

Bridging Tomorrow through Strengthening Partnerships

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Abstract – Western Carolina University and Asheville-Buncombe Technical Community College have a long standing partnership for service to the region and providing economic development opportunities. With recent losses of jobs in the manufacturing sector, both institutions have taken a forward thinking approach to meet needs of future engineering and technical careers. Strengthening the competitiveness of remaining industry through the development of regional based technology and educational resources can serve as a means to aid reviving local economies. Additionally, increasing the number of professionally prepared engineering and technology graduates will prove equally important in regional economic development. This paper will describe how the two institutions work together through (1) articulation, (2) advancing technical and engineering skills, and (3) economic development opportunities. Previous, current, and future projects will be discussed. Emphasis will be placed on educational approaches, student activities and educational merit.

Keywords: Curriculum integration, Engineering Technology curriculum, rapid product development.

INTRODUCTION AND BACKGROUND

Western Carolina University (WCU) was founded in 1889 as a semi-public high school. Four years later a normal department was established and in 1905, the institution became Cullowhee Normal and Industrial School, a title it held for twenty years. During its normal years, the school grew to equivalence of a junior college and in 1929, was elevated to the baccalaureate level and renamed Western Carolina Teachers College. The addition of graduate degrees led to a further change in name in 1953 to Western Carolina College, and in 1967, the institution was granted full university status [1]. Western Carolina University has a long history of service to the region. Even in the Cullowhee Normal and Industrial School era, certain “industrial” courses were taught to enhance the earning power of residents of western North Carolina, although no technical degree was granted. Today, the university has approximately 170 majors and concentrations for undergraduates in addition to more than 60 graduate-level programs of study [2] Western Carolina University continues to serve the population of Western North Carolina through resident and distance programs.

Asheville-Buncombe Technical Community College (AB Tech) was established Sept. 1, 1959, as the Asheville Industrial Education Center. The first curriculum program offered by AB Tech was Practical Nursing in 1960. Shortly thereafter, Electronics Engineering Technology and the Machinist programs were started. In 1963, following legislation creating the North Carolina System of Community Colleges, the name was changed to Asheville-Buncombe Technical Institute. The Board of Trustees approved a third name change to Asheville-

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Buncombe Technical College on Aug. 6, 1979. Another name change occurred in 1987, when the Board of Trustees approved Asheville-Buncombe Technical Community College as the college's current name. While the name has changed over the years, the mission remains the same; to provide accessible, quality educational opportunities for lifelong learning to meet the diverse and changing needs of the community. AB Tech, with strong community support, has grown in facilities, enrollment, curricula, and in service to the community. Today it has the largest total headcount enrollment of any institution of higher education in Western North Carolina, serving 25,508 in 1999-2000. The original three curricula are still included today among the 60 curriculum programs, 47 degrees, 17 diplomas and 50 certificates [3].

Western Carolina University (WCU) and Asheville-Buncombe Technical Community College (A-B Tech) have a long standing partnership for promoting engineering education, providing service to the region and enhancing economic development opportunities. With recent losses of jobs in the manufacturing sector and economic downturns, both institutions have taken a forward thinking approach to meet needs of future engineering and technical careers.

A-B Tech currently maintains a shared computer lab for use by WCU in the evenings. A-B Tech benefits from the relationship by using computers provided by WCU during the day and WCU benefits by having A-B Tech provide the space for night classes and technical support for the lab. A-B Tech also provides other engineering laboratories and classrooms as needed at no cost. Both institutions utilize these labs to better serve the local region. This arrangement allows students to earn a degree in engineering technology from A-B Tech, find an employer who will pay for night classes at WCU, earn a B. S. in Engineering Technology, and continue for a Masters in Technology, all at A-B Tech. Rarely do students have an opportunity to obtain educational degrees in the form of an A.A.S, B.S, and M.S. at a local area community college. This tradition has been in place for over 20 years, and continues to work in a cohesive and productive manner.

ARTICULATION

North Carolina has a mandated Comprehensive Articulation Agreement between the 16 universities in the University of North Carolina System and the 58 colleges of the North Carolina Community College System. This agreement is mandated by House Bill 739 and Senate Bill 1161. These bills require the two boards to develop a plan for the transfer of credits between all universities and community colleges, implement common course descriptions for all community college programs, and to provide accurate and accessible academic counseling for transfer students.

The provisions of the legislation are consistent with the strategic directions adopted by the University of North Carolina Board of Governors, the first of which is to "expand access to higher education for both traditional and non-traditional students through...uniform policies for the transfer of credit from community colleges to constituent institutions...development of electronic information systems on transfer policies, off-campus instruction, and distance education...[and] increased collaboration with other education sectors...." Similarly, the State Board of Community Colleges has established the education continuum as one of seven critical success factors used to measure the performance of programs consistent with the work force development mission of the North Carolina Community College System. College level academic courses and programs have been a part of the mission and programming of the North Carolina Community College System from its inception in 1963 [4].

