

Justification for Developing a Bachelor of Manufacturing Technology Program

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Abstract: Top industries impacting Ohio and East Central Indiana's economies are 1) agriculture; 2) manufacturing; 3) IT; and 4) service. Without continuation of agriculture and manufacturing receipts, our people and communities will be unable to afford to critical services throughout our region (Aiman-Smith & Green, 2002, Deryn, 1989, Ditcher, 2001, Gianesi, 1998, Liker, 1997, Lozano, 2009, Minarro-Viseras Baines, & Sweeney, 2005, Ohio Economy, 2016). Collaboration and articulation agreements between Wright State University-Lake Campus (WSU-LC), the State of Ohio and our bordering Indiana counties have ensured local agricultural students will have the opportunity to increase skill sets as necessitated by regulations and agricultural innovations. Manufacturing has an equal, if not greater, need for increased manufacturing skill sets. As a regional college campus in the University System of Ohio, we propose to create a Bachelor Degree in Applied Manufacturing Science (BAMS). The curriculum developed will provide a solid core of foundational coursework complemented by applied technical courses industrial manufacturing disciplines. The technical courses will focus on the practical application of manufacturing knowledge and include the basics of applied mathematics, manufacturing safety, and understanding manufacturing symbols and blueprints. Advanced skills will include mastering basic electrical through automation systems, hydraulics and pneumatics, additive and subtractive manufacturing processes, including CNC mill and lathes, machining, welding and 3D printing. Other coursework will include management theory.

Keywords: engineering technology, program design

Introduction

WSU-LC has offered the SkillsTrac Industrial Maintenance Technician program since 2007. This program serves three general workforce populations: 1) incumbent workers in an Industrial Maintenance Tech role, incumbent workers looking to parlay their current job in manufacturing into a higher-skilled, higher-paid position, and students who are seeking an Associates in Technical Studies (ATS) with a SkillsTrac concentration. In 2016, we essentially replicated our program, costs, methodologies, etc., and established it at the John Jay Center for Learning (JJCL) in Jay County, Indiana. These nearly identical programs are regularly assessed by WSU-LC staff to maintain consistency.

The JJCL program is also geared towards the same three workforce populations and, in addition, those completing the applied tech training at John Jay can have articulated credit into the ATS degree at WSU-Lake with additional credit hours taken at WSU. In 2012, WSU-LC initiated an ABET-approved Bachelor's Degree in Mechanical Engineering. With the addition of a BAMS degree, we believe we will help solidify manufacturing stability in our area. WSU-LC will not only be able to provide trained engineers to research and design state of the art products, but will also have high-skilled technicians who have the hands-on technical abilities to bring conceptual projects to reality. Small, medium, and large companies all need technically-trained personnel who can work equally well with engineers and shop floor veterans alike.

Proposed Curriculum

The proposed degree has a majority of coursework in applied, technical, and regionally common manufacturing processes. The breakdown of course disciplines for the degree are shown in the following table. The curriculum includes WSU-approved General Education Courses (WSU Core) as well as a wide array of technical applied coursework in manufacturing processes, advanced electronics, mechatronics, pneumatics, robotics and automation.

These courses have significant hands-on skill validation components. In this curriculum, the student will be able to choose a few of the technical electives from available courses in the fundamentals of design for manufacturing and assembly and knowledge of the industrial environment to perform effectively as well manage and lead others in the workplace. The semester hour breakdown by area is shown in the following table.

Table 1. Sample Curriculum

BAMS Degree	Credit Hours
Wright State Core Requirements	40 hours
Technical Manufacturing Courses	54 hours
Management & Communication Courses	15 hours
Applied Math & Computer Skill Electives	7 hours
Experiential Learning Requirement	4 hours
Total	120 hours

* Core Coursework is a WSU requirement, with pertinent areas defined as: Communication, Mathematics, Global Traditions, Arts & Humanities, Social Science and Natural Science

Population, Partnerships, Demographics

- 26 regional high schools (Table 2).
- Collaborations and articulation agreements are or can be developed between WSU-Lake Campus and Tri-Star Career Compact, Greenville Career Tech Center, John Jay Learning Center, Apollo Career Center, Edison State Community College, Ivy Tech Community College, and Vantage Career Center.
- Develop workforce development program to capture 18-25 year underemployed or unemployed population and those who face barriers to employment.

