

MACHINE TOOL TECHNOLOGY

Needs Assessment

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HIGHLIGHTS

Purpose: The purpose of this report is to review current industry needs and educational responses related to the Machine Tool Technology programs at Oakland Community College: Machine Tool Technology (MAC) and Machine Tool Technology with the Numerical Control Option (NUM).

Methodology: This report includes an extensive literature review, official data, information obtained from telephone interviews with industry experts, and analysis of data collected from telephone surveys with employers and current or former OCC students who have enrolled in the MAC or NUM program in the last six semesters (Summer 1994 to Fall 1995).

Existing Programs: The Auburn Hills campus of OCC offers a Certificate of Achievement program as well as an Associate of Applied Science (AAS) program in Machine Tool Technology. OCC also offers an AAS in Machine Tool Technology with the Numerical Control Option. In addition, the Center for Dislocated (CDW) workers offers a 15 week Machine Tool Technology Program.

Occupational Outlook: The national demand for employees in the machine tool industry is decreasing. However, in Michigan, the demand for machine tool operators and numerical control operators (Computer Numerical Control) is expected to increase through the year 2005, with an average of 190 and 160 openings per year respectively. According to the employer survey, 44% of the respondents predict the employment future for machine tool employees in their company to be *excellent*. This could be due to the fact that, in this geographic area, the automobile industry is doing very well at this point in time.

Wages: Respondents to the employer survey indicate that the average beginning wage for entry-level employees in this industry is \$8.08, while the average maximum wage is \$19.50. The type of shop that indicated the lowest entry-level wage was CNC prototype (\$7.72), while the highest maximum wage was reported by a fabricating shop (\$20.49).

Level of Education/Training Needed: According to the literature and responses from the employer survey, it is not necessary to have education or training to obtain an entry-level position in the machine tool industry. However, further education and/or training can enable an employee to advance to a higher position, and several employers indicated that they do provide on-the-job-training.

Available Training: In the state of Michigan, there are twenty-two community colleges (including OCC) that offer programs in Machine Tool Technology and/or Computer Numerical Control. In addition, there is a Machinist Training Institute within Focus Hope, which is a private school.

Student Survey Analysis: Nearly all of the students surveyed (83%) indicated that their main reason for attending OCC was to *improve specific skills*. The majority of the students also indicated that they were satisfied with the Machine Tool Technology programs at OCC, however several mentioned that they did not receive enough time on the machines, and that the classes were too large.

Cost Analysis: There is an apparent need to update the machine tool lab at OCC: certain machinery is in need of replacement, and additional new machinery (e.g., CNC) is necessary to provide students with adequate skills necessary for employment in the industry today.

Summary: Results from this report indicate that the machine tool industry in Michigan will continue to grow in the near future, and that computers will play a major role in this growth. Therefore, in order to meet industry needs, the college should consider updating the lab.

Oakland Community College

Machine Tool Technology Programs

Needs Assessment

INTRODUCTION

The purpose of this report is to review current industry needs and educational responses related to the machine tool industry. The programs being reviewed are Machine Tool Technology (MAC) and Machine Tool Technology with the Numerical Control Option (NUM).

The report includes a literature review, information compiled from telephone interviews with industry experts, and an examination of related programs in other higher education institutions. Phone surveys of businesses employing individuals in this field, as well as students who have enrolled in classes in these two programs within the last six semesters (Summer 1994 to Fall 1995) at Oakland Community College (OCC) were also conducted.

DESCRIPTION OF EXISTING PROGRAMS

Both of the programs being analyzed in this report are based on machine tool technology: Machine Tool Technology (MAC) and Machine Tool Technology/Numerical Control Option (NUM).

Machine Tool Technology (MAC)

The Auburn Hills campus of Oakland Community College offers both a Certificate of Achievement program as well as an Associate in Applied Science Degree (AAS) with a specialization in Machine Tool Technology (See Appendix A). The student must complete 45 credit hours before applying for a Certificate of Achievement in Machine Tool Technology. The AAS program, which requires a minimum of 64 credit hours, includes training in the following areas: the operation of basic machine shop equipment, metal cutting on the drill press, lathe, milling machines, grinders, and saws. This hands-on experience focuses on instruction ranging from basic hand tools through more complex numerical control operations. Training also emphasizes safe and proper practices.

Upon completion of this program, the student should have the necessary hands-on training and theory for an entry-level position as a machine tool operator or machinist.

Machine Tool Technology Numerical Control Option (NUM)

The Auburn Hills campus of OCC offers a Certificate of Achievement program as well as an AAS Degree in Machine Tool Technology with a Numerical Control Option (See Appendix A). This program, as described in the college catalog, emphasizes the use of punch tapes to operate machines. However, faculty members teaching the program indicate that they are currently teaching the operation of machines directly from a computer, rather than using a punch tape. Included in the program are instructions in the following areas: programming techniques; computer controls; computer numerical control (CNC); and the interfacing of CAD and CAM systems. This program is designated as an Extended Associate Program, due to the fact that the student must complete in excess of 72 credit hours.

Graduation from this program will allow the student to gain entry-level employment in the NC or CNC machining industry.

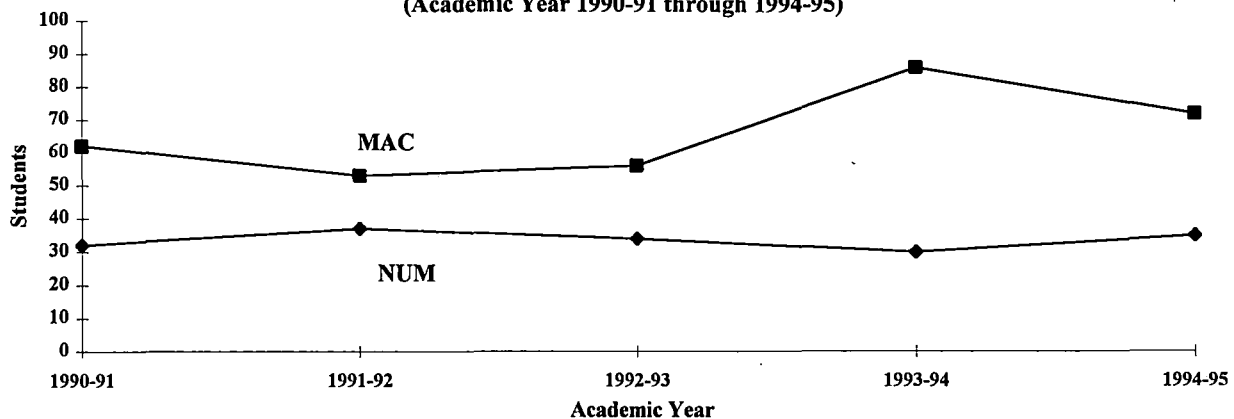
Enrollment Trends

Student headcount in MAC and NUM over the past five years indicate a fairly stable trend. Enrollment in MAC has continuously exceeded NUM by nearly twice as many students over a five year period (See Table 1, Figure 1).

Table 1
OCC Enrollment Trends for MAC and NUM

<i>Academic Year</i>	<i>MAC</i>	<i>NUM</i>
1990-91	62	32
1991-92	53	37
1992-93	56	34
1993-94	86	30
1994-95	72	35

Figure 1
OCC Enrollment Trends for MAC and NUM
(Academic Year 1990-91 through 1994-95)



This trend does not support the responses of employers and students. For example, students and employers have indicated that the current trend in the machining industry is CNC, and the future is sure to bring more computers into this field. However, based on the enrollment trend information, there is a much greater number of MAC students than NUM students. This could be indicative of the fact that the catalog description is not current with what is actually being taught in the program. The catalog description for NUM is not current, and does not appear to provide today's industrial needs, therefore, students may choose not to enroll in a program that is not going to furnish them with the skills and knowledge that they need for employment. In addition, employers may also be hesitant to send their employees to this program if they feel they will not acquire the necessary skills for employment in their company.

OCC Center for Dislocated Workers Machine Tool Technology Program

Oakland Community College, through the Center for Dislocated Workers (CDW), also offers an intensive 15 week program in Machine Tool Technology. This training program is based on current industry demands. Participants in this program receive training in job-seeking skills, assessment services, and job-placement assistance. CDW works directly with individuals, and provides supportive services and employability skills workshops. In addition, based on governmental requirements, laid-off workers and other displaced workers may be eligible for scholarships.

OCC Apprenticeship Program

In addition to the above mentioned machine tool technology programs, OCC offers various Apprenticeship programs which focus on the machine tool industry, including but not limited to the following: Machine Repair, Machine Builder, Machinist, and Tool Maker Jig and Fixture. These apprentices are likely to be currently employed in the machine tool industry. Potential apprentices must pass a company approved apprentice test in order to be accepted into the program by their employer; only the top five percent of applicants are accepted as apprentices. Entrance into the employer apprentice program depends on the test score and how many others are on the list.

DESCRIPTION OF OCCUPATIONS

The following is a list of various occupations that may be obtained by an individual who has training and/or education in one of the two programs (this list is not exhaustive):

****Machinist***

Maintenance Machinist

Automotive Machinist

Fixture Maker

Experimental Machinist

Construction Equipment Machinist

CNC Machinist

****Machine Tool Operator***

Production-Machine Tender

Transfer Machine Operator

Centrifugal-Control-Switches Operator

Machine Tool Setter

Die Setter

Job Setter

****Numerical Control Machine Tool Operator***

Numerical Control Machine Tool Programmer

Machine Tool Operators

Generally, machine tool operators use a variety of cutting or forming machine tools such as lathes, grinders, milling machines, drill presses, or special purpose machines to mass-produce metal tools, such as wrenches and parts for other products (e.g., automobiles, tanks, airplanes, televisions, etc.). In addition, they may have other duties such as loading automatic machine feeding devices, starting the machine, moving the controls to adjust the machine, etc.

Michigan is one of nine states with many metalworking industries, therefore there are numerous machine tool operators in this state (*Chronicle Guidance Publications, 1991*).

Numerical Control Operators

Machining with Numerical Control (NC), involves the automation of machine tools by computer numerical control. By way of electronic circuitry and controls, it is now possible to program a series of machining operations which allow the machine to automatically produce a part and duplicate it for as many pieces as necessary. If the part is positioned correctly, the machine will do the rest. The CNC operator feeds the machine from a computer, in contrast to a NC operator using a punch tape.

Almost all NC machines are now computer numerically controlled, meaning that the controllers are computers. Each type of CNC machine performs a specific task.. CNC machines are often used in Computer-Integrated Manufacturing (CIM) systems.

Duties of numerically-controlled machine tool operators (or computer numerical control) vary. In some cases, operators tend just one machine; however, some NC (or CNC) operators may tend a number of different machines and also do programming.

The use of CNC machine tools has revolutionized the machine tool industry, and it has been said that little skill or training is necessary to operate machines because the programming of them has been greatly simplified. (Losman and Liang, 1990). These findings support information compiled from the employer survey, in that there really are no educational requirements necessary for entry level employment in this industry.

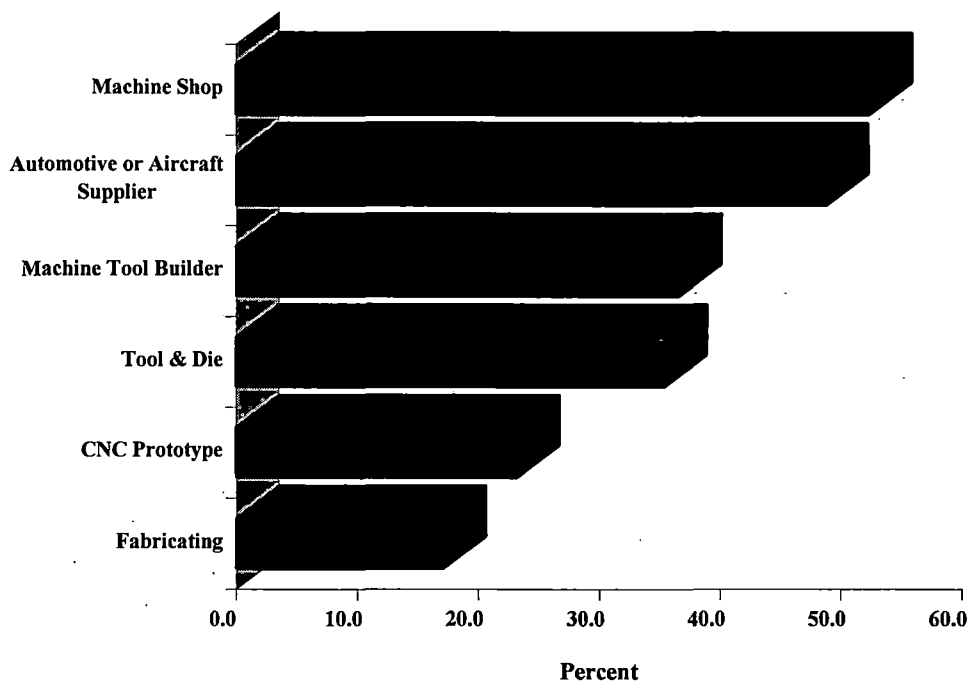
METHODOLOGY

In order to obtain information about the machine tool industries, a literature search was conducted, and 82 employers were surveyed by telephone (See Appendices B and C). In order to provide more detailed analysis related to industry type, employers were asked to categorize their business into one of the following classifications: machine shop, automotive or aircraft supplier, machine tool builder, tool & die, CNC prototype, or fabricating (See Table 2, Figure 2).

Table 2
Type of Organization

	<i>Number</i>	<i>Percent</i>
Machine Shop	43	52.4
Automotive or Aircraft Supplier	40	48.8
Machine Tool Builder	30	36.6
Tool & Die	29	35.4
CNC Prototype	19	23.2
Fabricating	14	17.1
Total	175	

Figure 2
Type of Organization



In addition, students who have taken classes in either the MAC or NUM program in the past six semesters were contacted and surveyed (See Appendix D). Of the 140 students classified as being in either the MAC or NUM curriculum in the past six semesters, 70 completed the survey.

Quantitative analysis of the employer and student survey data was conducted by means of frequency distributions, cross-tabs, correlations, and means analyses. Verbal responses were analyzed for their content (See Appendices E and F).

