The Seamless Pathway: A Partnership Between Community, Industry, and Academia

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Joe Fuehne received a BS degree in Aeronautical/Astronautical Engineering in 1983 from the University of Illinois and MS (1988) and Ph.D. (1990) degrees in Mechanical Engineering from Texas A&M University. In between undergraduate and graduate school, he worked for 2 years in the flight test department at McDonnell Aircraft Company in various locations including the Naval Air Test Center at Patuxent River in Maryland and the Air Force Flight Test Center at Edwards Air Force base in California. During graduate school, Dr. Fuehne focused his efforts on finite element analysis of laminated composite materials. After graduate school, Dr. Fuehne spent 7 years in Houston, Texas working for the Cooper Cameron Corporation doing finite element analysis on oil field equipment including wellheads, blow-out preventers, and subsea pipeline connectors. From 1998 to 2002, Dr. Fuehne performed similar work on automobile exhaust systems for the ArvinMeritor Inc. in Columbus, Indiana. In January of 2002, he accepted a position as an Assistant Professor of Mechanical Engineering Technology for Purdue University at their satellite campus in Columbus, Indiana. Since then, Dr. Fuehne has taught twelve different classes in the MET department and authored papers on real world applications in thermodynamics, assessment practices targeted at ABET accreditation and K-12 outreach programs. He has also received several grants that have supported the K-12 outreach programs and is part of a team that's offering a graduate education class to elementary school teachers that aims to improve science education at the elementary school level.

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Abstract

The Seamless Pathway is a partnership between community, industry, and academia in the southeastern Indiana region. The pathway is setup to meet the growing workforce needs for the three main local industries (manufacturing, healthcare, and hospitality/tourism) and increase the level of education for the workforce within the region. The authors of this paper have worked on the manufacturing aspect of this partnership and therefore the manufacturing aspect of the partnership will be the focus of this paper. The related activities provide students and the workforce with training opportunities that can assist them in obtaining higher paying STEM jobs. The initial implementation of the pathway has led to high school and college faculty working together, workforce members returning to school for additional training, and industry filling needs with locally educated students. This paper shows how this pathway was started and what progress has been made in fulfilling the needs of all of the partners.

Introduction

Manufacturing is the dominant economic activity within southeastern Indiana. Nearly 1 in 3 employed citizens within a ten county region of this part of the state are directly employed by manufacturing companies. The local workforce, however, has not improved to satisfy the need of those employers and a local initiative, Economic Opportunities through Education by 2015 (EcO15), was created in 2008 to address that deficiency. The main objective of the initiative was to move residents up one level in their education, training, and/or job placement. One of the program's primary successes was bringing Project Lead the Way (PLTW) programs and classes to every public high school in the ten-county region. PLTW is a pre-engineering, high school curriculum that promotes engineering careers through a rigorous curriculum of engineering design and analysis. Since 2008, student enrollment in PLTW classes in this mostly rural, 10-county region has increased over 900 percent while overall STEM enrollment has increased 30 percent. High school graduation rates have also increased over that period from 80.9 percent to 86.5 percent.[1]

The EcO15 initiative also created a program called the Seamless Pathway that endeavored to create certain pathways from high school to college to employment in one of the three main local industries (manufacturing, healthcare, and hospitality/tourism). As part of that program, Purdue University faculty members are engaged with teachers and students at two of the local high schools with an emphasis on assisting students entering the manufacturing fields. A faculty member is team-teaching a PLTW course called Computer-Integrated Manufacturing (CIM). Teachers and students spend a part of the year on the local campus utilizing computer numerical control (CNC) and measurement tools not available on the high school campus. There have also been significant investments in post-secondary education in the area because of this program. For Purdue University, this has specifically meant a new, environmentally-controlled metrology lab, a new CNC mill, and a new CNC lathe. These investments have given the faculty the means of engaging these types of STEM courses offered in high schools and developing the post-secondary curriculum to incorporate these investments.

This paper describes the manufacturing parts of the Seamless Pathway. This paper describes how community educational leaders, industry, and academia have partnered together through this program to enhance the learning opportunities for local students and meet the workforce educational needs of industry. The administrative challenges and faculty experiences will be presented and discussed. The outcomes and successes of the program will be shared as well as the challenges. The paper will conclude by discussing where the program is headed and how the partnerships formed and how this program is benefitting industry and academia.

Demonstrating the Need

According to the National Association of Manufacturers (NAM), the state of Indiana leads the United States in the percentage of total employment involved with manufacturing – 16.4% of all Indiana workers are in manufacturing. Similarly, the NAM states on their website that Indiana also leads the nation in the highest percentage of Gross State Product due to manufacturing – 28.2% of Indiana's GSP is manufacturing. 98.5% of all Indiana exports are manufactured products and since 2009, Indiana's manufactured goods exports rose 52.1% while the national average was 46.9%.[2] Clearly, the manufacturing industry is critical to the state of Indiana.

