OREGON INSTITUTE OF TECHNOLOGY
Bachelor of Science in Mechanical Engineering Technology Degree Program
Assessment Report 2007-08

August 4, 2008

INTRODUCTION

The Bachelor of Science in Mechanical Engineering Technology (MET) Program within the Manufacturing and Mechanical Engineering and Technology Department at the Oregon Institute of Technology participates in a comprehensive academic assessment activity. Included is a systematic plan that fits the curricula, student body, and faculty needs. The assessment plan is woven by threads of the department's structure and academic programs, general education, and the criteria given for accreditation of engineering and engineering technology programs by the Accreditation Board for Engineering and Technology (ABET).

The MET assessment plan has been extensively rewritten this year. With this in mind, we have tried to assess all of the areas within the plan during this year. This is an extensive undertaking, and it would be unfeasible to do this every year. The assessment results shown below cover most of the program outcomes. In the future we plan to carry out a three-year assessment cycle, where we will assess each outcome every three years. Since this is the first year of our extensively revised assessment plan, we chose to use holistic rubrics. Holistic rubrics are good at spotting large problem areas. For areas where we discover problems we will then apply analytical rubrics to get a better picture of the exact nature of the problem. We plan to continue to use the holistic rubrics in the near future in areas where there are no perceived problems (with an option to apply analytical rubrics depending on the situation).

The BSMET program is currently being taught at two locations by OIT; at our main campus in Klamath Falls, and at our Portland campus. Our Portland campus offers the BSMET degree program as a degree-completion program; this assumes that the student will have an associate's degree and OIT teaches the upper-division courses only. This program is set up for students working full-time jobs who will take courses as a part-time student; with our courses being offered during the evenings and weekends. It is normally expected that it will take a student 4 years to complete the upper-division courses while going to school part-time. And, we just received approval to start teaching this bachelors' program at our campus located on Boeing Company property in the Seattle, WA area. This campus offers courses only to employees of the Boeing Company, with the courses normally taught in the evenings. Both our Portland campus and our Boeing campus are (or will be) accredited by extension from the main campus in Klamath Falls. Being accredited by extension means that the programs at the extension sites are substantially equivalent to the main campus program; and thus our assessment plan covers all three sites.

Finally, it should also be noted that there are two other Bachelor of Science degree programs and one Masters of Science program within our department. The bachelor programs are: Bachelor of Science in Manufacturing Engineering Technology, and a Bachelor of Science in Mechanical Engineering. The masters program is a Masters of Science in Manufacturing Engineering Technology. Since the faculty of our department teach courses in all of our degree programs (depending on individual skills); we have tried as much as possible to have a common assessment approach. This has cut down on the amount of assessment required (since many courses are required for more than one major) and has hopefully resulted in a consistent application of our assessment rubrics.

The assessment of departmental courses is being done for three main reasons:

1) To satisfy our accreditation agencies
2) To show that our BSMET program is substantially equivalent at all three of our campus'
3) As part of a continuous improvement process

The current document summarizes the results of the 2007-08 assessment activities, and covers the main Klamath Falls campus and our Portland extension campus. In the future, our Boeing campus will be included in this reporting.

MISSION STATEMENT

The Mechanical Engineering Technology Program at Oregon Institute of Technology is an applied engineering program. Its mission is to provide graduates the skills and knowledge for successful careers in mechanical and manufacturing engineering. The main objectives of the MET program are to:

- *Prepare students with the applied engineering skills necessary to be successful in their chosen careers in industry, business, and government;*
- *Enable students to be effective communicators and life-long learners by assisting them in the development of critical thinking and problem solving skills, and ethical awareness;*
- *Provide a flexible and accessible educational opportunity to a wide range of students, and*
- *Develop partnerships with industry, business, and government to ensure quality programs that meet their needs.*

ASSESSMENT ACTIVITIES

The Mechanical Engineering Technology Program Outcomes have been mapped to the a-k ABET Outcomes. This mapping can be reviewed in the MET Program Assessment Plan. Within this report Outcomes will be referenced by the ABET a-k nomenclature. These are listed below for reference.

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, and
k) a commitment to quality, timeliness, and continuous improvement.

In addition to the 11 a-k Outcomes there are three Outcomes identified through the ABET Mechanical Engineering specific criteria for the 2007 – 2008 year. These have been defined as below.

> MET a) Technical expertise in engineering materials, statics, dynamics, strength of materials, fluid power or fluid mechanics, thermodynamics, and either electrical power or electronics.
> MET b) Technical expertise having added technical depth in a minimum of three subject areas chosen from: manufacturing processes, mechanical design, computer-aided engineering graphics, engineering materials, solid mechanics, fluids, thermal sciences, electro-mechanical devices and controls, and industrial operations.
> MET c) Expertise in applied physics having an emphasis in applied mechanics, plus added technical topics in physics and inorganic chemistry principles appropriate to the program objectives.

Note that for the 2008 – 2009 year the three MET-specific outcomes have been replaced by the following single MET-specific outcome:

> MET a) Baccalaureate degree programs must demonstrate that graduates can apply specific program principles to the analysis, design, development, implementation, or oversight of more advanced mechanical systems or processes depending on program orientation and the needs of their constituents.

Since this year we extensively rewrote our Assessment plan we decided to use holistic rubrics to evaluate student work. Our approach is to identify which student outcomes fall below faculty expectations, and then evaluate these outcomes using analytical rubrics in future years. This should give us a better understanding of exactly why our students are scoring below faculty expectations. We plan on evaluating most of our student learning outcomes on a 3-year cycle (see Appendix A for this cycle); but we may use a yearly cycle for those outcomes which score below departmental faculty expectations. See Appendix B for a description of the rubrics used by the MMET Department. The scoring for the holistic rubrics was broken up into 5 categories: Exceptional, Very Good, Good, Below Average, and Lacking. The departmental goal for each outcome was for 80% of the students to score at a good (which we also refer to as "acceptable") or better level.

The first version of an exit survey for the MET Program, which specifically asks our students to rate themselves for each ABET a-k outcome (using survey monkey) was introduced late this year. Due to the lateness of the posting of the survey, there were only 4 MET responses. Data from this limited response is included in this report. It will be a goal of the MET program to have every student complete this exit survey when they finish their senior projects (end of spring term).

The results of this year's assessment of the MET Program are shown below. They are listed in the order presented above, and include results and recommendations.

Outcome a

Graduates will have an appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines

Modern engineering tools include computers, test equipment, and controls. In the applied engineering program at OIT these tools include CAD systems (both two dimensional and 3-D solid modelers), various test equipment used in laboratories and projects, and an introduction to industrial controllers. Graduates will be able to operate the tools encountered and extend the knowledge gained to new unfamiliar programs and equipment.

MET Faculty selected a variety of graded course work in order to evaluate how well our students met the above outcome. These assignments cover a range of homework and laboratory reports representing student use and learning of modern engineering tools. A Faculty committee reviewed and evaluated the collected student work at the end of each term; using the MMET Departmental rubric R12. The rubric uses a scale between 1 and 5, five indicating excellent abilities and one being lacking. The percentage of students scoring at three or above was then tabulated. The desired result was for over 80% of our students to be performing at three or above. The results are shown below in Figure 1. The average for both courses evaluated was 86.4% (from a total of 44 individual evaluations).

Finally, the results of the MET exit survey shows that 100% of the respondents rate themselves as either prepared or highly prepared in this area.

Since the average for this outcome was above the desired result, this outcome will be evaluated again based on a three year cycle.

