SHORELINE COMMUNITY COLLEGE

MANUFACTURING PROGRAM REVIEW

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Overall Observations

The Manufacturing (MFGT) Program offers two associate degrees: Manufacturing/Machinist Technology and Mechatronics. It also offers six certificates: Basic Manufacturing, Principles of Precision Machining; Manufacturing Machinists; Machine Maintenance; Quality Assurance; and Industrial Maintenance Robotics and Manufacturing. This program is the beneficiary of three large federal grants in recent years. Program administrators and faculty have worked hard to make the most of these opportunities and it shows. The program demonstrates multiple innovations and best-practices including:

- Two pathways CNC Machining and Mechatronics each with stacked certificates and modularized curriculum.
- Block scheduling the first year of the CNC Machining pathway offers one 20-credit course each quarter. These courses are offered in a day or evening "shift" (and a soon to be reintroduced weekend shift) allowing for predictability and convenient scheduling for working students.
- IBEST teaching method allows the partnership of a math instructor with the content instructor to insure students graduate with the relatively high math abilities required in these occupations.
- Imbedded program navigation to support students with non-academic challenges or barriers to success.
- Industry accreditation through NIMS, the leading manufacturing skills standards organization in the United States.
- Industry certifications from NIMS and FANUC.

This rapid growth and development have understandably led to growing pains to which faculty and staff are eager to turn their attention. As will be explained more fully below, this includes a need to thoroughly review program learning objectives and map courses to those objectives. Marketing materials also need updating.

Priority Suggestion 1: Update program learning objectives.

Data from the former student survey indicated that the program may not have adequately covered a few of its learning objectives. Upon deeper exploration, the Advisory Committee noted that some of the learning objectives may not be as important in today's manufacturing environment. Faculty shared that the learning objectives may not cover the depth of learning actually occurring. They also discussed that they have not mapped the learning objectives to individual courses, an important step needed to ensure the program teaches everything required.

Suggestions

- 1.1 Update program learning objectives using Bloom's Taxonomy and industry input. (pp. 9-12)
- 1.2 Map courses to program learning objectives, noting in which courses program learning objective concepts are introduced, when they are reinforced, and when they are assessed. (p. 12)

As described above, the program offers many innovations that should be appealing to prospective students and aid their success. Marketing materials and the program's website reveal that the priority to date has rightly focused on launching and strengthening these innovations, not on marketing them. It's time to start sharing the good news with stakeholders, prospective students, and the community at large.

Suggestions

- 2.1 Review the program's website and make sure all certificates and degrees are listed properly. (pp. 25)
- 2.2 Review existing marketing materials for completeness and identify marketing gaps, then work with the Communications and Marketing department to develop a marketing strategy for the program and create existing needed materials. (p. 25)

Priority Suggestion #3: Add an additional tenured faculty to this program

The program size and complexity may be placing strains on the one full-time tenured faculty member for the program, especially for one with two different associate degrees. Because the percent of females in Shoreline's MFGT program is about half that found in industry, recruiting a well-qualified female for this position could help improve female enrollment.

Suggestions

- 3.1 Consider adding a second tenured position to this program. (pp. 22-23)
- 3.2 Use this opportunity to heavily recruit female applicants. (pp. 18, 23)

Program Review Findings

School-wide Findings

1. Shoreline Community College should develop a system for collecting contact information from graduating students. This information could be used by the Foundation for fundraising, as well as by individual departments to assess alumni satisfaction and the degree to which alumni achieved program outcomes. (p. 8)

Program Level Findings

- 1. The department offers multiple innovations and best practices in professional-technical education including block scheduling, IBEST, career pathways, stacked credentials, industry accreditation, industry certification, and imbedded program navigation. (pp. 8-9)
- 2. Evaluate math-related assessments in MFGT 105 and 106 and determine if extra math support is necessary. (pp.8-9)
- 3. Ensure each class has a grading rubric and faculty are using these rubrics consistently. (pp. 13-14)