ANALYSIS

Occupational Outlook & Employment Opportunities

Nationwide

According to *Career Information Center*, the national employment outlook for machine tool operators is poor and for numerical control machine operators is fair. *The Bureau of Labor Statistics (Discover)* states that the machine tool operator category is expected to decline by 16% through the year 2005 as a result of the increased use of automated tools which will decrease the demand for operators. *The Occupational Outlook Handbook* states that the national employment outlook for machine tool operators is expected to decline slightly by the year 2005, however many job openings will arise due to the loss of experienced machinists who have retired or transferred to a different occupation.

The *Occupational Outlook Handbook* states that employment of numerical controllers, or more specifically CNC operators, is expected to increase by the year 2005. This increase can be attributed to the vast amount of computerized machines that are becoming a part of the machining industry. It is also indicated that lower-skilled positions, such as manual machine tool operators, are likely to be eliminated in the near future. *MOIS* also states that the national employment of numerical control operators is expected to increase, although somewhat slowly, through the year 2005.

Statewide

Michigan employment of machinists is expected to show little or no change through the year 2005 (a possible expected growth of 1%) (*MOIS*). An average of 550 openings a year is expected. Employment for machine tool operators is expected to increase faster than the average for all Michigan occupations by the year 2005. The growth expected is 31%. An average of 190 openings in Michigan per year is expected. Those operators with a familiarity of numerical control (NC) and computer numerical control (CNC) will have an advantage over others in finding jobs as a machine tool operator (*MOIS*). In addition, Michigan employment of numerical control machine tool operators is expected to grow by the year 2005 at a rate of three percent (*MOIS*), and there is expected to be an average of 160 yearly openings for NC operators in Michigan.

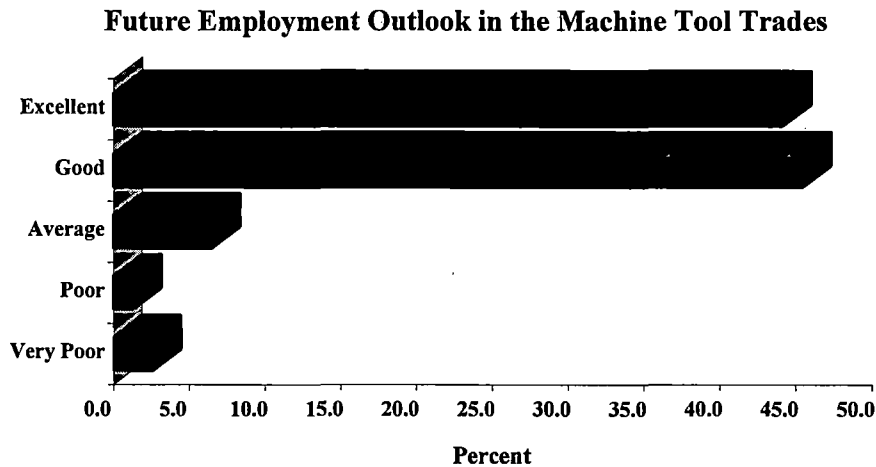
Employer Survey Analysis

Of the 77 employers who responded to the question regarding how they foresaw employment opportunities in the machine tool trades field, 44% (34) felt that the future was *excellent*, while only three percent (2) responded that it was *very poor* (See Table 3, Figure 3).

Table 3

Future Employment Outlook in the Machine Tool Trades		
	<i>Number</i>	<i>Percent</i>
Excellent	34	44.2
Good	35	45.5
Average	5	6.5
Poor	1	1.3
Very Poor	2	2.6
<i>Total</i>	<i>77</i>	<i>100.0</i>

Figure 3



This information contradicts what is expected at the national level, but supports state-wide expectations, which may be due to the fact that the automobile industry is presently doing very well in Southeastern Michigan.

Employee Wages and Benefits

Nationwide

The *Occupational Outlook Handbook* states that most machine tool operators, NC tool operators, and CNC operators receive standard benefits such as vacation and sick leave, pension plans, and retirement plans, and that most Machinists receive health and life insurance, paid vacations and sick leave, and a pension plan.

Statewide

According to *MOIS*, depending upon the employer, most machine tool operators and NC operators in Michigan receive fringe benefits such as paid vacations, life and medical insurance, paid holidays, and a pension plan. These benefits are usually paid for by the employer, at least in part. In some instances, employees and employers may contribute jointly to union trust funds to pay for other additional benefits.

Employer Survey Analysis

Of the 82 employers surveyed, each of them responded that their employees receive *basic benefits*, such as paid vacation, health benefits, and a retirement plan. In addition to these benefits, they were also asked what types, if any, of educational benefits were available to their employees. More than half responded that they would reimburse college tuition if the student passed the class with at least a *C* or better, and if the class pertained to the job.

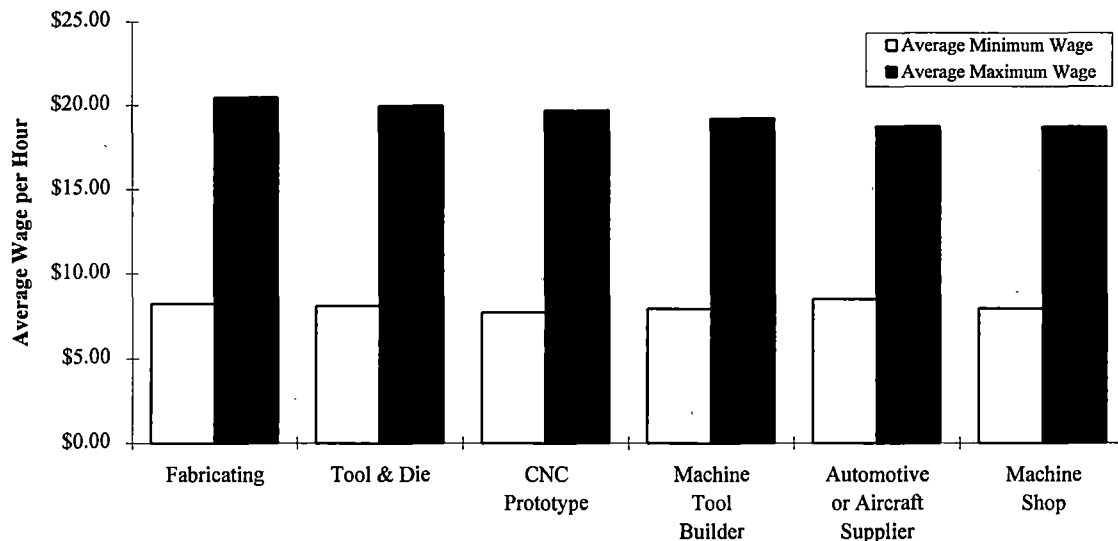
Employers were asked to specify the average minimum and maximum wages at their business (See Table 4, Figure 4).

Table 4
Average Wages for Machine Tool Trades Occupations

<i>Employer Type</i>	<i>Average Minimum Wage</i>	<i>Average Maximum Wage</i>
Fabricating	\$8.25	\$20.49
Tool & Die	\$8.11	\$19.98
CNC Prototype	\$7.72	\$19.73
Machine Tool Builder	\$7.94	\$19.24
Automotive or Aircraft Supplier	\$8.51	\$18.79
Machine Shop	\$7.95	\$18.76
Total Average	\$8.08	\$19.50

* 82 total respondents

Figure 4
Average Wages for Machine Tool Trades Occupations



The range of wages prove to be relatively high, considering the fact that the average minimum wage was \$8.08, while the average maximum wage was \$19.50. The type of shop responding with the lowest minimum wage was *CNC Prototype*(\$7.72), and the type of shop

with the highest minimum wage was *Automotive or Aircraft Supplier* (\$8.51). In addition, the type of shop with the lowest maximum wage was *Machine Shop* (\$18.76), and with the highest maximum wage was *Fabricating* (\$20.49). These figures indicate that those working in the machine tool industry appear to be earning a relatively high wage.

Advancement Opportunities

Nationwide

According to the *Occupational Outlook Handbook*, most machine tool operators, including NC operators, learn the basic operations and functions of a machine in the first few weeks, but may need several years to become a skilled operator, or to advance to more highly skilled jobs. Machine tool operators may become skilled operators with the appropriate training and skills; they may also enroll in machinist apprenticeships to become machinists (*Discover*).

Statewide

MOIS indicates that machine tool operators usually begin as trainees, and after several months of training, they may advance to operators. With experience, they may advance to a skilled machine tool operator, set-up operator, inspectors, machinists, or supervisors. Advancement depends upon further training or education. Advancements to positions such as supervisor is based upon individual initiative, ability, and work record. Machine operators may gradually advance to NC tool operators after gaining further training and experience (*MOIS*). In addition, some NC tool operators may advance to NC tool programmers.

Employer Survey Analysis

Overall responses from the employer survey indicate that employees can make the usual advancements such as lateral moves to a new machine, bench hand to tool maker, etc. Some employers indicated that the advancement opportunities are "unlimited" and "wide open". Other employers stated that employees could advance to leaders, supervisors, or foremen.

This information supports evidence from the literature: with experience and training, employees can advance to higher level positions.

Opportunities for Women and Minorities

Statewide

The 1990 Census indicated that four percent of machinists in Michigan were female, one percent were of Hispanic origin, and five percent were black (*MOIS*). It is also stated that two of the total number of NC tool operators in Michigan were women, and six percent were black.

Occupations in the machine trades have traditionally been dominated by men. It is stated in *MOIS* that although there are female machinists, some specialties (not mentioned) are open

only to men. In *Opportunities in the Machine Trades* (Bell, 1986), it has been stated that there remains to be some resistance by men in the trades to women competing with them for the skilled and better paying jobs. In addition to this hostility, women may face the discrimination of lesser pay, although the passing of the Federal Equal Pay Act of 1963 required equal pay for equal work. Despite these negative factors, women are increasingly entering the machining trades.

Employer Survey Analysis

Employers believe that with the expanding use of CNC machines in the future in the area of machine trades, more women and minorities will be entering the field. Until now, work in machine shops has required a great deal of strength, but with CNC, many machine trades tasks can be completed without a great demand for strength.

When asked about changes that may take place in the future in their company, only three employers of the 69 responding mentioned that the future would bring "more women" into machine tooling, while two of these three also stated that minorities in the field would increase. In support of these findings, of the 70 students surveyed, only two of them were women.

Level of Education/Training Needed

In general, most machine tool operators learn their skills on the job, and there are no special educational requirements for most entry-level occupations. However, employers would prefer to hire someone with basic skills and a high school diploma (*Occupational Outlook Handbook*). CNC machine tool operators must have adequate reading, writing, and English skills, due to the ever changing operations of new equipment.

Statewide

MOIS indicates that there is no special licensing or certification required for machine tool operators, but that there are several resources available for obtaining experience and training: vocational schools, community colleges, apprenticeships, etc.

Employer Survey Analysis

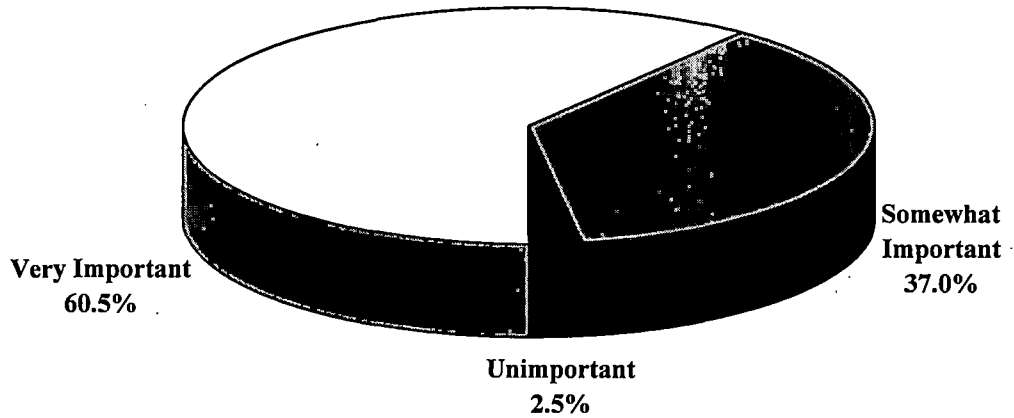
According to the employer survey, of the 81 responses regarding minimum educational requirements, 31% (25) require *no specific education*, while 68% (55) require an employee to have a *high school diploma*. Only one employer indicated a demand for *specific training*, such as CNC training or training on a specific machine. A total of 61% (49) of the employers also indicated that it is very important for an employee to have training/experience working with *manual machine tools*, while only two percent (2) employers feel that knowledge and training on manual machines is unimportant (See Table 5, Figure 5).

Table 5

**Employers' View on the
 Importance of Manual Machine Tool Training**

	<i>Number</i>	<i>Percent</i>
Very Important	49	60.5
Somewhat Important	30	37.0
Unimportant	2	2.5
Total	81	100.0

**Figure 5
 Importance of Manual Machine Tool Training**



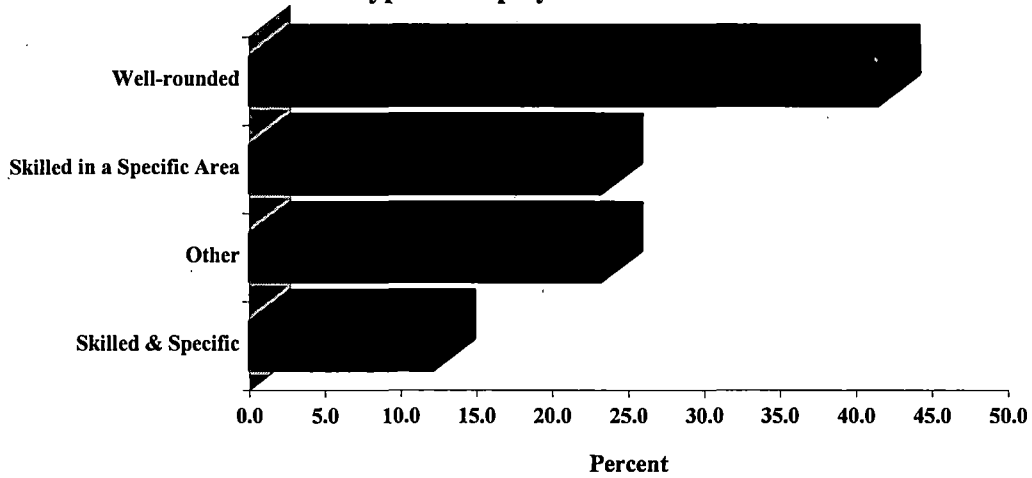
Several (42%, or 34) employers also indicate that they prefer to employ someone who is *well-rounded* and can perform various tasks, as opposed to 23% (19) preferring to hire someone who is *skilled in a specific area* (See Table 6, Figure 6).