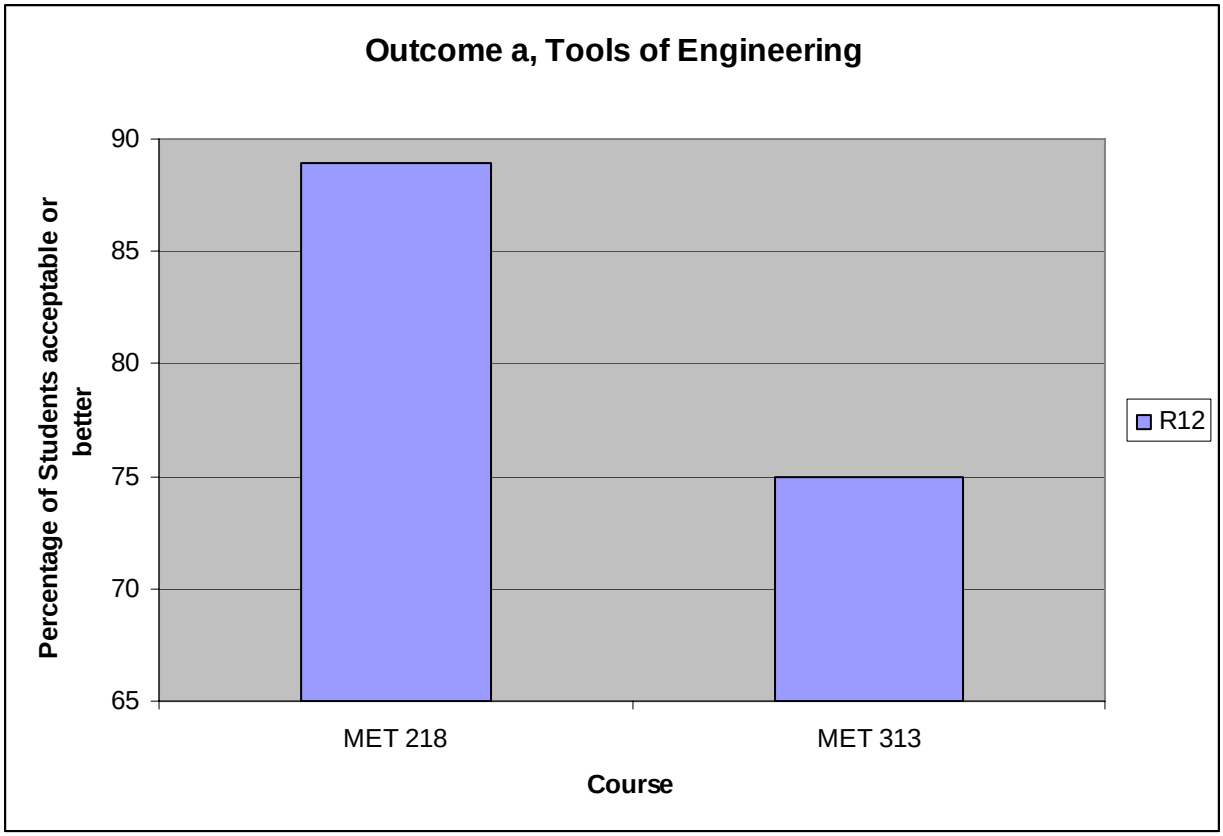

Figure 1Outcome a, 2008

Outcome b

Graduates will have an ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology

Graduates must have a fundamental knowledge of engineering and the underlying mathematics and science. They must also be able to apply this knowledge to real world problems. These skills are taught in required mathematics, science and core engineering courses. Please refer to the MET Assessment Plan for specific details.

Pre-Exams were chosen as the assessment method used to evaluate student learning in these areas. Pre-Exams were given in a select number of upper-division courses. These courses are generally the first professional courses encountered and have the math, science and core engineering courses as prerequisites. The Pre-Exams are given at the beginning of the professional course, the first week or two, and are designed to test the prerequisite material needed for that course. The specific courses selected include:

MET 313 Applied Thermodynamics
MET 315 Machine Design I
MET 218 Fluid Mechanics
MET 360 Materials II
MET 363 Instrumentation
MET 326 Electrical Power Systems

Pre-Exams were evaluated by a committee of faculty members using Rubrics. For Outcome b two Rubrics were used in evaluation. The first assessed mathematical ability (R1) and the second science and core engineering (R2). Graded Pre-Exams were collected this year from MET 313, MET 315, and MET 218. Then each participating faculty member evaluated each on a scale between 1 and 5, five indicating excellent abilities and one being lacking. The percentage of students scoring at three or above was then tabulated. The desired result was for over 80% of our students to be performing at three or above.

Pre-Exams from Machine Design I (MET 315), Fluid Mechanics (MET 218) and Applied Thermodynamics (MET 313), have been assessed; with the results shown below in Figure 2. The Pre-Exam assessment showed students performing above the base 80% only for MET 218 Fluid Mechanics. Low math and basic science and engineering core scores were found for MET 313 Applied Thermodynamics and MET 315 Machine Design I. The average score for all students for this outcome was 55% (from a total of 281 individual evaluations); well below the 80% target.

For MET 313 Applied Thermodynamic students scored close to the target rate of 80% acceptable or better score (68%) for their math prerequisites. But, the score for basic science and core engineering knowledge was very poor (32%). A minor change in the prerequisite curriculum (ENGR 355 Thermodynamics) is being made for next year, and this course will be evaluated with an analytical rubric during its next scheduled evaluation period.

For MET 315 Machine Design I the students again scored close to the target rate of 80% acceptable or better for their math prerequisites. But, the score for basic science and core engineering knowledge

was again very low (39%). This exam tested prerequisite knowledge in statics and strength of materials. The low results may result from the particular exam given. However, reviewing the exam in detail showed a fair exam covering core elements of statics and strengths.

Finally, the results of the MET exit survey shows that 100% of the respondents rate themselves as either prepared or highly prepared in this area.

The results on the Pre-Exam testing statics and strength of materials are being shared with the instructors of those courses. It has been confirmed that the material tested is included in these courses. Assessment will be ongoing to determine why students performed so poorly with statics and strength of materials skills.

The wide variation in student performance is also a concern. It has been recommended that fewer Pre-Exams be given and the efforts saved go into making these more consistent. This should give some indication whether the variation is due to variations in student learning or in the exams themselves. For next year analytical rubrics will be developed for both mathematical ability and for science and core engineering.

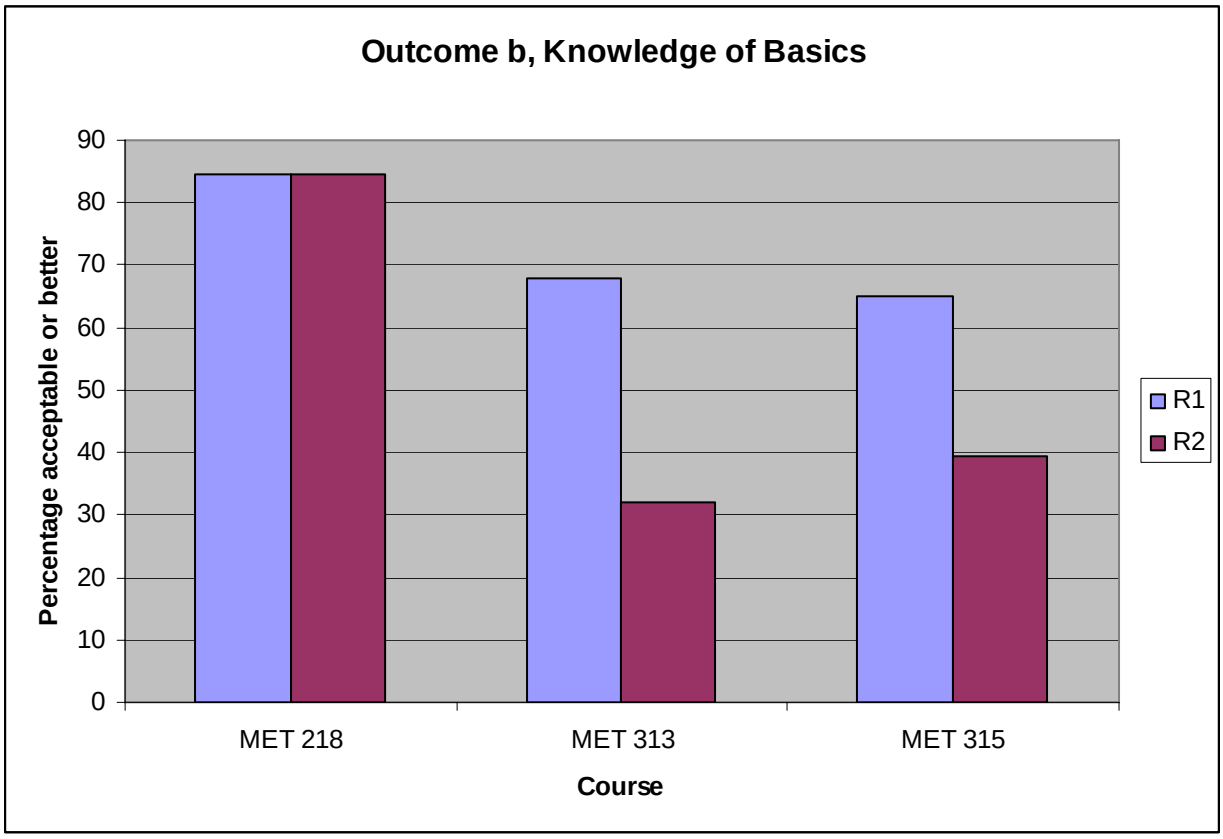

Figure 2Outcome b Results for 2008 (R1 math prerequisites, R2 basic science and core engineering prerequisites)

Outcome c

Graduates will have an ability to conduct, analyze and interpret experiments and apply experimental results to improve processes,

Being able to carry out experiments and apply the resulting data is critical to an applied engineering education. Graduates need to be able to select and set up appropriate equipment, conduct an experiment or test, interpret the resulting data and then use the results to improve processes. Students are exposed to experiments and tests through extensive laboratories. In these labs they set up experiments, collect and interpret data. In addition to laboratory courses, senior projects include testing and then application of the test results to improve their project.