- 1. A high percentage of alumni and former student survey respondents indicated they were employed for pay (almost 80 percent). (p. 15)
- 2. The vast majority of these working alumni (21 out of 23 respondents) are working in the manufacturing industry. (p. 15)
- 3. Data and results from the surveys indicate that students come to this program to gain skills, reflected in the much higher percent of certificates completed in MFGT compared to Shoreline overall. (pp. 15-16)
- 4. The acting director and navigator work intensively with students to encourage and help them complete the necessary paperwork to get certificates. (pp. 21-22)
- 5. Data and remarks from the Advisory Committee and faculty indicate that students are being hired to work in the industry before they complete degrees. (pp. 21-22)

Student/Course Level Findings

- 1. Enrollment in MFGT has increased by 30 percent since AY 2013, despite the increase in the economy and declining enrollments overall at Shoreline. This is the largest manufacturing program in Washington State, approximately 50 percent larger than its next closest competitor, Bates Technical College. (pp. 16-18)
- 2. The percent of female students in MFGT is about half of that found in industry. (pp. 18-19)
- 3. Racial and ethnic diversity is about three-times as high at Shoreline compared to the industry overall. (pp. 18-20)
- 4. There were no waitlist issues for this program. (p. 22)
- 5. There are relatively low fill rates for MFGT 155, 156, 244, 245, 246, and 247 courses needed for some students (p. 22)

Faculty Findings

- 1. The faculty fully participated in some of this program review and when they did, they were engaged, thoughtful, and had a good understanding of the needs of students and employers. (pp. 22)
- 2. To improve faculty participation in future program reviews, coordinate potential program review meeting dates with faculty. (pp. 22-23)
- 3. MFGT operates at higher student-to-faculty ratio than all of Shoreline Professional Technical programs and its peer department (Automotive), but very close to Shoreline overall. (p. 23)
- 4. Some faculty indicated a desire to increase training and job shadowing opportunities (p. 23)

- 5. Faculty use Shoreline training to improve teaching skills and find these opportunities satisfactory. (p. 23)
- 6. Faculty offering hybrid courses may benefit from additional training on these types of courses. (p. 23)
- 7. New faculty may benefit from additional Canvas training. (p. 23)

Resource Findings

- 1. MFGT is a highly equipment and space intensive program. (p. 23)
- 2. The Mechatronics associate degree will require additional controller training stations to bring it to the 5 to 6 trainers necessary to make the program efficient. (p. 24)
- 3. One faculty indicated a desire to offer CATIA programming at Shoreline faculty should examine the costs and benefits of doing so. (p. 24)

Partnerships

- 1. The program advisory committee members present at a meeting regarding this program review were engaged in the department and committed to its well-being. (p. 24)
- 2. Faculty are seeking new partnerships that would lend to better and more internship opportunity for their students (p. 24)

Program Services

- Not enough students with more than 1 class under their belt completed the survey, so the use of the survey in the program review was limited. (p. 8, 24)
- 2. Some students indicated that proper labeling of machines may help students independently complete hands-on teaching tasks, promote problem solving, and would align with LEAN strategies some factories pursue to improve performance and reduce waste. (p. 25)

Competition

- 1. The program could benefit from improved marketing materials. (p. 25)
- 2. The website needs updating. (p. 25)

Labor Market Opportunities

- 1. The SOC codes linked to this program do not describe main work anticipated of graduates new CIP codes should be explored to better capture the necessary SOC codes. (pp. 25-26)
- 2. Labor-market data does not capture impending retirements and the key occupations are noted as "in-decline" and not eligible for state subsidized education despite large impending retirements and considerable employer anxiety. (p. 26)

INTRODUCTION

In an effort to maintain the highest quality post-secondary education and meet regulatory requirements, Shoreline Community College hired Phippen Consulting, LLC in spring of 2018 to conduct a program review of its MFGT Program.

METHODOLOGY

Meetings

- One one-and-a-half-hour meeting with Division Dean, program chair, and Institutional Review staff to identify major issues of focus.
- Three two-hour meetings with staff and faculty to discuss all aspects of their program.
- One one-hour meeting with the MFGT Program Advisory Committee to discuss the relevance of this program.

