Manufacturing Engineering Technology
2013-14 Assessment Report

I. Introduction

The Bachelor of Science program in Manufacturing Engineering Technology is offered in three locations—Klamath Falls, Wilsonville, and at the Seattle campus located at Boeing. During the years 2004-2013, fall term full and part-time enrollment ranged from 75 to 147, with a high during 2005 of 147 students. Fall term 2013 enrollment was 75 full and part-time students. During the 2012-13 year, the program graduated a total of 12 students. The program has little data from this group of graduates with only two responding to the Career Services Graduate Survey six months after graduation, but graduates from 2011-12 reported an average salary of $61,900.

The Manufacturing Engineering Technology (MFG) Program at Oregon Institute of Technology was first accredited by ABET in 1985. Based on recommendations from the MMET Industry Advisory Council, curricular changes have been made over the past several years to keep the program current.

The Manufacturing and Mechanical Engineering and Technology (MMET) Department in which the MFG Program resides is the result of a merger of the Manufacturing Engineering Technology Department with the Mechanical Engineering Technology Department in 2004. This was done to increase administrative efficiency. In addition, the Mechanical Engineering program was added in 2005 and the masters program in Manufacturing Engineering Technology was approved in 2005. All four programs reside in the MMET Department under one department chair, not all programs are available at all three locations. The result of this unified department is a stronger program with more resources available and better faculty collaboration.

II. Program Mission, Objectives and Student Learning Outcomes

Following a fall 2008 ABET visit, the faculty revisited the program educational objectives and revised them. These were reviewed and approved by the faculty and the program's industrial advisory council in fall 2009. Most recently, at the Spring 2014 IAC meeting held on April 19th in Klamath Falls and attended by faculty and industry representatives in Klamath Falls and Wilsonville, the Program Educational Objectives (PEOs) for both the MET and MFG programs were reviewed and advisory board members recommended that there be an addition to the first PEO for each program. The recommendation was to include the word *implement* for the MFG program. The resulting PEO was discussed with the MMET faculty at the end of year assessment meeting and there was general agreement that the change should be implemented in next year's program documentation.

The new PEO for MFG will be:

- The MFG program produces graduates who are able to analyze, design, and implement practical mechanical and manufacturing systems.

Mission Statement

The Manufacturing Engineering Technology Program at Oregon Institute of Technology is an applied engineering technology program. Its mission is to provide graduates the skills and knowledge for successful careers in manufacturing engineering technology.

Program Educational Objectives
Program educational objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve. They are generally thought of as desired alumni achievements between three and five years after graduation.

The Program Educational Objectives of Oregon Tech's manufacturing engineering technology program are to produce graduates who:

- are able to analyze, design, and implement practical mechanical and manufacturing systems.
- communicate effectively and work well on team-based engineering projects.
- succeed in manufacturing engineering positions.
- pursue continued professional development.

The faculty planned an assessment cycle for the program's educational objectives as shown in Table 1 below.

Program Objective Assessment Cycle	2011-12	2012-13	2013-14
Review Program Mission and Educational Objectives by the industrial advisory committee	x		
Assess Program Educational Objectives		x	

Table 1. Program Education Objectives Assessment Cycle

Student Learning Outcomes
The Manufacturing Engineering Technology Program outcomes have been mapped to the ABET a-k outcomes. Within this report outcomes will be referenced by the ABET a-k nomenclature. These are listed below for reference. An engineering technology program must demonstrate that graduates have:

a. An appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines
b. An ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology
c. An ability to conduct, analyze and interpret experiments and apply experimental results to improve processes
d. An ability to apply creativity in the design of systems, components or processes appropriate to program objectives
e. An ability to function effectively on teams
f. An ability to identify, analyze and solve technical problems
g. An ability to communicate effectively
h. A recognition of the need for, and an ability to engage in lifelong learning
i. An ability to understand professional, ethical and social responsibilities
j. A respect for diversity and a knowledge of contemporary professional, societal and global issues
k. A commitment to quality, timeliness, and continuous improvement.

In addition to the eleven a-k outcomes there are two outcomes identified through the ABET Manufacturing Engineering specific criteria. These have been defined as below.

M1. Programs must demonstrate that graduates are prepared for careers centered on the manufacture of goods. In this context, 'manufacturing' is a process or procedure through which plans, materials, personnel, and equipment are transformed in some way that adds value.

M2. Graduates must demonstrate the ability to apply the technologies of materials, manufacturing processes, tooling, automation, production operations, maintenance, quality, industrial organization and management, and statistics to the solution of manufacturing problems. Graduates must demonstrate the ability to successfully complete a comprehensive design project related to the field of manufacturing.

III. Three-Year Cycle for Assessment of Student Learning Outcomes

The faculty planned a three-year assessment cycle for the program's student learning outcomes as shown in Table 2 below.

Student Learning Outcome	2011-12	2012-13	2013-14
a. An appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines			x
b. An ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology	x		
c. An ability to conduct, analyze and interpret experiments and apply experimental results to improve processes			x
d. An ability to apply creativity in the design of systems, components or processes appropriate to program objectives	x		
e. An ability to function effectively on teams		x	
f. An ability to identify, analyze and solve technical problems	x		
g. An ability to communicate effectively			x
h. A recognition of the need for, and an ability to engage in lifelong learning			x
i. An ability to understand professional, ethical and social responsibilities		x	
j. A respect for diversity and a knowledge of contemporary professional, societal and global issues		x	
k. A commitment to quality, timeliness, and continuous improvement		x	
M1. Programs must demonstrate that graduates are prepared for careers centered on the manufacture of goods. In this context, 'manufacturing' is a process or procedure through which plans, materials, personnel, and equipment are transformed in some way that adds value.	x		
M2. Graduates must demonstrate the ability to apply the technologies of materials, manufacturing processes, tooling, automation, production operations, maintenance, quality, industrial organization and management, and statistics to the solution of manufacturing problems. Graduates must demonstrate the ability to successfully complete a comprehensive design project related to the field of manufacturing.			x

Table 2. Assessment Cycle

IV. Summary of 2013-14 Assessment Activities

The Manufacturing Engineering Technology faculty conducted formal assessment of five student learning outcomes during 2013-14. These outcomes have been mapped to the curriculum as shown in Appendix A.