Laboratory Reports were collected from a number of selected courses including, MET 218 Fluid Mechanics (also shown as MET 407 at our Portland campus), MET 363 Instrumentation, MET 437 Heat Transfer Lab, and MET 426 Fluid Power Systems. For each lab report two Rubrics were applied; one for experimental methods and obtaining data (R4); and a second for analyzing and using experimental data (R3). A faculty committee reviewed the lab reports and scored each according to the Rubrics. The results are shown below in Figure 3.

Reviewing the data, it can be seen that the majority of students scored at an acceptable or better rating. It is our goal to have at least 80% of our students score at an acceptable or better rating. The total average score for all students for both rubrics was exactly 80% (from a total of 145 individual evaluations).

Finally, the results of the MET exit survey shows that 100% of the respondents rate themselves as either prepared or highly prepared in this area.

It can be seen that for MET 363 Instrumentation the average score for Rubric 3 (Ability to analyze, interpret, and use data) is 64%. A summer productivity grant was awarded to the course instructor in order to re-write the experimental laboratory handouts; and a new book has been chosen for the course. This course will be re-evaluated next year with an analytical rubric in order get a better idea of where there may be a problem.

Although it was planned to evaluate each senior project group for this outcome, it was decided to put this off until the next planned evaluation cycle. With the tremendous amount of material collected there was just not enough time available to carry this out.

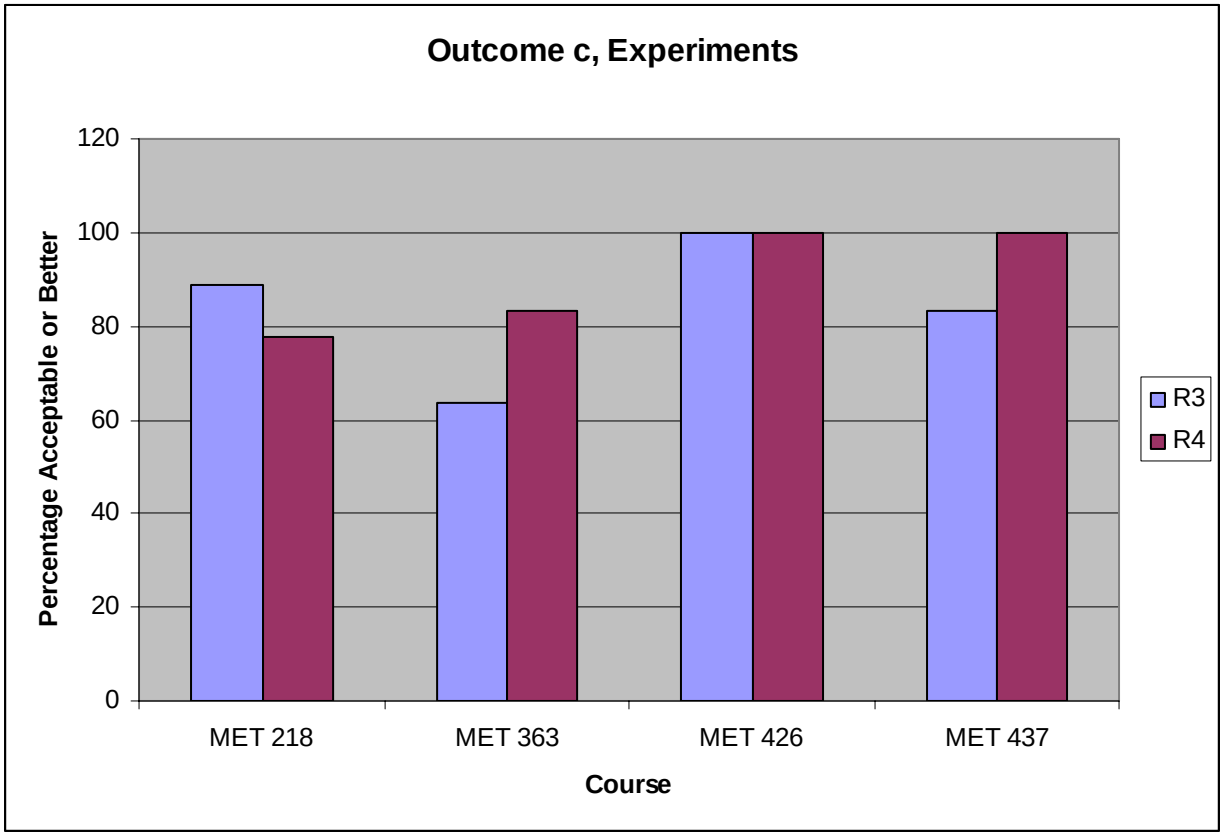

Figure 3 Outcome c Results, 2008 (R3 measures ability to use data, R4 measures the ability to obtain data)

Outcome d

Graduates will have an ability to apply creativity in the design of systems, components or processes appropriate to program objectives,

In the applied mechanical engineering technology program at OIT Outcome d is interpreted as the ability to plan and carry out an engineering project. The performance criteria of an engineering project include:

- Generate an appropriate set of Criteria, targets to be met
- Generate one or several Proposed Solutions to meet the Criteria
- Generate a Work Breakdown/Task Statements needed for project completion
- Generate a Time Line for work defined and given resources
- Apply engineering analysis and tools to accomplish the work defined
- Track or manage a project

Parts of this are taught throughout the curriculum. However the main emphasis is from project classes, Orientation MET 111/112 and Senior Projects MECH 490/491/492.

The primary assessment method was a review of Senior Project work. A faculty committee reviewed senior project reports and presentations. Senior Projects is a capstone sequence which allows students to apply their education to a real world problem. The committee evaluated the student's preparedness

to plan, propose, and manage an engineering project.

The committee reviewed student assignments, written and oral proposals fall term, and final reports and presentations spring term. A Rubric to assess planning and managing projects was used for both oral presentations and written reports. As above a base score of three was determined to be adequate with the desire that above 80% of our students attain this level.

Evaluation of fall term senior project proposals are shown in Figure 4 below. As can be seen, the score for evaluation of the students written proposals is slightly below 80%; while the score for their oral presentations is slightly above 80%. The average score was 79.5% (from a total of 60 individual evaluations).

Just the oral presentations were evaluated for spring term, with the results shown on Figure 4 below. It can be seen that only 73% were evaluated at the adequate or better level.

Finally, the results of the MET exit survey shows that 100% of the respondents rate themselves as either prepared or highly prepared in this area.

It was thus recommended that several small design projects be placed throughout the curriculum to better prepare students for senior projects and eventual project planning and management in industry. It was decided to require students to plan and manage very small design projects in Fluid Mechanics I and Machine Design II. This will be implemented next year, at which time we will evaluate the effectiveness of this change.