Table 6

Type of Employee Preferred

	<i>Number</i>	<i>Percent</i>
Well-rounded	34	41.5
Skilled in a Specific Area	19	23.2
Other	19	23.2
Skilled & Specific	10	12.2
Total	82	100.1

Figure 6
Type of Employee Preferred

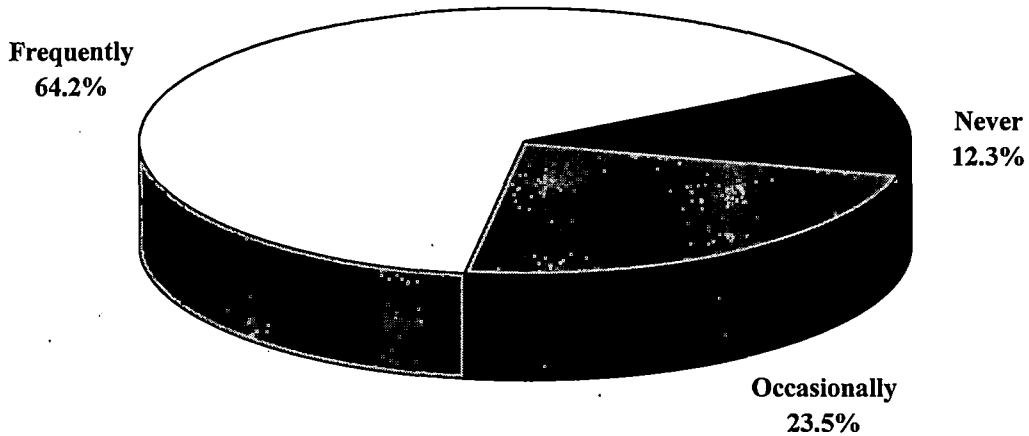


More than half (64%, or 52) of the employers surveyed indicate that they frequently have *difficulty finding qualified employees* (See Table 7, Figure 7).

Table 7
Employers Having Difficulty Finding Qualified Employees

	<i>Number</i>	<i>Percent</i>
Never	10	12.3
Occasionally	19	23.5
Frequently	52	64.2
Total	81	100.0

Figure 7
Difficulty Finding Qualified Employees



Some of the problems stated were as follows (a complete list can be found in Appendix F, Question 4):

- lack of CNC knowledge
- lack of math skills
- lack of experience in machine operations
- basic experience, math and writing skills
- can't find anyone with mechanical aptitude
- lack of training

Employers felt that many of these problems may be attributed to the following:

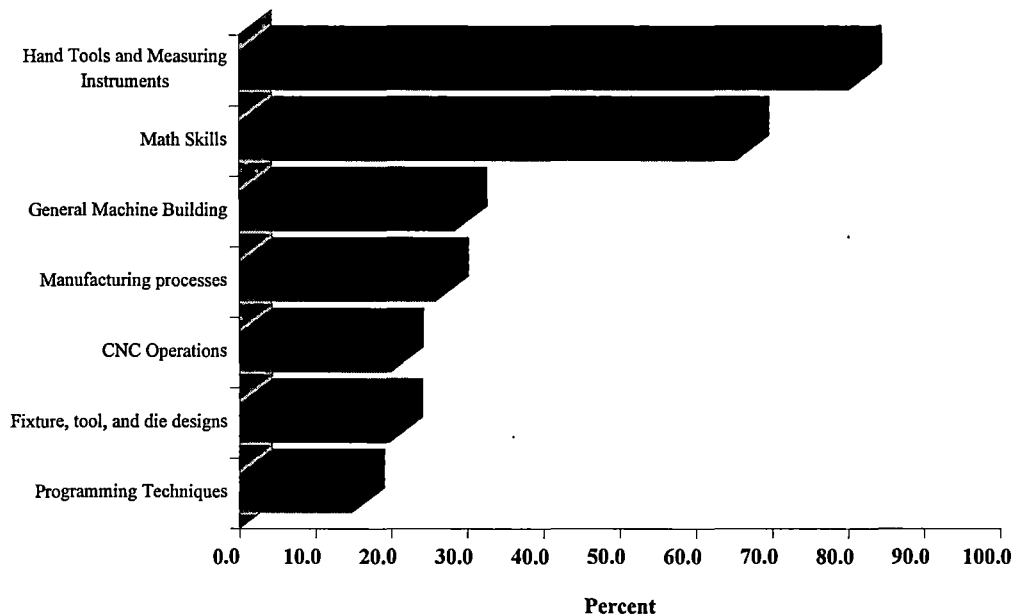
- lack proper education; they need trigonometry
- low entry-level pay
- poor vocational education in high schools; machine shop education is being phased out
- lack of training in tools
- work ethic has changed over the past few years

Employers were asked to rate various skills as being *Unimportant*, *Somewhat Important*, or *Very Important* for an entry-level employee to have (See Table 8, Figure 8).

Table 8
Work Skills Listed as "Very Important"

<i>Skill</i>	<i>Number</i>	<i>Percent</i>
Hand Tools and Measuring Instruments	65	80.2
Math Skills	53	65.4
General Machine Building	23	28.4
Manufacturing processes	21	25.9
CNC Operations	16	20.0
Fixture, tool, and die designs	16	19.8
Programming Techniques	12	14.8

Figure 8
Skills listed as "Very Important"



A large proportion of the employers (80%, or 65 of 82) indicate that having skills in *hand tools and measuring instruments* is *very important*. *Math skills* are also considered *very important* according to this sample of employers (64%, or 53 of 82). Very few employers (15%, or 12 of 82) feel that having skills in *programming techniques* is *very important*. Few employers (20%, or 16 of 82) feel it is *very important* for entry-level employees to have skills in *CNC operations*.

In addition, employers feel that there are additional skills that are important, for example:

- basic drafting skills
- blueprint reading
- total quality management, safety practices
- basic mechanical skills
- knowledge of proper workspace behaviors and expectations
- grinding, blueprint reading, applying blueprint processes, holding tolerances

According to the employer survey responses, it is necessary for an employee to have knowledge in the area of blueprint reading. As indicated in the college catalog, both the MAC program and the NUM program require that the student take Basic Blueprint Reading (TED 103). The machine tool courses at OCC also place great emphasis on work habits, shop safety, cooperation, and work attitude, all of which were mentioned as skills that are important to employers in this industry.

There were not many employers who had ever recalled hiring an OCC graduate (12 of 82), but of those who had, ten had felt that they were either *adequately prepared* or *somewhat prepared*. They felt that some of the skills that may have been lacking were as follows:

- practical applications
- specifics and uniqueness of springmaking
- hands-on time on machines
- quality aspects, reading measuring devices

Adequacy of Currently Available Training

Machine Tool Technology Programs in Michigan

Alpena Community College: ACC has both a Machine Tool Operator program (one-year certificate) and a Machine Tool Technology program (two-year AAS). The one-year program familiarizes the student with processes and tools used in industry. The two-year program introduces the student to all that is covered in the certificate program plus computer numerical control (CNC), computer-aided design (CAD), and computer-aided manufacturing (CAM).

Bay de Noc Community College: This college offers both a Certificate program and an Associate of Applied Science Degree program. The first year of work, after which a Certificate can be obtained, prepares the student for entry level positions. The second year, after which an AAS Degree is awarded, focuses more on Computer Numerical Control. At this college, the enrollment trend is that more students are working toward their AAS, rather than the Certificate. Job placement at Bay de Noc is 100%.

John Foltis, who has been a faculty member in the Machine Tool department at Bay de Noc for twenty-eight years, feels that it is essential to teach manual Machine Tool techniques, even though the industry is becoming largely focused on CNC. Approximately 60% of all of the Machine Tool Trades courses are taught with emphasis on manual tool operation. Mr. Foltis feels that a successful CNC operator must possess manual machine tool knowledge.

Delta College: This college offers both a certificate program and an AAS program in Machine Tool Operations. Students who enroll in the AAS program are offered two options: a greater breadth through supervisory training, or a greater focus on machine operator training.

Glen Oaks Community College: GOCC offers a certificate program which provides students with the technologies required for employment in the computerized machine tool industry.

Grand Rapids Community College: This college offers a certificate program in Machine Tool. The program provides the student with quick training making it possible to be a machine tool operator in industry. This college offers Co-op and job placement to students. Grandville Brown, who is an instructor in the Machine Tool area at GRCC, feels that there are many opportunities for careers in the field of machine tool technology.

Henry Ford Community College: HFCC offers a certificate program in Machine Tool which is designed to help the student gain immediate entry-level machining employment in industry. HFCC is pleased with the increasing level of enrollment in this program. HFCC also has a Certificate program in Computer Numerical Control, and an AAS degree program in Manufacturing Engineering Technology with an emphasis on CNC.

Jackson Community College: This college offers an AAS program in Manufacturing Technology. Within this Manufacturing Technology program, the student may choose from the following three concentrations: Numerical Control Technology; Machine Tool Technology; and Quality Control Technology. After completing the concentration courses, the student may apply for a Certificate of Achievement. According to Steve Brennan, who is the lead instructor at JCC, enrollment is steady, and manual machine operators in conjunction with CAD/NC operators will be increasing in demand between now and the year 2000. He also feels that a strong background in manual machining is necessary for a successful future in CNC.

Kalamazoo Valley Community College: KVCC offers a Machinist certificate program and an AAS Machine Tool Technology program. The Associate program is designed to prepare the student for a technical career.

Kellogg Community College: This college offers a certificate program in Industrial Machine Tool.

Kirtland Community College: KCC offers both a Certificate program and an AAS program in Machine Tool Operation which is designed to provide marketable skills and instruction for employment as machine operators in tool and die shops. In addition, KCC has an Industrial Technology Certificate program and an AAS program in CAD; these curriculums include a number of machine tool courses. KCC also has a Multi-Technology CAD/CAM AAS degree program. This program prepares the students for employment in both drafting/CAD and/or manufacturing/CNC. This college has both co-op and internship programs. Leonard Miller states that there have been increasing numbers of women and minorities in these programs in the past two years. He feels that this may be due to non-traditional funding and the increasing use of CNC machines.

Lake Michigan College: This college offers three courses of study in Machine Tool Technology: one-year certificate, two-year certificate, and the associate degree program.

Lansing Community College: LCC offers three programs of study in Machine Tool: Machine Repair certificate, Machine Maintenance AAS, and Machinist Toolmaker AAS. In addition, they have an AAS degree program in Computerized Numerical Control Programmer.

Macomb Community College: MCC has an Associate of Applied Science Manufacturing Technology program which provides students with both a broad overview of manufacturing technology as well as the flexibility of choosing a specialty area. The student will be qualified for entry level employment in programming, machining, and operation of machines. There is

also instruction in the areas of CNC micro computer programming, CNC operation, and tool room machining. MCC also offers Certificate options in the above three mentioned areas.

Mid Michigan Community College: This college offers a certificate program in Machine Tool Operation, and an Associate program in Machine Tool Technology. The Machine Tool Program was developed in 1967. Over the years, it has expanded to include CNC and CAD/CAM; about 30%-40% of the program courses are either CNC or CAD/CAM courses. There are about forty people in the program, and Larry Miller is the only faculty member in this program. Each year, about four students receive their degree, and in the past eleven years, there has been 100% job placement. This college offers co-op, but it is unpaid, and students are usually already working in a shop.

Montcalm Community College: Montcalm offers a certificate program in Machine Tool Operation. This certificate will provide the student with the eligibility to be a machinist helper.

Mott Community College: MCC offers both a certificate program (Machinist-Tool and Die) and an AAS program (Machinist). This program has been in existence since the early 1960s. Over the years, the program has been upgraded; all classes are computer-assisted. The college still has one manual Machining class, which is taken to familiarize the students with the various tools. This program does not offer co-op or internships. Mike Benner stated that most students are employed during their schooling. This program undergoes continuous modification according to current industry trends and needs.

Concerning the Machine Tool industry, Mike Benner feels that small job shops will continue to work manually for special projects, such as prototyping. He also feels that manual and CNC machining industries work together, and that manual machining as an occupation will not disappear in the near future.

Muskegon Community College: MCC has a certificate program in Machining Technology and an AAS program in Machining Technology. This program is designed to prepare the student in the production of machined objects. According to Jessy Sprayberrie, enrollment at Muskegon Community College is on the rise, and job placement is 100%. This program is upgrading to CNC, but still places great emphasis on manual tool operation.

There are few women and minorities in this program, but Mr. Sprayberrie feels that the changing trends in the machine tool industry will bring more women and minorities into this type of work.

Northwestern Michigan College: This college provides both a certificate and an AAS program in Machine Tool Operator. This program currently teaches basic manual machining, but most courses are CNC based. They use a software program, SurfCam, in teaching their courses. This program offers job placement for graduates, and most of the students attempt to complete the Certificate program, rather than the Associate program. From here, many students choose to enroll in the Apprenticeship program.

St. Clair County Community College: This college offers a certificate program in Machine Tool which is designed to help students upgrade their industrial skills or pursue a career in industry.

Washtenaw Community College: WCC offers two certificate programs (Toolroom Machine Operation and Numerical Control Machine Operation) and two AAS programs (Machine Tool Technology and Numerical Control Technology).

Wayne County Community College: This college offers three program options: Certificate and AAS in Machine Tool Technology and the Numerical Control AAS. These programs strongly emphasize hands-on activity and manipulative skills.

West Shore Community College: WSCC offers a two-year certificate and an AAS in Machine Tool Technology. This program is intended to prepare students for entry-level employment.

Each of the above mentioned programs seem to be very closely related to the programs at OCC, and it appears that OCC is teaching the same types of courses that other community colleges are.

Student Survey Analysis

A telephone survey of students who were enrolled in one of the two programs in the past six semesters was conducted to determine how OCC students in MAC or NUM felt about their learning experience at OCC. There were a total of 140 (93 MAC and 47 NUM) students in both of these curriculums, and the survey data is comprised of responses from 70 of these students (50 MAC and 20 NUM).

