Addressing the Technician Shortage in Ohio's Manufacturing Industry through an Innovative Work Study Model

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COLUMBUS STATE
COMMUNITY COLLEGE

1.0 The Problem

For decades, students have been encouraged to pursue a four-year degree, while the number of jobs requiring a bachelor's degree or higher has only risen from 20% of total jobs to 33% of total jobs between 1960 and 2018. In contrast, jobs requiring technical skills skyrocketed from 20% to 57% of total jobs in the same timeframe. Lastly, unskilled jobs dropped from 60% to 10%, indicating a critical demand for workers with at least some postsecondary training (Fleming, 2012).

The technical skills shortage, especially in the manufacturing industry, is a widespread and often discussed problem. For manufacturers in the U.S., 2 million out of 3.5 million jobs will go unfilled over the next ten years. 84% of manufacturing executives agree there is a talent shortage in U.S. manufacturing (Giffi et.al., 2015).

> *"The most important action manufacturers can take to help solve the skilled labor shortage is to engage local educators and determine ways to increase student and educator exposure to careers in manufacturing"*
>
> –Ryan Burgess, Director, Governor's Office of Workforce Transformation

Manufacturing is a major player in the industrial Midwest economy. In Ohio, manufacturing output is currently $106 billion, nearly 17% of the state's total GSP (BEA, 2016). Ohio also boasts the third largest manufacturing workforce in the U.S. With this tremendous industry strength, manufacturing professionals are in high-demand. **Centrally located in the state, Columbus State Community College was approached by manufacturing companies in the region who were struggling to fill the mission critical position of electro-mechanical support technicians.** These technicians are highly-trained professionals who serve as the backbone across manufacturing subsectors. As the amount of automation and reliance upon technology has grown within manufacturing, the electro-mechanical support technician has been called upon to provide design support and maintenance service for production-critical systems.

Columbus State began with a root-cause evaluation in partnership with Honda North America. This analysis resulted in the following conclusions:

1. *Quality:* Recent graduates of electro-mechanical technical programs would benefit from exposure to hands-on experience with the skills Honda was looking for, leading to additional training time once hired.
2. *Quantity:* The pipeline of candidates for work at Honda was small and had stagnant growth. Likewise, student enrollment in electro-mechanical education programs had no significant increases.
3. *Future State:* The demand for technicians will continue to increase, in response to industry growth and worker retirement.

2.0 The Background

Columbus State is involved in a number of institution-wide initiatives which provided context for the solution.

1. College Credit Plus – College Credit Plus is a statewide program where high school students can earn college and high school credits at the same time by taking courses from community colleges and universities. The cost to the student is free, including tuition and books. Columbus State supported 2,677 of these enrollees in the 2015-16 academic year, making it the third largest College Credit Plus program in the state (ODHE, 2016)
2. Project Lead the Way – This program is a nationwide initiative aimed at increasing the quality and quantity of STEM graduates by providing professional development to teachers and programming for elementary, middle, and high school students. One of the current pathways for Project Lead the Way (PLTW) Ohio is pre-engineering. High school students who are in certified PLTW courses and successfully master a college credit exam are eligible to apply for college credit or recognition (Project Lead the Way Ohio, 2014).
3. Guided Pathways – A strategic focus for the college, the concept of guided pathways is to provide clear transition pathways for students to move from high school, to college, to career and beyond.

Honda North America is highly committed to serving as a proactive, creative industry leader to solve their talent gap problems. "Honda did not want to sit back and wait for a solution to come to us, or wait for someone else to fix the skills gap problem. We thought about it and we realized that collaboration and creating a pipeline of talent is the key" –Scot McLemore, Manager of Talent Acquisition Honda North America

3.0 The Solution

Columbus State and Honda North America designed the Modern Manufacturing Work Study model in response to industry needs. This model's central premise is inspired by the traditional co-op model, but rather than briefly rotating students through a variety of companies and job positions, they are embedded within a company department for up to 18 months.

The heart of the Modern Manufacturing Work Study model is a five-semester program design that combines college curriculum with part-time paid employment at a partner company such as Honda. The students begin two full-time, academically intense semesters of Columbus State coursework. Near the end of the second semester, students and partner companies engage in an interview event designed to match companies with students that have a high potential to succeed within their specific organization. Beginning in the third semester, students are hired by the company as a work study student. Over the course of the next three semesters, students reduce class time to two days per week and begin working at the facility three days per week as paid part-time employees. At the end of the five semesters, students walk away with an electro-mechanical associate degree, paid work experience, enhanced technical skills, and potential full-time job offers.

Quality: Columbus State re-evaluated the historical associate degree plan of study and worked with companies such as Honda to enhance curriculum. This resulted in the front-loaded technical coursework design. The college pursued multiple funding sources, such as the Ohio Department of Higher Education and the National Science Foundation, to update labs to the latest equipment. The college has renewed its commitment to continuous improvement in both the physical facilities and course content with open feedback and direct input from industry partners.