Documents Reviewed

- One survey of current students (n=19)
- One survey of alumni and former students (n=48)
- Student demographic data
- Class cancellation and waitlists
- Student completion data
- Student completion ratios for MFGT, Shoreline, and the state
- Student grade distributions
- Comparative data on student-faculty ratios
- Comparative data on full-time to part-time faculty ratios
- Program and course level fill rates
- Labor market data
- Job openings data from EMSI
- Program level learning outcomes
- College and program website and planning guides
- Annualized FTEs, headcount, and percent of enrollment by program and by certificate/degree

Surveys

The program instituted an alumni and current student survey this year (see the separate document, "MFGT Surveys" for a copy of the survey results). Surveys were distributed by Shoreline's Marketing and Communications Department using MailChimp and Survey Monkey. One email and one follow-up email were sent to both current and former students resulting in a response rate of 25 percent for current students and 10 percent for former students. The former student survey response could be improved by collecting contact information for graduating students.

Despite the relatively high response rate for current students, 10 out of 21 respondents reported completing 0-1 courses. While this course is likely the 20-credit entry-level MFGT 105, the relatively low number of respondents with deeper experience with the department casts concerns about the validity of the survey results. For this reason, the only results from the current student survey included in this program review are the responses to open-ended questions and quantitative results that are not dependent upon experience with the department (e.g., questions about how they chose Shoreline).

CURRICULUM

Curriculum Review

The curriculum structure of this program offers several innovative components that deserve highlighting: block scheduling, IBEST, career pathways, stacked credentials, industry certification, and industry accreditation. It's rare to find so many best practices packed into one Professional-Technical program.

Block Scheduling

The core, entry-level components of the CNC Machining program is structured into three 20 credit courses with "shifts" (i.e., classes) running during days (Monday-Thursday, 9 a.m. to 3 p.m.) and evenings (Monday-Thursday, 4 p.m. to 10 p.m.). A weekend "shift" (Friday, 5 p.m. to 9 p.m. and Saturdays/Sundays from 8 a.m. to 5 p.m.) was temporarily suspended this year to be retooled and improve enrollment.

Arranging this program with a single registration required each quarter and a predictable weekly schedule can help working adults complete programs (for a broad summary of this and other challenges facing adult students see Bosworth, "The Crisis in Adult Education", National Academy of Sciences, 2008). More Professional-Technical programs should follow this model demonstrated by MFGT.

IBEST

This program includes an IBEST component to help students complete the math requirements. This ensures that two instructors are teaching at the same time – one to teach technical skills and the other(at 50 percent) to help with the contextualized math for machining required by the program.

Math is a critical challenge for many adult students and the math requirements in the manufacturing industry are significant. Both current and former students reported that the math required in this program was challenging. Some former students remarked

that the math they learned in this program was among the most valuable skills they gained. Incorporating IBEST into this program not only ensures better success for students, but it helps broaden the recruiting pool.

A few current student respondents to the survey reported that even with the IBEST instruction, some students still struggle with math. The department should analyze assessment data to see if this is a widespread challenge and, if so, engage the math department on additional strategies that could be pursued (such as a co-requisite).

Pathways and Stacked Credentials

Finally, programs are designed into two pathways: CNC Machining and Mechatronics. Each pathway offers stacked certificates that allow students flexibility and multiple options. In the CNC Machining pathway, courses are broken into weekly modules. A certificate of completion is awarded upon finishing both the first and second course, and a certificate of proficiency is awarded upon the conclusion of the third course. Completers of these first three courses are qualified to gain entry-level employment in a variety of manufacturing facilities. Students can continue to attain their associates degree for additional employment opportunities.

The new Mechatronics program offers an Industrial Maintenance, Robotics, and Manufacturing certificate of proficiency, and an Industrial Automation and Electronic Controls certificate of proficiency (offered through a partnership with North Seattle College). These credentials can be combined with additional coursework leading to an associates degree.

Industry Accreditation

The MFGT program is accredited by NIMS, which sets the industry standard for training and skill validation within precision manufacturing. NIMS accreditation requires a comprehensive curriculum review every five years, last conducted at Shoreline in 2017.

Assessing Student Learning

MFGT students are required to take assessment exams offered and required by the NIMS accreditation. These assessments are linked directly to the curriculum learning objectives and industry standards.

Program Outcomes

The NIMS accreditation has helped the curriculum structure and relevancy. However the program learning objectives need revising. Upon reviewing the program learning outcomes for the AAAS and the other certificates, faculty agreed that they needed to be updated. These outcomes were developed several years ago and have not been reviewed despite several significant changes to the program and evolution of industry standards.