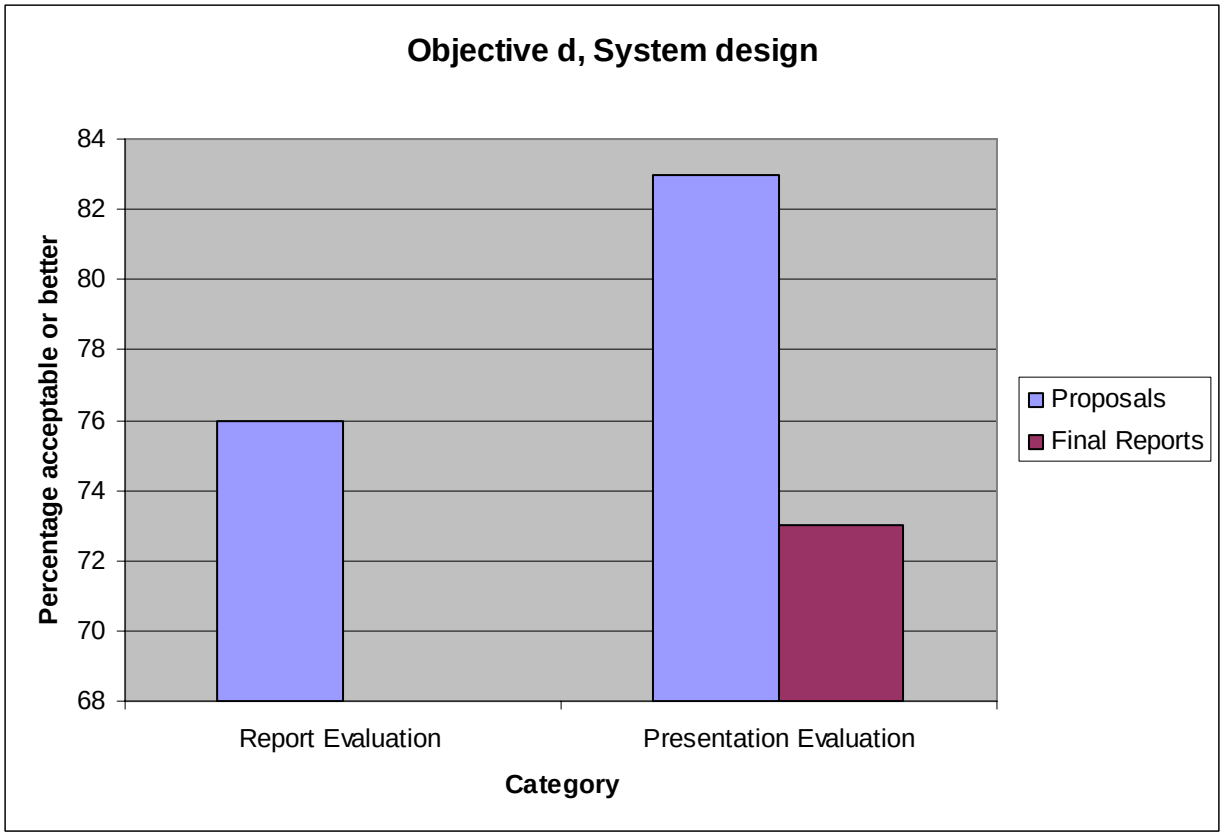

Figure 4 Objective d Results, 2008

Outcome e

Graduates will have an ability to function effectively on teams

Mechanical engineering technology graduates will be working on teams throughout their careers. It is important that they have the skills to succeed in a team environment and have the chance to apply these skills during their education.

The major experience students have with teams is in senior projects. Here Mechanical Engineering Technology students work on teams with at least a mix of Mechanical Engineering and Manufacturing Engineering Technology students. The desire is to involve team members from electronics, computer systems, and other majors are the projects allow. This is not always possible but these projects bring a real world element to teamwork and are encouraged.

Assessment of teamwork is not straight forward. The MMET department assessed teamwork in senior projects and in MET 111 Orientation. Senior projects will be assessed through exit interviews of current students. A cross section of students taking senior projects in 2007-08 will be surveyed and/or interviewed. One primary aim of this assessment will be to determine the teamwork and team interactions found within their senior projects. It will also be used to determine which courses and educational experiences best prepared them for a team project. Senior project faculty will then compare notes and look for way to promote better teamwork and better teach the skill needed.

The results for this outcome are shown below in Figure 4. Only the results from MET 111 Orientation are shown, as the senior projects assessment work was collected but has not been evaluated yet. The average score for the data collected was 96.9% (from a total of 130 individual evaluations).

Finally, the results of the MET exit survey shows that only 50% of the respondents rate themselves as either prepared or highly prepared in this area.

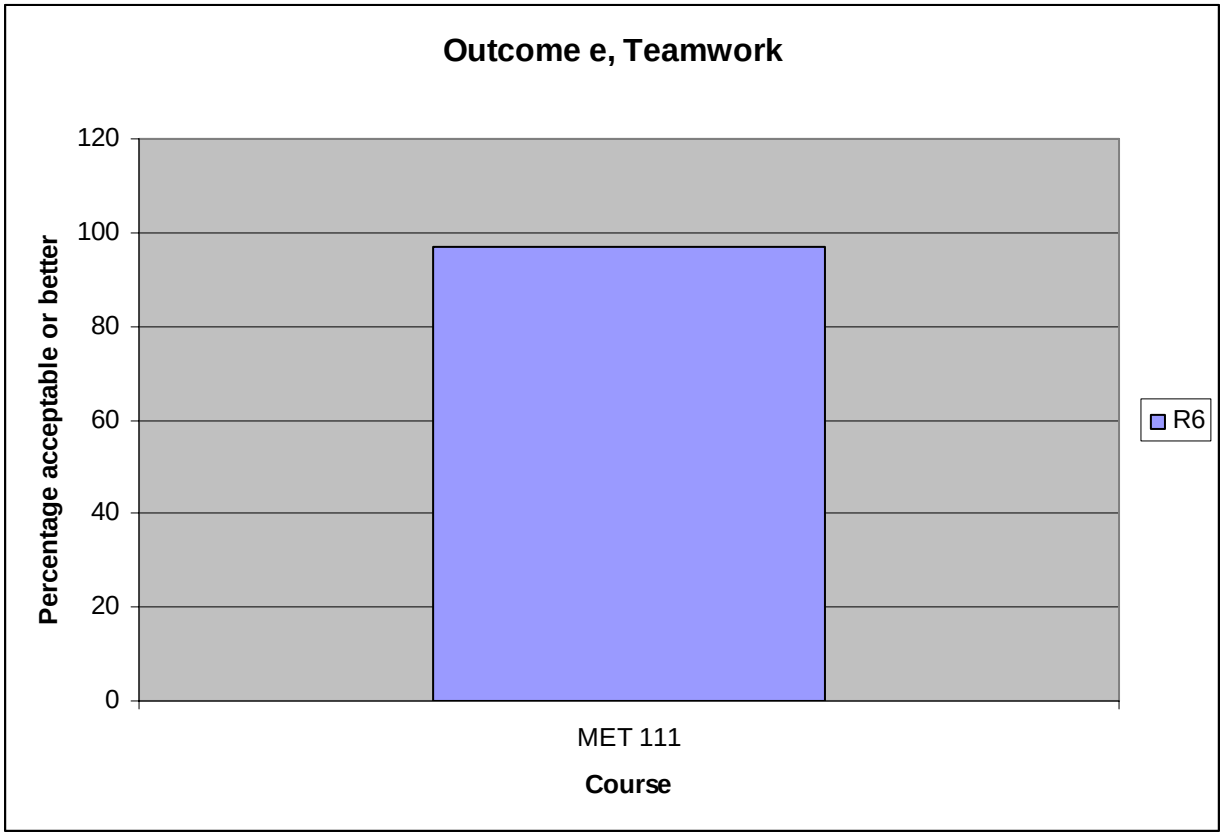

Figure 5 Outcome e, 2008

Objective f

Graduates will have an ability to identify, analyze and solve technical problems

The core of OIT's upper division mechanical engineering technology program concentrates on identification, formulation and solution of engineering problems. Graduates will have the ability to apply the analysis techniques taught in upper division MET courses. The specific skills involved include:

- Identification of an engineering problem
- Formulate a path for solution of an engineering problem
- Define a schematic or diagram depicting an engineering problem
- Make appropriate assumptions leading to useful solutions to an engineering problem
- Knowledge of engineering analysis techniques

Data was collected and evaluated using a holistic rubric (R7). Courses included MET 218, MET 313, MET 315, MET 323, MET 363, MET 426, and MET 437. The results from this evaluation are shown below in Figure 6. The average for all of the evaluations was 80.6% (from a total of 551 individual evaluations); with the highest score in MET 426 Fluid Power Systems (100%) and the lowest in MET 437 Heat Transfer Lab (62.5%).

Finally, the results of the MET exit survey shows that 100% of the respondents rate themselves as

either prepared or highly prepared in this area.

Based on these results this outcome will be evaluated again in accordance to our 3-year cycle.