The state of Indiana has divided the state into 12 economic growth regions. Region 9 consists of 10 counties in the southeast corner of the state – Bartholomew, Dearborn, Decatur, Franklin, Jackson, Jefferson, Jennings, Ohio, Ripley, and Switzerland counties. The EcO15 initiative briefly discussed earlier was created to investigate the work force in this region and to determine where there were deficiencies and to develop and implement a plan to address those if necessary. Data gathered during the investigation showed that in this region nearly 1 in 3 workers were employed by manufacturing companies – more than twice that statewide number determined by NAM. The data also revealed that 500 qualified workers are needed every year in this region just to maintain the current manufacturing economy.[1] This number does not include new emerging industries or growth of the current industrial base.

Data compiled by the US Census Bureau in their American Community survey showed that in this 10 county region the percentage of citizens 25 and over with a high school diploma was 84.1 percent and the percentage of citizens 25 and over with a BS degree was 15.3 percent.[3] Clearly, in order for the region to just maintain its current manufacturing activity, more young people would need to choose and be successful in science, technology, engineering, and math (STEM) careers or a significant numbers of people with STEM backgrounds would need to be relocated to the region. In order for the manufacturing industry to grow or add new companies, the need for qualified workers would be even greater and the manufacturing jobs available will require higher and more advanced skills than in the past.

Economic Opportunities through Education by 2015 (EcO15)

The EcO15 initiative was created as part of a proposal ultimately funded by the Lilly Endowment, Inc. for $38 million. A portion of those funds was used to construct the Advanced Manufacturing Center of Excellence in Bartholomew County, to develop learning centers with advanced technology in each of the 10 counties, to provide the Project Lead the Way pre-

engineering curriculum to all public high schools in the region, and to promote careers and encourage study in health care and hospitality/tourism fields.[1]

While these efforts were certainly necessary and encouraging, the challenge was (and is presently) to convince young people to pursue these careers, particularly manufacturing where negative perceptions involving the work and environment still exist. The challenge of encouraging these students is even more difficult because some of these negative perceptions come from parents of students that have lost jobs in manufacturing as low-skill jobs left the US for other countries. Much of the infrastructure needed to support the manufacturing industry in this region was now in place. The next step was to develop specific programs to encourage and engage young people to pursue manufacturing careers.

The Seamless Career Pathways Project

Collaboration among higher education institutions, companies, and other entities is common in this region of Indiana. This willingness to work together to benefit the entire region rather than individual entities was necessary and evident. The local PK-12 school corporation and the three local higher education institutions (Ivy Tech, IUPUC, and Purdue University) worked with the EcO15 organization and local industrial representatives to identify potential stakeholders in the process, to properly define pathways for students and workers needing training, and to list specific goals and outcomes of the process. In fact, the same project-based learning tools often used in the classroom were used to assist the core team in developing the specifics for the Seamless Pathway Initiative.

Definition of Seamless Career Pathways

The core team eventually defined seamless career pathways as “a series of connected education and training programs and student support services that enables individuals to secure a job or advance in a growing industry or occupation.” The focus is clearly on defining certain pathways and facilitating students’ entry and progress through the pathway leading to a stopping point either after earning an Associate’s Degree or a Bachelor’s Degree. Although the initial pathways led to either the AS or BS degree, there is a plan to include other successful completions including certifications, certificates, and other credentials.

Goals and Outcomes

The goals and outcomes of the initiative center on increasing the number of students with STEM credentials in demand occupations including those related to manufacturing, health care, and hospitality. The specific, measurable outcomes of the initiative include:

1. Maintaining the PLTW and STEM enrollments
2. Increasing the number of engineering and engineering technology graduates to thirty per year.
3. Increasing the number of technical associate graduates to two hundred per year.
4. Increasing the number of production industry recognized certification graduates to three hundred per year.

These data are gathered on a regular basis by the EcO15 team.

Types of Pathways

The initial pathways conceived for the manufacturing pathways lead to either an AS degree in mechanical engineering technology (MET) or BS degrees in either MET or mechanical engineering (ME). Each of those three options directs the student to a different higher education institution. There are, however, plans to develop pathways that lead to certificates, certifications and other credentials. Examples include the Manufacturing Skill Standards Council two relevant certifications – the Certified Production Technician (CPT) and the Certified Logistics Technician (CLT). The International Fluid Power Society has a relevant certification termed the Industrial Hydraulic Technician certification and the American Society for Quality offers the Certified Calibration Technician. All of these plus a CAD certificate defined by an individual company are under consideration for potential pathways.