A large proportion (46%, or 32 of 70) of the students were between the ages of 30 and 39. This suggests that students may be currently working in the field, and are taking classes to improve skills necessary for their job.

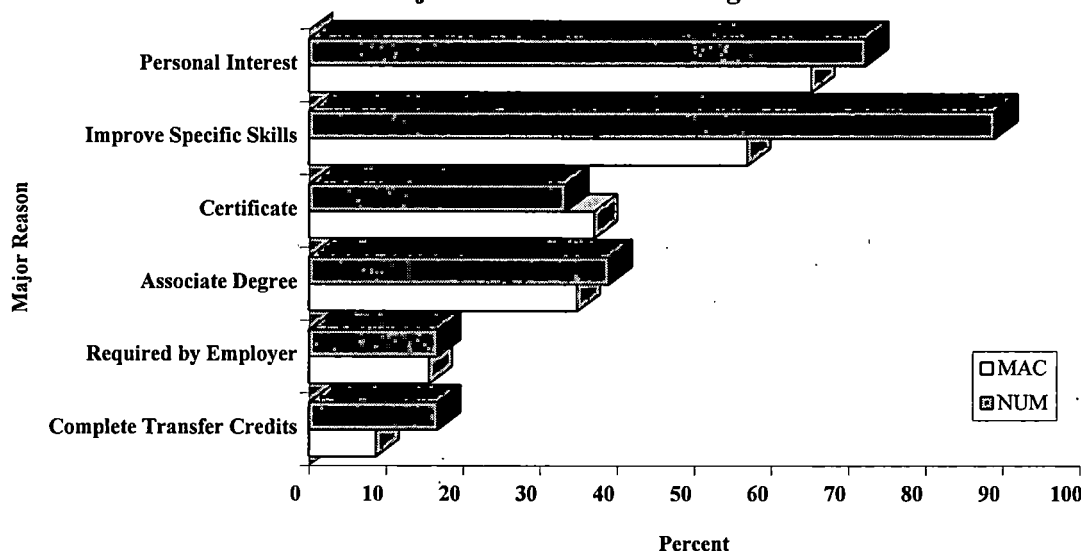
Nearly all of the students surveyed (83%, or 53) indicated that the *major reason* for attending OCC was to *improve specific skills*, while 67% (43) felt that *personal interest* was the *major reason* for attending OCC (See Table 9, Figure 9).

Table 9

Major Reason for Attending OCC by Main Area of Study

Major Reason	MAC		NUM	
	Number	Percent	Number	Percent
Personal Interest	45	65.2	18	72.2
Improve Specific Skills	45	56.9	18	88.9
Certificate	45	37.0	18	33.3
Associate Degree	45	34.8	18	38.9
Required by Employer	44	15.6	18	16.7
Complete Transfer Credits	45	8.7	18	16.7

Figure 9
Major Reason For Attending OCC



Of the students responding, 70% (45) said that MAC was their main area of study, while 28% (18) said that NUM was their main area of study.

Survey results show that of all the students responding, 90% (56) are currently employed in the machine tool trades. The majority of those students who are employed in the machine tool trades were in the MAC program. When asked to categorize what type of shop that they worked in, some of the responses were as follows: machine shop; CNC shop; automotive stamping; ceramic machine tool and carbide cutting; etc. (A complete list of the student narratives can be found in the Appendices).

More than half of the students responding (52%, or 33 of 63) felt that the skills that they obtained at OCC *adequately prepared* them for their occupation, while only 13% (8) felt that

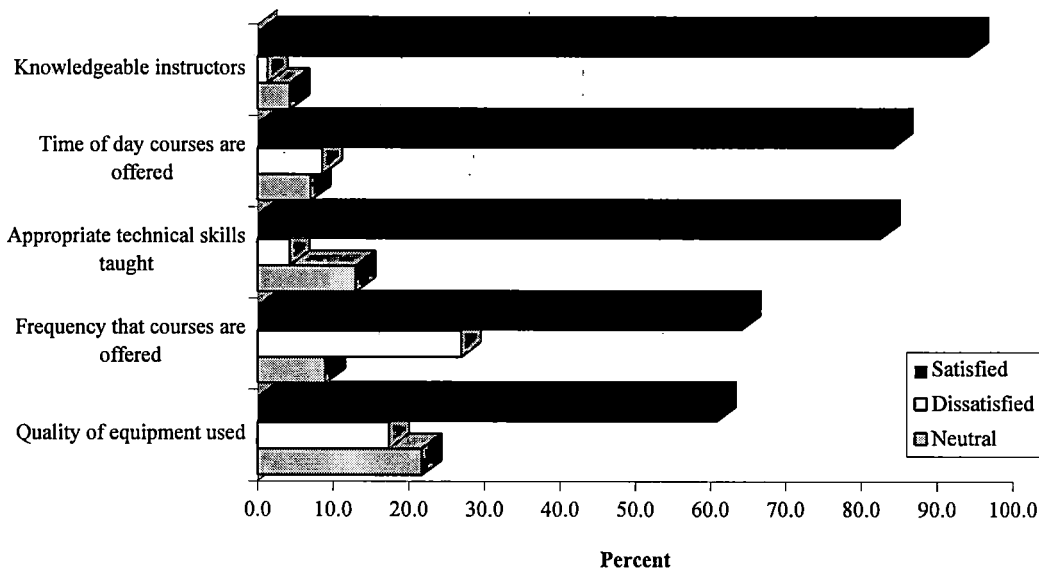
OCC *did not prepare* them for their occupation. In addition, nearly all of the students responding (80%, or 51 of 64) felt that the skills that they obtained at OCC were *relevant* to their specific trade.

When asked about satisfaction regarding specific issues (e.g., time courses are offered, instructors knowledge, etc.) students' overall responses indicate that they are *satisfied* with these aspects of OCC (See Table 10, Figure 10).

Table 10
Student Satisfaction with Machine Tool Courses at OCC

	<i>Satisfied</i>		<i>Neutral</i>		<i>Dissatisfied</i>	
	#	%	#	%	#	%
Knowledgeable instructors	66	94.3	3	4.3	1	1.4
Time of day courses are offered	59	84.3	7	7.1	6	8.6
Appropriate technical skills taught	57	82.6	9	13	3	4.3
Frequency that courses are offered	43	64.2	6	9	18	26.9
Quality of equipment used	42	60.9	15	21.7	12	17.4

Figure 10
Students Satisfaction with Machine Tool Courses at OCC



For example, 84% (59 of 70) students indicated that they were *satisfied* with the *time of day courses are offered*, and 83% (57 of 69) responded that they were *satisfied* with the *appropriateness of technical skills taught*. However, the percentage of students responding "*satisfied*" decreases to 61% (42 of 69) when asked about the *quality of equipment used*. This supports the findings which indicate that the equipment in the lab is in need of updating.

Regarding the scheduling process at OCC, 83% (57) of the 70 students responding felt that the scheduling met their needs. Students were asked how the scheduling process at OCC

could be changed to better meet their needs. Some of their responses include the following: "have scheduling flexibility for the working class", "break the class time up, two hours instead of four hours", "courses need to be offered more frequently than one time a year".

Students were asked what additional training not offered by OCC would be beneficial to them in doing their job. Some of their responses were as follows: "more math classes and blueprint reading", "more CNC programming classes", and "more hands-on time on the machines".

At the close of the survey, students were encouraged to make any additional comments about the machine tool technology programs at OCC, and what skills they felt could have helped them that OCC does not cover. Several students felt that the classes had too many students, which left them little time on the machines. For example, "MAC classes are too large for the limited amount of equipment and hands-on actually required", "too many students, and not enough one-on-one instruction", "too many students per instructor to be beneficial".

Various students also made positive comments about the instructors. It appears that the students were satisfied with the machine tool programs, but felt that they would be more beneficial with some changes, such as updated equipment, more machines, smaller class sizes, etc.

When asked about technological changes in the future, nearly all of the students predict that the machining industry will continue to grow in the next few years with the increasing use of CNC: "more computer-oriented", "computerized, CNC", "more technology involved; most will go to computer aided, even hands-on".

COST ANALYSIS

Faculty, students, and CDW staff indicate that there is an apparent need for updating the machine tool technology lab at OCC. Certain machinery that is being used is in need of replacement, and the lab is in need of additional new machinery. For example, there are machines in the lab dating back to the 1920's. In addition, there are a large number of students and outside industries who use these machines each week, and the wear on them is heavy. Faculty have provided a list of equipment necessary for bringing the lab to date. The following machines have been prioritized as being the most immediate need, but are not a complete list of necessary machinery:

- 3 Bridgeport Series I milling machines
- 1 Bridgeport Series II milling machine
- 3 Clausing 1440 precision lathes

According to faculty, to completely update and replace the above prioritized machinery in the lab, the approximate cost would be \$117,000.00. The cost for complete renewal of this part of the lab would be approximately \$568,500.00.

In addition to the above machinery indicated, there is a need for CNC equipment, as the college is teaching these courses and is not properly equipped with the necessary machinery. The CNC lab is in need of complete updating, which should include the following:

- 1 machining center
- 1 turning center
- CNC surface grinder
- CNC EDM, sinking
- CNC EDM, wire
- 6 current technology computers
- network cable installation
- 8 computer furniture sets
- PC network cabling system
- 2 RISC technology systems

The estimated total cost for this process, as indicated by faculty and confirmed by industry experts and suppliers, would be approximately \$801,000.00. The actual cost of each of these machines depends on the make and size of the machine, therefore there is a wide price range.

By updating the lab with current machines, employers may be more likely to send their employees to OCC, and students may be more inclined to enroll themselves.

CONCLUSION

Overall, this report indicates that there is a growing need for machine tool operators and CNC operators in Michigan. The trend seems to support the fact that the use of computers in this industry is growing. However, employers in this field feel very strongly about the importance of training in manual machine tool, that it is essential for any machine operator to have a background in manual machine operation. Therefore, this report suggests a continued focus on manual machining, with an increasing emphasis on CNC operations.

Industry experts have indicated that it is unnecessary to have specific education to become employed in the machine tool trades area, however, they prefer to employ someone who has some experience. Employers do indicate that they will train their employees, or reimburse them for tuition. This suggests that it is not necessary to be specifically educated to enter the field, but to advance, it may take some specialized education or training.

ISSUES

- There currently seems to be little marketing of the OCC Machine Tool Programs taking place. Faculty from other colleges suggest that marketing could be increased by going out periodically and talking with employers. This will help to keep them familiar with the college and the program, therefore leading to higher enrollment and job placement. This may also help to update faculty on current employer and industry needs.

- The college catalog description for NUM is out of date, and does not describe what is actually being taught. Employers would be more apt to send their employees to OCC if they knew exactly what the program consisted of (CNC). This may also be an issue for students, because they are most likely basing their decision on enrollment in a course by what the catalog description is.
- Students and faculty have indicated that some of the machinery in the lab is out of date, and they suggest replacing some of the old equipment, as well as updating the lab with new and additional machinery (CNC).
- Several students feel that class sizes are too large, and that they are not receiving enough one-on-one time with instructors, and not enough hands-on time on the machines. They suggest either more machinery or smaller class sizes.
- Based on employer responses to the survey regarding education, it may be the case that they are setting standards which are too low, in order to pay a lower entry-level wage.

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APPENDIX A

Machine Tool Technology

Program Descriptions (MAC, NUM)

Machine Tool Technology (MAC)

Auburn Hills

Associate in Applied Science

The student will be introduced to the world of machine tool metal cutting. Beginning with Machine Hand Tools and Layout Tools, the student will perform metal cutting operations on the drill press, lathe, milling machine, grinders, and the shaper, from basic to more complex and intricate objectives. The student will gain the theory, and the hands-on training required for employment as a machinist at job entry skill level. Safe and proper procedures will be greatly emphasized.

Major Requirements		Credits
ATM 110*	Introduction to Machine Tools	3
ATM 112*	Machine Tool Operation I	3
ATM 114*	Machine Tool Operation II	3
ATM 116*	Machine Tool Operation III	3
ATM 118*	Tool Machinist Techniques I	3
ATM 120*	Tool Machinist Techniques II	3
ATM 130*	Introduction to Numerical Control	3
ATM 220*	Numerical Control Machining	3

Required Supportive Courses		Credits
APT 850*	Metallurgy	3
APM 811*	Geometry-Algebra	3
TED 103	Basic Blueprint Reading	3
APM 821	Plane Trigonometry	3
DDT 100	Fundamentals for the Drafting Industry	3
DDT 105	Product Drafting	3
APM 823	Solid Trigonometry	3
APM 827	Compound Angles	2
IND 100	Introductory Seminar for Industrial Sciences	2
ENG 135* ¹	Business Communications	3

General Education Requirements

See graduation requirements for an Associate in Applied Science Degree on pages 47, 48, 49, and 50.

¹The student may substitute a higher level English course.

General Education courses listed as Required Supportive may be used to meet requirements of the General Education component.

*When all the courses marked with an asterisk are completed, the student may apply for a Certificate.

Machine Tool Technology (NUM) Numerical Control Option

Auburn Hills

Associate in Applied Science

The Numerical Control Option of the Machine Tool Technology Program emphasizes the concepts of automatically operating machines through the use of a punch tape or directly from a computer. Instruction will include programming techniques, dimensional tape and computer controls, numerical control (NC) and computer numerical control (CNC) machine tool operations. In addition, the interfacing of automated equipment with computer aided design (CAD) and computer aided manufacturing (CAM) systems will be addressed. The Numerical Control Option is designated as an Extended Associate Program in that the student must complete in excess of 72 credit hours.

¹This course is being developed at present.

²The student may substitute ENG 151.

General Education courses listed as Required Supportive may be used to meet requirements of the General Education component.

*When all courses marked with an asterisk are completed, the student may apply for a certificate in Numerical Control Technology.

