IMPACT OF MANUFACTURING TECHNOLOGY EDUCATION TO LOCAL INDUSTRIES

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Abstract

In this paper, the history of a newly-established two-year manufacturing engineering technology program is presented. Impact of the program to the local community has been characterized by student population, student employment situations, and on-going collaboration with local industries. Statewide and local need assessment indicated that industries demand better-educated manufacturing workforces. The Northwestern Missouri area did not have a single postsecondary vocational technical education program in manufacturing that could produce the needed technicians or technologists for local industries. A two-year manufacturing engineering technology program would fit right into Missouri Western State College’s career-oriented education. Upon the approval of the Missouri Coordination Board of Higher Education, the program started in 1998, and within two years, collaboration with local industries had been established. Articulations with area technical schools have been going smoothly especially in the areas of facility usage and continuing education for students. Student-body growth is in accordance with projection. Student current employment situations and feedback from local industries regarding the improvement of the curriculum is presented.

Introduction

Manufacturing Engineering Technology is the profession in which the understanding of abroad range of technologies is necessary to apply and control manufacturing processes. It includes methods of production of industrial commodities and consumer products. The manufacturing professional must be able to plan, design and implement the facilities, tools, machines, and the sequence of operations for producing high quality products at competitive prices.

Manufacturing Engineering Technology is a highly interdisciplinary field, requiring elements from other areas of engineering technology, along with an in-depth knowledge of materials and manufacturing processes. The manufacturing professional must posses excellent technical and communication skills, knowledge of computers, electronics, materials, information technology, and globalism and multiculturalism.

Graduates with Associate of Applied Science in Manufacturing Engineering Technology will be able to fill a wide variety of positions. Specifically, career opportunities exist in manufacturing engineering of facilities, machinery and tool design, process and quality engineering, computer-aided design and computer-aided manufacturing (CAD/CAM), robotics and industrial
automation, computer integrated manufacturing (CIM), technical sales, plant engineering, production and supervision of management processes, and productivity improvement. Graduates have a strong, broad foundation that enables them to perform well in any field which requires the application of manufacturing principles. The graduates will grow as new technologies develop and at the same time will be sensitive to the impact of technology on society. Manufacturing engineers get involved in the production of a variety of industrial and consumer goods and develop the expertise to see them through the completion.

Missouri Western State College is a public, state supported institution providing a blend of traditional liberal arts and sciences and career-oriented degree programs. Professional education programs such as those in teacher education, nursing, engineering technology, and businesses have played an important role at Missouri Western for many years and have come to be seen as an area of strength for Missouri Western throughout the northwest Missouri region. The college has chosen to retain its open access policy while continuing its commitment to pursue academic excellence and quality teaching.

Missouri Western State College has long had career-oriented education as a primary part of its mission and function. It has a solid undergraduate program in engineering technology accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET). It valuably serves both its students and the employers of the City of St. Joseph, the northern fringes of the Kansas City metropolitan area, and its five-county regional service area by providing highly skilled engineering technologists and technicians to help the region grow and prosper. It wishes to continue to serve the people of Missouri in this way.

Because of its history of service to the State and community through its Engineering Technology preparation functions, the development of an Associate of Applied Science degree in Manufacturing Engineering Technology at Missouri Western represents the extension of an existing area of study rather than movement into a new area of study.

Education Needs Analysis

Community and student need for the program

With international competition demanding better-educated manufacturing workforces, Missouri Western State College proposes the degree program in Manufacturing Engineering Technology. The career outlook for manufacturing engineering technology graduates is very good. With a distinctive shift toward a global economy and in the strategic thinking of U.S. industries toward more efficient and competitive manufacturing operations, manufacturing engineering technologists are in high demand.

The development of this plan for a system of postsecondary vocational technical education has been guided by a vision of the need for a timely, responsive, and strengthened system of postsecondary vocational technical education. The curriculum objectives are to prepare skilled manufacturing technicians for the state's employer community and is distinguished by the following characteristics:
• A population that requires technological literacy as well as technical competence.
• An accessible and contemporary technology for delivery of technical education.
• An active partnership between employers, and Missouri Western State College, and the technical schools that identifies: needed programs and services; the technical competencies required of a highly trained and well-educated workforce; and, shared responsibility for the success of the curriculum.
• A comprehensive and articulated program that helps individuals be academically and technically prepared to advance to higher levels of education, employment, and income.

