AC 2011-587: CREATING LINKAGES BETWEEN UNIVERSITY AND TECHNOLOGY EDUCATION PROGRAMS

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Creating Linkages Between University and Technology Education Programs

Introduction

Too few high school students understand that a technical career path can genuinely be exciting and neat. Some have the short-term view that good paying jobs are plentiful, so why take the really difficult courses. Many sell their own abilities short and convince themselves that it is too difficult a career path. And still others conjure up the image of a dirty, dull, dangerous, and demeaning factory floor and run (not walk) in the other direction.

What is needed to turn these impressions around are exciting exposures to technical topics in existing high school curriculums such as technology education, science, math and physics. The purpose of this paper is to identify exactly one such exciting module that has been successfully used to build bridges that link high school students to industrial technology and engineering technology career paths.

This presentation will identify specific outcomes that resulted from an extremely cost-efficient program. The success and simplicity of the program encourages it's continuance with existing high schools and even growth into a greater geographical area. Institutions seeking higher student enrollments in technical degree paths may wish to consider replicating this simple and exciting programmable logic controller module. This strong recruiting tool has provided us a pipeline of talented new students into the university program.

Working Towards a Diverse Population

Attracting a diverse student population has traditional been a difficult task for the University of Southern Maine. Based on 2004/2005 statistics [1], 95.4 % of the University's student population was "White/Non-Hispanic". In an effort to increase our total enrollments and also address our lack of racial diversity, we found a very "reachable" population in the local public schools. The public school student population in the region is in fact significantly more diverse [2] with a "White/Non-Hispanic" population of 80.81%. In both instances the balance of the populations were comprised of Blacks, American Indian, Asian/Pacific Islander, and Hispanic.

On average, two high school classes per month have traveled to campus to participate in laboratory based sessions. As a direct result of these sessions, four new majors have joined our program and several others have requested applications. Three of these new majors (two males and one female) began participating as high school juniors and are now completing their freshman year. The fourth "recruit" was a high school senior and is maintaining a 3.7 GPA as a sophomore. His academic achievement in the general education requirements as well as his technical core has been very impressive. In fact, an

interesting implication that is being discussed among our faculty is our ability to "raise the bar" in order to challenge incoming students who have insight into process control and automation.

The four new majors who joined our School had not considered enrolling prior to their high school interactions. None of them had ever been on campus before nor had any of them considered a technical career path. One of the four students does not fit the descriptor of "White/Non-Hispanic" and has moved our diversity percentages in a desirable direction. We are eagerly awaiting the five additional high school students (including one diverse) that are in the process of making application.

The Program

The University's relationship with a local high school began with a simple invitation to their technology education teacher. When asked if he would be interested in bringing a class to tour our Industrial Power and Control laboratory, our phone call was answered with a slightly skeptical – perhaps. The teacher wanted to visit us first and determine the usefulness of bringing a class to campus.

His skepticism resulted from a fear that a highly theoretical environment would intimidate and turn-off his students. He was however, searching for a method to motivate and challenge his classes. Immediately upon arriving, he began to see an environment that blended the theory of industrial power and control with "hands-on" fabrication of automated cells. Hydraulic and pneumatic "gadgets" supervised by programmable logic controllers were manipulating tennis balls and golf balls in a whirl of motion, noise, and excitement. This was really neat "stuff" that his student's would love!

During the first high school visit, we provided the group with a basic overview of programmable logic controllers. We intentionally kept the subject matter simple and clear. The overview began with brief definitions and a historical perspective. Before the visit was over, high school boys and girls were developing ladder logic and programming the controllers to sequence lights, motors, and buzzers with the assistance of their teacher. "The process engaged both the teacher and the learner and resulted in an even better educational experience".[3] They never imagined that learning could be so much fun and how much they accomplished in just a few short hours. The "hands-on" class visit was a huge success.

A follow-up phone call a week later led to a successful cooperative venture between the University and the high school. The high school purchased two programmable logic controllers and the programming software. Together, we found industrial donations of input and output devices such as switches, motors, valves, and pneumatic cylinders. The high school class returned to campus, to develop ideas for their own automated cell to be built from their newly acquired components. Four more visits were strategically planned over the next two months to provide the high school teacher and their students with the skill sets needed to replicate the University's automated cell projects on a smaller scale.

The design and fabrication of the modules purchased by the high schools were college-based class activities in electronics and material processing courses. The only expenses to the high schools were the cost of the components. The secondary educators were thrilled to have "plug and play" modules that genuinely turned-on their students. This is definitely one of those win/win initiatives that can provide an enjoyable, meaningful class project, and at the same time establish a pipeline for recruiting talented incoming majors!

Outcomes

In fifteen years of teaching experience, the high school teachers had never seen more motivated students. The demand for these classes continually increases and the excitement has become contagious. Three years into this relationship has yielded impressive results with increased retention in the three high school programs we are now working with and a growing stream of new majors for our School. The high school science and math teachers are utilizing their automated cells to help teach topics such as force, pressure and area relationships. "The kids love watching them work and being able to understand and calculate the science and math that makes it happen".

Perhaps the biggest impact has been on the high schools' Technology Education programs. Prior to their involvement, one of the Technology Education programs was in danger of being closed down. What was once a slightly fancier version of wood shop and metal shop evolved into a "pre-engineering" curriculum. Two high school teachers have taken university coursework and are truly replicating a similar learning environment in their schools. All three have established industry "partners" and are growing an automation base of components.

The initial effort required on the part of our faculty was substantial. Although this type of professional service to the community is expected at the University, some faculty were motivated because they had family members attending the high schools, and others because they genuinely enjoyed working with this population. By the second year most of the logistics had been established and hosting the high school classes required very little preparation.

The success and simplicity of the program encourages it's continuance with the existing three high schools and even growth into a greater geographical area. Institutions seeking higher student enrollments in technical degree paths may wish to consider replicating the simple and exciting programmable logic controllers and pneumatic modules. This effective recruiting tool has provided us a pipeline of talented new students into our university program.

This presentation has identified a successful relationship that was developed between a university and three high schools by implementing a simple and exciting "pre-engineering" activity module. The university class designed and fabricated programmable logic controller and pneumatic modules with the high school's purchasing the components. These modules were then utilized by the high school students, in pre-engineering classes, to learn about pneumatics, controllers, programming, wiring, input

devices, and output devices. The high schools have obtained their own collection of industrial power transmission and control components. They returned to our campus for strategically planned instructional visits and to brainstorm designs for their own automated cells.

Programmable Logic Controller Lab Activities

The documentation package provided to the high school teachers contained additional information on programmable logic controllers and the other components utilized in the modules. The module used inexpensive brick programmable logic controllers, switches for inputs, and lights, buzzers, and small motors as outputs. These modules are very transportable, can be fabricated on a "shoe-string" budget, and are easily interfaced with a variety of other outputs including fluid power components. The documentation also contained the more difficult to develop programmable logic controller activities. These well-written "hands-on" activities are fun for the students to "solve" yet very representative of actual industrial process control scenarios.

In addition to the above mentioned components, the appropriate software is also required to program the controllers. Each lab requires approximately two hours to complete. This includes the instruction session, controller logic development by the students, and the wiring/demonstrating of the input and output devices. The high school teachers that are involved in this program actually received their controller expertise by registering and attended traditional University classes. They are required by state law to demonstrate continued professional growth in order to maintain their public school teaching certifications.

Bibliography

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