All of the engineering technology programs offered by AB Tech are designed primarily to meet the needs of the region's students and employers. From the community college perspective, this need is met with two educational plans; a work ready plan and a college transfer plan.

The distinction is made through elective courses and options in the level of math and science the student chooses to follow. Students who plan to transfer are advised to take a higher level math and physics, as well as science classes which match the transfer target. The advantage of this plan is the inherent ability to adapt to changes. Program electives facilitate this adaptability. Change is constant and is driven by employers, universities and the students' individual situations. Some students are full time day students, while others are employed night students. It is also believed important not to segregate students into employment and transfer groups. Student interaction would suffer and in reality, enrollment would not justify distinct programs.

In designing a program that meets the needs of the employer, community college and transfer college, tradeoffs must be made. Cooperation between AB Tech, employers, and WCU is essential. It is here that a strong partnership between WCU and AB Tech has allowed many obstacles to be overcome. This partnership is illustrated by having both institutions actively represented at advisory meetings, by conducting joint projects that involve faculty and students, and by engaging in each others' classes as either instructors or students. As a result students have the information and guidance they need to make their decisions as their needs change.

In 2003, the Engineering Technology Program at WCU was created with the aim of supporting both an on campus 4-year program and a 2+2 off campus program. One goal was to facilitate transfer by recognizing that the off-campus students are a different population and have different needs from the on-campus students. Many work in the industry and already have skills that support program outcomes. They need courses that provide a background scientific theory relating to the skills they already possess. They also are looking for courses which relate directly to their specific jobs. Additionally, the distance program has associate degree graduates from different engineering technology programs (mechanical, industrial, electrical, etc.) as well as from several different community colleges in the region. The solution to these needs is to provide relatively large number of electives for both transfer and in the program, while still meeting the program outcomes.

In 2008, while preparing for a ABET accreditation visit, it was recognized by the program directors that the distance and on-campus programs needed a more visible separation. The eventual solution was to create two program concentrations. The creation of these concentrations gave the opportunity to revise the requirements for the off-campus program. The on-campus concentration was renamed Engineering Technology - Applied Systems Technology Concentration. This change reflected the general nature of the program. It provides a broad range of technology skills with many options for student opportunities after graduation. The off-campus concentration was renamed Engineering Technology - Engineering and Technical Operations Concentration". It was redesigned to reflect diverse student educational backgrounds and the fact that students already working in industry may have varying career goals relating to their jobs. See the following:

Bachelor of Science Engineering Technology

Liberal Studies

(44 hours)*

(May be taken at a North Carolina Community College, or student may opt to fulfill the 44 hour Comprehensive Core at the community college)

- C1: ENGL I (3)
- C1: ENGL II (3)
- C2: MATH (3)
- C3: Oral Comm. (3)
- C4: Wellness (3)
- C5: Science (4)
- C5: Science (4)
- P1: Soc. Science (3)
- P1: Soc. Science (3)
- P3: History (3)
- P4: Humanities (3)
- P5: Fine/Perf Arts (3)
- P6: World Cult. (3)
- First Year Sem. (3)
- Upper Level Req. (Duplicate hours for C4 – C6) (0)

* Two extra hours are required above the customary 42 hours of liberal studies because of chemistry and physics course requirements.

Mathematics and Sciences

(8 hours)

(Mathematics and science courses that are required in the major may be used to satisfy liberal

studies categories C2 and C5, therefore the hours are not listed for the LS courses.)

- CHEM 139 General Chemistry I C5
- PHYS 130 Introductory Physics I C5
- MATH 140 Introductory Calculus (5)
- MATH 145 Applied Trigonometry C2
- or MATH 146 Trigonometry
- MATH 170 Applied Statistics (3)

Engineering Technology (Core)

(51 hours)

- ET 132 Engineering Graphics (3)
- ET 141 Engineering Materials and Processes (3)
- ET 231 3-D Computer Modeling (3)
- ET 232 Statics and Strength of Materials (3)
- ET 331 Quality Systems (3)
- ET 335 Occupational Safety Standards (3)
- ET 362 Engineering Logistics (3)
- ET 420 Polymer Technology (3)
- ET 436 Engineering Economic Analysis (3)
- ET 461 Engineering Project Management (3)
- ET 478 Integrated Systems Project (3)
- ECET 301 Electrical Systems (3)
- ENGL 305 Technical Writing (3)
- Electives (12)

Total

(103 hours)

Applied Systems Technology (APT) Concentration Requirements

(21 hours)

- ET 349 Rapid Tooling and Prototyping (3)
- ET 351 Engineering Analysis (3)
- ET 410 Adv. 3-D Mod. and Rapid Prototyping (3)
- ET 425 Metrology and Reverse Engineering (3)
- ET 441 Power Transmission Systems (3)
- ET 449 Adv. Tooling and Rapid Prototyping (3)
- ET 472 Integrated Control Systems (3)

Total

124 hours

Engineering and Technical Operations (ETO) Concentration Requirements (21 Hours)