Quantity: Columbus State developed the Advanced Automation Institute as a four-day in-depth experience for incoming students. To assist with recruiting, 20% of the Institute's students are current high school students that are interested in the work study program. The first two days of the Institute expose students to hands-on learning experiences with industry topics such as electrical systems, fluid power systems, and mechanical drives. The students are also given examples of contextualized core content, such as mathematics applications for engineering technicians. On the third and fourth day of the Institute, students and teachers come together to tour partner companies' plants to experience what it feels like to be a part of the highly-skilled, highly-trained workforce in advanced manufacturing.

Future State: Columbus State and Honda realized early on that the key to addressing the skills gap was to expose students to manufacturing earlier than college, and provide them options to pursue continuous education once the associate degree is complete. The

ELECTRO-MECHANICAL ENGINEERING ASSOCIATE DEGREE

Summer	1st Semester	2st Semester	3rd Semester (summer)	4th Semester	5th Semester
Advanced Automation Institute	First Year Experience	Physics	Robotics	Manufacturing Materials & Processes	Basic AC Electronic Systems
Manufacturing Plant Tour	Motors & Control Logic	Control Logic & PLCs	Welding: Intro Stick	Machine Tools	Data Acquisition Systems
	Industrial Applications & Software	Basic DC Electronic Systems	Basic Mechanisms & Drives	Social Behavioral Science elective	Humanities elective
	Engineering Graphics	Basic Digital Systems	CAD I		
	Mathematics	English Comp I	Technical Writing		
		Interviews	*Work Study*	*Work Study*	*Work Study*

model is therefore further enhanced with strategies for high school and four-year university partnerships. Students who are participating in Project Lead the Way and College Credit Plus can choose engineering career pathways and earn credit towards the associate degree while they are still in high school. Four-year college and university partners work with the College to create articulation agreements that allow graduates of the work study program to apply their Columbus State credits to the continuation of a bachelor's degree.

4.0 Results

Through Honda's leadership, the program has been diversified across multiple industry sub-sectors and added 10 employer partners since its inception in 2013.

Pharmaceutical Manufacturing	PharmaForce, Abbott Labs
Steel and Steel Products	Worthington Steel, Worthington Cylinders
Robotic Integration	PK Controls, Rimrock Corp., Kroger Bakery, Autotool Inc.
Automotive Suppliers	Stanley Electric, Nissen Chemitec America

Student outcomes are highly effective in the four crucial stages of enrollment, retention, completion, and placement.

Cohort #3 (Began 2015)
- 25 students enrolled in model
- 19 students interviewed with companies
- 12 students began work-study at employer site
- 11 students graduated the program
- 11 students offered full time positions

Cohort #4 (Began 2016)
- 30 students enrolled in model
- 28 students interviewed with companies
- 27 students began work-study at employer site
- Graduation and Placement - TBD 2018

Cohort #5 (Began 2017)
- 52 students enrolled in model
- Work Study, Graduation, and Placement - TBD 2019

"When I found out I could get a paying job while I was in school doing something I love, and be a candidate for a full-time job with a great starting salary when I graduate – it seemed like a perfect choice"

–Erica Miller, Student

"It was a smooth transition from high to college and now I'm here"

–Anton DeLa Fuente, Graduate. Anton is continuing his education while working at Honda, pursuing a bachelor's degree in Engineering from Miami University.

5.0 Lessons Learned

Through the implementation of this work-study model, the College received positive feedback that the students were arriving job-ready on day one and were able to contribute to their employer immediately. This is in contrast to the employers' experience with internships and co-ops, which were described as burdensome and training intensive on the part of the employer.

