

**Central Washington University
Assessment of Student Learning
Mechanical Engineering Technology Program Report**

Please enter the appropriate information concerning your student learning assessment activities for this year.

Academic Year of Report: **2011-2012**

College or Support Area: ***College of Education and Professional Studies***

Department and Program: ***Industrial and Engineering Technology, Mechanical Engineering Technology***

Check here if your assessment report covers all undergraduate degree programs: []

Check here if your assessment report covers all graduate degree programs: []

CWU supports accreditation of the Mechanical Engineering Technology Program by the TAC (Technology Accreditation Committee) of ABET. The applicable program accreditation objectives/outcomes as specified by ABET-TAC can be found online (from www.abet.org/forms.shtml scroll down to “For Technology Programs Only”, 2010-2011 Criteria).

This program report, as requested, addresses only a small subset of topics that are addressed in the ABET documents, as indicated below:

ABET Criteria #1 (Students)	Not addressed in this report
ABET Criteria #2 (Program Educ. Objectives)	Not addressed in this report
ABET Criteria #3 (Program Outcomes)	Partially addressed in this report
ABET Criteria #4 (Continuous Improvement)	Not addressed in this report
ABET Criteria #5 (Curriculum)	Not addressed in this report
ABET Criteria #6 (Faculty)	Not addressed in this report
ABET Criteria #7 (Facilities)	Not addressed in this report
ABET Criteria #8 (Support)	Not addressed in this report
ABET Criteria #9 (Program Criteria)	Partially addressed in this report

Our CWU MET ABET accreditation self-study report is in force, with the last site visit occurring 11/09. Work continues to address issues raised during this accreditation review. For further information on those documents see the ETSC Department Chair, Dr. Craig Johnson (MET Program Coordinator) or view documents on the S Drive (Athena server) (IET > 15. MET - Program Information > “MET Assessment”).

Please direct inquiries of MET Program issues to the MET Coordinator, Dr. Johnson.

1. What student learning outcomes were assessed this year, and why? (ABET #3, #9)

In answering this question, please identify the specific student learning outcomes you assessed this year, reasons for assessing these outcomes, with the outcomes written in clear, measurable terms, and note how the outcomes are linked to department, college and university mission and goals.

Our program chose to review four outcomes this year. This is done specifically to create longitudinal perspective. Three of these outcomes have been monitored in this document before. The fourth is one of the outcomes targeted by the current ABET review cycle. These outcomes are:

1. Students will demonstrate “an appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines” (ABET Criteria #3a). This outcome is related to CWU Goal 1: “Provide for an outstanding academic and student life on the Ellensburg campus”. This outcome is also related to the CEPS goal #1 “Provide for an outstanding academic and professional growth experience for students at all CWU locations. (CWU Goals 1,2,5)”. This outcome is related to the Industrial and Engineering Technology Department Goal#1 “To nurture excellent programs in Technology, and Engineering Technology related disciplines by maintaining or obtaining national accreditation in the following programs”. Finally this outcome is related to the MET Program Learner Outcome #I.1 “Integrate the body of knowledge and skills required to function as a Mechanical Engineering Technology professional in industry”. This outcome was chosen because the MET program values, and continuously monitors basic discipline knowledge, and uses this feedback to plan course content and growth.
2. Students will demonstrate “an ability to apply creativity in the design of systems, components, or processes appropriate to program objectives” (ABET Criteria #3d). This outcome is related to CWU Goal 1: “Provide for an outstanding academic and student life on the Ellensburg campus”. This outcome is also related to the CEPS goal #1 “Provide for an outstanding academic and professional growth experience for students at all CWU locations. (CWU Goals 1,2,5)”. This outcome is related to the Industrial and Engineering Technology Department Goal#1 “To nurture excellent programs in Technology, and Engineering Technology related disciplines by maintaining or obtaining national accreditation in the following programs”. Finally this outcome is related to the MET Program Learner Outcome #I.2 “Design machine components and integrate subsystems to produce an overall design solution to a design requirement.” This outcome was chosen because the MET Program highly values design skills, continuously monitors basic engineering design skills, and uses this feedback to plan course content and growth.
3. Students will demonstrate “an app and modern tools of their disciplines” (ABET Criteria appropriate mastery of the knowledge, techniques, skills #3a). This outcome is related to CWU Goal 1: “Provide for an outstanding academic and student life on the Ellensburg campus”. This outcome is also related to the CEPS goal #1 “Provide for an outstanding academic and professional growth experience for students at all CWU locations. (CWU Goals 1,2,5)”. This outcome is related to the Industrial and Engineering Technology Department Goal#1 “To nurture excellent programs in Technology, and Engineering Technology related disciplines by maintaining or obtaining national accreditation in the following programs”. Finally this outcome is related to the MET Program Learner Outcome #I.1 “Integrate the body of knowledge and skills required to function as a Mechanical Engineering Technology professional in industry”. This outcome was chosen because the MET program continuously monitors basic discipline knowledge, and uses this feedback to plan course content and growth.
4. Students will demonstrate “ABET 3[k] a commitment to quality, timeliness and continuous improvement”. The MET faculty members decided to emphasize both courses content employ a metric for this outcome in our senior capstone course. The source of this concern was the current ABET response. Though we had significant content in our capstone course, there appeared insufficient feedback to measure the related outcomes. This was remedied.

2. How were they assessed?

In answering these questions, please concisely describe the specific methods used in assessing student learning. Please also specify the population assessed, when the assessment took place, and the standard of mastery (criterion) against which you will compare your assessment results. If appropriate, please list survey or questionnaire response rate from total population.

A) What methods were used?

B) Who was assessed?

C) When was it assessed?

Note: Question 2, parts A, B, and C are addressed below for each of the three assessments.

1. (Dynamics) The program goal that students demonstrate “an appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines” was evaluated through the course MET327 (Dynamics) during the spring quarter of their junior year. The discipline of Dynamics was also evaluated during the student’s senior year when they take the NCEES Fundamentals Exam. Both FE and data from MET327 in 2008 (7 students), 2009 (23 students) and 2010 (21 students) were evaluated. Commensurate with recent NCEES protocol, discipline scores are referenced to national norms. The MET Program expects our students to be within a standard deviation of the FE norms (national or Carnegie).
2. (Design) The goal that students demonstrate “an ability to apply creativity in the design of systems, components, or processes appropriate to program objectives” was evaluated using the ‘RADD’ metric (Requirements/Analysis/Design/Documentation). The ‘design of systems’ ability was evaluated during the student’s senior year when they are expected to participate in MET495: a capstone course required by all ABET accredited programs. Diagnostic data from students in MET495 (15 in 2008, 11 in 2009, and 17 in 2010) were evaluated. Commensurate with recent NCEES protocol, discipline scores are referenced to national norms. The MET Program expects our students to be within a standard deviation of the FE norms (national or Carnegie).
3. (Modern Tools: Testing) Our goal, that students demonstrate “an appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines”, was evaluated using the ‘RPMS’ metric. The ‘mastery of modern tools’ ability was evaluated during the student’s senior year when they are expected to participate in MET495: a capstone course required by all ABET accredited programs. Diagnostic data from students in MET495 (15 in 2008, 11 in 2009, and 17 in 2010) were evaluated. Commensurate with recent NCEES protocol, discipline scores are referenced to national norms. The MET Program expects our students to be within a standard deviation of the FE norms (national or Carnegie).
4. (QC, CQI: Timeliness) Our goal, that students demonstrate “a commitment to quality, timeliness and continuous improvement”, was evaluated using a metric designed to support our mid-quarter and final ‘Design Reviews’. This metric is employed in both the MET495A and MET495B capstone courses (fall and winter).