One learning outcome in particular that needed revision was for the Precision Machining Certificate of Completion and states "use systems to support the manufacturing business to meet the needs of internal and external customers". In this case, the term "systems" needs a definition and how they "...meet the needs of...customers" needs better clarification. Another learning outcome that needs attention is "demonstrate knowledge of Statistical Process Control" (SPC). Former students and alumni were asked the degree to which they learned each of the learning outcomes associated with the degree or certificate they completed. Respondents to the survey reported a relatively lower agreement that they learned skills related to SPC. Advisory committee members questioned the relevancy of this learning outcome in today's manufacturing environment and pointed out that SPC would be a subset of another learning outcome, "demonstrate basic and precision measurement methods."





The following tables share the results of program outcomes evaluated using Bloom's Taxonomy. In the 1960's, Bloom and his colleagues developed a system for understanding the type of learning being required from basic "did the student understand a concept" to the more advanced, "can the student analyze the quality of information and make or defend arguments based on this analysis." This analysis revealed that most of the existing program outcomes consistently fell under Bloom Level III: Application. At this level students can solve problems in new situations by applying acquired knowledge in new ways.

Manufacturing AAAS Program Objective	Bloom's Taxonomy Level
Perform entry-level tasks as a machinist; program basic machine tools to perform routine machining functions.	III
Use mathematics skills to solve basic manufacturing problems.	III
Safely set-up mills and turning tools making tool length and work piece offsets.	III
Apply teamwork, inspection and SPC to manufacturing problems.	III
Utilize properties of materials and establish correct speed of tool rotation and feed rate of forward motion.	III
Interpret mechanical blueprints.	III
Use current software for computer assisted machining.	III
Perform entry-level tasks as a machinist; program basic machine tools to perform routine machining functions.	III

Precision Machining CC Program Objective	Bloom's Taxonomy Level
Work effectively in a manufacturing environment.	III
Use systems to support the manufacturing business to meet the needs of internal and external customers.	III
Participate and contribute to the effectiveness of teams.	III
Understand Statistical Process Control (SPC).	II
Use fundamental skills in (writing, reading, math, speaking, listening and computing) to meet the needs of the workplace.	III
Gather, interpret and use data consistently and accurately to make decisions and take action.	III/IV
Contribute to the maintenance of a safe and healthy work environment.	III

Employers are increasingly requiring more critical thinking skills of their new employees. Advisory committee members confirmed that this is true in the MFGT industry as well. With this in mind, it may be worth considering re-evaluating the program outcomes to incorporate a few higher-level learning outcomes that will help students improve their critical thinking skills. Faculty shared that some of these program learning outcomes are not reflecting the higher-level learning that is occurring in the courses.

After updating the program learning outcomes, the department should map courses to the outcomes. This will help faculty understand where learning and assessment occurs throughout the program, identifying gaps that could improve uptake of program learning outcomes.

Grades

An examination of MFGT pass-no pass awards (all MFGT students, not just professional-technical students) and grades reveals that MFGT pass rates and grades are slightly higher than all Shoreline Professional-Technical programs during the same time period.



MFGT Pass-No Pass by Academic Year

Professional-Technical Program Pass-No Pass by Academic Year



MFGT Grades by Academic Year



Professional-Technical Grades by Academic Year



The variability in grades across academic years could be because of the relatively fewer students in Manufacturing compared to all Professional-Technical students. However, it could also be because of poor use of grading rubrics. Ensuring each class has a grading rubric and all faculty are using the rubric in the same manner will improve consistency of grading and help improve student learning outcomes. To understand employment outcomes, two data sources are typically used. First, MFGT alumni survey responses regarding their employment status is considered. Almost 80 percent of alumni respondents reported that they were employed for pay part- or full-time, a relatively high number compared to other Shoreline professional-technical programs.



When responding to an open-ended question about their current jobs and responsibilities, 21 of 23 respondents indicated they were working in a field related to the MFGT program. This is a high correlation and points to the relevancy of the program and the tight manufacturing labor market.