Major Requirements		Credits
ATM 110*	Introduction to Machine Tools	3
ATM 112*	Machine Tool Operation I	3
ATM 114*	Machine Tool Operation II	3
ATM 116*	Machine Tool Operation III	3
ATM 118*	Tool Machinist Techniques I	3
ATM 130*	Introduction to Numerical Control	3
ATM 210*	Basic N/C Programming and Operation	3
ATM 215* ¹	APT Programming Applications	3
ATM 216* ¹	APT Language Programming	3
ATM 220*	Numerical Control Machining	3

Required Supportive Courses

APT 850	Metallurgy	3
APM 811	Geometry-Algebra	3
APM 821	Plane Trigonometry	3
APM 823	Solid Trigonometry	3
APM 827	Compound Angles	2
APS 810	Machine Shop Theory	3
TED 103*	Basic Blueprint Reading	3
IND 100	Introductory Seminar for Industrial Sciences	2
ENG 135 ²	Business Communications	3
MAT 115	Intermediate Algebra	4
MAT 156	Trigonometry	3

General Education Requirements

See graduation requirements for an Associate in Applied Science Degree on pages 47, 48, 49, and 50.

APPENDIX B

Machine Tool Technology

Employer List

Machine Tool Technology

EMPLOYER LIST

BOLD: Interested in helping OCC improve/develop Machine Tool programs.

ITALICS: Willing to give OCC students opportunity for internship/co-op.

Accum-Matic Systems, Inc.
11973 Mayfield
Livonia, MI 48150
313-261-8060

Acutus Industries, Inc.
2800 Alliance, P.O. Box 506
Pontiac, MI 48056
810-674-4861

Air Gage Co.
Livonia, MI 48150
313-591-9220

Ajax Rolled Ring Co.
Wayne, MI 48184
313-729-6110

Alro Specialty Metals
24800 Plymouth Rd.
Redford Twp., MI 48239
313-534-1300

Alternative Technologies
Warren, MI 48089
810-755-3200

Apex Broach & Machine Co.
6401 E 7 Mile Rd.
Detroit, MI 48234
313-891-8600

Arrowsmith Tool & Die, Inc.
P.O. Box 407
Southfield, MI 48037
810-357-4400

B/G Industries
Oak Park, MI 48237
810-546-7600

Big Beaver Consolidated, Inc.
839 Rochester Rd.
Clawson, MI 48017
810-589-3650

Bilco Tool Corporation
30076 Dequindre
Warren, MI 48092
313-574-9300

Buckingham Tool Corporation
11915 Market Street
Livonia, MI 48150
313-591-2333

Cargill Detroit Corporation
1250 Crooks Rd.
Clawson, MI 48017
810-435-3500

Central Screw Products Co.
6425 E Hildale
Detroit, MI 48234
313-893-9100

Columbia Tool & Die Co.
24400 Maplehurst
Clinton Twp., MI 48036
810-465-8030

Combine Tool & Die Co.
17157 E 10 Mile Rd.
Eastpointe, MI 48021
810-777-9720

D-M-E Co.
29111 Stephenson Hwy.
Madison Hts., MI 48071
810-398-6000

Deco Grand
4850 Coolidge Hwy.
Royal Oak, MI 48073-102
810-435-0100

Dependable Gage & Tool Co.
15321 W 11 Mile Rd.
Oak Park, MI 48237
810-545-2100

Dexco Corporation
387 S Street
Rochester, MI 48307
810-650-2008

Distel Tool & Machine Co.
12800 E 10 Mile Rd.
Warren, MI 48089
810-755-5505

Dominion Tool & Die Co.
15736 Strugeon
Roseville, MI 48066
810-773-3303

Fairlane Gear, Inc.
P.O. Box 409
Canton, MI 48170
313-459-2440

Forging Specialties, Inc
12600 Beech Daly Rd.
Detroit, MI 48239
313-535-1784

Form Flow, Inc.
P.O. Box 607
Wayne, MI 48184
313-729-3100

Fuller Tool Co.
4000 W 11 Mile Rd.
Berkley, MI 48027
810-544-1500

Future Products, Inc.
885 N Rochester Rd., Box 407
Clawson, MI 48017
810-588-1060

Grinding Products Co.
11084 9 Mile Rd.
Warren, MI 48089
810-757-2118

H & G Tool Co.
30700 Ryan Rd.
Warren, MI 48092
810-573-7040

Haber Tool
12850 Inkster Rd.
Detroit, MI 48239
313-255-1750

Harry Major Machine & Tool
17850 14 Mile Rd.
Fraser, MI 48026
810-294-0200

Hart Precision Products, Inc.
13920 E 10 Mile Rd.
Warren, MI 48216
313-537-0490

Hercules Mach Tool & Die
Warren, MI 48089
810-778-4120

Hi-Tech Tool Industries, Inc. 1600
W Maple
Troy, MI 48084
810-649-0690

Hope Tool, Inc.
17230 Mt. Elliott
Detroit, MI 48212
313-893-2300

Hydraulic Service, Inc.
21251 Ryan Rd.
Warren, MI 48091
810-758-0100

Intra Corporation
681 Manufacturers Dr.
Westland, MI 48185
313-326-7030

J. Brisbois Tool Sales & Service
15040 Cleat St.
Plymouth, MI 48170
313-455-1144

K & K Stamping Co.
34230 Riviera Dr.
Fraser, MI 48026
810-296-1440

Keener Tool & Engineering
17425 Stephens Ave.
Eastpointe, MI 48021
810-774-8380

Langlois Corporation
54400 Pontiac Trail
Milford, MI 48381
810-685-3188

M & S Spring Co., Inc.
34137 Doreka, P.O. Box 388
Fraser, MI 48026
810-296-9850

Machine Design
Fraser, MI 48026
810-294-1740

Mark Engineering Co.
6250 19 Mile Rd.
Sterling Hts., MI 48314
810-254-2112

McKenna Industries, Inc.
2222 Stephenson Hwy.
Troy, MI 48084
810-689-4800

McLaren Engines, Inc.
32233 W 8 Mile Rd.
Livonia, MI 48152
810-477-6240

Merchants Automatic Products
5701 Sheldon Rd.
Canton, MI 48188
313-397-1020

Mercury Gage Co.
5740 E Nevada Ave.
Detroit, MI 48234
313-366-0880

Metro Machine Works
11977 Harrison
Romulus, MI 48174
313-941-4571

Michigan Roll Form, Inc.
9100 Hubbell
Detroit, MI 48228
313-836-1844

Michigan Spline Gage Co.
Hazel Park, MI 48030
810-544-7303

Milco Manufacturing Co.
2147 E 10 Mile Rd.
Warren, MI 48091
810-755-7320

Moore Production Tool Spec.
37531 Grand River
Farmington Hills, MI 48335
810-476-1200

National Bronze Mfg. Co.
3558 Garfield Ave.
Detroit, MI 48207
313-921-2616

Norbert Industries, Inc.
Sterling Hts., MI 48312
810-977-9200

North Tool & Manufacturing
17140 E 10 Mile Rd.
Eastpointe, MI 48021
810-776-6680

Novi Die & Engineering
1485 Temple City Dr.
Troy, MI 48084
810-649-1600

Numerical Machining Co.
30 Company Dr.
Auburn Hills, MI 48326
810-335-8400

O. Keller Tool Engineering Co.
12701 Inkster Rd., Box 2498
Livonia, MI 48843
313-425-4500

Ort Tool & Die Corporation
6555 S Dixie Hwy.
Erie, MI 48133
313-848-6845

Paramount Boring & Machine
15255 W 11 Mile Rd.
Oak Park, MI 48237
810-543-2100

Peak Industries, Inc.
5320 Oakman Blvd.
Dearborn, MI 48126
313-846-8666

Peerless Steel Co.
Troy, MI 48083
313-528-3200

Perch Machining, Inc.
Detroit, MI 48234
313-891-9163

Piece Maker Company
Troy, MI 48084
810-524-1155

Pioneer Steel Corporation
7447 Intervale
Detroit, MI 48238
313-933-9400

Porath Tool Co.
11274 Allen Rd.
Taylor, MI 48180
313-287-6250

Powerline, Inc.
2821 Industrial Row
Troy, MI 48084
810-280-2040

Progressive Tool & Ind Co.
21000 Telegraph Rd.
Southfield, MI 48034
810-353-8888

Quality Chaser Co.
120 E Pond Dr., P.O. Box 496
Romeo, MI 48065-0496
810-752-5555

Quinco Tool Products
2100 Hubbell
Oak Park, MI 48237
810-968-5000

Redford Lathe Turning, Inc.
27242 W 7 Mile Rd.
Redford, MI 48240
313-535-2700

Ring Pattern & Mfg. Co.
12901 Stephens Dr.
Warren, MI 48089
810-759-3500

Sensor Developments
1050 W Silverbell Rd.
Orion, MI 48359
810-391-3000

Standard Machine & Tool Co.
29900 Hayes Rd.
Roseville, MI 48066
810-773-6800

Swiss American Screw Products
5740 S Sheldon Rd.
Canton, MI 48188
313-397-1600

U.S. Tool & Cutter Co.
P.O. Box 9050
Farmington Hills, MI 48334
810-553-7745

Viscount Industries
24704 Hathaway
Farmington Hills, MI 48335
810-471-5071

Visi-Trol Engineering Co.
12720 Burt Rd.
Detroit, MI 48223
313-535-4140

Widell Industries, Inc.
6622 Industrial Ave.
Port Richey, FL 34668
813-848-1811

Wit-O-Matic, Inc.
22605 Heslip
Novi, MI 48050
810-349-2730

Wolverine Carbide Die Co.
2613 Industrial Row
Troy, MI 48084
810-280-0300

APPENDIX C

Machine Tool Technology

Employer Survey

Oakland Community College
Machine Tool Trades Programs
Employer Survey
 February, 1996

Name: _____
Title: _____
Business: _____
City/Zip: _____
Phone: _____ Total No. Employees: _____

1. Please tell me what type of organization most accurately describes your company: (*Check one only*)

	<i>Yes</i>	<i>No</i>
Machine Shop	1	0
Tool & Die	1	0
Fabricating	1	0
Machine Tool Builder	1	0
CNC Prototype	1	0
Automotive or Aircraft Supplier	1	0

Other (*please specify*): _____

2. Does your company currently employ Machine Tool Operators?

1 _____ Yes
 0 _____ No (*Thank them for their time and terminate survey*)
 How many? _____

2b. Do any of these machine tool operators have training in CAD/CAM or Numerical Control?

CAD/CAM:	NUM:
1 _____ Yes	1 _____ Yes
0 _____ No	0 _____ No
How many? _____	How many? _____

3. Do you **Frequently, Occasionally, or Never** experience difficulty finding qualified employees for entry level positions?
- 2 Frequently
 1 Occasionally
 0 Never (*Skip to Question 6*)
 9 No response (*Skip to Question 6*)
4. What kind of problems do you encounter? _____

5. What would you attribute these problems to? _____

6. What is the minimum level of **education** your company requires for entry level positions in the machine tool area? (*Check one only*)
- 1 No specific educational requirement
 2 High school diploma or equivalent
 3 Certification
 4 Associate degree
 5 Bachelor's degree
 6 Specific training, only
 7 Other (*please specify*): _____

7. Do you require these individuals to have work experience?
- 1 Yes
 0 No
 If "Yes", how much? _____
8. Does your company prefer to employ someone who is: (*check one only*)
- 1 Skilled in a specific area
 2 Well-rounded and able to perform various jobs
 3 Other (*Please specify certain skills*): _____

9. Please tell me whether you feel it is **Very Important, Somewhat Important, or Unimportant** for entry level employees to have training in manual machine tool operations:
- 3 Very Important
 2 Somewhat Important
 1 Unimportant
 9 No response

10. What hourly pay range could someone entering the machine tool industry expect to receive throughout their career?

Entry level Maximum

\$ _____/hour \$ _____/hour

10b. Approximately how many hours per week do these employees work? _____

10c. If they work more than 40 hours, do they receive overtime pay?

¹ _____ Yes

⁰ _____ No

11. And, what benefits are available for machine tool employees? (*Prompt only if necessary*)

⁰ _____ None

¹ _____ Basic benefits (*i.e., paid vacation, sick pay, health, dental, etc.*)

² _____ Other (*please specify*): _____

12. What type of educational benefits, if any, do you provide your employees? (*i.e., In-house training, college tuition reimbursement, etc.*): _____

13. And, what advancement opportunities are available for machine tool employees? _____

14. Would an employee be eligible for these same advancement opportunities without further training?

¹ _____ Yes

⁰ _____ No

⁸ _____ Don't know

⁹ _____ No response

15. In terms of employment in the machine tool area in your company, do you foresee the future as *Excellent, Good, Average, Poor, Very Poor*, or are you *Uncertain*?

⁵ _____ Excellent

⁴ _____ Good

³ _____ Average

² _____ Poor

¹ _____ Very Poor

⁸ _____ Uncertain

⁹ _____ No response

16. In the **Machine Tool** Area, what types of technological changes do you foresee taking place at your company over the next 5-10 years? (*Probe: Computer Numerical Control=new trend?, more women & minorities?*): _____

17. In order that we may provide you with the best possible trained employees, we would like to know which skills and competencies are important when hiring entry level employees in the machine tool area. Please tell me whether the following skills are **Very Important, Somewhat Important, or Unimportant**:

	<i>VI</i>	<i>SI</i>	<i>UI</i>	<i>No Response</i>
Experience in general machine building	3	2	1	9
Knowledge of hand tools and measuring instruments	3	2	1	9
Strong math skills	3	2	1	9
Knowledge of computer numerical control machine tool operations	3	2	1	9
Knowledge of programming techniques	3	2	1	9
Knowledge of design on CAD and CAM systems	3	2	1	9
Knowledge of fixture, tool and die design	3	2	1	9
Knowledge of CAD drafting practices and production	3	2	1	9
Knowledge of manufacturing processes	3	2	1	9

Are there any other important skills you require that I haven't already mentioned? (*please specify*): _____

19. Are you familiar with the various Machine Tool Technology programs at OCC?

- Yes
- No

Which ones? _____

20. Has your company ever hired an OCC graduate or student?

- Yes
- No (*Skip to Question 22*)
- Don't know (*Skip to Question 22*)
- No response (*Skip to Question 22*)

21. In your opinion, was this person(s) *Adequately prepared, Somewhat prepared, or Not At All prepared* for the job they were hired for?