SLO a. An appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines.

The performance criteria for this learning outcome are:

1. Use computers and a wide range of programs effectively.
2. Appropriate mastery of modern engineering tools.
3. Use the techniques and skills necessary for engineering practice.

Direct Assessment #1 Klamath Campus
The faculty assessed this outcome in MFG 344 Tool Design II spring 2013, using a project assignment scored with a rubric. This assessment was administered to students from all majors in the MMET Department. There were three manufacturing and one mechanical engineering technology student involved in the assessment. The manufacturing student's results, shown in Table 3 below, reflected the overall results of this assessment.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	MFG Results
Use computers and a wide range of programs effectively	Rubric, assignment	1-4 proficiency scale	80% score 3 or 4	100%
Appropriate mastery of modern engineering tools.	Rubric, assignment	1-4 proficiency scale	80% score 3 or 4	100%
Use the techniques and skills necessary for engineering practice.	Rubric, assignment	1-4 proficiency scale	80% score 3 or 4	100%

Table 3. Assessment Results for SLO a, spring 2014, Klamath Campus

Strengths: The students' use of CAD in 3d modeling is very good.

Weaknesses: Students lack the ability to connect between the 2D part and the requirements to make a die work in a 3D solid model. In addition, the students' work in costing of the project was not as detailed as it should have been.

Actions: Rework the rubric and the assignment to emphasize the connection between 2D and 3D modeling, as well as add an expectation for costing.

Direct Assessment #2 Wilsonville Campus
The faculty assessed this outcome in MET 375 Solid Modeling fall term 2013, using an assignment scored with a rubric. This assessment was administered to students from all majors in the MMET Department. There was one manufacturing, two mechanical engineering technology (MET) students involved in the assessment. The manufacturing student's results were in line with the other results of this assessment. The combined results are shown in Table 4 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	MMET Results
Use computers and a wide range of programs effectively	Rubric, assignment	1-4 proficiency scale	80% score 3 or 4	100%
Appropriate mastery of modern engineering tools.	Rubric, assignment	1-4 proficiency scale	80% score 3 or 4	100%
Use the techniques and skills necessary for engineering practice.	Rubric, assignment	1-4 proficiency scale	80% score 3 or 4	100%

Table 4. Assessment Results for SLO a, fall 2013, Wilsonville Campus

Strengths: Students are beginning to see the 3D model as more than a single file and can be revised in the future which a useful understanding in the industry.

Weaknesses: Students need to include more detail in their solid models.

Action: Redesign the assignment with more specific instructions and require review of the material as the student develops the work.

Direct Assessment #3 Seattle Campus
The Seattle faculty failed to conduct this assessment as planned in MECH 315.

Indirect Assessment #1 MMET Undergraduate Exit Survey
During the spring term, each graduating senior completes an exit survey. The survey includes questions on how well the program prepared the student on each SLO. This survey data is reviewed by faculty to determine any strengths or weaknesses as perceived by students on this SLO. Eight seniors in manufacturing responded to the survey, representing the Klamath Falls and Wilsonville locations, there were no responses from Seattle students. For SLO a, 63% indicated that they were highly prepared and 38% indicated that they were prepared on this learning outcome.

SLO c. An ability to conduct, analyze and interpret experiments and apply experimental results to improve processes

The performance criteria for this learning outcome are

1. Ability to conduct experiments.
2. Ability to analyze and interpret data.
3. Ability to use experimental results to improve processes.

Direct Assessment #1 Klamath Campus
The faculty assessed this outcome in MFG 447 Lean Manufacturing in spring 2013, using data collected from lab sessions scored with a rubric. This assessment was administered to students from all majors in the MMET Department. There were four manufacturing, eight mechanical engineering, and four mechanical engineering technology (MET) students involved in the assessment. The manufacturing student's results reflected the overall results of this assessment. The results of the four manufacturing students are shown in Table 5 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	MFG Results
Ability to conduct experiments	Rubric-scored experiment	1-4 proficiency scale	80% score 3 or 4	100%
Ability to analyze and interpret data	Rubric-scored experiment	1-4 proficiency scale	80% score 3 or 4	100%
Ability to use experimental results to improve processes	Rubric-scored experiment	1-4 proficiency scale	80% score 3 or 4	100%

Table 5. Assessment Results for SLO c, spring 2013, Klamath Campus

Strengths: The students grasped the fundamental concepts of lean manufacturing by conducting, analyzing and interpreting the simulation lab results. They also obtained the ability to improve the processes by applying the lab results.

Weaknesses: none

Actions: None at this time.

Direct Assessment #2 Klamath Campus
The faculty assessed this outcome in MFG 331 Industrial Controls in spring 2013, using data collected from a PLC lab scored with a rubric. This assessment was administered to students from all majors in the MMET Department. There were four manufacturing, two mechanical engineering, and nine mechanical engineering technology (MET) students involved in the assessment. The manufacturing student's results are similar to the overall results of this assessment. The results of the four manufacturing students are shown in Table 6 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	MFG Results
Ability to conduct experiments	Rubric-scored experiment	1-4 proficiency scale	80% score 3 or 4	100%
Ability to analyze and interpret data	Rubric-scored experiment	1-4 proficiency scale	80% score 3 or 4	50%
Ability to use experimental results to improve processes	Rubric-scored experiment	1-4 proficiency scale	80% score 3 or 4	25%

Table 6. Assessment Results for SLO c, spring 2013, Klamath Campus

Strengths: Overall, the students fulfilled the design requirements with high proficiency and expressed positive comments in regards to the experience.