Pick List – 6 credits required from list

- ET 349 Rapid Tooling and Prototyping (3)
- ET 351 Engineering Analysis (3)
- ET 410 Adv. 3-D Mod. and Rapid Prototyping (3)
- ET 425 Metrology and Reverse Engineering (3)
- ET 434 Plant Layout (3)
- ET 441 Power Transmission Systems (3)
- ET 449 Adv. Tooling and Rapid Prototyping (3)

- ET 470 AIDC for the Enterprise (3)
- ET 472 Integrated Control Systems (3)
- ET 480 Independent Study (3)
- ET 493 Special Topics (3)
- ET 495 Engineering Technology Seminar (3)

Concentration Electives

- Advisor Approved Technical Electives (15)

Total **124 hours**

Note

- *The BSET with the Applied Systems Technology Concentration is offered only on the main campus in Cullowhee and is ABET accredited.*
- *The BSET with the Engineering and Technical Operations Concentration is offered only off-campus and plans to apply for ABET accreditation in 2010. Further information regarding the off-campus BSET may be found at <http://www.wcu.edu/2822.asp>*

ADVANCING TECHNICAL AND ENGINEERING SKILLS

An important component of Western Carolina University’s mission statement is to support economic development through engagement and partnerships. The university has mandated that faculty support engagement with regional business and industry. Engagement activities have focused on sustaining economic development and boosting entrepreneurial startups through projects that develop intellectual capital and technology transfer [5][6].

An example of such commitment and partnership success has been previously demonstrated through the Hybrid Water Heating and Dehumidifying (WHD) Project

A focused partnership was formed between Oak Ridge National Laboratory (ORNL), Western Carolina University (WCU), Asheville-Buncombe Technical Community College (ABTech), and Sci-Cool Incorporated to develop a marketable energy efficient hybrid water heating and dehumidifying (WHD) product. A request for proposals successfully secured funds from the Department of Energy's Office of Energy Efficiency and Renewable Energy [7] to facilitate a technology transfer from the National Laboratory, to engineering technology faculty, students, and industry. The proposal was to accomplish product development, prototyping, fabrication, instrumentation, controls and testing procedures. All phases of the project were integrated into relevant engineering technology courses in the two-year engineering technology programs at A-B Tech, four-year engineering technology program at WCU, and at the graduate level in the WCU M. S. Program. Project classes were the vehicles in all these programs for allowing the student to integrate the technical and non-technical skills.

The WHD project, with multidisciplinary challenges, was well suited for this type of student experience. It provided students an opportunity to apply active learning, collaborative learning and to synthesize the knowledge gained in many courses. Faculty also benefited by having an opportunity to update their knowledge in current hardware, software and engineering processes. This benefited the curriculum, and provided stronger ties with industry, community stakeholders, government agencies, and between the educational partners.

ECONOMIC DEVELOPMENT OPPORTUNITIES

In support of the universities' mission of regional outreach, WCU distance students on the A-B Tech campus have done many projects to benefit regional companies. Current research suggests that creative and innovative engagement projects be coupled with student learning to strengthen the competencies of ET graduates [8]. These projects were done for team class projects, and were designed to support the class outcomes for subject proficiency, teamwork, communication skills. They also utilized A-B Tech's facilities to benefit local companies. Examples of team projects are:

- Eaton/Cutler-Hammer: Development of test equipment and pre-delivery test procedure to solve logistical issues, with cost savings of \$25,000 for first year and projected savings of \$60,000 for second year. Skyland, NC.
- Eaton Cutler-Hammer: Lean manufacturing implementation to support production and warehousing for a new product. Skyland, NC.
- Volvo Construction Equipment: Developed a more efficient way of packing goods for inter-continental shipping. Skyland, NC.
- BorgWarner: Analysis of manufacturing process and plan for implementation of Failure Mode Effects Analysis (FMEA) concept to improve production. Fletcher, NC.
- BorgWarner: Flowchart order cycle time to seek areas for improvement. Fletcher, NC.

SUMMARY AND CONCLUSION

Western Carolina University and Asheville-Buncombe Technical Community College have a proven relationship for service and economic development in Western North Carolina. Due to plant closings and layoffs, Western North Carolina has been particularly hit hard. The magnitude of job loss in manufacturing and the effect on local economies have been reported as near crises proportion, so the partnership shared by WCU and AB Tech is even more important today than ever before. The success of articulation of engineering programs between the two institutions has been used as a model for the other community colleges in the region. Advancing technical knowledge for students in the region was illustrated by the Hybrid Water Heating and Dehumidifying (WHD) Project through Oak Ridge Nation Labs. Class projects, completed through distance students on the AB Tech campus, were designed to support the class outcomes for subject proficiency, teamwork, communication skills, and were excellent examples of economic development activities.

In conclusion, the partnership existing between WCU and AB Tech is a model for universities and community colleges. It not only strongly influenced the development of a new concentration for the Engineering Technology curriculum, but it also provided a plus-two avenue for AB Tech graduates. The added benefits of economic development in the region are evident by the many student-led projects resulting in job creation, cost savings and product improvement. It is hoped that other universities and community colleges will follow suit in this mutually beneficial endeavor.

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