Statewide needs for associate degree in manufacturing engineering technology

Often, students, with support from their families, choose to pursue a course of study leading to the baccalaureate degree when the pursuit of an associate level degree might be the better choice. In addition, proportionately too few students choose to enroll in programs of study leading to the associate of applied science degree in a technical area when graduates of these programs are in such high demand by the employer community. This is particularly true of those programs that support manufacturing, which is an industry so critical to supporting the state's economy.²

Community colleges and private career schools, offering associate degree and certificate programs, are typically relied upon to provide vocational technical education at the post secondary level while area vocational technical schools provide the secondary-level instruction and training as well as programs for adults. These providers of post secondary vocational technical education in Missouri are not, however, sufficiently dispersed throughout the state to provide the geographic and financial access needed for a strong accessible system of post secondary vocational technical education. Several Missouri communities identified as regional trade centers and/or those communities developing a substantial base of manufacturing industries do not have the kind of access to post secondary vocational technical education and training opportunities needed for continuing education, training, and retraining of prospective and existing employees needed by employers.² While employer and education partnerships are beginning to emerge, there is not sufficiently comprehensive and meaningful exchange between educators and employers that is necessary for the state's post secondary vocational technical education programs to meet employer needs. Too many employers identify weaknesses in the preparation of students for employment; both in basic and technical skills.

Accessibility Analysis

Expanding the Accessibility of Technical Education Statewide According to the same study mentioned above, Missouri has 12 local community college districts and 57 areas vocational schools, all offering some form of secondary and post secondary vocational technical education. The number of industrial-related technical education programs offered by the state's public and private colleges and universities are limited, concentrated mostly at Missouri Western State College, Central Missouri State University, and Southeast Missouri State University. Several private career schools offer programs in industrial-related education and training; however, these are concentrated in St. Louis and Kansas City. Many Missouri communities have only limited, if
any, local or regional access to post secondary vocational technical education, training, and retraining opportunities. Consequently, expanding geographic and financial access to technical education programs, customized training and related support for Missouri’s employers is critical to the delivering of post secondary vocational technical education and training statewide. Thus, a series of interrelated strategies, that are best employed on a regional level, are needed to expand access to post secondary vocational and technical education. This can be accomplished through:

-- Development of regional plans for consortia of collaborating public and private schools, colleges, and universities to provide the ongoing education, training, and retraining of prospective and existing employees.

-- Delivery of programs, such as proposed AAS degree in Manufacturing Engineering Technology by Missouri Western State College would provide educational opportunities through technical education and training at the associate of applied science degree level that is not commonly offered by community colleges or area vocational technical schools.

-- Investments by the state of Missouri to establish centers of technological excellence to focus on the development and delivery of advanced technological education and training. Such centers of technological excellence would be recognized by the state of Missouri for being principal locations for the concentration of expertise and the targeting of financial and other resources in support of specific areas of excellence. Examples of such centers might include a focus on integrated manufacturing and industrial technologies.

Employment Projection

The Greater Kansas City area is examined for local job growth. Previous data indicate that 90.5% of all graduates found jobs in local area. The other 9.5% of graduates left Missouri for employment.¹

It has been shown that the number of jobs for manufacturing in Kansas City Metropolitan area would rise from its 1994 level of 106,874 to 141,108 in the year 2005. This rate is for both durable goods manufacturing and non-durable goods manufacturing. The durable goods manufacturing would rise from 50,706 in 1994, to 52,935 in 2005 with an increase of 2,229 jobs and a 4.40% growth rate. The non-durable goods manufacturing would rise from 56,168 in 1994, to 61,173 in 2005 with an increase of 5,005 jobs and an 8.9% growth rate. The same study also shows that the total number of jobs in goods producing industries in the Kansas City Metropolitan area will increase from 146,796 in 1994 to 159,886 in 2005 with an increase of 13,090 jobs and a growth rate of 8.92%.¹

Many local manufacturing industry groups have rebounded from 1991-1992 recession and are expected to add employment by 2005. The study divides manufacturing into two basic areas: durable goods and non-durable goods. Durable goods manufacturing are expected to increase by 5.5 percent (12,640) between 1994 and 2005. Non-durable goods manufacturing shows large gains in rubber and miscellaneous plastic products (3,987), food and kindred products (2,470)
and printing and publishing (1,796). Due to foreign completion, leather industry and apparel and textile industries show losses early in the projection period.¹