Weaknesses: A portion of the students omitted one or more of the analysis/improvements requirements.

Actions: Consider redesigning the assignment into two segments rather than one final project to encourage students to focus on the analysis/interpretation of data and improvement of the experiment.

Direct Assessment #3 Wilsonville Campus
The faculty assessed this outcome in MFG 447 Lean Manufacturing in winter 2014, using a rubric-graded lab assignment. This assessment was administered to students in the MMET Department. There were

seven manufacturing and four mechanical engineering technology (MET) students involved in the assessment. The manufacturing students' results are shown in Table 7 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	MFG Results
Ability to conduct experiments	Rubric-scored experiment	1-4 proficiency scale	80% score 3 or 4	71%
Ability to analyze and interpret data	Rubric-scored experiment	1-4 proficiency scale	80% score 3 or 4	71%
Ability to use experimental results to improve processes	Rubric-scored experiment	1-4 proficiency scale	80% score 3 or 4	71%

Table 7. Assessment Results for SLO c, winter 2014, Wilsonville Campus

Strengths: The students all have obtained the basic lean concepts and they can apply them in the real world projects.

Weaknesses: No obvious weakness found. One of the students who got the lower score was because he was heavily involved in his professional projects. Also, the sample size of the assessment is very small. To the instructor, the 71% rate is an acceptable score.

Actions: None at this time.

Direct Assessment #3 Seattle Campus
The assessment activity conducted in MET 160 did not involve any MFG students, therefore the results are not included in this report.

Indirect Assessment #1 MMET Undergraduate Exit Survey
During the spring term, each graduating senior completes an exit survey. The survey includes questions on how well the program prepared the student on each SLO. This survey data is reviewed by faculty to determine any strengths or weaknesses as perceived by students on this SLO. Eight seniors in manufacturing responded to the survey, representing the Klamath Falls and Wilsonville locations. No Seattle students responded to the survey. For SLO c, 75% indicated that they were highly prepared and 25% indicated that they were prepared on this learning outcome.

SLO g. An ability to communicate effectively.

This student learning outcome was assessed in two parts: written communication and oral communication. Each comprised separate activities with specific performance criteria and separate rubrics.

Written Communication

The performance criteria for written communication are:

1. Clearly conveys purpose and main ideas (purpose and ideas).
2. Organizes written material effectively (organization)
3. Supports main ideas adequately with detail and/or research (support).
4. Uses appropriate voice, word choice and sentence structure (style).
5. Uses standard English (conventions).
6. Documents support correctly and responsibly (documentation).

Direct Assessment #1 Klamath Campus
The faculty assessed this outcome in MFG 462 Senior Project II, winter 2014, using a rubric-graded written assignment. There were seven manufacturing students involved in the assessment. The results are shown in Table 8 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	MFG Results
Purpose and Ideas	Rubric-graded assignment	1 to 4 proficiency scale	80% score 3 or 4	100%
Organization	Rubric-graded assignment	1 to 4 proficiency scale	80% score 3 or 4	100%
Support	Rubric-graded assignment	1 to 4 proficiency scale	80% score 3 or 4	100%
Style	Rubric-graded assignment	1 to 4 proficiency scale	80% score 3 or 4	100%
Conventions	Rubric-graded assignment	1 to 4 proficiency scale	80% score 3 or 4	86%
Documentation	Rubric-graded assignment	1 to 4 proficiency scale	80% score 3 or 4	86%

Table 8. Assessment Results for SLO g, winter 2014, Klamath Campus

This assessment of writing was conducted using an essay focused on lifelong learning. While students performed well in all categories, there was not much opportunity for research and documentation in the assignment. Consider supplementing this assessment with another piece of writing that includes these elements as a significant focus of the assignment.

Direct Assessment #2 Wilsonville Campus
The faculty assessed this outcome in MFG 462 Senior Project II winter term 2014, using a rubric-graded written assignment. There was one manufacturing and six mechanical engineering technology (MET) students involved in the assessment. The results for all seven MMET students are shown in Table 9 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	MMET Results
Purpose and Ideas	Rubric-graded assignment	1 to 4 proficiency scale	80% score 3 or 4	100%
Organization	Rubric-graded assignment	1 to 4 proficiency scale	80% score 3 or 4	100%
Support	Rubric-graded assignment	1 to 4 proficiency scale	80% score 3 or 4	100%
Style	Rubric-graded assignment	1 to 4 proficiency scale	80% score 3 or 4	100%
Conventions	Rubric-graded assignment	1 to 4 proficiency scale	80% score 3 or 4	100%
Documentation	Rubric-graded assignment	1 to 4 proficiency scale	80% score 3 or 4	100%

Table 9. Assessment Results for SLO g, winter 2014, Wilsonville Campus

Student writing at the senior level meets faculty expectations. No action necessary.

Direct Assessment #3 Seattle Campus
The Seattle faculty failed to complete this assessment as planned.

Oral Communication
The performance criteria for oral communication are:

1. Supports thesis adequately with detail and/or research, and documents support correctly and responsibly (content).
2. Organizes oral material effectively (organization)
3. Presents appropriately for audience and purpose (style).
4. Speaks clearly and correctly, using standard English (delivery).
5. Uses visual communication effectively (visuals).