The second data source is the Data Linking for Outcomes Assessment database compiled by the Washington State Board for Community and Technical Colleges linking program outcomes and employment data. This data shows the employment outcomes for alumni that completed their degree or certificate. The data does not show what jobs these individuals have.

Academic Year	Estimated Employment Rate for Completers	Estimated Employment Rate for Leavers
2011-2012	82%	1%
2012-2013	73%	38%
2013-2014	92%	49%
2014-2015	92%	89%

Prior to AY 2014, completers were gaining employment at a much higher rate than leavers. In 2014, leavers also began gaining employment at a high rate. The

Completers -Average Wages (2011-2015)							
Completion Year	Completers	Leavers					
2011-2012	\$16.15	N/A					
2012-2013	\$18.32	\$18.54					
2013-2014	\$17.42	\$15.99					
2014-2015	\$17.17	\$17.56					

advisory committee and faculty indicate that this is likely because students are being hired for manufacturing jobs before completing the program.

Reported wages for this program were strong for both completers and leavers. Again, leavers wage strength may indicate that those included in this dataset are being hired for manufacturing jobs before completing their degree or certificate.

STUDENT DATA TRENDS

Enrollment

As the following table shows, MFGT headcount and FTE enrollment increased by almost 30 percent between AY 2013 and 2016. This increase can be attributed to several large US Department of Labor grants that were acquired during this time period which allowed the college to increase program resources and recruiting. In comparison, all Shoreline professional-technical program headcount increased by 3 percent during the same time period; FTE increased by 0.5 percent.



MFGT Headcount and FTE by Academic Year



Professional-Technical Headcount and FTE by Academic Year

In comparing MFGT enrollment to other local area colleges, the following table demonstrates the strength and size of Shoreline's program.

YEAR	PROGRAM TITLE	Shoreline	Everett	Renton	L. WA	Bates	B'ham	Clover	Green
								Park	River
2014-		164.58	14.89	35.16	94.23	84.20	55.47	45.91	77.35
2015	MANUFACTURING TECH	69.35	0.00						
	CAD DRAFT/DESIGN TECH	2.53		4.29	34.69	0.00			17.45
	MACHINE TOOL TECH	92.69	14.89	30.87	59.54	84.20	55.47	45.91	59.90
2015-	2015-		20.33	23.16	82.90	109.77	49.41	42.75	85.07
2016	MANUFACTURING TECH	84.42	0.00						
	CAD DRAFT/DESIGN TECH	3.73		5.07	27.53				13.47
	MACHINE TOOL TECH	132.40	20.33	18.09	55.38	109.77	49.41	42.75	71.61
2016-		215.78	45.87	19.24	80.74	85.92	44.04	41.22	72.22
2017	MANUFACTURING TECH	81.69	6.67						
	CAD DRAFT/DESIGN TECH	3.87	0.00	3.78	31.62	0.00			11.36
	MACHINE TOOL TECH	130.22	39.20	15.47	49.12	85.92	44.04	41.22	60.87

Program growth between AY 2014 to AY 2016 at Shoreline has also been significant in comparison in both absolute and percentage figures.

Manufacturing Program Growth between AY 2014 and AY 2016

PROGRAM TITLE	Shoreline	Everett	Renton	L. WA	Bates	B'ham	Clover Park	Green River
Overall program	31%	208%	-45%	-14%	2%	-21%	-10%	-7%
MANUFACTURING TECH	18%	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CAD DRAFT/DESIGN TECH	53%	N/A	-12%	-9%	N/A	N/A	N/A	-35%
MACHINE TOOL TECH	40%	163%	-50%	-17%	2%	-21%	-10%	2%

Student Demographics

MFGT is much more male than Shoreline's overall Professional-Technical programs on average. It does offer greater racial, economic and age diversity than Shoreline as a whole. While only 10 percent of Shoreline's students are female, the U.S. Bureau of Labor Statistics report that between 20 to 22 percent of the workforce is female.^{1,2} Staff report that recruiting women to their program is quite difficult, despite pursuing multiple strategies to encourage women to enroll and help them stay. This includes participating in the Women in Trades fair and starting a Women in Manufacturing student club. Unfortunately, the navigator that sponsored the student club was laid off at the completion of a grant. Hiring a female faculty member and encouraging women alumni to help recruit would boost female enrollment and persistence.

