grant and provides a summary of its very promising outcomes that may revolutionize engineering and technology education at 2- and 4-year institutions and increase student interests in pursuing these programs. The SEATEC consortium is a collaborative effort of five different teams across Tennessee. Each team is based at a two-year technical college and includes multi-disciplinary college faculties, industry partners, university partners, and high school tech-prep teachers. The unique partnership with the industry along with the rigorous training of the participating faculty have produced industry-based case-study models that are interdisciplinary, multi-media enhanced, open-ended, and use active collaborative learning. The current paper provides a brief account of the various curriculum development activities throughout the SEATEC project.

I. Introduction

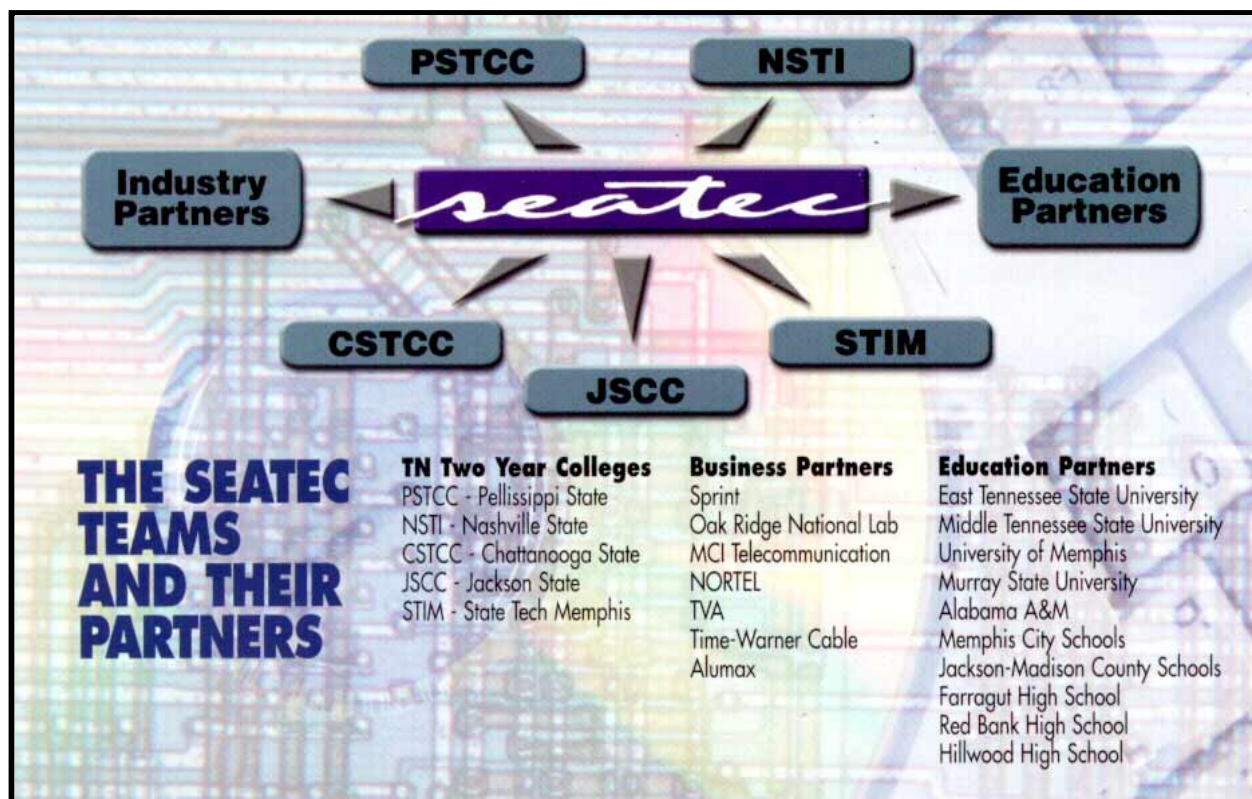
The SEATEC grant is a continuation of an earlier two-year NSF-funded grant entitled “Tennessee Exemplary Faculty for Advanced Technology Education, TEFATE.” The purpose of the coalition was to develop a group of faculty who would provide leadership in curriculum development and delivery in emerging technologies. Several major outcomes of the TEFATE grant will positively impact engineering technology education in general and will significantly improve technology programs at the participating institutions in particular. These outcomes are now being tested for dissemination nationally and worldwide and are available at the SEATEC website <http://www.nsti.tec.tn.us/SEATEC>. These include:

1. The development of twenty-five work-based case studies in the areas of telecommunication, computer networking, and network administration.
2. A comprehensive Internship Guide that helps faculty in other institutions in planning, applying, and using industrial internship experiences effectively in the classroom.
3. A comprehensive Faculty Development Guide that provides a model and the steps necessary for the personal development of any technology or engineering faculty.