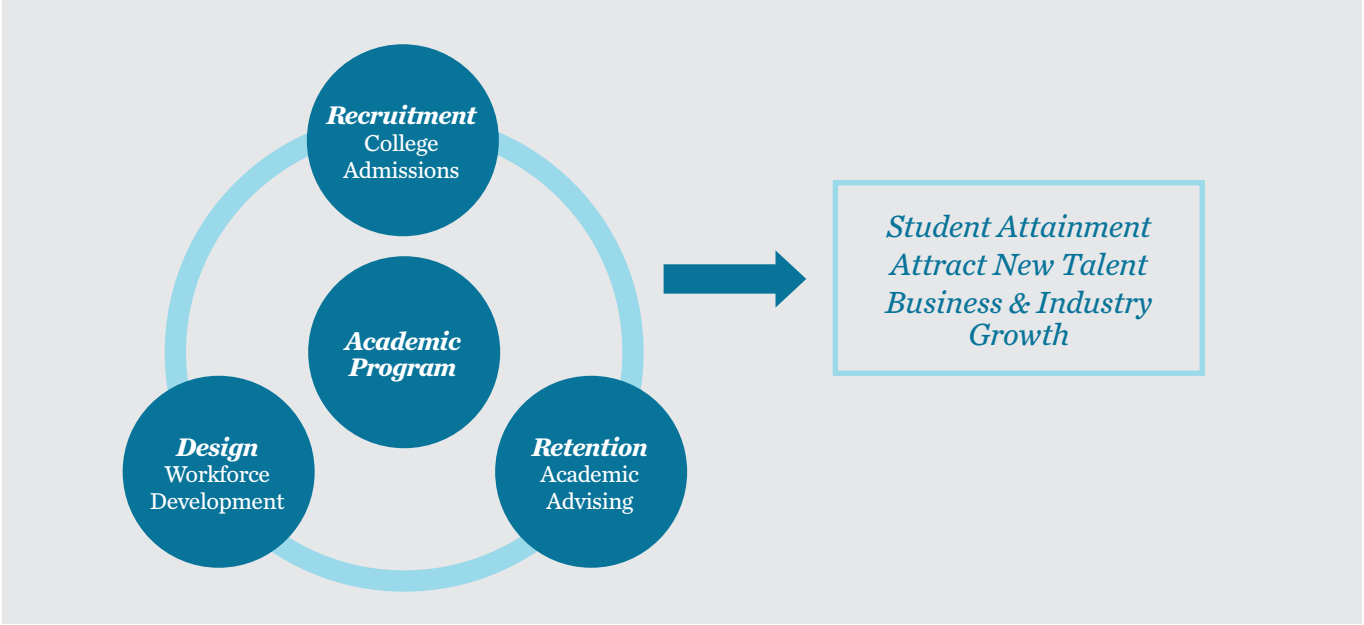
Ultimately, the model required re-sequencing of key curriculum in order to place those technically intensive courses at the beginning of the student's program. This redesign was only successful with the support of the program faculty and chair.

Students from the economically disadvantaged school districts experienced barriers in transportation to employment sites. To address this, alternative sites that were close to, or located directly in, their home area were targeted to be brought on as program partners.

Recruitment for the program was especially challenging in the suburban school districts where a negative reputation of the manufacturing industry was pervasive. To address this, recruitment efforts in these districts began at the parent level to gain buy-in before directly addressing the students.

6.0 Best Practices and Future Implementations

One of the key outcomes of implementing the model is the following best practices model:



***Recruitment**:* The College's admissions team assists in recruitment events and marketing for the program. Key activities that are successful include:

- Manufacturing Night, a manufacturing showcase for central Ohio high school students and their families that features discussions with academic program faculty, current students, and employers.
- Direct educator outreach, consisting of collaboration between college faculty and high school pre-engineering faculty.
- Business commitment as part of being invited to participate in the work study model, businesses commit to participating in active recruiting events through speaking on employer panels and other activities.
- Current Student Outreach – Targeted marketing and information for current students enrolled in the electro-mechanical academic program but who are not participating in the work-study model.

***Retention**:* A dedicated academic advisor supports the program to increase student retention. The key attributes of the advising services include:

- Intrusive academic advising and counseling at multiple touchpoints in the program design.
- Creation of custom orientation to College course, which all college freshman are required to attend, tailored with information specifically designed to support this program. This course is where students are advised on resume writing, professional dress, and communication in order to prepare for their upcoming workplace experience.
- The dedicated academic advisor teaches the custom orientation to College course, providing personal relationships and early exposure to support services so the students are more likely to utilize them throughout their academic program.
- All academic courses are scheduled in a cohort to encourage retention.

***Design**:* A dedicated representative from the College's Workforce Development division serves as the business liaison. Key activities of the role include:

- Grow current relationships and secure new program business partners.
- Facilitate design and development of work-study program with input from industry and from students in the field.
- Act as one-stop shop to answer business concerns, suggest pilot designs, and identify alignment opportunities between industry and the college.

Future implementations for the program at Columbus State include expansion into Logistics Engineering Technology through a project funded by the National

Science Foundation (Logistics Engineering Technology Work Study; DUE 1700520; 5/15/17) and into the Mechanical Engineering Technology program.

In addition, a recent award from Lightweight Innovations for Tomorrow (LIFT) will expand the manufacturing work study program at Marysville Early College High School through supporting staffing efforts and other sustainability costs. The program will provide expanded content on light weighting concepts, an ideal fit for local area employer Honda North America. The courses will be using a new manufacturing engineering laboratory built with funding from the Ohio Department of Education.

7.0 For More Information

- Columbus State Modern Manufacturing Work Study project (http://www.cscc.edu/admissions/manufacturing-work-study-program.shtml)
- Electro-Mechanical Engineering Associate Degree (http://www.cscc.edu/academics/departments/engineering/electro-mechanical.shtml)
- Logistics Engineering Technology Associate Degree (http://www.cscc.edu/academics/departments/supply-chain-management/logistics-engineering-technology.shtml)
- Mechanical Engineering Technology Associate Degree (http://www.cscc.edu/academics/departments/engineering/mechanical-engineering.shtml)
- LIFT and CSCC (http://lift.technology/lift-columbus-state-community-college-ramping-modern-manufacturing-work-study-program-marysville/)

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