

A New Professional Masters Program: The Master of Science in Technological Processes

David A. Pape, Thomas E. Kullgren, Saginaw Valley State University

Abstract

Saginaw Valley State University (SVSU), founded in 1963, is a regional comprehensive public university that has seen steady growth in enrollment to its current level of about 8500 students. Within the University, the College of Science, Engineering, and Technology is home to ABET accredited undergraduate programs in both mechanical and electrical engineering, but does not offer any discipline specific graduate programs. In 1998, to meet the needs of working professionals, a graduate program designed to add technical knowledge, leadership and management strategies to existing workplace skills was initiated. This degree, called the Master of Science in Technological Processes, includes coursework in both technical and professional disciplines, and is targeted at individuals with undergraduate degrees in science, engineering, computer science, mathematics, or engineering technology. The program is offered entirely on campus with evening classes and concludes with an industry-based capstone Field Project. In this paper the first two plus years of the program are presented and analyzed. The student population, which has developed into an interesting mixture that includes a significant international population and a broad representation of undergraduate majors, is discussed. Other demographics of interest presented include the ratio of full time to part time students, and the gender and age distribution of the students. Also included is a description of the faculty who make up the program, both full time and adjunct, who themselves represent a wide variety of disciplines. Interaction with industry, including participation in final projects and acceptance of program graduates is also presented.

Introduction

Saginaw Valley State University (SVSU), founded in 1963, is a regional comprehensive public university that has seen steady growth in enrollment to its current level of about 8500 students. The University is located in a heavily industrialized area of east-central Michigan in which over 2200 manufacturing firms, ranging from small operations to Fortune 500 companies, are based. The area is also the home of major product divisions of the Dow Chemical Company, Dow Corning Corporation, General Motors, and Delphi and to large health care centers, a significant banking community, and other similar organizations that employ large numbers of technical professionals. SVSU provides a

comprehensive array of baccalaureate degree programs and a select number of masters degree programs in the following five Colleges: Arts and Behavioral Sciences, Business and Management, Education, Nursing and Health Sciences, and Science, Engineering, and Technology. The College of Science, Engineering, and Technology is home to ABET accredited undergraduate programs in both mechanical and electrical engineering, but does not offer any discipline specific graduate programs. In order to meet the needs of working professionals, a graduate program designed to add technical knowledge, leadership and management strategies to existing workplace skills was initiated.

There are an increasing number of institutions offering masters degrees in Engineering Management¹. However, this degree option is generally limited to students with undergraduate degrees in engineering. Merino², discusses “executive level” masters programs in Technology Management, Management of Technology and Engineering Management at various institutions, which also have a limited audience. More inclusive technical masters degrees, available to a broader spectrum of students are described by Depew et. al.³, Qazi, et.al.⁴, and Curtis and Latif⁵. The program described herein belongs to this latter class of programs.

In 1995 faculty and staff, at the urging of graduates and industry leaders, began discussing the current situation with respect to the needs of these technical professionals for advanced education. In 1996 a survey was mailed to graduates in science and engineering residing in our closest three counties. It was apparent that SVSU graduates, like those from other universities, were well educated in the technical fundamentals of their undergraduate discipline but not in a wide variety of issues, both technical and organizational, facing them on a daily basis in the workplace. Graduates from SVSU were employed in a variety of sectors and had a keen interest in pursuing more education but only if the effort they would expend was very directly related to their progress in their workplace. MBA programs, both at SVSU and at other regional institutions, are attractive to some, but not a majority, of technical professionals. On the other hand, discipline specific graduate programs were in some cases viewed as not focused on the needs and interests of this group. Thus, the results of this survey showed a strong interest in a program that was both technically oriented and that also addressed the professional issues viewed as important for career advancement and career enhancement.

Therefore, in the 1996-1997 time frame, a program was developed with objectives that support the development of the technical professional in the following five areas:

- *The technical knowledge and expertise to become more effective and productive in a technically complex workplace.*
- *Leadership and management strategies for promotion to middle- and upper-level positions.*
- *The ability to engage in a personal program of life-long learning.*
- *A high level of proficiency in written and oral communication*
- *An understanding of ethical, regulatory and social responsibilities of public and private sector technical professionals*

This program, called the Master of Science in Technological Processes, is targeted at individuals with undergraduate degrees in science, engineering, computer science, mathematics, or engineering technology. The program requires 33 credits to complete and includes coursework in both technical (information technology, manufacturing, systems modeling, and quality) and professional (management, finance, and leadership) disciplines. All program course work supports one or more of these objectives. The program is offered entirely on campus with evening classes and concludes with a three-credit industry based capstone Field Project. The Field Project provides an experience in which all five of the above objectives are integrated and evaluated. The mix of course and project work is designed around the specific, demonstrated needs of the workplace. Course offering times are designed with the working student in mind. Courses are "stand alone" without prerequisites so each student can design their program in a flexible manner. In the fall of 1998 the first set of students enrolled, and the program had its first graduates in May 2000.