Racial diversity is much better at Shoreline than in the industry overall. Almost 20 percent of manufacturing workers are non-white in industry, while almost 60 percent of Shoreline's students are non-white.

¹ Bureau of Labor Statistics, 2017. <u>https://www.bls.gov/cps/cpsaat18.htm</u>. Machinery manufacturing – 22%, Aircraft and parts manufacturing – 22%, Aerospace products and parts manufacturing – 20%)

² Faculty and staff shared that they believe many fewer women work in manufacturing than are reported by this data. They rightly point out that these figures do not include the types of jobs females have in manufacturing. While it's true that in medium and large companies, human resources staff might be mostly female, it's also important to point out that there are relatively fewer people in these types of departments than on the factory floor.

MFGT Mean Age







MFGT Race/Ethnicity







Completion Data

Feedback about completions from alumni, the Advisory Committee, and faculty consistently showed that students do not need a degree or certificate to gain work in the industry. Former students and alumni were asked why they enrolled in MFGT courses at Shoreline. Almost 70 percent of the responses stated they were there to gain new skills or brush up on existing skills. Indeed, they frequently do not complete degrees, and frequently complete certificates.



An analysis of MFGT completions reveals that few students pursue the degree or certificates.

Completions	AY 2013	AY 2014	AY 2015	AY 2016
Manufacturing/Machinist Technology - AAAS	22	18	14	14
Manufacturing/Machinist Technology - CP	36	35	24	51
Principles of Precision Machining-CC	30	43	54	42
Basic Manufacturing-CC	23	34	22	23

When comparing MFGT completion ratios to Shoreline Community College and statewide ratios, MFGT completion ratios for workforce degrees and certificates are much higher than for Shoreline or the state.

All Workforce Certificates and Degrees		2010- 2011	2011- 2012	2012- 2013	2013- 2014	2014- 2015	2015- 2016
State	Ratio	Unavail.	20%	20%	20%	Unavail	Unavail
	Completions	641	626	694	652	702	545
Shoreline	Headcount	2262	2110	2331	2156	2075	1854
	Ratio	28%	30%	30%	30%	34%	29%
	Completions	43	86	105	112	130	122
Manufacturing	Headcount	46	89	125	158	181	193
	Ratio	93%	97%	84%	71%	72%	63%

When certificates are filtered out (the 2nd table below), the MFGT completion rates are much lower than Shoreline's. The school and staff are doing a few things to boost certificate completion rates. First, certificates of completion are

automatically conferred. Second, both the acting director and the navigator work intensively with students to encourage and help them complete the necessary paperwork to get their certificate of proficiency. Without this extra staff help, completion rates would likely be lower.

Workforce Degrees Only		2010-	2011-	2012-	2013-	2014-	2015-
		2011	2012	2013	2014	2015	2016
	Completions	251	194	206	203	208	181
Shoreline	Headcount	1798	1616	1786	1643	1534	1389
	Ratio	14%	12%	12%	12%	14%	13%
	Completions		1	2	22	18	14
Manufacturing	Headcount	3	4	22	68	69	85
	Ratio	0%	25%	9%	32%	26%	16%

Waitlists and Fill Rates

Shoreline Community College's Institutional Review Department (IRD) studies waitlist data for the college, analyzing number of seats waitlisted by course and quarter, in addition to several additional factors of importance. IRD develops a ratio of class capacity to waitlist to help identify impacted courses. The lower the ratio, the more impacted the class. For example, a course with capacity of 100 seats and 10 people waitlisted would have a ratio of 10. A class with capacity of 20 and 10 people waitlisted would have a ratio of 2.

For this program review, no courses had a ratio of 5 or less for 2 or more quarters - there were no waitlist issues.

Fill rates are determined by comparing the number of students enrolled in a course during an academic year, with that course's capacity for the year. Analyzing fill rates by cluster identified a few courses with typically low fill-rates: MFGT 155 and 156 are quality control courses offered only once per year. MFGT 244, 245, 246, and 247 is a maintenance certificate.