Program Specifics

Figure 1 shows an overview of the program with the higher education institutions involved in the program. The pilot project that occurred at the Columbus Signature Academy – New Tech High School embraced this framework because of the unique project-based learning structure of the school, the scheduling flexibility, and the school's requirement that students earn at least 12 hours of college credit by the time they graduate. Additionally, students at the New Tech are required to complete a 75-100 hour internship with a local company and are required to take 4 years of math and science courses. Also, the New Tech School was open to having a local university faculty member team-teach one of the courses at their school. The New Tech School has been encouraging students to follow this pathway. Figure 1 shows how the school organized this pilot program to present to students to show the different pathways to obtaining a college education.

Figure 2 also demonstrates the goal of doing this seamlessly. High school students would begin in their freshman year to consider the pathway that they would follow. By their junior and senior years students could have already earned some dual credit with Ivy Tech Community College and could also be dual enrolled at any of the three local post-secondary institutions to already be on the path to earn an Associate of Science degree (Ivy Tech) or a Bachelor of Science degree (IUPUC or Purdue University). Career paths would lead to degrees in MET, ME, design technology with emphasis on Computer-Aided Drafting (CAD).

Local University Motivation and Investment

Purdue University has made a substantial investment in the program. One faculty member in the MET department was paid for much of a summer to prepare for this program. First, the faculty member was trained at a PLTW site to teach the Computer Integrated Manufacturing (CIM) class that's available to high school students who have completed the first two PLTW courses. The same faculty member was then provided summer salary to "flip" two of his assigned fall classes to allow him to better participate in the high school class during the next two semesters. The total investment of the university was in excess of $20,000 to support the seamless pathway program.