Direct Assessment #1 Klamath Campus
The faculty assessed this outcome in MET 360 Materials II in fall 2013, using a rubric-graded oral presentation. There were two manufacturing, three mechanical engineering, and five mechanical engineering technology (MET) students involved in the assessment. The results for the manufacturing and all ten MMET students are shown in Table 10 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	MFG Results	MMET Results
Content	Rubric-graded presentation	1 to 4 proficiency scale	80% score 3 or 4	100%	100%
Organization	Rubric-graded presentation	1 to 4 proficiency scale	80% score 3 or 4	100%	90%
Style	Rubric-graded presentation	1 to 4 proficiency scale	80% score 3 or 4	100%	100%
Delivery	Rubric-graded presentation	1 to 4 proficiency scale	80% score 3 or 4	100%	100%
Visuals	Rubric-graded presentation	1 to 4 proficiency scale	80% score 3 or 4	100%	100%

Table 10. Assessment Results for SLO g, fall 2014, Klamath Campus

Students showed strong skills in oral presentation. The emphasis on this outcome has proven to successfully demonstrate improved student performance in this area.

Direct Assessment #2 Wilsonville Campus
The faculty assessed this outcome in MFG 463 Senior Project III spring term 2013, using a rubric-graded oral presentation. There were three manufacturing and four mechanical engineering technology (MET) students involved in the assessment. The manufacturing students results were in line with the rest of the class, the results are shown in Table 11 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	MFG Results
Content	Rubric-graded presentation	1 to 4 proficiency scale	80% score 3 or 4	100%
Organization	Rubric-graded presentation	1 to 4 proficiency scale	80% score 3 or 4	100%
Style	Rubric-graded presentation	1 to 4 proficiency scale	80% score 3 or 4	100%
Delivery	Rubric-graded presentation	1 to 4 proficiency scale	80% score 3 or 4	100%
Visuals	Rubric-graded presentation	1 to 4 proficiency scale	80% score 3 or 4	100%

Table 11. Assessment Results for SLO g, spring 2013, Wilsonville Campus

Student performance in oral presentations at the level of senior projects meets the expectations of faculty.

Direct Assessment #3 Seattle Campus
The faculty assessed this outcome in MFG 461 Senior Project I fall term 2013, using a rubric-graded oral presentation. There were two manufacturing, six mechanical engineering, and six mechanical engineering technology (MET) students involved in the assessment. The manufacturing students results were in line with the rest of the class, the results are shown in Table 12 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	MFG Results
Content	Rubric-graded presentation	1 to 4 proficiency scale	80% score 3 or 4	100%
Organization	Rubric-graded presentation	1 to 4 proficiency scale	80% score 3 or 4	100%
Style	Rubric-graded presentation	1 to 4 proficiency scale	80% score 3 or 4	100%
Delivery	Rubric-graded presentation	1 to 4 proficiency scale	80% score 3 or 4	100%
Visuals	Rubric-graded presentation	1 to 4 proficiency scale	80% score 3 or 4	100%

Table 12. Assessment Results for SLO g, fall 2013, Seattle Campus

Student performance in oral presentations at the level of senior projects meets the expectations of faculty.

Indirect Assessment #1 MMET Undergraduate Exit Survey
During the spring term, each graduating senior completes an exit survey. The survey includes questions on how well the program prepared the student on each SLO. This survey data is reviewed by faculty to determine any strengths or weaknesses as perceived by students on this SLO. Eight seniors in manufacturing responded to the survey, representing the Klamath Falls and Wilsonville locations. There were no Seattle students who responded to the survey. For SLO g, 50% indicated that they were highly prepared and 50% indicated that they were prepared on this learning outcome.

SLO h. A recognition of the need for, and an ability to engage in lifelong learning

The performance criteria for this learning outcome are:

1. Identify and discuss the concept of lifelong learning.
2. Demonstrate awareness of the need for professional development to remain current.
3. Describe short- and long-term career plans.

Direct Assessment #1 Klamath Campus
The faculty assessed this outcome in MFG 462 Senior Project II, winter 2014, using a rubric-graded written assignment. There were six manufacturing students involved in the assessment. The results are shown in Table 13 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	MFG Results
Lifelong learning	Rubric-graded assignment	1 to 4 proficiency scale	80% score 3 or 4	100%
Professional development	Rubric-graded assignment	1 to 4 proficiency scale	80% score 3 or 4	100%
Short and long-term career plans	Rubric-graded assignment	1 to 4 proficiency scale	80% score 3 or 4	100%

Table 13. Assessment Results for SLO h on lifelong learning, winter 2014, Klamath Campus

Based on the recent requirement for all students to take the FE exam, students seem to have a much clearer vision of the value of professional certification. In addition, they see the connection between their education and the certification requirements.

Direct Assessment #2 Wilsonville Campus
The faculty assessed this outcome in MFG 462 Senior Project II winter term 2014, using a rubric-graded written assignment. There was one manufacturing and six mechanical engineering technology (MET) students involved in the assessment. The results for all seven MMET students are shown in Table 14 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	MMET Results
Lifelong learning	Rubric-graded assignment	1 to 4 proficiency scale	80% score 3 or 4	100%
Professional development	Rubric-graded assignment	1 to 4 proficiency scale	80% score 3 or 4	100%
Short and long-term career plans	Rubric-graded assignment	1 to 4 proficiency scale	80% score 3 or 4	100%

Table 14. Assessment Results for SLO h on lifelong learning, winter 2014, Wilsonville Campus

The redesigned lifelong learning assignment was a better fit for students with a broad range of career options. The additional requirement of the FE exam has helped students see value in professional development activities.