Program Title

Perhaps no other issue caused as much discussion or took as much time as the selection of a program title. It was important to acknowledge in the title the nature of the program and to clearly state what the program was, and was not. Words like "management" were too much like the MBA for technically oriented students; "engineering" might intimidate technical professionals who did not receive their undergraduate degree in engineering. Further, it was important that something like "technology" was present in the title to signify the technical nature of the program.

Robert A. Lutz, former President and Chief Operating Officer of Chrysler Corporation, was instrumental in resolving this dilemma when, during a luncheon address at the 1996 Engineering Development Forum, he said:

"How will we know when universities have truly knocked down their chimneys? Well, how about when two departments get together on a program that leads- not to a degree in either one specialty or the other, or else to two separate degrees – but to a single hybrid degree? Say, something like a "Master's in Process Management," rather than just the traditional choice between an MBA and a Master's in Engineering. I don't know if that's practical or not – but, then again, a lot of people said that platform teams would never work in the auto industry either!"

So the word "technological" was married to Bob Lutz's "processes" to produce the present program title, Master of Science in Technological Processes, or MSTP.

Program Structure

The MSTP program consists of eleven courses totaling 33 credit hours. These courses are distributed as follows: four core courses, four "track" courses, two electives, and one capstone "field" project.

*"Proceedings of the 2001 American Society for Engineering Education Annual Conference & Exposition
Copyright © 2001, American Society for Engineering Education"*

Core (12 Credits)

All students are required to take the four core courses. These courses are designed to address a common set of issues necessary for the technical professional to perform effectively and to advance within an organization. The core courses are:

- *MGT 501 Leading and Managing the Technical Organization*
- *MSTP 502 Safety, Regulatory Issues, and Ethics*
- *MSTP 503 Information Technology and Management*
- *MSTP 504 Design of Experiments*

Concentration Track (12 Credits)

The selection of a concentration track depends upon a student's career path and goals. Track 1 has been designed for manufacturing professionals. These individuals are employed predominately in organizations affiliated with the automotive industry. Track 2, for technical sector professionals, tends to attract students from chemical processes and information technologies companies. The selection of a concentration track by a student is made after consultation with the faculty advisor. The courses that comprise each of the two tracks are listed below:

Track 1 (For Manufacturing Professionals)

- *MSTP 511 Manufacturing Methods*
- *MSTP 512 Manufacturing Materials*
- *MSTP 513 Product Design and Development*
- *FIN 602 Accounting and Finance for Technical Managers*

Track 2 (For Technical Sector Professionals)

- *MSTP 521 Scientific and Engineering Systems and Modeling*
- *MSTP 522 Industrial Ecology*
- *MSTP 523 Quality Methods in the Technical Organization*
- *OLA 670/671 Leadership Seminar/Practicum and Research in Leadership or
MGT 621 Organizational Behavior and Leadership*

Electives (6 Credits)

Two elective courses totaling six credits must be selected either from the concentration track not chosen or from a list of graduate courses offered by other graduate programs within the university. Alternatively, either or both of two courses offered by MSTP faculty may be used as electives. These are *Special Topics* and *Research in Science and Engineering*. The list of electives offered by other graduate programs is as follows:

- *Mediation and Conciliation*
- *Gender and Ethic Issues*
- *Professional Ethics*
- *Cross-Cultural Relations*
- *Personnel Management*
- *Operations Management*
- *International Management*
- *Legal Environment of Business*
- *International Legal Environment*
- *Labor Law and Collective Bargaining*

Field Project (3 Credits)

The student must complete a field project designed in consultation with and guided by a faculty advisor and a representative from the sector most closely related to the subject of the field project. The faculty advisor, the MSTP program coordinator, and the Dean of the College of Science, Engineering, and Technology must approve the project. The results of the field project must be presented in both oral and written forms. The following list of titles for some projects completed or currently underway gives an idea of the wide variety of applications investigated through these projects:

- *Industrial Solvent Recovery*
- *Environmental Indicators for Bay County- A Study*
- *Dockboard Standards Project*
- *Vacuum Assisted Casting: Investigation of a Product Line*
- *Optimum Method of Function Testing Prototype Power Steering Gears*
- *Improving Leak, Break, and Spill Reporting Processes*

The Faculty

The faculty who teach MSTP courses in the program are drawn from a variety of academic departments within the College of Science, Engineering, and Technology, including chemistry, biology, computer science, electrical engineering, and mechanical engineering. Further, the course load is distributed such that any one department teaches no more than two courses. Elective courses are taught by faculty from the College of Business and Management and the College of Arts and Behavioral Sciences.