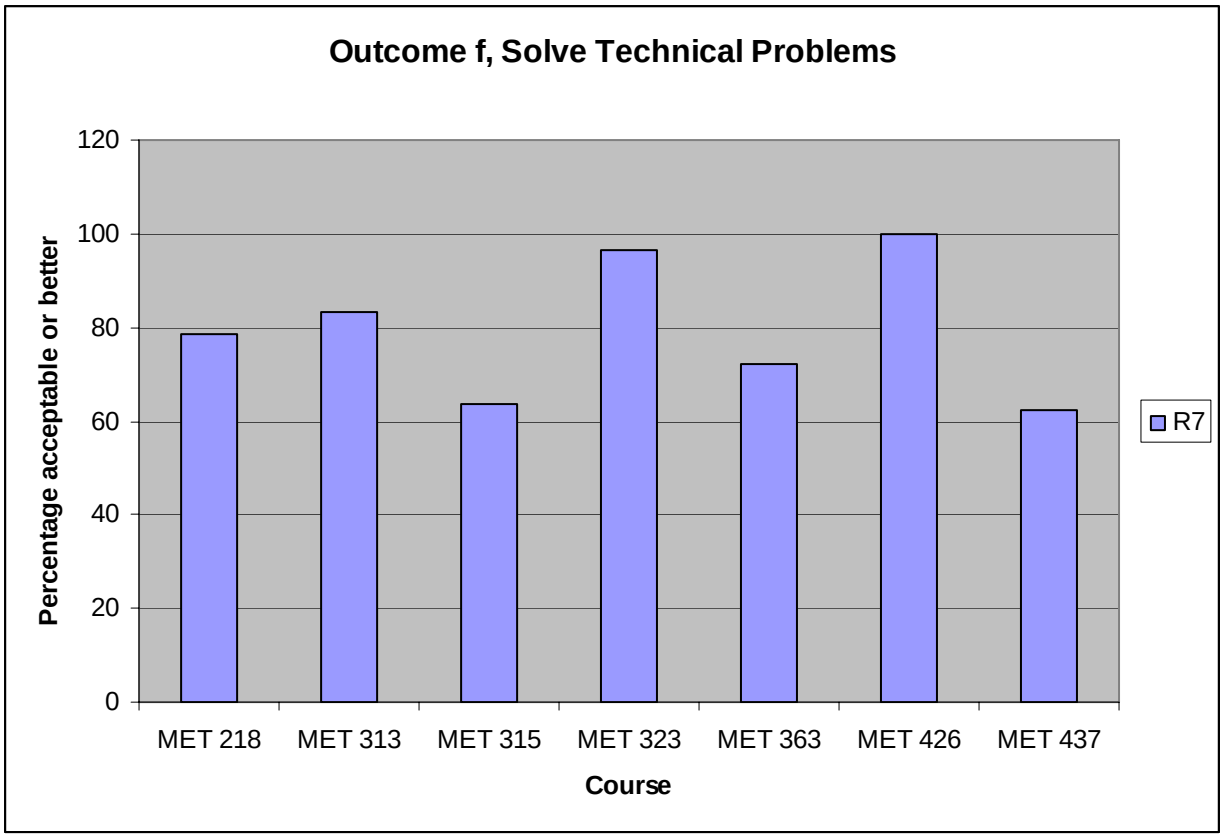

Figure 6Outcome f Results, 2008

Objective g

Graduate will have an ability to communicate effectively

Effective communication is critical to a successful career in mechanical engineering. Students must be able to communicate in writing, speech, and graphically. OIT's Mechanical Engineering Technology program has a particular strength in this area. The specific skills addressed include:

- Ability to communicate clearly and concisely in written reports
- Ability to communicate verbally, both prepared presentations and impromptu discussions
- Ability to communicate through drawings, both formal drawings and sketches

The results are shown in Figure 7 below. The average score is 80.5% (from a total of 113 individual evaluations). Written evaluations were done in MET 363, MET 426, MET 437, and in Senior Projects. Oral evaluations were done in Senior Projects. And visual communications (via drawings) were evaluated in MET 242.

Based on these results the MMET department considers the communication skills of our students to have met our goals. One problem area has been identified, and that is MET 363 Instrumentation. A

summer productivity grant has been awarded to the instructor of this course to create and/or rewrite a number of laboratory handouts. It is hoped that this will help clarify what is expected of the students in their laboratory reports. This course will be evaluated again next year to see the results of this effort.

Finally, the results of the MET exit survey shows that only 50% of the respondents rate themselves as either prepared or highly prepared in this area.

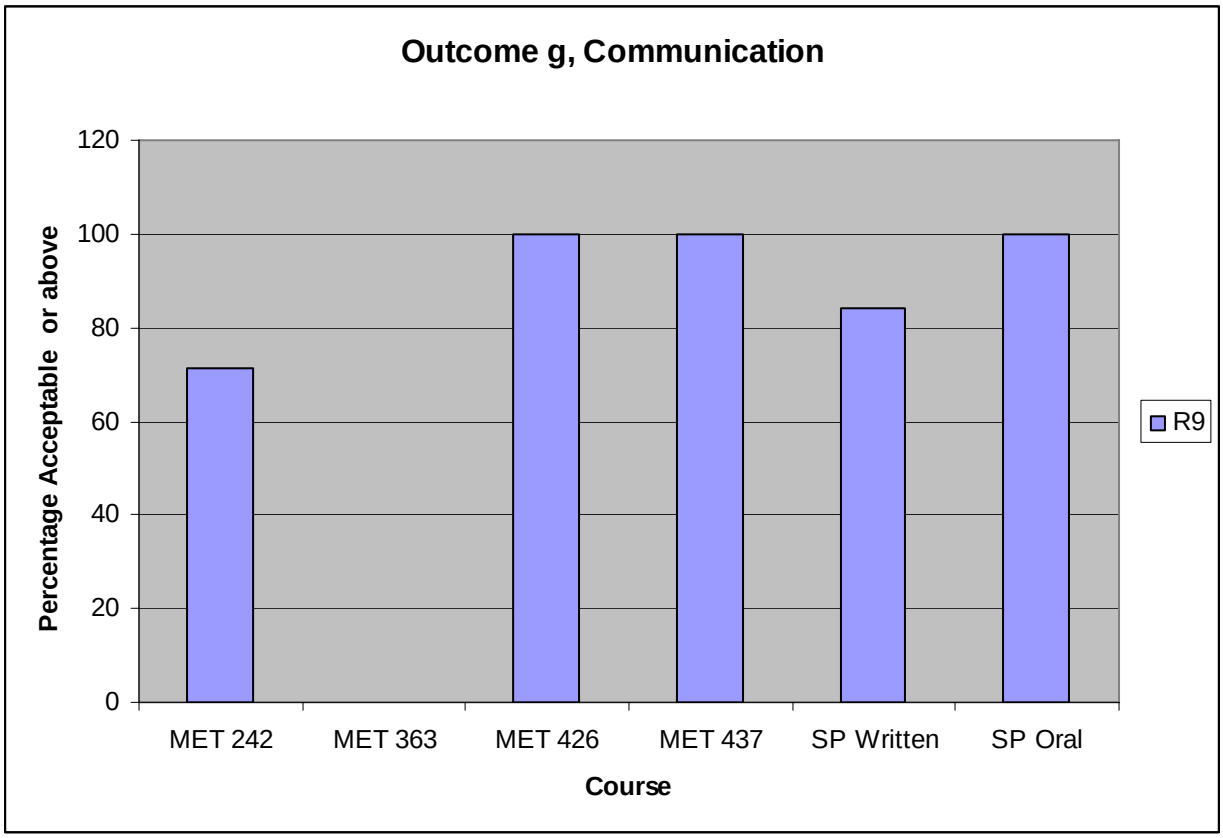

Figure 7Outcome g, 2008

Objective h

Graduates will have recognition of the need for, and an ability to engage in lifelong learning

In a rapidly changing world, particularly technological change, a commitment to life long learning is essential for a successful career. Starting in 2006, all on-campus courses at OIT may be offered as Hybrid-WebCT courses. WebCT is a distance-learning tool which allows learning opportunities beyond the time and place constraints of the traditional classroom. Since more-and-more continuing education courses are being offered to working professionals by distance education; we feel that introducing our students to this method of learning will encourage them to become life-long learners. In particular, MET 323 Heat Transfer and MET 326 Electrical Power Systems are using this tool to argument the in-class lectures.

This year the only tool used to assess this outcome was our exit survey. The results of the MET exit survey shows that 100% of the respondents rate themselves as either prepared or highly prepared in this

area. Using this limited amount of data it is hard to derive any conclusive results. It is recommended that a second evaluation method be developed to evaluate this outcome, and that this outcome be reevaluated next year.

Objective i

Graduates will have an ability to understand professional, ethical and social responsibilities

Graduates will gain an understanding of professional and ethical responsibilities through their education at OIT. Further they are expected to act with high professional and ethical standards. During the Orientation sequence (MET 111/MET 112) fundamentals of professional, ethical, and social responsibilities are introduced. Our students are also required to take either the Fundamentals of Engineering (FE) Exam (ENGR 485), or the Manufacturing Engineering Certification Exam (MFG 428). By requiring our students to take a certification exam, the ideas of professionalism, ethical, and social responsibility is stressed. In the future we hope to use the results of the FE exam to evaluate ethical behavior (as this is one area covered by the test).

This year the only tool used to assess this outcome was our exit survey. The results of the MET exit survey shows that only 50% of the respondents rate themselves as either prepared or highly prepared in this area. Using this limited amount of data it is hard to derive any conclusive results. It is recommended that a second evaluation method be developed to evaluate this outcome, and that this outcome be reevaluated next year.