	2013-2014	2014-2015	2015-2016	2016-2017
Cluster Title	Fill Rate by	Fill Rate by	Fill Rate by	Fill Rate by
	Cluster Sums	Cluster Sums	Cluster Sums	Cluster Sums
MFGT 155	48.8%	23.6%	34.4%	47.9%
MFGT 156	28.1%		43.8%	
MFGT 244	68.8%	30.6%	51.4%	42.6%
MFGT 245		55.6%	37.0%	27.8%
MFGT 246		61.1%	56.3%	44.4%
MFGT 247		45.8%	37.5%	62.5%

FACULTY

MFGT has one full-time faculty, one I-BEST instructor and three associate faculty (one of which has a full teach load). In the fall of 2018, they plan to have one fulltime faculty, one I-BEST instructor, two associate faculty with a full-load assignment, and two additional associate faculty. The majority of faculty fully participated in some of this program review. When they participated they were engaged, thoughtful, and had a strong understanding of the needs of students and employers. The acting director indicated that a lesson learned in this process for her was to coordinate future program review meetings with faculty schedules to improve participation.

Having one full-time faculty member for a program this size places an inordinate amount of work on the one faculty member. Adding another full-time position, perhaps with the addition of the new Mechatronics associate degree, would help balance workload, improve stability, enhance departmental leadership, and ensure there is a diversity of experience to support student learning.

Faculty Workload

Historically, MFGT operates at higher student-to-faculty ratio than all of Shoreline Professional Technical programs and to its peer program, Automotive. Its ratio is very close to Shoreline overall.

QUARTER	MFGT	Auto.	PROFTECH	SHORELINE
Fall 2011	1:38	1:17	1:16	1:21
Fall 2012	1:32	1:17	1:14	1:20
Fall 2013	1:28	1:16	1:15	1:20
Fall 2014	1:24	1:13	1:15	1:20
Fall 2015	1:19	1:15	1:13	1:19
Fall 2016	1:20	1:16	1:13	1:19

Professional Development

Faculty make use of professional development to keep their skills up to date. This includes taking extra classes, especially with the development of the Mechatronics degree. Faculty indicate an ongoing need for this type of additional training, especially if plans to offer a new certificate in precision measurement becomes reality.

Faculty also indicated a desire to increase job shadowing opportunities. Spending time on the factory floor, talking to incumbents, will help them both keep curriculum up to date and also better advise students on current working conditions.

To improve teaching skills, faculty make use of Shoreline resources to fulfill the 10-hour requirement for all faculty. Faculty report that this training has been helpful. In response to a student survey response about hybrid courses, faculty and staff discussed the utility of pursuing additional hybrid training offered by Shoreline. New faculty may benefit from additional Canvas training.

RESOURCES

MFGT is a highly equipment and space intensive program. Graduates of the program will be required to be able to use a variety of equipment found in manufacturing companies, including lathes, mills, CNC machines, and precision

measuring instruments. More modern machines are automated and incorporate processors and software to improve function. These are large, expensive machines. In order to accommodate larger class sizes, multiple machines are required. Faculty and the Advisory Committee shared that the variety and quantity of machines offered at Shoreline makes the program substantially more competitive, and the teaching more robust than its peer institutions. There is sufficient equipment available for the manufacturing degree and certificates.

The mechatronics associate of applied arts degree requires additional equipment. Faculty are aiming to have classes of 16 to 18 people and will need ratios of about 3 students per controller training station, meaning they will need between 5 and 6 training stations to make the program efficient.

The alumni survey and conversations with the Advisory Committee indicated that being able to teach students the CATIA programming language would improve their employability. However, the Advisory Committee also noted that employees with a background in MasterCam learn CATIA relatively quickly. Faculty indicated a desire to purchase CATIA, although the expense is significant. Because of the significant expense of CATIA, faculty should weigh whether the money spent on purchasing CATIA could be better spent elsewhere.

PARTNERSHIPS

Active Partners

The MFGT advisory committee has eight members representing the industry and one labor representative. Industry members represent a wide variety of company roles. At a meeting to discuss this program review, seven members representing four companies were present. The advisory committee members present were engaged in the industry and make active contributions to the department, including internships, job opportunities for students, and participating in Shoreline events. They fully participated in the meeting and made thoughtful contributions to the review.

When asked about partnerships they would like to grow, faculty keyed in on those that would provide more and broader internship opportunities for their students.