Direct Assessment #3 Seattle Campus
The faculty assessed this outcome in MFG 461 Senior Project I fall term 2013, using a rubric-graded written assignment. There were two manufacturing, six mechanical engineering, and four mechanical engineering technology (MET) students involved in the assessment. The results for all twelve MMET students are shown in Table 15 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	MMET Results
Lifelong learning	Rubric-graded assignment	1 to 4 proficiency scale	80% score 3 or 4	83%
Professional development	Rubric-graded assignment	1 to 4 proficiency scale	80% score 3 or 4	100%
Short and long-term career plans	Rubric-graded assignment	1 to 4 proficiency scale	80% score 3 or 4	100%

Table 15. Assessment Results for SLO h on lifelong learning, fall 2013, Seattle Campus

Indirect Assessment #1 MMET Undergraduate Exit Survey
During the spring term, each graduating senior completes an exit survey. The survey includes questions on how well the program prepared the student on each SLO. This survey data is reviewed by faculty to determine any strengths or weaknesses as perceived by students on this SLO. Eight seniors in manufacturing responded to the survey, representing the Klamath Falls and Wilsonville locations. There were no responses from Seattle students. For SLO h, 75% indicated that they were highly prepared and 13% indicated that they were prepared on this learning outcome.

SLO M2. Graduates must demonstrate the ability to apply the technologies of materials, manufacturing processes, tooling, automation, production operations, maintenance, quality, industrial organization and management, and statistics to the solution of manufacturing problems. Graduates must demonstrate the ability to successfully complete a comprehensive design project related to the field of manufacturing.

The performance criteria for this learning outcome are:

1. Use of materials to solve a manufacturing problem.
2. Apply manufacturing processes to solve a manufacturing problem.
3. Use of tooling to solve a manufacturing problem.
4. Apply automation and design production operations to solve a manufacturing problem
5. Describe maintenance to the tooling used in solving a manufacturing problem
6. Apply quality principles to a manufacturing problem.
7. Use industrial organization and management techniques to solve a manufacturing problem.
8. Design a detailed manufacturing process.

Direct Assessment #1 Klamath Falls Campus
The faculty assessed this outcome in MFG 453 Automation and Robotics in Manufacturing fall term 2013, scoring student projects with a rubric. There were six senior manufacturing students involved in this assessment. The assessment results are in Table 16 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	MFG Results
Materials	Faculty rating of project	1 to 4 proficiency scale	80% score 3 or 4	n/a
Manufacturing Processes	Faculty rating of project	1 to 4 proficiency scale	80% score 3 or 4	100%
Tooling	Faculty rating of project	1 to 4 proficiency scale	80% score 3 or 4	n/a
Automation & Production Operations	Faculty rating of project	1 to 4 proficiency scale	80% score 3 or 4	100%
Maintenance	Faculty rating of project	1 to 4 proficiency scale	80% score 3 or 4	n/a
Quality	Faculty rating of project	1 to 4 proficiency scale	80% score 3 or 4	100%
Industrial Organization & Management Techniques	Faculty rating of project	1 to 4 proficiency scale	80% score 3 or 4	100%
Design Manufacturing Process	Faculty rating of project	1 to 4 proficiency scale	80% score 3 or 4	n/a

Table 16. Assessment Results for SLO M2 on design project, fall 2013, Klamath Falls Campus

Strengths: The project clearly showed student proficiency in the areas of manufacturing processes, automation and production, quality, and industrial organization and management.

Weaknesses: The students did not address materials, tooling, maintenance, and a detailed design of a manufacturing process in this assignment. It seems that this is a deficiency in the assignment design rather than in student performance.

Actions: Program faculty from the three locations will meet spring term 2014 to design an assessment plan and project(s) to address all the criteria for this outcome. A rubric will be designed based on the new 2014-15 ABET criteria for this outcome.

Direct Assessment #2 Klamath Falls Campus
The faculty assessed this outcome in MFG 343 Tool Design I winter term 2014, scoring student projects with a rubric. There were four junior manufacturing students involved in this assessment. The assessment results are in Table 17 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	MFG Results
Materials	Faculty rating of project	1 to 4 proficiency scale	80% score 3 or 4	100%
Manufacturing Processes	Faculty rating of project	1 to 4 proficiency scale	80% score 3 or 4	100%
Tooling	Faculty rating of project	1 to 4 proficiency scale	80% score 3 or 4	75%
Automation & Production Operations	Faculty rating of project	1 to 4 proficiency scale	80% score 3 or 4	75%
Maintenance	Faculty rating of project	1 to 4 proficiency scale	80% score 3 or 4	n/a
Quality	Faculty rating of project	1 to 4 proficiency scale	80% score 3 or 4	100%
Industrial Organization & Management Techniques	Faculty rating of project	1 to 4 proficiency scale	80% score 3 or 4	75%
Design Manufacturing Process	Faculty rating of project	1 to 4 proficiency scale	80% score 3 or 4	75%

Table 17. Assessment Results for SLO M2 on design project, winter 2014, Klamath Falls Campus

Strengths: The project was designed to assess critical thinking, but captures most of the criteria for this outcome as well. Generally students performed well in all areas that were directly addressed in the assignment.

Weaknesses: The assignment did not address maintenance. The sample size was small therefore one student with low performance pulled the class results down. The faculty felt that the weakness in this assessment is related to assignment design.

Actions: Program faculty from the three locations will meet spring term 2014 to design an assessment plan and project(s) to address all the criteria for this outcome. A rubric will be designed based on the new 2014-15 ABET criteria for this outcome.

Direct Assessment #4 Wilsonville Campus
The faculty assessed this outcome in MFG 453 Automation and Robotics in Manufacturing spring term 2014, scoring student projects with a rubric. There were four manufacturing students who participated in this assessment. The assessment results are shown in Table 18 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Materials	Faculty rating of project	1 to 4 proficiency scale	80% score 3 or 4	25%
Manufacturing Processes	Faculty rating of project	1 to 4 proficiency scale	80% score 3 or 4	50%
Tooling	Faculty rating of project	1 to 4 proficiency scale	80% score 3 or 4	N/A
Automation & Production Operations	Faculty rating of project	1 to 4 proficiency scale	80% score 3 or 4	75%
Maintenance	Faculty rating of project	1 to 4 proficiency scale	80% score 3 or 4	25%
Quality	Faculty rating of project	1 to 4 proficiency scale	80% score 3 or 4	75%
Industrial Organization & Management Techniques	Faculty rating of project	1 to 4 proficiency scale	80% score 3 or 4	N/A
Design Manufacturing Process	Faculty rating of project	1 to 4 proficiency scale	80% score 3 or 4	50%

Table 18. Assessment Results for SLO M2 design project, spring 2014, Wilsonville Campus

Strengths: Most students were able to apply the concept of a repetitive set of actions to this problem and to describe the action of the equipment.