The current SEATEC grant builds on the success of the TEFATE approach to curriculum development, which involved direct industrial cooperation and partnership, by expanding the

scope of the case study approach to include all technical fields. The NSF-funded consortium (\$1.8 million) is composed of five two-year technical colleges with representatives from four-year universities, secondary schools, business and industry, and government institutions in Tennessee, Kentucky, and Alabama (Figure 1). The three-year grant has the following goals:

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



II. Curriculum Development Using Industry-Based Case-Study Approach

Case studies have been proven to be effective teaching tools in many fields ranging from business and finance to medical. Case studies are usually based on real-world problems that students can easily identify with and allow them to use their critical thinking and logic reasoning abilities. Collaborative education and team building concept can be used effectively in a case-study environment. The use of the sciences, mathematics, technical writing, and oral

communication knowledge as well as the SCANS 2000 skills and competencies can be integrated easily in case studies. Finally, case studies can make classroom learning an enjoyable experience. The use of case studies in technical education, however, has been somewhat limited. Recently and after recognizing the importance of case studies, engineering and technology educators are trying to follow their counterparts in other fields. As a result, there is a growing need and interests in work-based case studies for engineering and technology education.

III. SEATEC Partnership with Industry

The SEATEC faculty used the following methods to identify competencies and skills required by area industry:

1. Industrial Site Visits: Each team visited over 15 industrial sites. Team members identified the technical skills needed by observing the operational activities at each site and by continuous discussions with the technical and managerial staff of each company. These visits helped the teams gain the essential understanding of how their various disciplines are integrated into the workplace. An industry visit questionnaire was also developed in order to assure completeness and coherence of relevant data gathered from each site visit.
2. Faculty Internships: The mission of the TEFATE and SEATEC internship programs is to assist in faculty development and to prepare each faculty to utilize team-oriented and cross-disciplinary approach to curriculum development and delivery. Piloted internships allowed the faculty to identify successful techniques in developing and managing the internship activities as well as challenges.
3. Conducting DACUM (Develop a Curriculum) Studies: Several DACUM studies (<http://www.uis.edu/~iscc/dacum.html>) were conducted in order to develop a list of core tasks and skills for a specific field. Panels of experts from several regional and national industries identified the competencies and skills needed from current and future employees. 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.
4. Industrial Partnership: Each team has two or more industrial partners that provide continuous support and consultation as well as direct involvements in curriculum development.

IV. Multimedia Enhanced Case Studies

SEATEC faculties have found that case-based instruction in technology education is a great way to involve all student-learning styles in a classroom experience. Case studies, especially the multimedia-enhanced ones, offer students the opportunity to learn basic technical and general education skills in a workplace context. Adding multimedia to written cases only enhances the activity level of the students while adding even more workplace exposure to the learning experience. Video clips, photographs, and sound clips allow the student to view the work site and interact with the employees even if the industry is located hundreds of miles away. Adding

software components to cases allow the student to perform directed research via the Internet, take quizzes on key technical concepts, and receive immediate computer-generated feedback. Students soon find that they are the facilitators of their own educational experience and can choose how they maneuver throughout the case without following the one “right” path. SEATEC team members are currently adding multimedia components to these case study models and two cases are being produced in CD-ROM format, with plans for more CD-ROM versions to be created.

V. Field Testing and Assessment

For the purpose of constructive assessment of the SEATEC approach to curriculum development, the Learning Technology Center (LTC) <http://peabody.vanderbilt.edu/ctrsltc/> at Vanderbilt University was contracted to assess the effectiveness of the case study approach in technology education. Each of the SEATEC teams identified the courses where field-testing will be conducted. Assessments are currently being performed at community colleges and four-year universities across Tennessee, Alabama, and Kentucky. A National Advisory Committee was also formed to monitor the progress in meeting this objective.

Initial field-testing instruments indicated that students often feel as if they are employees at the job site in which the technical problem is taking place. Since case-based instruction is student-centered, students have more responsibility for their own learning, thereby allowing instructors to spend more time facilitating than lecturing. Students graduate with marketable skills and virtual industrial experience. Employers who have participated with SEATEC in the case writing process are enthusiastic about the graduating new workforce who is trained in problem-based and case-based learning using an interdisciplinary approach, with critical thinking and problem solving skills, and who possesses the required communication tools.

Another job skill easily explored through case-based instruction is teamwork. Cases are often assigned as small group work to be completed both in and outside classroom. Groups must share resources and work toward a common goal. This reflects the problem-solving method most often employed in industry: interdepartmental committees. Each of the TEFATE and SEATEC case studies has components that are easily adaptable for small group work such as communications assignments (reports, memos, and/or oral presentations).

VI. Participation by Other Faculties

In order to support and develop instructors who want to use the case method in their classrooms, a Professional Development Team was formed from SEATEC members. Thus far, the Professional Development team has conducted campus-wide inservice sessions, which introduced approximately 625 faculty members from universities, community colleges, and K-12 faculties to the case method and tenants of active, collaborative, problem-based learning. Numerous industrial site visits continue to expose SEATEC faculty to the latest technological practices in area industry and provided the basis for new “real-world” based problems which will be used in case studies, further fueling the Professional Development Team’s mission of providing current methodology to technical and general education faculty.

VII. Dissemination

Finally, SEATEC members who have published several papers and presented at various international, national, and regional conferences are disseminating the preliminary results of this grant. A web site has been also created to electronically disseminate materials related to the grant. For additional information or to sign up for the SEATEC newsletter and mailing list please check the following: <http://www.nsti.tec.tn.us/SEATEC/>

VIII. Acknowledgments

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