Table 2. High Schools Served by Lake Campus

High Schools Served by Lake Campus	
Anna High School	Memorial High School
Ansonia High School	Minster High School
Arcanum-Butler High School	New Bremen High School
Botkins Local High School	GED-Diploma Holders
Celina Senior High School	Parkway High School
Coldwater High School	Perry High School
Delphos-Jefferson High School	Russia Local School
Fort Loramie High School	Saint Henry High School
Fort Recovery High School	Saint Mary's High School
Greenville Senior High School	Sidney High School
Jackson Center High School	Van Wert City High
Marion Local High School	Versailles High School
McComb High School	Wapakoneta Senior High

Statewide/Regional Manufacturing

- Ohio has 48 out of 88 counties where manufacturing accounts for at least 20% of total employment earnings (Table 3).
- 26,000+ jobs directly tied to advanced manufacturing sector in our service area
- 280+ operations/companies involved in this sector (Table 4).
- About 68% of these counties are located in rural or metropolitan areas.
- Reciprocity agreements between WSU and several bordering Indiana Universities

Table 3. County w/Percentages of Manufacturing Earnings, Employment, & OMB Designation

County	Mfg. % age of Total Earnings	Mfg. % age of Total Employment	Metro. Micro, Rural Areas
Ohio Counties			
Shelby	52%	34%	Micro
Auglaize	40%	25%	Micro
Van Wert	30%	21%	Micro
Mercer	29%	21%	Micro
Preble	35%	20%	Metro
Miami	31%	18%	Metro
Paulding	27%	17%	Rural
Allen	24%	13%	Metro
Darke	23%	15%	Micro
Indiana Counties			
Adams	35%	21%	Micro
Randolph	33%	21%	Rural
Jay	32%	26%	Rural

Table 4. Lake Campus Regional Manufacturing Employers

Lake Campus Regional Manufacturing Employers		
American Trim	ATI Portland	CAPT
Coldwater Machine	Continental Contitech	Cooper Farms
Crown Equipment	Dannon	DRT Power Systems
Eaton Corp.	Emerson Climate Technologies	Excel Machine & Tool
Federal Mogul	Fort Recovery Industries	Greenville Technologies
Honda of America	JR Manufacturing	Machine Concepts
Midmark	Midwest Poultry	Nidec Minster
Pax Machine	Parker Hannifan	Plastipak
Precision Strip	Reynolds & Reynolds	Setex
St. Marys Foundry	Lincoln Electric	Whirlpool

Projected Regional Workforce Attrition Rates

Currently, high-quality, high-paid, skilled positions are going vacant. From a variety of company contacts—with heavily diversified product lines—we have learned many of our local companies are or will be facing a 10-20% attrition rate in skilled workers due to an aging workforce within the next 5 to 10 years. A generation ago, word of mouth was responsible to keep youth interested in manufacturing careers as well as young people witnessed the excellent livelihoods created by parents working in the manufacturing industry.

Over the last few decades, this mindset has shifted considerably. Economic downturns, overseas manufacturing sourcing, and a generation of parents who thought a four-year college degree would give their child the best start

for economic success, have all impacted how people look at manufacturing and manufacturing careers. Young people are often not aware of paths available to them in the manufacturing field including those requiring advanced skills commensurate with excellent pay. This lack of talent in the hiring pipeline needs to be addressed immediately. We learned during the last recession that the economy cannot run only on the service or knowledge sectors.

Without products, no one has the financial wherewithal to buy services. We need to manufacture products required by other tier or end customers. Technology is changing so rapidly, this type of training opportunity will allow companies within our region to access a pipeline of potential employees with the skills and industrial knowledge to increase workplace / product flexibility. Currently training is undertaken in more urban areas with higher costs plus travel plus lost work time to attend those centers. We plan to create a flexible, cohesive program that teaches specific needs as well as the management, communication, and leadership skills needed by our local companies.