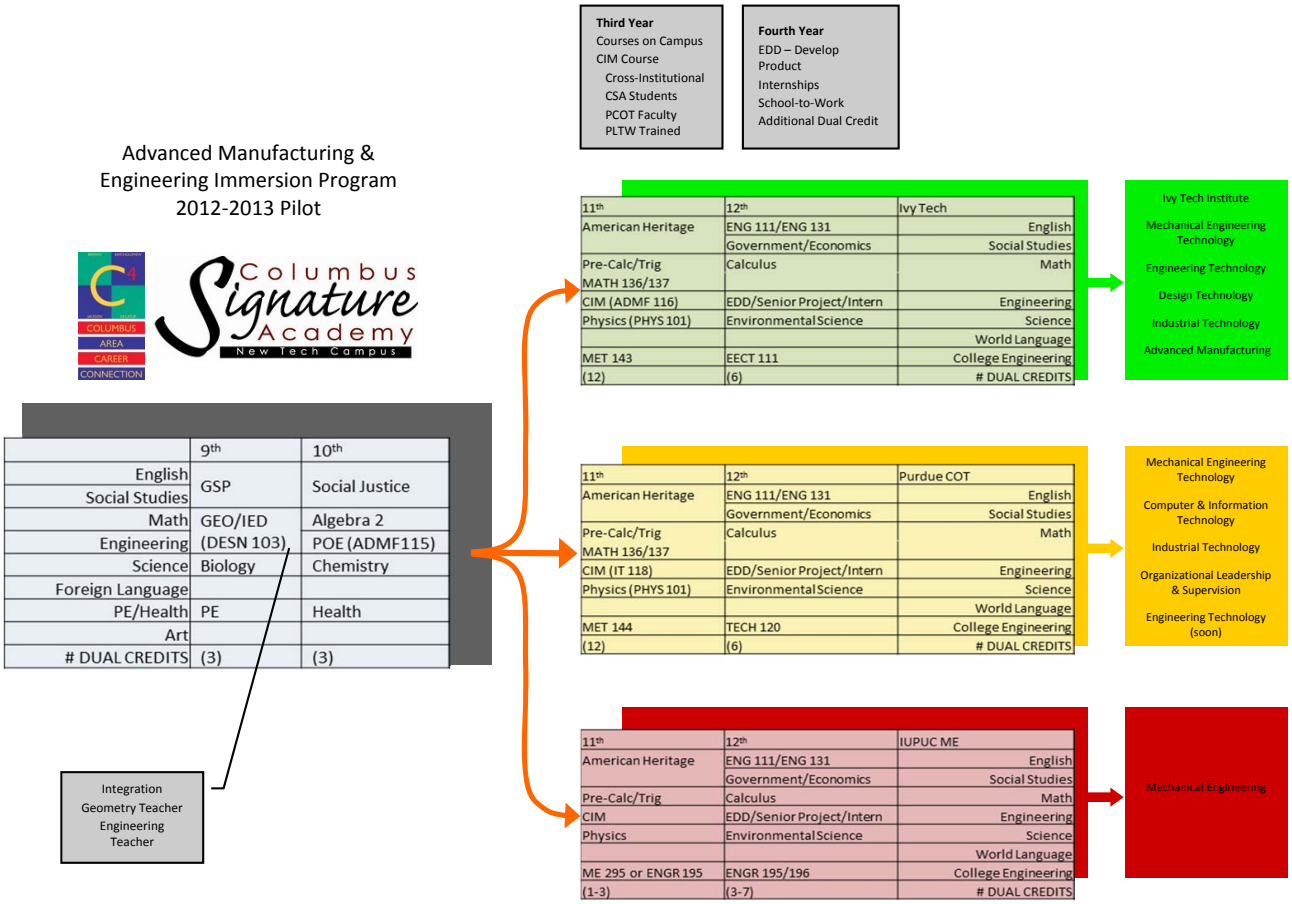

Figure 1. Secondary school organization for students interested in pursuing STEM degrees in the local community.

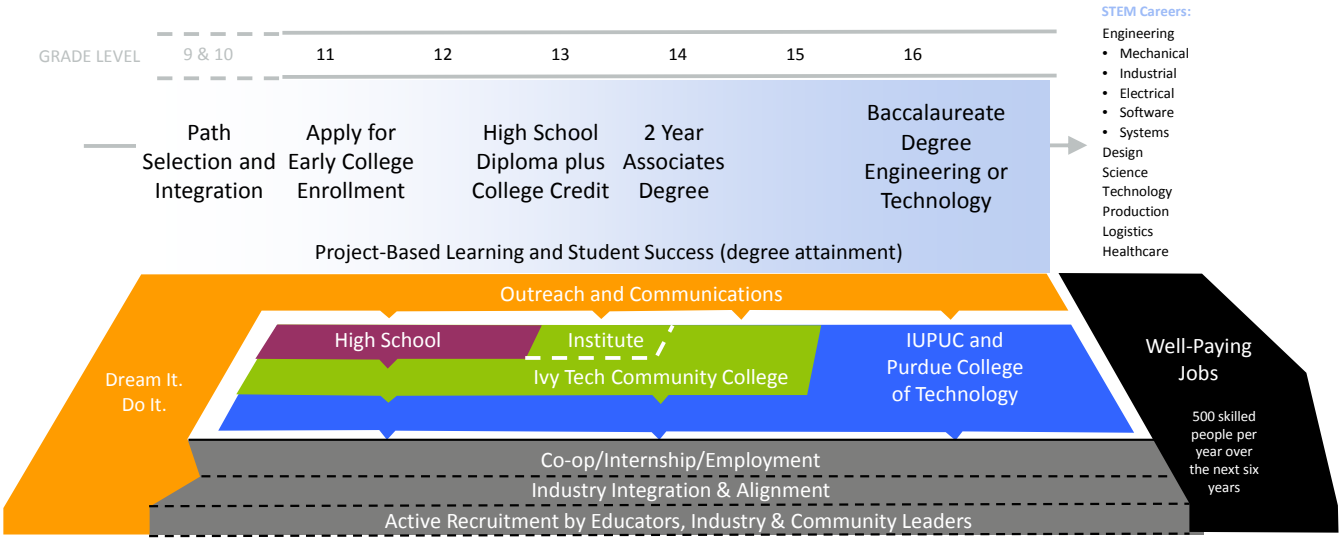

Figure 2. The project-based learning region: seamless high school and post-secondary education framework.

As a return on the investment, three of the students in the CIM class participated in a university MET class during the spring semester (their last semester in high school) and two of them are currently attending the university and majoring in MET. The value of their past, current, and future credit hours makes the return of the investment easily worthwhile. A companion paper presented here at the ASEE conference (entitled Team-Teaching Secondary STEM Courses) covers the specifics of the CIM class taught to the high school students.

Industry Needs

The program has not grown sufficiently to meet all of the industry needs of the area. Students attending the local colleges in the STEM fields are finding numerous opportunities both before and after graduation with local industry. Specifically industry is getting quality employees with training related to metrology, which was emphasized by the industry. Industry partners are offering students reimbursement opportunities for taking courses and in some cases mandating that employees take specific courses as part of their employment. These actions are training the local workforce population and allowing industry to fill needs with local members of the workforce.

Conclusion

This initial implementation of the Seamless Pathway has been a success. High school and college faculty are team teaching students with these students visiting the local college campus and meeting the faculty. Local industry is hiring students to fill needs and sending current employees to obtain needed training. This initial implementation has shown the possibilities of success, but needs to be expanded to additional high schools and local industry members. This expansion is plausible because the successes of the implementation can be shown to the administration of the high schools and the management of local industry.

References

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