- Adequately prepared (*Skip to Question 22*)
- Somewhat prepared
- Not at all prepared
- No response (*Skip to Question 22*)

21b. What areas do you feel they were lacking in skills? *(please specify)*: _____

22. Would you be interested in working with OCC to improve or develop the Machine Tool programs?

¹ _____ Yes

⁰ _____ No

⁹ _____ *No response*

23. Would you be interested in giving an OCC student the opportunity to work in a Co-op program or internship at your company?

¹ _____ Yes

⁰ _____ No

⁹ _____ *No response*

24. Are there any other comments you would like to make about your employment needs or training available? _____

Thank you for your time and assistance. We appreciate your help and believe that your responses may help to influence what happens at OCC in the future. If you have any further questions please contact the Office of Planning & Analysis at (810) 471-7746.

Interviewer Signature: _____

Date: _____

APPENDIX D

Machine Tool Technology

Student Survey

Oakland Community College
Machine Tool Trades Programs
Student Survey
March, 1996

We are evaluating the various Machine Tool programs at OCC, and are interested in your comments about your experience at OCC.

1. To begin, our records indicate that your main area of study is/was _____. Would you please verify that you have taken classes in _____?

- ¹ _____ Yes
- ⁰ _____ No (*Skip to Question 3*)
- ⁹ _____ No response (*Skip to Question 3*)

2. Would you consider this to be your main area of study?

- ¹ _____ Yes
- ⁰ _____ No
- ⁸ _____ *Not concentration, just took classes in*
- ⁹ _____ *No response*

3. Have you taken courses in the following curriculums? (*Interviewer: Do not ask the one that they have already identified*)

- ⁰ _____ Machine Tool Technology (*MAC*)
- ¹ _____ Machine Tool Technology with the Numerical Control Option (*NUM*)
- ² _____ Computer Aided Drafting & Design Technology with Machine Tool Option (*CAM*)
- ⁹ _____ *No response*

(Interviewers: If they have not taken at least one course in any of these programs, terminate survey.)

4. Now, I am going to read you a list of reasons why students enroll at OCC. Please tell me if the following statements were a **Major Reason**, **Minor Reason**, or **Not At All a Reason** for enrolling at OCC to take classes in a MAC program:

	<i>Major Reason</i>	<i>Minor Reason</i>	<i>Not At All a Reason</i>	<i>No Response</i>
a. To obtain an OCC Associate Degree	3	2	1	9
b. To obtain an OCC Certificate	3	2	1	9
c. To improve specific skills for your current job	3	2	1	9
d. Required by employer	3	2	1	9
e. To complete courses necessary to transfer	3	2	1	9
f. For personal interest	3	2	1	9

g. Other (describe) _____

5. What is your current employment situation?
- 0 Self employed
- 1 Employed full-time
- 2 Employed part-time
- 3 Unemployed and actively seeking employment (*Skip to Question 8*)
- 4 Unemployed and not seeking employment (*Skip to Question 14*)
- 9 No response
6. Is your occupation in the Machine Tool industry?
- 1 Yes
- 0 No (*Skip to Question 8b*)
7. What type of shop do you work in? (*Skip to Question 9; Probe Machine shop, Tool & Die, etc.*): _____
-
8. Are you looking for employment in the machine tool area?
- 1 Yes
- 0 No
- 9 No response (*Skip to Question 14*)
- 8b. Have you previously worked in the Machine tool field?
- 1 Yes
- 0 No (*Skip to Question 14*)
- 9 No response
9. How long *did*/have you been working in Machine Tool trades?
 _____ Years
10. On average, how many hours per week *did*/do you work?
 _____ Hours
11. Would you please tell me if you feel that the skills you obtained at OCC **Adequately prepared** you, **somewhat prepared** you, or **did not prepare** you for your occupation:
- 0 Adequately prepared
- 1 Somewhat prepared
- 2 Did not prepare
- 9 No response
12. Would you please tell me if you think the courses you took at OCC were:
- 0 Relevant
- 1 Somewhat relevant
- 2 Not at all relevant
- 9 No response

13. What additional training/knowledge, that OCC does not offer, *would have been/would be* helpful to you in doing your job? _____

14. Now I am going to read you several statements. Please tell me if you are **Satisfied**, **Neutral**, or **Dissatisfied** with each of the following:

	<i>Satisfied</i>	<i>Neutral</i>	<i>Dissatisfied</i>	<i>No Response</i>
a. The time of day courses are offered	3	2	1	9
b. The frequency with which specific courses are offered	3	2	1	9
c. Knowledgeable instructors	3	2	1	9
d. Quality of equipment used	3	2	1	9
e. Appropriate technical skills taught	3	2	1	9

15. Does the scheduling of courses at OCC meet your personal needs?

- ¹ _____ Yes (*Skip to Question 17*)
- ⁰ _____ No
- ⁹ _____ No response (*Skip to Question 17*)

16. How can the scheduling of courses be improved to better meet your individual needs?

17. In your opinion, what ways do you think the machine tool industry will change over the next few years? (*Probe: more CNC, more women and minorities, etc.*) _____

18. Are there any other comments you would like to make about the Machine Tool Technology programs at OCC? _____

"Thank you very much for your time and assistance. We sincerely appreciate your help."

Interviewer Signature: _____ Date: _____

APPENDIX E

Machine Tool Technology

Employer Survey Narrative Responses

Machine Tool Trades Programs

Employer Survey

March, 1996

Narrative Responses

Q1. What type of organization accurately describes yours?

- 5. Cutting tools production.
- 8. Fixtures, dies, gauges.
- 9. Gauge shop.
- 10. Oil industry, G.E. turbines.
- 11. Steel service center.
- 13. Parts for diesel and locomotive engines.
- 19. Manufacturer of springs, clips, and fasteners for Ford, Chrysler, and GM, and for the military.
- 23. Build production lines.
- 28. Gauge manufacturers.
- 34. Gauge shop.
- 35. Build machines, cold headings.
- 36. Automotive wood model prototype fixtures.
- 44. Manufacturer of special cutters.
- 50. Production shop.
- 51. Steel service center (SIC 5051).
- 58. Gear manufacturer.
- 63. Supplier to appliance and furnace companies.
- 71. Open die forging plant.
- 73. Repair hydraulic equipment and pumps.
- 74. Manufacturing specialty tooling.
- 75. Gauge manufacturer.
- 76. Stamping company.
- 78. Precision tooling.
- 80. Steel distributor.

Q2. If your company employs Machine tool operators, how many?

1. 30	7. 4	16. 100
2. 25-30	8. 16	17. 1
3. 2	11. 7	18. 10
4. 56	12. 18	19. 6
5. 15	13. 15	20. 10
6. 15	14. 18	21. 150

22. 18	42. 15	60. 50
23. 16	44. 60	61. 40
24. 11	45. 11	62. 50
26. 15	46. 11	63. 43
27. 4	47. 6	64. 8
28. 18	48. 10	65. 90
29. 15	49. 12	66. 8 or 9
31. 2	50. 30	67. 6
32. 30	51. 15	71. 20
33. 15	52. 10	76. 20
34. 5	53. 16	77. 6
36. 6	54. 110	78. 5
37. 45	55. 30	79. 5
38. 20	56. 33	80. 55
39. 4	57. 35	81. 8-10
40. 30	58. 20	82. 6-8
41. 25	59. 10	

2b. Do any of these Machine Tool Operators have training in CAD/CAM or Numerical Control, and if so, how many?

<u>CAD/CAM</u>		<u>NUM</u>	
1. 4	40. 2	1. 3	32. 10
2. 3	42. 5	2. 25-30	33. 2
3. 1	43. 6	3. 1	34. 5
4. 3	45. 3	4. 8	35. 6
6. 3-4	46. 1	5. 1	37. 2
8. 5	48. 2	6. 11	38. 12
11. 2	49. 5	7. 2	39. 3
13. 4	50. 4	12. 2	40. 8-10
15. 1	52. 3	13. 15	41. 8
16. 2	53. 1	14. 3	42. 5
17. 6	54. 6	15. 1	43. 4
20. 1	60. 25	16. 65	44. 4
25. 3	61. 12	17. 1	45. 3
29. 3	62. 6	18. 3	46. 11
30. 30	63. 4	20. 1	47. 3
31. 2	65. 3	21. 50	48. 7
33. 1	70. 6	22. 2	50. 2
35. 3	72. 5	23. 6	51. 15
36. 6	75. 4	25. 8	52. 3
37. 6	76. 3	29. 12	53. 1
38. 3	77. 1	30. 30	54. 70
39. 1	78. 2	31. 2	55. 30
82. 3		57. 10	67. 6
		59. 1	69. 6
		60. 25	70. 12
		61. 20	72. 6
		62. 2	74. 10
		63. 12	75. 25
		64. 1	78. 2
		65. 20-25	82. 8

Q4. What kind of problems are encountered when trying to hire entry level employees?

1. Cannot find people with any basic skills.
3. Absenteeism, tardiness.
5. No experience.
6. Lack of CNC knowledge.
7. Lack of interest in the field.
8. Lack of math skills.
9. Few respond to want ads.
10. People lack experience and knowledge.
11. Potential hires cannot pass drug screening test or entrance exams.
13. Qualified employees are not out there.
14. Not enough skills.
15. Getting them to show up, or do an honest days work.
16. Lack of experience in machine operations.
17. Lack of skills in soldering delicate wiring.
18. Good help is hard to find.
19. Finding someone with experience in their field.
20. Lack of all-around experience; lack of math skills.
21. Difficulty getting people to come to work; lack of literacy skills.
22. Finding people with experience.
23. Not a "neat" industry to work in.
25. Finding quality people.
26. Attitude: younger people do not want to work in a shop; have to train them from the ground up.
27. Work attitude; people are lazy, not intelligent.
28. Basic experience, math and writing skills.
29. Many cannot pass drug screening and lack practical experience.
30. There are not qualified people out there.
31. Lack of qualified people.
32. Finding good people.
33. Lack of knowledge/skills.
35. Not trained in the basics; lack discipline skills.
38. Finding good, steady people.
40. Can't find qualified people.
41. Can't find qualified people.
42. Lack of shop experience.
43. Work habits, education.
44. Can't find anyone with mechanical aptitude.
45. Engineering needs.
46. Have to train them ourselves.
47. Qualified, experienced persons; must be skilled trades.

48. Don't respond to ads; lack of basic skills; dependability.
49. Can't find them.
50. Inexperience, poor work ethics.
52. Employees claim to have experience, when they don't; attendance problems.
53. Cannot read measuring instruments; lack of machine shop environment experience.
54. Can't find skilled help.
56. Poor morale; poor work ethics.
57. Lack of training.
58. Hard to find gear cutters.
59. Finding good employees who report to work, and do their jobs.
60. Lacking basic skills, work experience, and work ethics.
61. Can't find anyone who is willing to work.
62. People don't have experience or the mechanical background.
63. People have little blueprint reading knowledge, little skills in measuring tools; what they know is outdated. Don't have the basic machine concepts, and have no concept of cost-effectiveness.
65. Need people with 3-4 years experience. Tried working with Focus Hope, but people in that program had a dependability problem, they didn't show up for work.
66. Nobody applies for the job, and people that do aren't reliable.
67. Can't find anybody willing to work.
68. Lack of people applying for work. People who show up, last about a day.
69. Lack of people with aptitude, individuals who are responsive to learn, and people have attitude problems.
70. Can't pass a test and physical.
71. Shortage of qualified people who want to work.
72. No knowledge of basic math.
73. Very few are trained.
74. Lack of training.
75. Lack of people who want to work and answer the newspaper ads.
76. Lack of knowledge, not enough experience.
78. What we do is such close precision, no one has training in it or prior experience.
79. Lack of common sense and motivation; people don't want to work, and they don't care about quality.
80. People can't even use a tape measure in the entry level measuring test. People just don't have background in overhead crane, hi-lo, or bandsaw.
81. Lack of skills.
82. People do not have enough experience, can barely read or print, and don't want to work.

Q5. What would you attribute these problems to?

1. Students have no exposure to machine tool trades; high schools don't have vocational machine shops.
3. Lack of interest, not wanting to work.

5. No one wants to train employees.
6. CNC production involves button-pushing; they're not developing higher level skills at these jobs.
7. Employees want to start at the top; they don't want the lower paying, low skilled jobs.
8. Lack proper education; they need trigonometry.
9. Not enough trade people around.
10. Improper schooling; can't read tape measure.
11. Lack of education.
13. Employee's market.
14. Lack of education; we have higher skilled trade standards than most.
16. Good market; anyone who wants to work is working.
17. Low entry level pay.
18. Kids don't want to work; they want high pay. They have no skills and bad listening skills; short attention spans.
19. Spring-making is a non-apprenticeable trade. There are unique machines in this industry, and we want people with some experience on them.
20. People can no longer attend trade schools like they had in the past, i.e., Ford Trade School.
21. Who knows-the school systems?
22. No available training out there.
23. Bad image problems; ignorance; people don;t know we exist; laser mentality.
25. Unsure; "fatherless society".
26. Work ethic of younger people: they don't have any.
27. In the machining industry, people aren't really excited about it; there's a lack of interest in it. Could be due to the downturn of the industry in the late 70s; there were alot of layoffs.
28. Poor vocational education in high schools; teachers do not have a good handle on what to teach kids. Machine shop education is being phased-out.
29. Lack of education at the high school level. Manufacturing developed a dirty name in the 70s. High school teachers are lacksadazical about co-op; they also have stone age equipment in high schools.
30. Lack of training.
31. Image problem.
32. Society; no work ethic.
33. Too few apprenticeship programs these days.
35. Dicsipline; hygiene.
38. Lack of ambition.
40. Students are being counseled out of this field, at home and in high school.
41. Lack of education.
43. Never working and lack of education.
44. Specialized.
45. Everyone is going into CAD, so it's hard to find people.
46. Not much training out there.

