Developing and Delivering Engineering Technology Degree Programs for Incumbent Workers in Technical Industries

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Introduction

Vermont Technical College (VTC) has been delivering associate degrees, designed for employees in specific industries, at the industry locations for a little over six years now. Over 250 students/employees are currently enrolled in engineering technology programs at IBM, BF Goodrich Aerospace, Verizon, and a consortium of small manufacturers in northeastern Vermont. This paper will provide an overview of the curricula design process, the on-site delivery strategies, and finally issues and concerns that still need to be addressed.

Curricula Design Process

VTC had been delivering a "package" of courses to IBM as part of the company's in-house employee training programs since 1990. Student/employees needed a foundation in technical mathematics, physics, and electronics to work as technicians. Some were process technicians, working on the line producing semiconductor chips, while others were maintenance technicians, maintaining the manufacturing tools. A combination of a tight labor market and an effort to improve employee morale led IBM-Burlington management to approach VTC regarding the development of full degree program for the technicians. In response, the College created the General Engineering Technology degree program to be coordinated by a new administrative arm of the College called the Technology Extension Division.

The General Engineering Technology degree program is designed for incumbent workers in technical positions. The first two-thirds of the curriculum is consistent from company to company and provides students with a solid foundation of general education: technical mathematics, calculus, physics, English, humanities, and social sciences. In addition, companies can choose from computer applications, computer programming, or engineering graphics as part of the foundation courses, depending on the prerequisite needs for the engineering technology courses that will follow.

The last third of the curriculum is engineering technology courses that are deigned by a Curriculum Development Team. The Team is composed of engineering, manufacturing, and human resource personnel from the company and VTC faculty. Team sizes have ranged from five members to seven. Once the courses have been selected by the Team, a VTC faculty member from the appropriate discipline (electronics, telecommunications,

mechanical engineering, etc.) modifies the courses to meet the specific industry applications and to take advantage of equipment and materials available at the industry location. This last third of the curriculum forms the General Engineering Technology degree emphasis*: telecommunications, semiconductor processing, electronics for the aerospace industry*, etc.

On-site Delivery Strategies

During the new program review process many faculty at the College expressed concern that the courses would be delivered exclusively with adjunct personnel, selected more because of their geographic proximity to the industry site than their academic expertise. A common refrain was that these adjuncts would not teach according to "the VTC way." In response, the President of VTC and the Head of the Technology Extension Division made a concerted effort to attract experienced, full-time faculty to travel to the corporate sites to teach in the programs. Incentives included an enhanced compensation rate for teaching an overload for Technology Extension, pay for travel, hotel accommodations in the event of bad weather, use of high-tech equipment that may not be available in the campus lab facilities, and the intrinsic benefits of a student cohort comprised of adult workers who would not have access to engineering technology education without this effort[1]. Since the onset of the Technology Extension Division full-time faculty have never taught less than 50% of the courses in any semester and adjuncts are assigned a faculty mentor from the campus and face the same faculty evaluation process as on-campus faculty.

The College has used some web-based instruction but considers that instructional methodology still experimental; thus more than 90% of the instruction is in the traditional classroom and laboratory format.

The Senior Project, a capstone experience, is designed by the Senior Project Team: the student, a student mentor, a faculty member, and the Head of the Technology Extension Division. The mentor is an engineer or senior technician with the company who helps the student identify a project that will not only demonstrate the skills gained from the degree program but will solve an existing engineering or manufacturing problem at the company. The faculty member is the instructor-of-record who oversees the student's progress throughout the project. The Head of the Technology Extension Division assists the Team throughout the semester[2].

Issues

While all feedback from the company personnel, students, and faculty indicate a high level of satisfaction with the degree programs, the College has identified three issues that are still unresolved: financial viability and program growth, adequate and equitable laboratory facilities, and student support services.

To ensure the financial viability of each program, companies must commit to at least fifteen student/employees per course. Because some students/employees may have

transfer credit and therefore not need a particular course, companies may pay fifteen tuitions even though there may be less than fifteen students/employees in that course. For large companies with high education and training budgets, providing at least fifteen students/employees in a course or even paying for "an empty seat or two" in a course is within their means and consistent with their corporate goals. For smaller companies this is cost prohibitive. Because 98% of all Vermont companies are small, less than 500 workers, the growth of Technology Extension Division programs is an issue for the College. In response, the College is experimenting with a consortium approach, identifying four small manufacturers in the same region that want an on-site engineering technology degree program for their employees. By combining the student/employee cohorts from EHV-Weidmann, Lydall-Westex, Greenfield Industries, and Fairbanks Scales, all of St. Johnsbury, Vermont, the College was able to begin a General Engineering Technology associate's degree program with 60 incoming students/employees in the Fall, 2000 semester. The College is using its existing corporate degree programs as a model for curriculum design and on-site delivery. It remains to be seen, however, if that model will be as successful when used for a consortium of companies.

Laboratory facilities is another issue for the College at its corporate locations. The Technology Extension Division uses a "mobile computer lab" comprised of 18 laptop computers and uses simulation software, like Electronics Workbench and Teletutor, to simulate electronics and telecommunications equipment for laboratory projects, respectively. However, the fact that simulation software is used much more at off-campus locations than on campus, where the College has excellent laboratory facilities, is a concern among some faculty who question whether a laboratory exercise done via simulation is equitable to one done with hardware. As one would guess, these concerns vary among the faculty and from company to company. BF Goodrich Aerospace, for examples, prefers the use of simulation software since that's how they design their products. In addition, each company has been eager to have students/employees use their corporate facilities and equipment as part of the laboratory component of their education. It has not been difficult, thus far, to gain access to the companies' equipment, tools, and machines during off-shift periods.

Finally, student support services, or the lack thereof, for off-campus students are still a concern of the College. While library materials are available electronically for all students, academic support services (tutors and learning disability assessment services) are difficult to provide at corporate locations. Students/employees are informed of the availability of these services but the distance from the campus, where these services are housed, and the student/employees workplace and home makes accessing these services difficult. Faculty are contracted for an additional two hours per week to be at the corporate locations for "office hours" but the simple fact remains that the on-campus students have access to a much wider range of services than the off-campus students.

Conclusion

The Technology Extension Division of VTC is serving two very important functions for the College: meeting technical workforce needs in the state and acting as the entrepreneurial arm of the College (the Division provides significant financial support to several components of the College). For the Division and the College it has been a "learn as you go" experience and all of the corporate programs are in a process of continual improvement.

For the state of Vermont, the Division is enabling Vermonters to get high-tech, high-paying jobs in state, while they work in their current jobs. For businesses, the on-site degree programs add value to their employees, assist in recruiting new employees, and allow them to "grow" technicians from within. For smaller companies, especially, who have difficulty competing for skilled workers in a tight labor market these programs will be crucial to their long-term success.

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[1] Draves, W.A. *How to Teach Adults*, The Learner Resources Network, Manhatten Kansas, 1997.
[2] Sternberg, S.P.K. et al "Delivery and Assessment of Senior Capstone Design via Distance Education," *Journal of Engineering Education*, vol. 89, No. 2, 2000, pp.115-117.

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