Outcome j

Graduates will have a respect for diversity and knowledge of contemporary professional, societal and global issues

To be productive citizens, graduates need a broad understanding of world affairs and the impact of these affairs on the engineering profession. During our orientation sequence (MET 111 and MET 112) topics of contemporary professional, societal and global issues are discussed. Considerations of these issues are also discussed during MET 415 Design Project and our senior design sequence (MET 490, MET 491, and MET 492).

Students also take a broad range of Social Science and Humanity electives. These give students a broad perspective of world affairs even though they are electives and each student will have a different mix of subjects. How these world affairs affect the engineering profession is discussed in the engineering courses, particularly upper division courses.

This outcome was evaluated during winter term of our senior projects sequence. The students were asked to research “peak Oil” and to write a paper describing the impact of this issue on the world. The papers were then evaluated using a holistic rubric (R10), with a desire outcome of 80% of our students scoring at an acceptable level or above. The results are shown below in Figure 8.

Finally, the results of the MET exit survey shows that 100% of the respondents rate themselves as either prepared or highly prepared in this area.

As can be seen, just over 83% of the students evaluated scored at an acceptable level or better. Based on this, this outcome will be evaluated again in accordance to our 3-year cycle. It is recommend that at that time an additional evaluation method be applied; which should better define our students understanding of this topic.

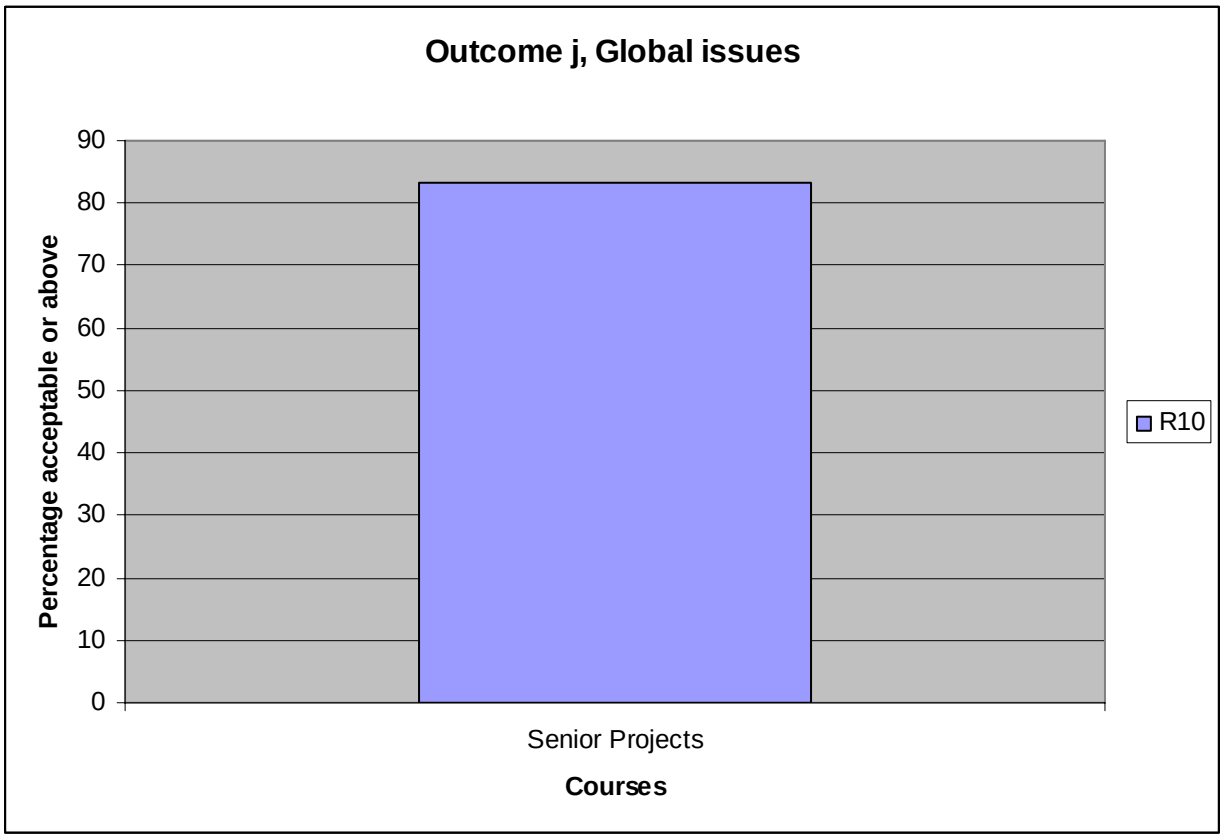

Figure 8 Outcome j, 2008

Outcome k

Graduates will have a commitment to quality, timeliness, and continuous improvement

Throughout the curriculum quality, timeliness, and continuous improvement are stressed. In particular, during our Senior Project sequence (MET 490, MET 491, and MET 492) our students design and build a project. As part of building a project, the students are required to produce a Project Schedule (timeliness), follow a defined set of project specifications and documentation (quality), and to continuously evaluate their project during weekly meetings with their project advisor (continuous improvement).

This year the only tool used to assess this outcome was our exit survey. The results of the MET exit survey shows that 100% of the respondents rate themselves as either prepared or highly prepared in this area. Using this limited amount of data it is hard to derive any conclusive results. It is recommended that a second evaluation method be developed to evaluate this outcome, and that this outcome be reevaluated next year.

Outcome MET a)

> *Baccalaureate degree programs must demonstrate that graduates can apply specific program principles to the analysis, design, development, implementation, or oversight of more advanced mechanical systems or processes depending on program orientation and the needs of their constituents.*

This outcome was evaluated based on the completion of the student's senior project using a simplistic holistic rubric. The scoring for this rubric was a simple acceptable/unacceptable; with a target of at least 80% of the student groups scoring as acceptable.

As can be seen in Figure 9 below, 100% of the evaluated senior projects were determined to be acceptable. For this evaluation five senior projects from Klamath Falls were evaluated.

Based on this year's evaluation it is recommended that an additional evaluation should also be applied when this outcome is evaluated again.

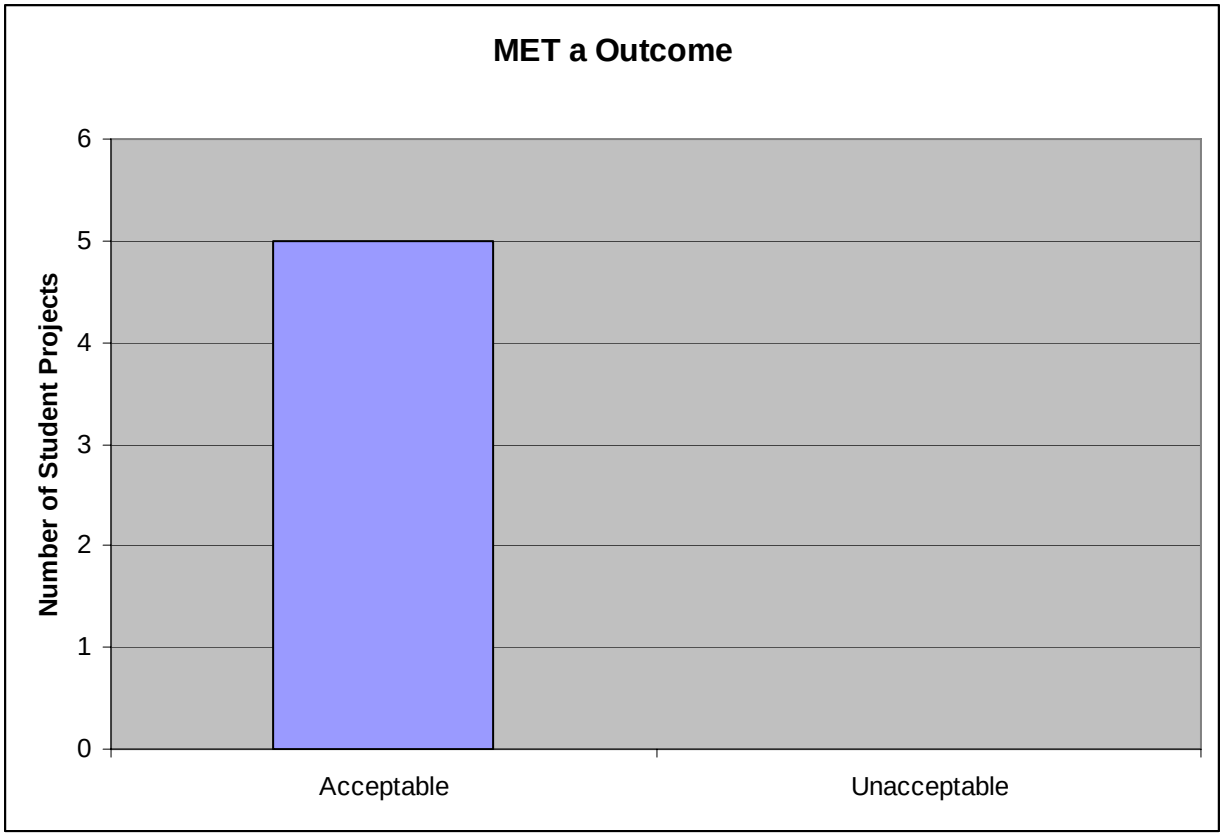

Figure 9 MET Program-specific outcome

OIT MMET Department-specific Outcomes

There are six OIT MMET department-specific outcomes specified in our assessment plan; with the goal of assessing all six every year. Due to the amount of work required for our upcoming ABET visit in

the fall of 2008 these outcomes were not evaluated this year. It is planned to evaluate these in future years.