47. Lack of concern for training people in skilled trades.
48. Poor training and individual image problems.
49. Lack of training; they go to auto's if trained.
50. Mental problems, alcoholism, family problems, ignorance.
52. Good work habits weren't instilled in them growing up.
53. Top notch tool makers flock to the "Big Three".
54. High schools aren't training anymore.
56. Parents don't set good work examples for their children to follow these days.
57. The economy: it's a workers market.
58. Inadequate high school preparation in this area, no more emphasis on machine education; lack of government funding for these programs at the high school level. High school programs need to be re-grouped vocationally and academically.
60. Less apprenticeship programs than in the past.
61. No more trade and apprenticeship programs.
62. Today's school system doesn't emphasize the trades. There's no machining classes in school anymore.
63. Overall lack of interest and knowledge; not enough qualified trade schools. Younger people are coming in and want top dollar for knowing nothing.
65. This country has gone about ten steps backwards in the area of skilled trades. Everything got so high tech, where does a person start? People need courses in machining. No one wants to get their hands dirty.
66. Kids don't want to get dirty; no one's interested in these jobs anymore.
67. Hard to say-upbringing? Background?
68. No family discipline; lack of basic skills; lack of good work ethics and basic math.
69. Lack of basic education.
70. Quality of people looking for work now.
71. Morale; decay of the population.
72. Schooling.
73. Lack of education in the field.
74. Lack of training in tools.
75. Lack of motivation.
76. Not too many people left in the trade; old people are dying off, and new generation is not going into this field.
78. Owners of the tooling association quit training people. No apprenticeships anymore.
79. Upbringing?
80. Lack of qualification of the workforce.
81. Once business slows down, the first ones laid off are the machine tool people; they find jobs in other areas and don't come back.
82. Work ethic has changed over the last few years.

Q6. Minimum level of education required for entry level positions in the machine tool area?

- 4. Experience on the job.
- 47. 4-6 years experience; blueprint reading.

Q7. If work experience is required, how much?

- 3. 5 years.
- 4. 1 year.
- 5. 1 year minimum.
- 6. 1-2 years.
- 13. 1 year.
- 20. 3-5 years.
- 25. 6-8 years.
- 31. 1 year of high school machine shop or design.
- 32. Varies.
- 33. 5 years.
- 36. Whatever it calls for in their apprenticeship; at least 2 years.
- 39. 5-7 years.
- 42. 5 years.
- 47. 4-6 years; blueprint reading.
- 49. 1-2 years.
- 53. 2 years after high school.
- 54. 2 years high school experience in machine shop.
- 62. 1 or 2 years.
- 65. 3-5 years.
- 67. 2 years.
- 73. Very helpful if in hydraulics.
- 77. 3 years.
- 78. 8 years.
- 81. 3-4 years.
- 82. 2-3 years.

Q8. In addition to, or aside from being skilled in a specific trade, well-rounded, or a combination of both, what type of employment preferences does your company have?

- 4. Depends on trade; welders.
- 10. Bidding involved because of union shop.
- 14. Depends on needs.
- 15. Trainable and willing to work.
- 34. Hire at entry level and train ourselves.
- 35. Basic machine/tool shop skills (blueprint reading, math, drafting).

41. Depends on the position that is being filled.
48. Depends on the job being hired for.
49. Depends on the job being hired for.
50. We like to cross train.
51. Train our own.
54. Depends on needs.
72. Cross-skilled.
73. Hydraulic field.

Q11. Besides basic benefits, what benefits are available for machine tool employees?

11. 401K.
19. Profit sharing.
47. Pension and 401K.

Q12. What type of educational benefits do you provide your employees?

1. Will pay for a course related to a person's job, but they must keep at least a 2 pt. To be reimbursed.
2. Will pay tuition for job-related classes if employee gets a "C" or better.
3. College tuition reimbursement and on the job training.
4. College tuition reimbursement if job related.
5. College tuition reimbursement.
6. College tuition reimbursement if job related and they pass the class.
7. Job related college tuition reimbursement.
8. 100% tuition reimbursement for job related courses.
9. Reimbursement for night school.
10. In-house training, college tuition reimbursement for job related courses only.
11. Both in-house training and college tuition reimbursement for job related courses only.
12. We will let a person leave work early if they have to attend class.
13. Tuition reimbursement if they get a "C" or better; work related only.
14. Apprentice training program, tuition reimbursement if "B" or better and work related.
15. Tuition reimbursement and books.
16. Tuition reimbursement.
18. Apprenticeship training, tuition reimbursement if "C" or better and job related.
19. 100% tuition reimbursement if "C" or better and job related.
20. 100% tuition reimbursement for "A's", and decreasing reimbursement for lower grades. Flexible program, so courses do not necessarily have to be work related.
21. Reimbursement for work related classes (up to \$250) if "C" or better.
22. Tuition reimbursement if they pass the class and it is job related.
23. In-house and tuition reimbursement if job related.

24. Out of house training.
25. College tuition reimbursement.
26. 100% reimbursement for passed, job related courses.
27. 100% reimbursement for "C" or better, job related courses.
28. Percentage of job related tuition reimbursement based on grade received.
29. Tuition reimbursement for job related courses; pay for books.
30. In-house, seminars, skilled trades.
31. In house training and outside training.
32. College tuition reimbursement.
33. Apprentice program through the Michigan Tooling Association.
34. Seminars provided by manufacturer.
35. Will pay tuition for shop related classes.
36. \$350/year for job related courses. Must get "C" or better.
37. 100% reimbursement for job related classes if "C" or better.
38. After one year, reimbursement for job related classes. 100% for an "A", 90% for a "B", and 80% for a "C".
40. Tuition reimbursement for work related courses.
41. 50% college tuition reimbursement with a 3.0 or better, for job related courses.
42. College tuition reimbursement.
43. 50% tuition reimbursement for "C" or better.
44. In house training. Help with tuition if "C" average is maintained.
45. In house training and seminars.
47. Work with MCC- internship; college tuition reimbursed if job related.
48. In house training.
49. College tuition reimbursement if job related.
50. 50% tuition reimbursement if "C" or better, not necessarily job related.
51. Tuition reimbursement if job related.
52. Tuition reimbursement if job related.
53. In house training.
54. College tuition reimbursement if work related.
55. In house training, college tuition reimbursement.
56. College tuition reimbursement if work related.
57. 50% college tuition reimbursement if work related.
58. Tuition reimbursement if job related.
60. Tuition reimbursement for trade related courses completed with a "C".
62. 50% reimbursement if the person gets a 3.0 or better.
63. Tuition reimbursement based on grade received.
64. Total tuition reimbursement for job related classes.
65. Tuition reimbursement for any math class or job related class if passed.
66. Reimbursement after one year with the company.
68. Reimbursement.
70. Apprenticeship at Macomb Community College.

71. In house training, training at Schoolcraft, tuition reimbursement.
72. Reimbursement if they complete tool and die courses and receive at least a "B".
73. If job related, will reimburse.
75. Up to \$400 reimbursed if trade related.
76. 100% reimbursed for work related classes with a passing grade.
78. 100% reimbursement for classes to finish an apprenticeship; job related classes, especially in ISO 9000; pay for books.
81. 50-100% for job related courses.
82. 100% tuition reimbursement, books, and lab fees if an "A" is received; 100% tuition for a "B"; and 50% tuition for a "C".

Q13. What advancement opportunities are available for machine tool employees?

1. Person can advance to a group leader or even a plant foreman.
2. Die makers, CNC operators and programmers, group leaders, foreman.
3. Pay raises.
4. Management positions, if available.
6. Lateral moves to different machines.
7. Unlimited: with proper education they can become engineers.
8. A lot; proficiency on machinery makes them promotable to more advanced machines with higher pay.
9. Experience working on new machines.
12. Advance to more difficult machines.
13. Increase in pay; team leadership.
14. Lateral movement from machine to machine.
15. Unlimited; could become president of company.
16. Varies: trainees to assistants to foremen, to machine set-up, etc.
17. Advance to group leader or supervisor.
18. There's no limit; can become president.
19. A production worker can advance to a complete set-up person; can become a group leader or even the plant manager.
20. Group leader or department head.
21. Can advance to an engineer or a group leader.
22. Openings are posted; there's room for growth.
23. Lateral moves to different machines.
24. Start as helpers, move to bench hands, machine builders, leaders, supervisors, and finally management.
25. CAD/CAM promotion.
27. Machine tool operator to shop supervisor.
28. Advancement is in the difficulty of the machinery. Believe in self-management concept-no leaders or shop foremen.
29. Can advance to a set-up person, a group leader, or foreman.

30. Apprenticeship. Three grades for advancement and can move on through apprenticeship program.
31. To management, to ownership.
32. Promotions to white collar positions; management.
33. Lateral moves to different machines or to management.
34. Monetary increases.
35. Many levels available with math and blueprint reading skills.
36. Can advance to more difficult machines; also can become a leader.
37. Machine tool operators can move up in grade four levels. Can also move up to supervisory positions.
38. Leader to engineer to plant manager.
39. Promotion to foreman or plant manager.
40. Bench hand to toolmaker to foreman.
41. Bench hand to toolmaker.
42. Usual progression in machine shop.
43. Advancement opportunities are wide open.
44. Can advance through a variety of departments to a thread grinder.
45. Many opportunities; CAD programmer.
48. Lots of advancement.
49. Advance to supervisor.
50. Advance to management positions in related areas.
52. Lateral moves; usual upward progression: bench hand to toolmaker to foreman.
53. Lateral moves to different machines, pay raises.
54. Usual progression, lateral moves.
55. Usual progression.
56. Lateral moves to different machines.
57. Unlimited.
58. Lateral moves to different machines.
59. Usual progression.
60. Usual progression; upgrading their own skills.
61. Usual progression; bench hand to toolmaker to foreman.
62. Leader, foreman.
63. Advance to engineer, group leader, foreman, even sales.
65. Group leader or foreman.
66. Can move up in grade.
67. Group leader, foreman, or plant manager.
68. Apprentice, journeyman.
69. Depends on employee and product line.
70. Tool and die maker, apprentice, journeyman.
71. Finish machine, management, metallurgical programs.
72. Depends on experience; journeyman, tool and die.
73. Unlimited.

74. Can advance if cross-trained.
75. Highest level; engineer.
77. Die maker, die leader, foreman, and sales if they have good communication skills.
78. Move up in grade; become a group leader; even buy the company.
79. More difficult jobs.
80. Foreman position.
81. Leader, supervisor, foreman.
82. Leader, builder, builder leader, project leader, sales, manager.

Q16. In the machine tool area, what types of technological changes do you foresee taking place at your company over the next 5-10 years?

1. A lot of potential with computers. Internal tracking of our products with a computer could be done in the future.
2. Now it is CNC and NC; in the near future there will be a complete reversal and they will have mostly CNC and no NC. Constant upgrading of equipment to keep up with the Big 3.
3. More CNC.
4. Upgrade tool machinery.
5. More CNC.
6. More CNC.
7. More sophisticated machines, more CNC, more electrical.
8. Increase in machining centers.
9. CNC is taking over; we've already bought one.
10. More CNC.
12. Will have more CNC machines.
13. More sophisticated CNC equipment is being ordered.
14. Experience of building; replace machines with CNC equipment.
15. Building machinery that doesn't require an operator or attendant. Because of difficulty finding people who want to work, this is the biggest demand in the industry right now.
17. Getting away from hand operated mills to more automated CNC equipment.
18. More NC and CNC equipment.
19. More computerization. Also, more standardization because of the AIAG (Automotive Industrial Action Group) set up by the Big 3.
20. More CNC equipment.
22. More CNC machines; changing tool ideas.
23. More CNC; people are scared and don't come to the industry anymore.
24. CNC, robotics, moving from hydraulic to electrical power.
25. Higher technological equipment.
26. Nothing. Everything is done manually. Perhaps upgrading some of the measuring equipment.
28. More automation; reduction in employees, already downsized.

29. More CNC.
30. Everyday there are changes: more machines and computers.
31. More CNC.
32. More CNC.
34. More CNC.
35. Anything new has to be made/developed.
36. More computerized machines.
37. Whatever new happens in the market- we're updating all technology accordingly.
38. Upgrading machines.
39. More CNC. Added safety regulations.
40. More CNC; more computers in manufacturing, tracking, and design; metrics.
42. CNC increase; newer, faster equipment.
43. Computers.
44. CNC, more automatic machines.
45. Everything computer controlled.
46. More women and minorities.
47. Electronic controls growing- technology is moving very fast.
48. More use of computers and automation, more women.
49. New software, more women and minorities.
50. More CNC, more research/design, more production.
52. More CNC.
53. More CNC, greater emphasis on quality.
54. More CNC; we'll have to adapt to customer demands.
55. More work cells, more CNC.
56. More CNC.
57. Equipment upgrades from manual to unattended, i.e., more CNC.
58. More sophisticated equipment.
59. More CNC and CAD.
60. More sophisticated equipment.
62. More CNC, more intech in computer programming.
63. Operator will be running more than one machine; more unmanned machining hours due to cost effectiveness.
64. More improved quality procedures; upgrading of machinery.
65. All CNC in the future.
66. More CNC equipment down the road. No drastic changes.
67. Programming of equipment through CAD systems.
70. More computer oriented.
71. ISO 9000; computers.
72. Much more computers.
73. Robotics.
75. Less hands on, more computerized.
76. More automation.

77. Everything will be CNC, from Bridgeports to grinders.
78. More CAD/CAM.
80. Updated equipment.
82. More NC machines and machining centers.

Q17. Other unmentioned, important skills?

1. Basic drafting skills.
2. Statistical Process Control (SPC), geometrical drawing and tolerancing. Employees should have "fire in their belly", i.e., desire, good work habits, and good work ethic. There should be a class in industrial etiquette.
5. Blueprint reading.
7. Blueprint reading, motivational skills.
8. Blueprint reading.
12. Total quality management, safety practices.
14. Blueprint reading.
16. Reading of gauges, calipers.
18. Motivational skills.
19. Knowledge on light, general machine shop equipment. More of the basics, such as working with the lathe, milling machine, surface grinder, and drill presses.
20. Interest to do a good job.
22. Blueprint reading and tool sharpening.
23. People skills, communication skills.
24. Purchasing, estimating project management.
25. Common sense, level-headedness.
26. Work ethic.
31. Motivational skills.
35. Math, blueprints, computers.
40. Punctuality, good work habits, dedication.
42. Basic mechanical skills.
43. Reading design.
49. Having a work history; dependable.
50. Grinding, blueprint reading, applying blueprint processes, "holding tolerances".
52. "A will to work".
57. Work ethics, attendance.
58. Blueprint reading.
59. Blueprint reading.
60. Knowledge of proper workspace behaviors and expectations.
61. Punctuality.
65. SPC, quality programs are important.
66. Reliability.
68. Showing up everyday; know decimals and basic math.