PROGRAM SERVICES

While response rates were too low for quantitative ratings, current students offered their opinions of MFGT's program services in several open-ended responses.

Related responses to two different questions indicate a need for additional classroom support. In response to a question about supporting individual learning needs, one student commented that it can be difficult to get answers to some of the hands-on teaching tasks. In response to a question about whether the department offers adequate program resources, one student commented "Manuals and comparison charts would be really helpful to explain the machines. Not all the controls are labeled and the commands in

each lab assignment aren't necessarily explained step by step." Proper labeling of machines may help students independently complete hands-on teaching tasks, promote problem solving, and would align with LEAN strategies some factories pursue to improve performance and reduce waste.

COMPETITION

As described above, few other local community colleges offer the breadth or amount of equipment available at Shoreline. Only one offers an I-BEST math instructor embedded in the program (South Seattle College). Other unique program components, as described above, include block scheduling, stacked certificates, career pathways, and industry certification. These are large selling points of the program and could be better highlighted on the program's website. A video on the website does an excellent job of describing why one would pursue a career in manufacturing, but doesn't really highlight why one would pursue their education at Shoreline. Additional marketing information describing the things that make Shoreline's program unique could improve enrollment.

The website also lacks a full description of all the certificates available for this program. Because so many students discover and learn about this program through the Internet, it is critically important to enrollment to keep the website up to date.

Current students were asked what other programs they considered before selecting Shoreline and their responses indicated that Shoreline competes with several different public and private programs in Washington and across the country including:

- Renton Technical College
- South Seattle College
- Bellingham Technical College
- Bates Technical College
- Art Institute of Seattle
- North Seattle College
- Skagit Valley College
- Seattle Pacific University
- Seattle Central College
- University of Washington

LABOR MARKET OPPORTUNITIES

The current SOC codes linked to this program are:

- Industrial Engineering Technicians
- Electro-mechanical Technicians

The Electro-mechanical technician makes sense as it describes the field of mechatronics, for which a new degree was launched last year. The Industrial engineering technician occupation makes less sense. It describes a class of workers who apply engineering theory to industrial layout and production

problems. When asked about this, the advisory committee agreed that most, but not all, incumbents in these positions would hold baccalaureate degrees.

The advisory committee and faculty agree that the main problem with the SOC code assignments is that they do not describe the main work anticipated of graduates. Those that seem a better fit include:

- Machinist (51-4041)
- CNC Machine Operator (51-4011)
- Assembler (51-2000)
- Manufacturing production technician (17-3029)

The advisory committee also reviewed the labor market data for this program (below). They confirmed faculty input that while these jobs may not be in demand, most employers are anticipating significant retirements in the coming decade. For example, a Boeing representative to the advisory committee noted that he gets many applications for open CNC jobs when they occur, but no CNC operators were included in a recent voluntary lay-off. He anticipates half of his manufacturing workforce is over the age of 55.

That these jobs are listed as not in demand misses the retirement conundrum completely and makes it more difficult than necessary for students to seek public subsidies to train in these occupations. Almost one-third of the respondents to the current student survey indicated that they were unemployed, seeking work when they enrolled in this program. A high percentage of those are probably using state subsidies to help pay for their education. Removing the "not-in-demand" categorization of this program will help boost enrollment for these types of students.

SOC	SOCTITLE	KING DD LIST	SNO DD LIST	2017	2019	2021	% Change
17-3026	Industrial Engineering Technicians	Demand	Not In Demand	1961	1962	1958	-0.2
17-3024	Electro-Mechanical Technicians	Not In Demand	Not In Demand	202	204	205	1.5
51-4041	Machinist	Demand	Demand	5974	6159	6294	5.4
51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic	Not In Demand	Not In Demand	1112	1167	1219	9.6
51-2000	Assemblers and Fabricators	Not In Demand	Not In Demand	26787	26880	26917	0.5

The MFGT program should consider examining the SOC codes linked to this program and update them to ensure a strong fit with job opportunities for graduates.

MFGT should also work with Shoreline's Workforce Development to get the demand-decline list changed for these occupations to "Demand".

The Program Advisory Committee indicated a relatively strong alignment between program and employer expectations.