3. What was learned?

In answering this question, please report results in specific qualitative or quantitative terms, with the results linked to the outcomes you assessed, and compared to the standard of mastery (criterion) you noted above. Please also include a concise interpretation or analysis of the results.

1. (Dynamics) Students demonstrate “an appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines” (e.g. dynamics). The NCEES Fundamentals Exam and Diagnostic

Instruments are intended to include the relevant concepts. As such, no single concept can be evaluated. Other ‘concept inventory’ assessment instruments can be used to identify issues with specific concepts. Fundamental Exam and Diagnostic instruments are ‘valid’ and ‘reliable’, with supporting metadata generated and stored by NCEES.

Discipline Area	# of stdts	Scores: FE Diag in %	% Stds Met 50% Expectation =	NCEES PASS
Dynamics (2008-9)	7	48%	38 %	44%
Dynamics (2009-10)	19	50%	26%	50%
Dynamics (2010-11)	23	43%	54%	63%
Dynamics (2011-12)	27	53%	54%	N/A

Discussion:

Trends over five years indicate that we are approaching our goals in dynamics. Pass rates of over half in the FE are typical of comprehensive universities. We still have 10-15% of students in the Physics pre-engineering program, and have decided to look at a longitudinal study of the data to determine how important it is to parse any data with respect to program affiliation.

2. (Design) Students demonstrate “an ability to apply creativity in the design of systems, components, or processes appropriate to program objectives”. Specifically, MET Seniors (MET495B) over the past few years have been evaluated, regarding ‘design’, using the ‘RADD’ metric. This metric was developed by Dr. Johnson and published via ASEE. There is no database or system at CWU to support comprehensive ‘validity’ or ‘reliability’ metadata. Support of RADD ‘validity’ and ‘reliability’ are not presented here.

RADD (Requirements, Analyses, Design, Documentation) Summary Table:

‘Design’ Areas	Scores (ref 70% goal) (yr1/yr2/yr3/yr4/yr5/yr6/yr7/8yr)	Std Dev (past/current)	% Students that met expectation(80%criteria)
Requirements	60/73/75/71/83/81/81/84	0.98/24	69/62/96/75/82/88/100/93
Analyses	67/69/74/54/86/77/84/46	1.95/16	89/69/64/25/91/82/73/0
Design	55/83/72/72/84/83/89/81	1.78/29	54/85/69/94/91/76/82/86
Documentation	39/77/71/79/85/83/80/19	2.07/5	31/64/88/81/91/82/82/0

Discussion:

Engineering design is a cornerstone requirement of any engineering program, and is required for ABET accreditation. All of the four Design Areas were improved regarding scoring or expectation criteria until this year when a new professor taught the class. There appears to be a general increase in the ‘Requirements’ outcome over the past seven years to a level commensurate with our goal of 80%. Similar trends exist for the ‘Design’ outcome. But the latest data suggests that ‘Analysis’ and ‘Documentation’ are of issue. It is also noted that the standard deviation went up a couple orders. We think this is a result of different interpretations of the metric, and are comparing notes. Longitudinal data may provide some insight to this observation.

3. (Modern Tools: Testing) Students demonstrate “an appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines”. Specifically, MET Seniors (starting in 2008 in MET495C) were evaluated, regarding ‘evaluation’, using the TDR (Testing Design Review) metric. This metric was developed by Dr. Johnson and presented at ASEE. There is no database or system at CWU (yet) to support comprehensive ‘validity’ or ‘reliability’, thus metadata support of TDR ‘validity’ and ‘reliability’ is not presented here.