Weaknesses: There were problems with the design and timing of the assignment which resulted in low performance or insufficient evidence for many criteria. It would be difficult to draw conclusions about student learning from this assessment.

Actions: Program faculty from the three locations will meet spring term 2014 to design an assessment plan and project(s) to address all the criteria for this outcome. A rubric will be designed based on the new 2014-15 ABET criteria for this outcome.

Direct Assessment #5 Seattle Campus
Seattle faculty did not conduct this assessment as planned.

Indirect Assessment #1 MMET Undergraduate Exit Survey
During the spring term, each graduating senior completes an exit survey. The survey includes questions on how well the program prepared the student on each SLO. This survey data is reviewed by faculty to determine any strengths or weaknesses as perceived by students on this SLO. Eight seniors in manufacturing responded to the survey, representing the Klamath Falls and Wilsonville locations. There were no responses from Seattle students. For SLO M2, 63% indicated that they were highly prepared and 25% indicated that they were prepared on this learning outcome.

V. Summary of Student Learning for 2013-14

MMET faculty from Klamath Falls and Wilsonville met on May 27, 2014 to review assessment results, to determine if improvements were needed, and to decide upon future action plans. A summary of their findings is outlined below.

SLO a. An appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines

Strengths: Students are proficient in the use of 3D drawings and FEA.

Weaknesses: Both the IAC and assessment results point to weaknesses in the 2D/3D connection.

Actions: The department will review articulation agreements for CAD and Solid Modeling courses taught at transfer institutions and set up a schedule for renewal. In addition, program faculty will discuss at Fall 2014 Convocation opportunities to emphasize 2D design work in projects and assignments in upper division courses.

SLO c. An ability to conduct, analyze and interpret experiments and apply experimental results to improve processes

Strengths: Students were able to conduct experiments with proficiency.

Weaknesses: Students were less proficient in the analysis of experimental results and identifying appropriate improvements for processes.

Actions: Program faculty will redesign the assignment to include two parts. Part I conduct the experiment and Part II analysis and improvement. This assignment will be embedded in MFG 331 beginning in 2014-15.

SLO g. An ability to communicate effectively in writing

Strengths: Students met faculty expectations for this outcome.

Weaknesses: None identified from the assessment activity.

Actions: Continue to provide students with rubrics containing common expectations.

SLO g. An ability to communicate effectively orally

Strengths: Students met faculty expectations for this outcome.

Weaknesses: None identified from the assessment activity.

Actions: Continue to provide students with rubrics containing common expectations.

SLO h. A recognition of the need for, and an ability to engage in lifelong learning

Strengths: Most students have clear career goals and understand the need to stay current in the field.

Weaknesses: None identified from this assessment.

Actions: The faculty would like to embed this assignment in MET 485 Fundamentals of Engineering review course so all students will have the opportunity to reflect on their ability to stay current in their profession as lifelong learners.

SLO M2. Graduates must demonstrate the ability to apply the technologies of materials, manufacturing processes, tooling, automation, production operations, maintenance, quality, industrial organization and management, and statistics to the solution of manufacturing problems. Graduates must demonstrate the ability to successfully complete a comprehensive design project related to the field of manufacturing.

Strengths: Most students were able to show proficiency in the areas of manufacturing processes, automation and production, quality, and industrial organization and management.

Weaknesses: The projects failed to address many aspects of this outcome. It seems that this is a deficiency in the assignment design rather than in student performance.

Actions: Program faculty from the three locations will meet spring term 2014 to design an assessment plan and project(s) to address all the criteria for this outcome. A rubric will be designed based on the new 2014-15 ABET criteria for this outcome.

Appendix A1
SLO-Curriculum Map

Outcome a: An appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines

I = Introduced R = Reinforced E = Emphasized

	Freshman			Sophomore			Junior			Senior		
Fall	Math 111	Coll Alg		MET 160	Materials I	R E	MET 375	Solid Model		ANTH 452	Global	
	MET 111	Orient I	I	MATH 252	Integral Calc		MFG 313	Mfg An & Plan		MFG 453	Robotics	
	WRI 121	Eng Comp		MFG 314	Geo Tol		MET 315	Machine Des I		MFG 454	Thermal Systems	
		Hum/ Soc Sci		PHY 201/221	Physics		MFG 341	Num Con Pr		MFG 461	Sr Proj	E
		Hum/ Soc Sci		MET 242	CAD II		MET 360	Materials II		WRI 327	Adv Tech Wr	
											Engr/ science	
Win	CHE 101/4	Chem		ENGR 211	Statics		MET 326	Elec Power		MFG 462	Sr Proj II	E
	Math 112	Trig		Math 361	Stats		MFG 333	Stats for QI			Bus/ MGT	
	MFG 120	Mfg Proc I		MFG 112	Mfg Proc	R	MFG 342	Comp Mach			Mfg elec	
	WRI 122	Eng Comp		PHY 201/222	Physics		MFG 343	Tool Design	E		Mfg elec	
	MET 112	Orient II	I				MET 316	Mach Design			Hum/ Soc Sci	
								Hum/ Soc Sci				
Spr	Math 251	Diff Calc		ENGR 236	Elec Circuits		MGT 345	Eng Econ		ENGT 415	Occ Safety	
	MFG 103	Welding		Math 362	Stats II		MFG 331	Ind Controls		ENGR 485	FE Exam	
	MET 241	CAD I		WRI 227	Tech Report		MFG 344	Des Mfg Tooling	E	MFG 447	Lean Mfg	
	SPE 111	Speech		ENGR 266	Program Engr		SPE 321	Small Gr Team	E	MFG 463	Sr Proj III	E
		Hum/ Soc Sci		ENGR 213	Materials			Bus/ MGT			Hum/ Soc Sci	
											Mfg Electives	