- 73. Assembly and die.
- 76. Reliability-show up.
- 77. Well-rounded person, the more experience the better.
- 79. Desire.
- 82. Blueprint reading.

Q19. Are you familiar with the various Machine Tool Technology programs at OCC; which ones (If "Yes")?

- 12. CIM; some of the computer classes.
- 13. Machine Tool school at Auburn Hills.
- 14. Don Trempers program.
- 15. Related Trades programs.
- 16. Machine training programs.
- 19. RTI.
- 20. CAD/CAM, General machine shop, Quality assurance drafting.
- 25. CAD/CAM, Numerical control.
- 26. Vaguely; remember reading about them in the paper, but can't name any.
- 29. Can't name any specific classes.
- 30. Familiar with all of them. Mr. Tremper is the coordinator at Auburn Hills for apprenticeship programs.
- 31. Can't name any.
- 33. Manufacturing, drafting.
- 64. Can't name any off-hand.
- 66. Sent some guys for drafting and math classes.
- 70. Auburn Hills.
- 73. Royal Oak; many employees get education there.
- 78. Can't say which ones.
- 81. Can't think of any.

Q21b. If you have hired an OCC graduate and you feel that they were "somewhat prepared" or "not at all prepared", which areas do you feel they were lacking in skills?

- 4. Practical applications.
- 15. Lacking in motivation. Have no work ethic. Math skills not adequate. OCC's standards have become power. Turning out people who must be re-trained. They need more hands-on training. Most feel if they have computer knowledge, that's all they need. WRONG! They need more math (addition, trigonometry, geometry).
- 19. Specifics and uniqueness of springmaking.
- 29. Hands-on time on machines.
- 36. Depends on the person. One person needed more good machinery experience.
- 43. Experience. Too much emphasis on schooling, not enough on work experience, on the job.
- 76. Quality aspects, reading measuring devices.

Q24. Are there any other comments you would like to make about your employment needs or training available?

1. I'm quite glad that someone called from a community college.
2. Contact Rich Steinhelper, managing director of the Michigan Tooling Association.
5. We need more skilled broach builders.
15. Experience in machine tool operation is not as important as experience in machine tool building.
16. People coming out of OCC program aren't interested in operating machines, they want to do CAD or program.
25. Quality inspection positions in demand.
28. Should include in your classes videos on grinding techniques, turning techniques, the basic knowledge of lathes, wheels, etc.
29. Students need more hours on machines; conventional machining helps with understanding CNC equipment. Should have a basic knowledge of the main machines, like drills, reemers, etc.
35. When students apply for a job, they need to look interested and well-dressed.
47. Glad to see OCC interested in this. People are afraid to get their hands dirty.
48. Glad to see community colleges getting into skilled trades. Need more real life experiences in college.
49. Employees have to be drug-free.
54. Get high schools to train their students.
56. It's hard to find people who want to come into work everyday.
57. We are willing to donate tools: endmills, cutting tools for milling machines.
58. Knowledge of materials needed; better technical education needed so people can learn the machines.
61. It's hard to get good help.
66. We want people who are reliable, who want to learn, have initiative, are punctual, and show interest.
67. We would like someone from OCC to come and implement a custom-made on-site class for the company.
71. We're looking for reliable individuals who want to work. Please contact Mark Wejroch if you would like help developing co-op.
72. Please send information regarding OCC's Tool and Die program.
76. More people should get involved in the field.
77. Can't find anyone who has the experience. Anyone who's getting an education in the machine tool area now will be making alot of money in ten years.
78. Lack of skilled training. You need to contact someone at the Machine Tooling Association, in Dearborn, and talk to them. We believe in selecting people from HFCC skilled trades program and from Focus Hope, which is not very good.

APPENDIX F

Machine Tool Technology

Student Survey Narrative Responses

Machine Tool Trades Programs

Student Survey

March, 1996

Narrative Responses

Q4. Other reasons for enrolling at OCC.

1. Free from Center for Dislocated workers.
3. Heard good reviews about the program.
11. Just interested in the program.
21. Job training.
30. Plan to go into the machine tool business.
34. Took it through the Center for Dislocated Workers.
35. Obtain new job skills.
51. Career change.
54. To advance in the trade and company; to make myself more marketable.
63. Career change.
88. Job training.

Q7. What type of shop do you work in?

3. Tool & Die.
4. Productions/skilled trade.
5. GM.
7. Die shop.
8. Model.
11. Automotive supplier; design in-house machines.
12. Machine shop.
13. Machine shop.
14. Numerical control manufacturing shop.
16. Production machine/tool room.
17. Automotive stamping.
19. Machine tool.
23. Diamond wheel making shop.
24. Machine shop/production.
25. Machine shop/casting.
26. Machine shop/tool making.
27. Machine shop/CNC.
28. Engineering dept.
29. CNC shop.
31. Machine shop/toolmaker .
40. Prototype shop.
41. Metal fabrication, Automotive research and development.

44. Tool & Die mold shop.
46. Gear and machine tools manufacturer.
47. Assembly plant.
49. CNC mill and lathe shop.
50. Stamping plant.
51. CNC machine shop.
52. Die shop.
53. Plastic injection mold shop.
54. Tool shop.
56. Custom machine builders.
57. Machine shop.
58. Automotive prototype.
59. Machine shop.
60. Aircraft and automotive tooling.
61. Automotive prototype.
62. Numerical control shop.
63. Ceramic machine tool and carbide cutting.
64. CNC turning and milling.
65. Automotive components production.
66. Sales representative for assembly line parts selling for GM; private company.
67. Manufacturing.
68. Casting department.
70. Automated welding.
71. Engine plant.
72. Production.
73. Sales manager.
74. Engineering; design tools for automotive parts.
75. Pattern making/fixture building.
76. Foundry and machine shop.
77. Manufacturing.
79. Cutting service.
80. Machine tool.
81. Tool & Die.
82. Install sunroofs.
83. Machine shop.
84. Manufacturing.
85. Boring mill.
86. Contract machine shop.
88. Automotive prototype/tool & die.
89. Tool & Die.
90. Prototype.
91. Manufacturing.

92. Machine shop.

Q13. What additional training/knowledge that OCC does not offer, would have been/would be helpful to you in doing your job?

3. More time on machines; a class for understanding the machinists handbook.
4. More CNC.
6. Training wasn't long enough, only sixteen weeks.
7. Offer Auto CAD.
8. Hands-on experience that is relevant to machines in todays world.
17. QAT class never seems to be offered; geometric tolerance.
26. More advanced courses in CNC.
29. Less introduction material.
35. More extensive programming training.
36. More math classes and blueprint reading.
39. Instruction on the Electrical Discharge machine.
44. More CNC programming courses.
45. More Electrical Discharge machining.
48. More CAD classes.
62. More numerical control.
63. Machine tool grinding.
68. More hands-on and lab work; smaller classes.
73. It would be beneficial to do a field trip in introduction class.
74. Require numerical control in CAM program.
77. Shop-math class in connection with the class offered.
78. More accelerated program; independent studies.
79. CAD software needs to be updated and relevant to todays workplace.
89. Additional math classes.

Q16. How can the scheduling of courses be improved to better meet your individual needs?

4. Have morning classes.
10. Have classes at an earlier time.
11. CAD labs-few and far between and not enough open lab time.
19. More classes, or more advanced classes in the evening.
22. Offer more spring and summer classes.
25. Schedule MAC classes more frequently.
29. Scheduling is bad for people who work 55 hours per week.
35. Have more day classes, so that those who work midnights can attend classes.
36. Package a CAD kit like ITT does.
44. Offer more courses at different times.
47. Offer more CAD classes; they fill up too quickly.

58. Need to offer more classes at different times; classes get closed too often; sometimes takes a year to get a class.
61. Break the class time up; two hours instead of four hours.
63. Have scheduling flexibility for the working class.
71. Classes need to be offered more frequently in the evenings.
72. Frequency of classes, especially towards the end of the program.
83. Drafting classes should be offered in the evenings also.
84. Would like to see certain courses, like Math, offered at different campuses.
87. Courses need to be offered more frequently than once a year.
89. Classes aren't offered when needed; some classes are only offered once every one and a half years.

Q17. In your opinion, what ways do you think the machine tool industry will change over the next few years?

1. It will become more automated and computer-related.
2. More computerized; more accurate.
3. More computer-aided; machinists must have prior training.
4. More computers.
5. Moving toward more computers and programming.
6. Computerized, CNC.
7. Computerized.
8. More computer-oriented.
9. More computer applications.
10. All CAD and away with board work.
11. Heavier into CNC.
12. Majority will go to computers.
14. More computerized and more technology orientated.
15. All computer.
16. More technology involved; most will go to computer aided, even hands on.
17. Completely computer orientated.
18. More computerized and high-tech.
19. More advanced; new machines being brought in constantly.
22. More technological; CAM, major role in manufacturing.
23. The industry is going to grow.
24. More CNC will be required.
25. More CNC.
26. More technical knowledge will be required; not necessarily computers or automation.
27. NUM will be required.
28. More CNC.
29. More CNC will be needed.
30. More CNC.

31. More CNC will be mandatory.
32. Require more CNC.
33. More computerized, less workers, less pay.
34. Machine tooling is a dying trade; horrendously boring. Companies will have to pay a lot of money just to get people to work. In the next ten to fifteen years, there will be no one to replace the "old-timers".
35. More CNC, more set-up.
36. Diversity of CNC, Bridgeports, and assembly.
37. It will all go into computers, numerical controls, and CAT/A.
38. More CNC, CAD/CAM, and the ICAM system.
39. More CNC applications.
40. More use of robotics.
41. More CNC adaptive composition, metallic, and plastic materials used.
42. More CNC.
43. More technology and robotics will be used.
44. More CNC will be required.
45. Most of all, machining will be hands-free; machines will be set-up by robots and run by computers.
46. More automated, more computers (CNC), less manual intervention.
47. Nothing more than technical advances.
48. It will become really technical.
50. More computerized.
51. Leading more towards the CNC end of it.
52. See alot more of computer aided machines; overall it's a dying field.
53. More CNC controls.
54. More automated; need more people for programming and leadership.
55. More automation and computer-driven.
56. Higher-tech, more computers; things being done by hand now will be turned over to computers.
57. More CNC, more computer controlled.
58. More automated, CNC, and computers.
59. More advanced; keep up with the new technology.
60. More towards computers.
61. Computers will take over; robotics.
62. More advanced in production and running.
64. More automated.
65. More toward flexible machines.
66. I feel that the industry will be expanded.
67. More computerized.
68. The more you know, the better chance you have of holding on to your job. More numerical controlling and computer aided.
69. All will be computerized; CNC type.

70. Back to alot more apprenticeships. Older workers are retiring, and people have not been taking vocational classes.
71. More computerized. Foreign countries will be sending people to work in American companies.
73. More of an emphasis on numerical control and less on manual machining.
74. Revolutionary turnover in technology; people will become more specialized.
75. More computer aided; more numerically controlled.
77. Alot more computerized and virtual reality.
79. More computer-driven.
80. More computer aided.
81. More CNC, math and trigonometry, and digital operations.
86. Technology will keep on increasing; computerized machines.
87. More dependant on computers.
88. Much more technology; use of lasers.
89. Greatly advanced; shortage of engineers.
90. Alot more computer aided machines like CNC.
91. More computers.
92. More automated.

Q18. Are there any other comments you would like to make about the Machine Tool Technology programs at OCC?

2. Good programs.
3. The geometric dimension and tolerance class was very helpful for blueprint reading. GDT and blueprint reading classes should be coordinated together.
4. Low level of education taught here; very dissatisfied with OCC.
5. Enjoyed the programs. More machine time would be nice.
6. Machining courses should be offered at more of the campuses.
10. Every instructor should be given an evaluation, and these should be taken very seriously. Schedules should also have names next to classes.
12. Too many students per instructor to be beneficial.
13. Too many people per class to learn much. Need more one-on-one. Machines are not adequate for the number of people in the classes.
17. Alot of instructors say they have been doing this for ten or more years, perhaps they should update and not be so routine year after year.
23. Too many students and not enough one-on-one instruction.
25. MAC classes are too large for the limited amount of equipment and hands-on actually required.
26. MAC program classes should be offered more frequently.
29. Introductory and advanced MAC students should not be in the same classes; too many students in one class; not enough instructors; not enough equipment; I'm not getting what I paid for.

30. The textbooks for the courses are inadequate and inconsistent in format and subject content.
31. Students at various technical skills should not be in the same courses.
34. Generally satisfied with everything. Not enough equipment available; we had to have three-man teams, instead of two-man teams. Not enough practical experience on the equipment. Also, G-PAC were not very serious, and were always goofing-off.
35. I learned a lot; everything went well, and I'll put everything to good use.
36. You should start out with what machine tool is, then go to CNC. When people can see exactly what happens with a machine, it will be easier for them. They can visualize it more.
38. Steve Atma was a very good teacher; the class size was a little too big, but he dealt with it. He came in early and gave us a lot of extra time to compensate for the bigger class. He kept us busy.
39. I went through G-PAC to get the training and it bothers me that you could only do this if you were laid-off. Everyone should have the same opportunity. We had to wait two weeks for the class to start because they couldn't get enough people.
40. I took a CNC course, and the instructor tried to cover too much material in one semester.
41. Steve Atma and Billy Turner are excellent instructors.
44. Offer more classes at different times.
45. Definitely would recommend all the hands-on experience.
54. Some equipment is outdated.
56. Would be better if classes started at 7:00 instead of 6:00, because most people work until 6:00.
65. The two courses were combined, and I don't think it was fair to students.
68. The classes were so huge, there wasn't enough time for all of us to use the machines.
69. Need more instructors. Combining three classes in one room does not allow you to get any training. If it stays this way, I'll go to another school; at this rate, you don't get any training.
73. Paul Wayrenan is an extremely good instructor. Ron Demerino is excellent with the metallurgy.
74. Offer more choices for people who work during the day.
75. Too many students for so few pieces of equipment.
77. Make an effort for guys who have been out of school for awhile to do some basic math review of what is needed.
79. CAD software is outdated. I've had bad experiences with this program, and I'll go to Macomb rather than go back to OCC.
91. I've been trying for three semesters to get ATM 118 or ATM 120.