TDR (contains: Requirements, Test Parameters, Test Methods, Schedule) Summary:

Evaluation Areas	Scores (ref 70% goal) Data for 2008/09/10/11	Std. Deviation (past/current)	% Students that Met Expectation(80%criteria)
Test Requirements	82/83/78/51	1.2/40	93/100/47/36
Test Parameters	79/82/77/65	1.0/24	93/82/35/9
Test Methods	83/83/78/92	1.1/10	89/82/47/82
Test Schedule	81/85/81/83	1.0/28	93/91/82/73

Discussion:

MET students must evaluate their senior projects using appropriate industry practices, and compare their project performance to predictions. These outcomes were met for most areas (though not from all metrics), but the data was not consistent. Again, standard deviations were an order bigger this year, and differences in application of the metrics seem apparent. We will continue to observe this issue as we discuss our techniques within the faculty.

4. (QC, CQI: Timeliness) Our goal, that students demonstrate “a commitment to quality, timeliness and continuous improvement”, is assessed with metrics given in MET493B (winter quarter) as shown below:

TDR (contains: Requirements, Test Parameters, Test Methods, Schedule) Summary:

Evaluation Areas	Scores (ref 70% goal) Data for 2011/12	Std. Deviation (current)	% Students that Met Expectation(80%criteria)
495B CDR#6, 3k	79/78	9	64
495B MDR#6, 3k	86/77	14	82

Discussion:

The CDR metric is given midterm, the MDR is given at the end of the class. In general we have consistent behavior (see the standard deviations) shows reasonable performance over the quarter. We will continue to collect this data, and have no comments at this time.

4. What will the department or program do as a result of that information?

In answering this question, please note specific changes to your program as they affect student learning, and as they are related to results from the assessment process. If no changes are planned, please describe why no changes are needed. In addition, how will the department report the results and changes to internal and external constituents (e.g., advisory groups, newsletters, forums, etc.).

All program data is published on the ‘department-shared’ drive (accessed by colleagues and supervisors). MET program faculty (Beardsley and Johnson) review the outcomes and data as they are generated (per quarter). The MET program faculty (currently including Charles Pringle) meet at least monthly with Tasks listed in a file (on the shared drive). The MET program has an Industry Advisory Committee (mandated by ABET) that meets at least two times a year on campus. During the fall meeting the program objectives are reviewed. During the spring meeting the program outcomes are reviewed. The MET IAC generates Tasks that are listed in the meeting minutes and recorded on the MET Task List. An additional CWU program assessment report is generated specifically for CWU administrators. Each spring (after the ASME student conference) at least one newsletter is generated that highlights significant events that occurred during the year. Each MET course has syllabi and schedules on the shared drive, with instructors uploading the appropriate outcomes metric data on their ‘Course Summary’. Each ‘MET course summary’ is generated by the instructor, with any Tasks concurrently loaded onto the MET program Task List as deemed appropriate by the instructor. The MET Task List file is the document that tracks these issues and their disposition.

1. (Dynamics) The MET Program instituted the FE Diagnostic instrument in 2010. We are currently analyzing the metric, its validity and our course content. It would appear our students performed 'average' with regard to national norms, and the trend shows improved student performance. Changes are reviewed each spring.

2. (Design) Only one 'design outcome' metric was discussed in this report, but the trend continues to be favorable. At this time the program will continue to support the historical position of increasing the credits for Senior Design. The MET Program has two course sequences supporting 'design' as a major outcome: MET 418/419 Machine Design, and MET495A,B,C Senior Project. ABET requires MET495 (a 'capstone' course), and many of our program outcomes can be evaluated during this effort. Even with some aberrant data in the last cycle, we judge that our goals are being met in this area.

3. (Modern Tools: Testing) The Testing metric shows consistent results until last year. We will follow this longitudinally and determine if changes are appropriate. As above, the MET Program uses MET495 to collect data on student performance in many areas. Use of modern tools in a project evaluation scenario is just one of them. We judge that we are current meeting our goals in this area, but continue to refine our assessment methodology.

One current impact on student performance is the continued work on the New Hogue Addition & Renovation. This still disturbs the execution of labs and completion of course objectives.