In addition to the full time faculty, adjunct faculty with special expertise in various areas have been recruited to teach certain courses. For instance, a senior staff attorney from a major chemical company teaches MSTP 502 Safety, Regulatory Issues, and Ethics, supplying the “real world” experiences that even the best full time faculty cannot provide. At the present time, adjunct faculty are used to teach four of the twelve core and concentration track courses.

Student Demographics

After the first two full years of operation, some interesting statistical information has been gathered by the university's graduate admissions office. Table 1 shows the distribution of students by gender, broken down by both full time and part time students. A strong majority (93 percent) of the students are part time, reflecting the target audience and intended nature of the program. The 2-1 ratio of male to female students is remarkably strong for a technology based graduate program, and possibly indicates the appeal of this program to a diverse audience including women.

Table 1: Gender of MSTP students

<i>Gender:</i>	<i>Full-time</i>		<i>Part-time</i>		<i>All Students</i>	
	<i>Headcount</i>	<i>Percent</i>	<i>Headcount</i>	<i>Percent</i>	<i>Headcount</i>	<i>Percent</i>
Female	0	0.0%	15	34.9%	15	32.6%
Male	3	100.0%	28	65.1%	31	67.4%
Total	3	100.0%	43	100.0%	46	100%

The ethnic background of MSTP students is presented in Table 2. While a majority (71.7 percent overall) of both male and female students describe themselves as "white", it is significant that the rest of the student population is relatively evenly distributed among several ethnic groups. The second largest "ethnic" grouping, with six students, or 13.0 percent, are the international students. It is interesting to note that these six students come from five different countries (China, India, Korea, Mexico, Russia) indicating widespread acceptance of this degree.

Table 2: Ethnic Background of MSTP students

<i>Ethnic Background:</i>	<i>Female</i>		<i>Male</i>		<i>All Students</i>	
	<i>Headcount</i>	<i>Percent</i>	<i>Headcount</i>	<i>Percent</i>	<i>Headcount</i>	<i>Percent</i>
American Indian/Alaskan Native	0	0.0%	0	0.0%	0	0.0%
Asian/Pacific Islander	1	6.7%	1	3.2%	2	4.3%
Black	2	13.3%	1	3.2%	3	6.5%
Hispanic	0	0.0%	1	3.2%	1	2.2%
White	10	66.7%	23	74.2%	33	71.7%
Canadian	0	0.0%	0	0.0%	0	0.0%
International	1	6.7%	5	16.1%	6	13.0%
Multi-cultural	1	6.7%	0	0.0%	1	2.2%
Not Reported	0	0.0%	0	0.0%	0	0.0%
Total	15	100.0%	31	100.0%	46	100%

The age distribution of MSTP students is presented in Table 3. The average age of an MSTP student is 32.8 years, with the average age of female and male students 31.2 and 33.6 years, respectively. As can be seen in this table, over 50 percent of students are

between 25 and 34 years old, while almost three-quarters (73.9 percent) are between 25 and 39 years old. Although there are not large differences due to gender in most age brackets, two trends are noted. First, a much larger percentage (20.0 to 3.2 percent) of female students are beginning the program between ages 22 and 24 compared to male students. On the other hand, all students over the age of 50 are male.

Table 3: Age Distribution of MSTP students

<i>Age Distribution:</i>	<i>Female</i>		<i>Male</i>		<i>All Students</i>	
	<i>Headcount</i>	<i>Percent</i>	<i>Headcount</i>	<i>Percent</i>	<i>Headcount</i>	<i>Percent</i>
21 and under	0	0.0%	0	0.0%	0	0.0%
22 to 24	3	20.0%	1	3.2%	4	8.7%
25 to 29	5	33.3%	10	32.3%	15	32.6%
30 to 34	3	20.0%	8	25.8%	11	23.9%
35 to 39	2	13.3%	6	19.4%	8	17.4%
40 to 49	2	13.3%	4	12.9%	6	13.0%
50 or over	0	0.0%	2	6.5%	2	4.3%
Total	15	100.0%	31	100.0%	46	100.0%

Enrollment Trends

At this time, two complete cycles of course offerings have been completed. Course enrollments for all courses offered strictly to MSTP students since the inception of the program are given in Tables 4 through 6. Since elective and other courses taken by non-MSTP students are not included, these numbers show actual MSTP students registered. Virtually without exception, course enrollments have significantly increased from year one to year two of the program. Total student credit hours (SCH) have increased by 27.1% from 1998-1999 to 1999-2000 (354 SCH to 450 SCH).