Appendix A2
SLO-Curriculum Map

Outcome c: An ability to conduct, analyze and interpret experiments and apply experimental results to improve processes

I = Introduced R = Reinforced E = Emphasized

	Freshman			Sophomore			Junior			Senior		
Fall	Math 111	Coll Alg		MET 160	Materials I		MET 375	Solid Model		ANTH 452	Global	
	MET 111	Orient I	I	MATH 252	Integral Calc		MFG 313	Mfg An & Plan		MFG 453	Robotics	
	WRI 121	Eng Comp		MFG 314	Geo Tol		MET 315	Machine Des I		MFG 454	Thermal Systems	
		Hum/ Soc Sci		PHY 201/221	Physics		MFG 341	Num Con Pr		MFG 461	Sr Proj	E
		Hum/ Soc Sci		MET 242	CAD II		MET 360	Materials II		WRI 327	Adv Tech Wr	
											Engr/ science	
Win	CHE 101/4	Chem		ENGR 211	Statics		MET 326	Elec Power		MFG 462	Sr Proj II	E R
	Math 112	Trig		Math 361	Stats		MFG 333	Stats for QI			Bus/ MGT	
	MFG 120	Mfg Proc I		MFG 112	Mfg Proc		MFG 342	Comp Mach			Mfg elec	
	WRI 122	Eng Comp		PHY 201/222	Physics		MFG 343	Tool Design			Mfg elec	
	MET 112	Orient II	I				MET 316	Mach Design			Hum/ Soc Sci	
								Hum/ Soc Sci				
Spr	Math 251	Diff Calc		ENGR 236	Elec Circuits		MGT 345	Eng Econ		ENGT 415	Occ Safety	
	MFG 103	Welding		Math 362	Stats II		MFG 331	Ind Controls		ENGR 485	FE Exam	
	MET 241	CAD I		WRI 227	Tech Report		MFG 344	Des Mfg Tooling		MFG 447	Lean Mfg	
	SPE 111	Speech		ENGR 266	Program Engr		SPE 321	Small Gr Team		MFG 463	Sr Proj III	E
		Hum/ Soc Sci		ENGR 213	Materials			Bus/ MGT			Hum/ Soc Sci	
											Mfg Electives	

Appendix A3
SLO-Curriculum Map

Outcome g: An ability to communicate effectively in writing

I = Introduced R = Reinforced E = Emphasized

	Freshman			Sophomore			Junior			Senior		
Fall	Math 111	Coll Alg		MET 160	Materials I		MET 375	Solid Model		ANTH 452	Global	E
	MET 111	Orient I		MATH 252	Integral Calc		MFG 313	Mfg An & Plan		MFG 453	Robotics	
	WRI 121	Eng Comp		MFG 314	Geo Tol		MET 315	Machine Des I		MFG 454	Thermal Systems	
		Hum/ Soc Sci		PHY 201/221	Physics		MFG 341	Num Con Pr		MFG 461	Sr Proj	E
		Hum/ Soc Sci		MET 242	CAD II		MET 360	Materials II		WRI 327	Adv Tech Wr	
											Engr/ science	
Win	CHE 101/4	Chem		ENGR 211	Statics		MET 326	Elec Power		MFG 462	Sr Proj II	E
	Math 112	Trig		Math 361	Stats		MFG 333	Stats for QI			Bus/ MGT	
	MFG 120	Mfg Proc I		MFG 112	Mfg Proc		MFG 342	Comp Mach			Mfg elec	
	WRI 122	Eng Comp		PHY 201/222	Physics		MFG 343	Tool Design			Mfg elec	
	MET 112	Orient II					MET 316	Mach Design			Hum/ Soc Sci	
								Hum/ Soc Sci				
Spr	Math 251	Diff Calc		ENGR 236	Elec Circuits		MGT 345	Eng Econ		ENGT 415	Occ Safety	
	MFG 103	Welding		Math 362	Stats II		MFG 331	Ind Controls		ENGR 485	FE Exam	
	MET 241	CAD I		WRI 227	Tech Report		MFG 344	Des Mfg Tooling		MFG 447	Lean Mfg	
	SPE 111	Speech		ENGR 266	Program Engr		SPE 321	Small Gr Team		MFG 463	Sr Proj III	E
		Hum/ Soc Sci		ENGR 213	Materials			Bus/ MGT			Hum/ Soc Sci	
											Mfg Electives	