4. (QC, CQI: Timeliness) Our students demonstrate "a commitment to quality, timeliness and continuous improvement", but we have just started to apply assessment methodology to support this statement. This information directly supports our current responses to ABET for accreditation purposes.

5. What did the department or program do in response to last year's assessment information?

In answering this question, please describe any changes that have been made to improve student learning based on previous assessment results. Please also discuss any changes you have made to your assessment plan or assessment methods.

Human Resources: The I&ET Department Chair controls the scheduling and workload of the two MET faculty. The MET Program fields more courses than two faculty can teach, so we use adjuncts and other resources. One human resource is an 'administrative' faculty (as stated in the 'Job Description'). This faculty is Mr. Pringle, who taught two MET courses last year. Adjuncts include Mr. Cattin (MET255, 345, 355, etc.). Dr. Johnson coordinates the MET program. It was recently announced that a new faculty member was to be hired, but a job description is not available at this time.

General: The MET Program is accredited by the TAC of ABET. Thus, the management of assessment processes is critical to the program (and university). The MET faculty believe that CWU assessment methodology is not sufficient at this institution. For example, there is no 'on-demand' data sharing system in place, and no lower division course outcomes are available to the MET faculty. Specifically, no alumni feedback (from CWU MET graduates) is available to respond to ABET regarding our success at meeting our Objectives (the first 'weakness' listed in our accreditation response).

1. (Dynamics) We continue efforts on the FE preparation in all areas, including dynamics. Specifically, we introduced a new course: MET488 FE Preparation. For four years both Roger Beardsley and Craig Johnson taught weekly sessions that were scheduled by discipline topic. Just last year a formal course was accepted into our program (MET488). These class sessions lasted through winter into spring quarter and culminated in a 'practice test' given a week prior to the actual exam in April. A 'professional' course like this is quite common, and the overlying theme is to prepare our students for a successful career. This has been a major success, and our current FE pass rates show it (70% vs. below 50%). Our specific needs/response to support dynamics are still occurring.

2. (Design) The MET Program has developed a number of assessment instruments addressing both ABET and internal student learning outcomes: RADD (design), CDR (systems design), MDR (manufacturing design) and TDR (test design). The department has continued to deny our request to increase credits our MET 495 capstone design courses (currently at 3 credits, 3 contact). We are currently working with EET and IT faculty to combine some aspects of our shared outcomes for a capstone course, and perhaps realize some synergy and efficiency of our workload. This is the first year that EET has participated in the capstone course.

3. (Modern Tools: Testing) The design assessment instrument shows reasonable results, so we have taken no actions. It will be interesting to see how/if the new building affects this metric, as well as multiple instructors. There is a need for both metadata (validation and reliability), as well as better presentation of this type of data, though the department has only approved workload plans with minimal research allocation.

4. (QC, CQI: Timeliness) Our assessment of students ability to demonstrate “a commitment to quality, timeliness and continuous improvement” is still at the start (with two data points). The trend is positive, and we are optimistic that our goals will continue to be met.

6. Questions or suggestions concerning Assessment of Student Learning at Central Washington University:

The MET Program has opted to collect and store data on our department shared drive, as it is the only available option for ‘transparent’ storage and access. ABET accreditation visit occurred on November 15-17 of 2009. As such, the MET Program did not have access or support for Student Learning Assessment of our core and support courses (as required by ABET) or graduate objectives information (in any format that has ‘transparent’ storage and access. The ABET visitation team did not have access all appropriate data via their wireless laptops, and fell back on a terminal (provided) with real-time face-to-face queries). The MET program was given a ‘2R’ accreditation, so we will be writing a report in two years for sustained accreditation. We are applying for this review in January of 2013. We are still concerned about writing the ABET response, and cannot support our ‘weakness’ in measuring ‘Objectives’ with data from our graduates. The MET faculty encourage CWU to allow access to MET alumni survey information for this purpose.