The core courses are approaching capacity (25 students) and will likely reach this level in the 2000-2001 academic year or following. When this level is reached it will trigger a decision regarding the feasibility of additional offerings of these courses.

Table 4: Course Enrollment, Fall Semesters

	<i>Fall 1998</i>	<i>Fall 1999</i>	<i>change</i>
MSTP 503	14	22	+57.1%
MSTP 504	18	19	+5.6%
MSTP 512	9	11	+22.2%
MSTP 523	7	15	+114.3%
Total	48	67	+39.6%

Summary and Conclusion

In this paper a new interdisciplinary Masters degree program has been described. Preliminary data from the first two years of the program are presented and analyzed. The

student population, which has developed into an interesting mixture that includes a significant international population and a broad representation of undergraduate majors, was analyzed. Other demographics including the ratio of male to female students and the ethnicity and age distribution of the students are discussed. An outline of the courses comprising the program and some examples of capstone field projects have been listed. The program, although still in its early stages, seems to be providing a significant benefit for citizens in our technically oriented service region.

Table 5: Course Enrollment, Winter Semesters

	<i>Winter 1999</i>	<i>Winter 2000</i>	<i>change</i>
MGT 501	14	18	+28.6%
MSTP 502	21	19	-9.5%
MSTP 511	10	16	+60.0%
MSTP 521	5	12	+140.0%
Total	50	65	+30.0%

Table 6: Course Enrollment, Spring/Summer Semesters

	<i>Spr/Su 1999</i>	<i>Spr/Su 2000</i>	<i>change</i>
MSTP 513	2	18	+800.0%
MSTP 522	6	10	+66.7%
FIN 602	12	*	n/a
Total	20	28	+40%

*Not offered

Bibliography

1. Koehn, E., "Innovative Masters Degree in a Professional Program," *Proceedings, 1999 ASEE Annual Conference*, Session 2515.
2. Merino, D.N., "Executive Level Masters Programs in Technology Management (TM), Management of Technology (MoT) and Engineering Management (EM)," *Proceedings, 2000 ASEE Annual Conference*, Session 2342.
3. Depew, D.R., Dunlap, D.D., and Newton, K., "A Different Model in Graduate Education for Full Time Professionals," *Proceedings, 2000 ASEE Annual Conference*, Session 3255.
4. Qazi, S., Hsie, A., Das, D.K., "An Integrated Master of Science Program in Advanced Technology," *Proceedings, 1998 ASEE Annual Conference*, Session 3448.
5. Curtis, K. and Latif, N., "Master of Science in Technology: Program Design, Development, and Implementation," *Proceedings, 1998 ASEE Annual Conference*, Session 3448.

Biographical Sketches

DAVID A. PAPE

David A. Pape is an Associate Professor of Mechanical Engineering and Chair of the Mechanical Engineering Department at Saginaw Valley State University. He also serves as the Program Coordinator for the Master of Science in Technological Processes Program. From 1989 to 1998 he was a faculty member at Alfred University, where he served as Department Chair from 1995-1998. Dr. Pape earned a B.S. degree with distinction in Civil Engineering from Clarkson University in 1980 and a Ph.D. in Engineering Mechanics from the State University of New York at Buffalo in 1988. He has been elected into the Chi Epsilon, Tau Beta Pi, and Phi Kappa Phi honor societies.

THOMAS E. KULLGREN

Since 1984 Thomas E. Kullgren has served as the Dean of the College of Science, Engineering, and Technology at Saginaw Valley State University. Dr. Kullgren received a B.S. degree in Engineering Science and a commission in the United States Air Force in 1964 following graduation from the Air Force Academy. He received a M.S. in Applied Mechanics from Stanford University in 1972, and a Ph.D. in Mechanical Engineering from Stanford University in 1976. From 1976 to 1984 Dr. Kullgren taught at the Air Force Academy, and was promoted to Professor and Head of the Department of Engineering Mechanics in 1982.