Appendix A4
SLO-Curriculum Map

Outcome g: An ability to communicate effectively orally

I = Introduced R = Reinforced E = Emphasized

	Freshman			Sophomore			Junior			Senior		
Fall	Math 111	Coll Alg		MET 160	Materials I		MET 375	Solid Model		ANTH 452	Global	E
	MET 111	Orient I		MATH 252	Integral Calc		MFG 313	Mfg An & Plan		MFG 453	Robotics	
	WRI 121	Eng Comp		MFG 314	Geo Tol		MET 315	Machine Des I		MFG 454	Thermal Systems	
		Hum/ Soc Sci		PHY 201/221	Physics		MFG 341	Num Con Pr		MFG 461	Sr Proj	E
		Hum/ Soc Sci		MET 242	CAD II		MET 360	Materials II		WRI 327	Adv Tech Wr	
											Engr/ science	
Win	CHE 101/4	Chem		ENGR 211	Statics		MET 326	Elec Power		MFG 462	Sr Proj II	E
	Math 112	Trig		Math 361	Stats		MFG 333	Stats for QI			Bus/ MGT	
	MFG 120	Mfg Proc I		MFG 112	Mfg Proc		MFG 342	Comp Mach			Mfg elec	
	WRI 122	Eng Comp		PHY 201/222	Physics		MFG 343	Tool Design			Mfg elec	
	MET 112	Orient II					MET 316	Mach Design			Hum/ Soc Sci	
								Hum/ Soc Sci				
Spr	Math 251	Diff Calc		ENGR 236	Elec Circuits		MGT 345	Eng Econ		ENGT 415	Occ Safety	
	MFG 103	Welding		Math 362	Stats II		MFG 331	Ind Controls		ENGR 485	FE Exam	
	MET 241	CAD I		WRI 227	Tech Report		MFG 344	Des Mfg Tooling		MFG 447	Lean Mfg	
	SPE 111	Speech		ENGR 266	Program Engr		SPE 321	Small Gr Team		MFG 463	Sr Proj III	E
		Hum/ Soc Sci		ENGR 213	Materials			Bus/ MGT			Hum/ Soc Sci	
											Mfg Electives	

Appendix A5
SLO-Curriculum Map

Outcome h: A recognition of the need for, and an ability to engage in lifelong learning

I = Introduced R = Reinforced E = Emphasized

	Freshman			Sophomore			Junior			Senior		
Fall	Math 111	Coll Alg		MET 160	Materials I		MET 375	Solid Model		ANTH 452	Global	
	MET 111	Orient I	I	MATH 252	Integral Calc		MFG 313	Mfg An & Plan	R	MFG 453	Robotics	
	WRI 121	Eng Comp		MFG 314	Geo Tol	E	MET 315	Machine Des I		MFG 454	Thermal Systems	
		Hum/ Soc Sci		PHY 201/221	Physics		MFG 341	Num Con Pr		MFG 461	Sr Proj	E
		Hum/ Soc Sci		MET 242	CAD II		MET 360	Materials II		WRI 327	Adv Tech Wr	
											Engr/ science	
Win	CHE 101/4	Chem		ENGR 211	Statics		MET 326	Elec Power		MFG 462	Sr Proj II	E R
	Math 112	Trig		Math 361	Stats		MFG 333	Stats for QI	E		Bus/ MGT	
	MFG 120	Mfg Proc I	I	MFG 112	Mfg Proc	E	MFG 342	Comp Mach			Mfg elec	
	WRI 122	Eng Comp		PHY 201/222	Physics		MFG 343	Tool Design			Mfg elec	
	MET 112	Orient II	I				MET 316	Mach Design			Hum/ Soc Sci	
								Hum/ Soc Sci				
Spr	Math 251	Diff Calc		ENGR 236	Elec Circuits		MGT 345	Eng Econ		ENGT 415	Occ Safety	
	MFG 103	Welding		Math 362	Stats II		MFG 331	Ind Controls		ENGR 485	FE Exam	
	MET 241	CAD I		WRI 227	Tech Report		MFG 344	Des Mfg Tooling		MFG 447	Lean Mfg	E
	SPE 111	Speech		ENGR 266	Program Engr		SPE 321	Small Gr Team		MFG 463	Sr Proj III	E
		Hum/ Soc Sci		ENGR 213	Materials			Bus/ MGT			Hum/ Soc Sci	
											Mfg Electives	

Appendix A6
SLO-Curriculum Map

Outcome M2: Graduates must demonstrate the ability to apply the technologies of materials, manufacturing processes, tooling, automation, production operations, maintenance, quality, industrial organization and management, and statistics to the solution of manufacturing problems. Graduates must demonstrate the ability to successfully complete a comprehensive design project related to the field of manufacturing.

I = Introduced R = Reinforced E = Emphasized

	Freshman			Sophomore			Junior			Senior		
Fall	Math 111	Coll Alg		MET 160	Materials I		MET 375	Solid Model		ANTH 452	Global	
	MET 111	Orient I	I	MATH 252	Integral Calc		MFG 313	Mfg An & Plan	R	MFG 453	Robotics	
	WRI 121	Eng Comp		MFG 314	Geo Tol	E	MET 315	Machine Des I		MFG 454	Thermal Systems	
		Hum/ Soc Sci		PHY 201/221	Physics		MFG 341	Num Con Pr		MFG 461	Sr Proj	E
		Hum/ Soc Sci		MET 242	CAD II		MET 360	Materials II		WRI 327	Adv Tech Wr	
											Engr/ science	
Win	CHE 101/4	Chem		ENGR 211	Statics		MET 326	Elec Power		MFG 462	Sr Proj II	E R
	Math 112	Trig		Math 361	Stats		MFG 333	Stats for QI	E		Bus/ MGT	
	MFG 120	Mfg Proc I	I	MFG 112	Mfg Proc	E	MFG 342	Comp Mach			Mfg elec	
	WRI 122	Eng Comp		PHY 201/222	Physics		MFG 343	Tool Design			Mfg elec	
	MET 112	Orient II	I				MET 316	Mach Design			Hum/ Soc Sci	
								Hum/ Soc Sci				
Spr	Math 251	Diff Calc		ENGR 236	Elec Circuits		MGT 345	Eng Econ		ENGT 415	Occ Safety	
	MFG 103	Welding		Math 362	Stats II		MFG 331	Ind Controls		ENGR 485	FE Exam	
	MET 241	CAD I		WRI 227	Tech Report		MFG 344	Des Mfg Tooling		MFG 447	Lean Mfg	E
	SPE 111	Speech		ENGR 266	Program Engr		SPE 321	Small Gr Team		MFG 463	Sr Proj III	E
		Hum/ Soc Sci		ENGR 213	Materials			Bus/ MGT			Hum/ Soc Sci	
											Mfg Electives	