The total number of manufacturing jobs in the State of Missouri in 1994 was 415,643. This number of jobs is projected to increase to 432,354 in the year 2005 with an increase of 16,711 jobs and a percentage change of 4%. Out of this total number of jobs, the study shows that durable goods manufacturing jobs were 228,901 in 1994. This number would increase to 241,541 in the year 2005, with an increase of 12,640 and percentage change of 5.5%. The non-durable goods portion of jobs in 1994 was 186,742. This portion would increase to 190,813 in the year 2005, with an increase of 4,071 and percentage change of 2.2%.¹

Enrollment Growth

The first manufacturing engineering technology course was offered in the Fall semester, 1998. The student body at Missouri Western State College primarily consists of traditional students with about 5000 FTEs. Considering the nature of an A.A.S. degree in manufacturing engineering technology, in the contrary, we anticipated that the majority of the students in the program would be non-traditional, i.e, over 25 years of age and graduated from high school 2 or more years ago. Currently, 95 percent of our MET students hold full-time or part-time jobs. 75 percent of the MET student body are full-time employed. According to the above definition of non-traditional student, 90 percent of the MET students in first semester of the program were non-traditional. In the Fall, 1999, the percentage of non-traditional students dropped 75, which was still relatively high. The following table shows the enrollment growth by semester.

<table>
<thead>
<tr>
<th>Semester</th>
<th>Fall, 1998</th>
<th>Spring, 1999</th>
<th>Fall, 1999</th>
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<tbody>
<tr>
<td>Student Number</td>
<td>11</td>
<td>19</td>
<td>25</td>
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With very limited resources available for advertising, we face the most difficult task in student recruiting, to increase the awareness of the program in the community at its starting stage. While various methods such as flyers, web pages, school visits have been tested, it is apparent that the direct communication between faculty members and potential candidates is the most effective in recruiting.³

Community Support and Articulation

Local community welcomes technical education programs. When we were setting-up an advisory board, 16 people representing the middle or upper management of local industries, technical school as well as the chamber of commerce enthusiastically attended the advisory meetings twice in a period of six months. Advisory members provided supportive comments and ideas to recruitment, curriculum, and placement. They played a positive role in publicizing the program. Some of the advisory board members advised their employees to enroll in the program. Many members coordinated plant tours for faculty members and students to visit their facilities.
Several local companies intentionally set-up internship programs for MET students. The managers in those companies are very considerate for the students who are doing intern. Usually, they arrange flexible working hours to accommodate student’s class schedules and provide experienced individual to supervise the student.

Articulation between different educational institutions is an effective way to form a chain of technical education and training from lower level to higher level. The MET program is articulated with local technical schools or training center in two facets: curriculum articulation and facility-usage articulation. In curriculum articulation, six programs in welding, precision machining, industrial electricity and electronics from local technical schools or career centers have been articulated with the MET A.A.S degree. Students in these programs can get a head-start in the MET degree program by obtaining college credits under certain provisions. In facility articulation, most of the MET labs are conducted at local technical schools since our facility does not have appropriate equipment.

Future Demand

Manufacturing is a complex process which involves a series of activities such as designing, production, inventory, management, and shipping. To develop highly competitive workforce, an educational program should cover a broad band of subjects including mechanics, electronics, automation, material sciences, and management besides the general academic training. The majority of the students realize that there is much more to learn beyond the two-year program. Most of them indicated the strong wishes to pursue more. In our survey, 85 percent of the currently enrolled students in the program say they would pursue a B.S. degree in MET after they finish the A.A.S. degree while another 15 percent are undecided.

Conclusions

Clearly, today's economy and the world of work that supports/engenders it is significantly different from even ten years ago. The rate of change has exploded. The amount of technology readily available to all has increased exponentially. Job security has decreased considerably. Competition has escalated to global proportions. The future is much less predictable than before.

Today's and tomorrow's economy (gross domestic product) and quality of life are far more inextricably linked to the educational level of our peoples than ever before. Unless we are highly capable, we will be unable to attract new industry to Missouri. We will be unable to keep the competitive ones we already have. A human resource capability factor must be included into the equation used to calculate gross products. In plain words, our future and success depends on how many highly skilled people Missouri can offer its business and industry.
Bibliography


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