Summary of 2008 MET Program Assessment

The MET assessment plan was extensively rewritten this year, and a very ambitious overall program assessment was attempted during the 2007-2008 academic year. The new plan was written with the hope of assessing all of our courses in all applicable areas. There were many successes during this assessment cycle, and a few disappointments; these are discussed below. One thing became evident during this year was that trying to assess almost every course for each pertinent SLO is not sustainable. The results of this year's assessment activities will be used to update the MET Program assessment plan; with a goal of making it both thorough and sustainable.

The areas that were successfully assessed (the outcome was assessed such that 80% of our students scored include the following:

- Outcome a: Graduates will have an appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines. Over 86% of the students scored at a good or better level, and 100% of the respondents to the exit survey rated themselves prepared or better.
- Outcome c: Graduates will have an ability to conduct, analyze and interpret experiments and apply experimental results to improve processes. Exactly 80% of our students scored at a good or better level; and 100% of the respondents to the exit survey rated themselves prepared or better.
- Outcome e**:** Graduates will have an ability to function effectively on teams. Over 96% of the students scored at a good or better level; however only 50% of the respondents to the exit survey rated themselves prepared or better.
- Objective f: Graduates will have an ability to identify, analyze and solve technical problems**.** Just over 80% of the students scored at a good or better level; and100% of the respondents to the exit survey rated themselves prepared or better.
- Outcome g: Graduates will have the ability to communicate effectively. Just over 80% of the students scored at a good or better level; however only 50% of the respondents to the exit survey rated themselves prepared or better.
- Outcome j: Graduates will have a respect for diversity and knowledge of contemporary professional, societal and global issues. Just over 83% of our students scored at a good or better level; and 100% of the respondents to the exit survey rated themselves prepared or better.

Areas identified as needing improvement include the following:

- Outcome b: Graduates will be able to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology. Only 55% of the students were scored at the good or better level for this outcome; although 100% of the respondents to the exit survey rated themselves prepared or better. Changes to the course content in some of our core engineering courses are being made, and this outcome will be reassessed next year to see if these changes improve our students' score for this outcome.
- Outcome d: Graduates will be able to apply creativity in the design of systems, components or processes. Overall, slightly less than 80% of our students scored at the good or better level for this outcome. Several small design projects will be placed throughout the curriculum next year to better prepare students. This outcome will be reassessed to see if these changes improve out students' knowledge in this area.

Finally, areas needing additional data in order to properly evaluate them include the following (at least one more rubric will be developed, and these areas will be reassessed next year):

- Outcome h: Graduates will see the need for, and an ability to engage in lifelong learning.
- Outcome i: Graduates will be able to understand professional, ethical and social responsibilities.
- Outcome k: Graduates will have a commitment to quality, timeliness, and continuous improvement.
- MET a: Baccalaureate degree programs must demonstrate that graduates can apply specific program principles to the analysis, design, development, implementation, or oversight of more advanced mechanical systems or processes depending on program orientation and the needs of their constituents.

Appendix A MET Program Assessment Cycle

The assessment cycle for the MET program is shown below.

OUTCOME	2007-2008	2008-2009	2009-2010	2010-2011
ABET TAC a	**X**	**X**		
ABET TAC b	**X (every time taught)**	**X (every time taught)**	**X (every time taught)**	**X (every time taught)**
ABET TAC c	**X**	**X**		
ABET TAC d	**X**	**X**		
ABET TAC e	**X**		**X**	
ABET TAC f	**X**			**X**
ABET TAC g	**X**			**X**
ABET TAC h	**X**			**X**
ABET TAC i	**X**		**X**	
ABET TAC j	**X**		**X**	
ABET TAC k	**X**		**X**	
ABET TAC MET a	**X**	**X**	**X**	**X**
MMET Outcome 1	**X**	**X**	**X**	**X**
MMET Outcome 2	**X**	**X**	**X**	**X**
MMET Outcome 3	**X**	**X**	**X**	**X**
MMET Outcome 4	**X**	**X**	**X**	**X**
MMET Outcome 5	**X**	**X**	**X**	**X**
MMET Outcome 6	**X**	**X**	**X**	**X**

Appendix B Rubrics

This appendix contains the rubrics used for the evaluations contained in this document; which are as follows:

R1	Math
R2	Science and core Engineering
R3	Analyze and use experimental data
R4	Experiments
R5	Plan and Manage Projects
R6	Teamwork
R7	Identify, formulate, and solve engineering problems
R8	Ethics
R9	Communications
R10	Contemporary Issues
R11	Life-long Learning
R12	Engineering Tools
R13	Job Ready
R14	Impact of Engineering
MET a	MET Specific

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology
ASSESSMENT RUBRIC (R1)

Math

Ability Level	***Description***	***Value***
Exceptional	Can apply pre-requisite math skills to new situations as needed.	5
Very Good	Between Exceptional and Good.	4
Good	Understands math from pre-requisite courses but has difficulty applying to new situations.	3
Below Average	Between Good and Lacking	2
Lacking	Minimal understanding of pre-requisite math.	1

Course Number _____ Term _____

Assessed Assignment _____ Expected Level _____

Assessing Faculty _____

Scores for each students work (1 to 5):

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology
ASSESSMENT RUBRIC (R2)

Science and Core Engineering

Ability Level	***Description***	***Value***
Exceptional	Through understanding of pre-requisite science and core engineering classes. Can apply these techniques to new and unique situations.	5
Very Good	Between Exceptional and Good.	4
Good	Understands pre-requisite science and core engineering materials but has some difficulty applying those to new situations.	3
Below Average	Between Good and Lacking	2
Lacking	Has difficulty with science and core engineering topics.	1

Course Number _____ Term _____

Assessed Assignment _____ Expected Level _____

Assessing Faculty _____

Scores for each students work (1 to 5):

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology
ASSESSMENT RUBRIC (R3)

Ability to Analyze, Interpret and Use data

Ability Level	***Description***	***Value***
Exceptional	Shows ability to analyze experimental data independently extracting and presenting insightful results. Can appropriately apply statistical methods to clarify result. Has ability to apply these result to improve experiments, design and/or processes.	5
Very Good	Between Exceptional and Good.	4
Good	Ability to analyze experimental data given general direction and guidance. Can present and report results in an orderly and understandable manner. Can use results to improve experiments design and/or processes with guidance.	3
Below Average	Between Good and Lacking	2
Lacking	Has difficulty analyzing experimental data. Presentation and reporting of results is confusing and hard to follow.	1

Course Number _____ Term _____

Assessed Assignment _____ Expected Level _____

Assessing Faculty _____

Scores for each students work (1 to 5):

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology
ASSESSMENT RUBRIC (R4)

Experiments (getting data)

Ability Level	***Description***	***Value***
Exceptional	Able to design experiments, select equipment, set up and carry through experiments obtaining solid data appropriate to the investigation at hand.	5
Very Good	Between Exceptional and Good.	4
Good	Set up and carry through pre-defined experiments obtaining useful data.	3
Below Average	Between Good and Lacking	2
Lacking	Has trouble carrying out pre-defined experiments.	1

Course Number _____ Term _____

Assessed Assignment _____ Expected Level _____

Assessing Faculty _____

Scores for each students work (1 to 5):

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology
ASSESSMENT RUBRIC (R5)

Plan and Manage Projects

Ability Level	***Description***	***Value***
Exceptional	Shows ability to define project criteria, proposed solutions, work breakdown (tasks) and schedule for a small to medium sized engineering project. Can carry through Project Management for such a project. Will lead a team of peers.	5
Very Good	Between Exceptional and Good.	4
Good	Shows ability to define project criteria, proposed solutions, work breakdown (tasks) and schedule for a small to medium sized engineering project. Can manage components for such a project.	3
Below Average	Between Good and Lacking	2
Lacking	Has difficulty clearly defining project criteria, proposed solutions, work breakdown (tasks) and schedule for a small to medium sized engineering project.	1