Skill Demands

Currently, advisory boards (Business Enterprise Center (BEC), Manufacturing Center, and Robotics Curriculum & Equipment) have several recurring themes that are essential and overdue. To offer education and training to the local incumbent workforce, the underemployed, those who face barriers to employment, and direct from high school graduates in these areas:

- Integration of skills (this includes high-end automation integration as well as integration of soft skills along with technical training)
- Troubleshooting skills & training in processes of troubleshooting
- Automation and robotics
- Set up, calibrate and maintain new equipment as well as repair and re-calibrate existing equipment
- Strong communication abilities (written, verbal, presentation)
- General manufacturing skills for entry-level and high skilled personnel
- Create workforce pipelines in manufacturing
- PLC's, CNC's, code-writing, programming skills, etc.
- Technical integration of computerized languages
- Specific skills related to specific equipment or facilities as needed

Program Competition

We are the only four-year university that has the ability to offer this degree within a 50-75 mile radius. Technically- trained students will receive an officially transcribed education from a well-known Ohio university. But there are career tech high schools and community colleges that offer technical training programs in our region. A few manufacturers even have on-site training programs. This hasn't seemingly made a negative impact our business due to:

- Highly flexible training options with well-rounded curriculums
- Offers more in-depth, hands-on training than many on-site programs
- A wide variety of training equipment located in one area
- Our instructors are industry-trained and possess the skills required to do or to effectively teach these skills to a wide range of ages. This requires a unique skill set.

We do have limited competition from training centers such as Greenville CTC, Tri Star Career Compact, etc. These high school and/or adult instruction programs can partner with the WSU-Lake Campus BAMS program in order to not duplicate resources. Articulation agreements can be established to offer credit to students from those programs with additional credit hours taken at WSU-Lake Campus.

Program Implementation

The Bachelor of Applied Manufacturing Science (BAMS) degree program is proposed for implementation in fall 2019.

1. Quality and Efficiency

Annual assessment reviews of each program are conducted by each department in accordance with WSU requirements. These assessments include measurements of success for the goals for each program and include pertinent data such as enrollment figures, retention rates, and student academic progress. Measures used for assessment include student course evaluations, student success in completion of selected courses, evaluation of student projects by faculty, and annual surveys of alumni and employers of alumni. A continuous improvement component is contained in each program assessment.

2. Appropriateness

Feedback and quantitative data will be used to modify or extend the program's offerings. An assessment plan will be developed by BSME/BAMS faculty to evaluate the strengths and weaknesses of the program and to implement a continuous improvement cycle.

3. Student Demand

WSU-LC enrollment data indicate student demand for the educational opportunities offered by the Applied Manufacturing Science program. Continuous monitoring of actual enrollment and retention rates will be conducted along with the annual program assessment to show student demand and satisfaction levels. The recent increases in the BSME program have been, in large part, due to the interest of students to work within local manufacturing facilities. Continued demand is anticipated and the proposed degree provides a more focused opportunity for students.

4. Student Access

WSU-LC has an institutional commitment to facilitate student academic success. Currently, many support programs and tutoring opportunities are available through such academic programs as Math Center and the Student Success Center to assure students have access to those programs. In addition, WSU-LC also have offices for Disability Services as well as Veterans Services.

The proposed program is designed to be flexible in providing reasonable transfer credit for entry into the program, and program transfer without major loss of credit. Initial elective areas can be reconfigured in reaction to market trends and employment opportunities. The adoption and integration of evolving technologies to meet changing needs will also be a priority in the proposed program. Immediate market or short-term demand for Applied Manufacturing Science graduates will be gathered and tracked through company human resources departments, local job listings, technical managers of local industries, and industrial advisory committee members.

Conclusion

The geographic region to be served by this proposed program is primarily West Central Ohio and East Central Indiana. As a regional campus, many students attending WSU-LC are considered "non-traditional" and are employed in the area. Most students are linked to the region by family, employment or other financial responsibility. Most graduates of the proposed degree program with are expected to seek or continue employment in our area.

Due to the attrition of highly-skilled technicians because of an ageing workforce, the resurgence of manufacturing throughout Ohio & Indiana, along with emerging manufacturing technologies, this training need is critical to maintain the stability of our manufacturing firms. Offering the Bachelor of Applied Manufacturing Science at Wright State University Lake Campus will provide high-quality, reasonably-priced advanced education opportunities locally. Our region and our state will keep training dollars in the area, maintain high local employment rates, and retain manufacturing base.

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