Course Number _____ Term _____

Assessed Assignment _____ Expected Level _____

Assessing Faculty _____

Scores for each students work (1 to 5):

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology
ASSESSMENT RUBRIC (R6)

Multi-disciplinary Teamwork

Ability Level	***Description***	***Value***
Exceptional	Shows ability to lead a team, takes responsibility, performs tasks effectively, attends and actively participates in all meetings. Helps others on the team to develop cohesive team ideas.	5
Very Good	Between Exceptional and Good.	4
Good	Takes responsibility, performs tasks effectively, attends and actively participates in all meetings. Participates in the development of team ideas.	3
Below Average	Between Good and Lacking	2
Lacking	Does not collect relevant information to address team's needs. Rarely carries out assigned tasks, relies on others to do the work. Often argues with team members. Wants to have things done his way and does not listen to alternative approaches.	1

Course Number _____ Term _____

Assessed Assignment _____ Expected Level _____

Assessing Faculty _____

Scores for each students work (1 to 5):

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology
ASSESSMENT RUBRIC (R7)

Identify, Formulate and Solve Engineering Problems

Ability Level	***Description***	***Value***
Exceptional	Shows an ability to clearly identify an engineering problem and able to formulate a path for providing sound solutions. Be able to define a clear schematic or drawing of the problem if applicable. Ability to make solid assumptions that lead to a logical conclusion.	5
Very Good	Between Exceptional and Good.	4
Good	Can identify an engineering problem and able to formulate a path for providing sound solutions. Be able to define a schematic or drawing of the problem if applicable. Ability to make some assumptions that lead to a conclusion.	3
Below Average	Between Good and Lacking	2
Lacking	Has problems identifying an engineering problem and is unable to formulate a path for providing solutions. Cannot define a clear schematic or drawing of the problem if applicable. Does not make assumptions.	1

Course Number _____ Term _____

Assessed Assignment _____ Expected Level _____

Assessing Faculty _____

Scores for each students work (1 to 5):

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology
ASSESSMENT RUBRIC (R8)

Understand Professional and Ethical Responsibility

Ability Level	***Description***	***Value***
Exceptional	Understands engineering codes of ethics and has a sound knowledge of the potential impact of ethical issues. Conducts himself in an organized and professional manner understands and is conversant in professional issues. Applies relevant aspects of a professional code when considering alternative decisions.	5
Very Good	Between Exceptional and Good.	4
Good	Has a basic understanding of engineering codes of ethics and has knowledge of the potential impact of ethical issues. Conducts himself in an organized and professional manner. Considers some aspects of a professional code when weighing alternative decisions.	3
Below Average	Between Good and Lacking	2
Lacking	Has little understanding of engineering codes of ethics and has remote knowledge of the potential impact of ethical issues. Does not conduct himself in an organized and professional manner. Does not consider any aspects of a professional code when thinking about alternative decisions.	1

Course Number _____ Term _____

Assessed Assignment _____ Expected Level _____

Assessing Faculty _____

Scores for each students work (1 to 5):

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology
ASSESSMENT RUBRIC (R9)

Ability to Communicate Effectively

Ability Level	***Description***	***Value***
Exceptional	Graduate expresses himself clearly and precisely both verbally and in writing. Thought formulation, grammar and spelling are excellent. The student's sketching and CAD skills are excellent.	5
Very Good	Between Exceptional and Good.	4
Good	Speaking skills are good, but grammar and spelling are not always accurate; or grammar and spelling are good, but speaking skills are somewhat lacking. The student has moderate sketching and drafting skills.	3
Below Average	Between Good and Lacking	2
Lacking	Poor speaking skills; grammar and spelling need constant correcting. Sketching and CAD skills are not properly developed and below what is expected.	1

Course Number _____ Term _____

Assessed Assignment _____ Expected Level _____

Assessing Faculty _____

Scores for each students work (1 to 5):

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology
ASSESSMENT RUBRIC (R10)

Knowledge of Contemporary Issues

Ability Level	***Description***	***Value***
Exceptional	Is fluid and conversant in contemporary issues, enjoys discussing current and topical events and issues. Illustrates a sound knowledge and keen interest in contemporary issues.	5
Very Good	Between Exceptional and Good.	4
Good	Is only moderately studied in contemporary issues and speaks only occasionally of them.	3
Below Average	Between Good and Lacking	2
Lacking	Has little knowledge of contemporary issues and does not refer to any in conversation or when discussions are opened.	1

Course Number _____ Term _____

Assessed Assignment _____ Expected Level _____

Assessing Faculty _____

Scores for each students work (1 to 5):

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology
ASSESSMENT RUBRIC (R11)

Ability to Engage in Life Long Learning

Ability Level	***Description***	***Value***
Exceptional	Embraces a project with an inquiring mind and researches subject in depth. Is illuminating and enthusiastic in detail and scope of information and shows a strong interest in discovering new technologies and applications. Is interested in online work, active in seminars and professional groups.	5
Very Good	Between Exceptional and Good.	4
Good	Does only the surface research necessary and is complacent about finding new technologies and applications. Marginally active with online work, professional groups and seminars for advanced learning.	3
Below Average	Between Good and Lacking	2
Lacking	Does not do much research and does not show an interest in new technologies or applications. Does little or no online work and does not show any interest in professional groups or seminars.	1

Course Number _____ Term _____

Assessed Assignment _____ Expected Level _____

Assessing Faculty _____

Scores for each students work (1 to 5):

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology
ASSESSMENT RUBRIC (R12)

Ability to use Techniques, Skills and Engineering Tools

Ability Level	***Description***	***Value***
Exceptional	Applies engineering techniques and skills appropriately to new problems and situations. Can apply a broad range of engineering tools, such as CAD and experimental equipment, to new situations and can quickly learn to use new tools.	5
Very Good	Between Exceptional and Good.	4
Good	Applies core engineering techniques and skills to new situations with little direction. Can apply engineering tools, such as CAD and experimental equipment, used in laboratories to new situations.	3
Below Average	Between Good and Lacking	2
Lacking	Has trouble with core engineering techniques and skills and can not apply these tools to new situations. Can apply engineering tools, CAD and lab equipment, with difficulty and only with direction.	1

Course Number _____ Term _____

Assessed Assignment _____ Expected Level _____

Assessing Faculty _____

Scores for each students work (1 to 5):

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology
ASSESSMENT RUBRIC (R13)

Job Ready: Timeliness, Quality and Continuous Improvement

Ability Level	***Description***	***Value***
Exceptional	Demonstrates a sense of urgency and desire for constant improvement. Always on time and very careful about presenting the highest quality and detail.	5
Very Good	Between Exceptional and Good.	4
Good	Is normally timely and expresses a sense of usual promptness. Illustrates a desire to improve, but is inconsistent. Quality and detail are not always of the highest order-somewhat average.	3
Below Average	Between Good and Lacking	2
Lacking	Not timely with much at all, no sense of urgency. Sloppy about quality and shows little attraction to continuous improvement. No attention to detail.	1

Course Number _____ Term _____

Assessed Assignment _____ Expected Level _____

Assessing Faculty _____

Scores for each students work (1 to 5):

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology
ASSESSMENT RUBRIC (R14)

Understands Engineering Impact in a Global, Economic, Environmental and Social Context

Ability Level	***Description***	***Value***
Exceptional	Has a sound grasp of engineering impact in global, economic, environmental and social context and can converse freely about this.	5
Very Good	Between Exceptional and Good.	4
Good	Has only a partial understanding of engineering impact on global, economic, environmental and social contexts. Has some difficulty expressing ideas on these topics.	3
Below Average	Between Good and Lacking	2
Lacking	Has little understanding of engineering impact on global, economic, environmental and social contexts. Cannot discuss them in any depth at all.	1

Course Number _____ Term _____

Assessed Assignment _____ Expected Level _____

Assessing Faculty _____

Scores for each students work (1 to 5):

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology
ASSESSMENT RUBRIC

MET a

Ability Level	***Description***	***Value***
Acceptable	Students can apply specific program principles to the analysis, design, development, implementation, or oversight of more advanced mechanical systems or processes.	Y
Unacceptable	Students CAN NOT apply specific program principles to the analysis, design, development, implementation, or oversight of more advanced mechanical systems or processes.	N

Course Number_____ Term _____

Assessed Assignment_____ Expected Level ____

Assessing Faculty _____

Scores for each students work (1 to 5):
