Central Washington University
Assessment of Student Learning
Department and Program Report

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

Academic Year of Report: __2011-2012__ College: CEPS
Department ETSC_____ Program: M.S., Engineering Technology

1. What student learning outcomes were assessed this year, and why?

The MSET program has six learner outcomes. The assessment plan uses elements from each course in the core, plus the IET526, Engineering Project Cost Analysis. The outcomes are listed below:

1. Access information databases on details of recent technological innovations in areas such as materials, manufacturing, electronics, design, and instrumentation;
2. Learn how to conduct research in an efficient manner;
3. Present results of research in a clear and concise manner, both verbal and written;
4. Understand how products are designed and developed in the commercial sector with knowledge of design, manufacturing processes, materials, and information transfer;
5. Develop analytical and practical techniques to analyze systems of related components such as manufacturing facilities, machinery, and fluid/thermal systems; and
6. Develop an interdisciplinary approach to problem solving by utilizing knowledge of electronics, mechanics, materials, manufacturing and economics.

The following sections demonstrate how the MSET learning outcomes are tied to I&ET, CEPS, and university goals and mission:

MSET Learning Outcome 1

Access information databases on details of recent technological innovations in areas such as materials, manufacturing, electronics, design, and instrumentation

I&ET Goal 10: Promote lifelong learning for students, faculty and staff.
CEPS Goal 1: Provide for an outstanding academic and professional growth experience.
University Mission: Encourage professional growth

MSET Learning Outcome 2

Learn how to conduct research in an efficient manner

I&ET Goal 10: Promote lifelong learning for students, faculty and staff.
CEPS Goal 1: Provide for an outstanding academic and professional growth experience.
University Mission: Encourage professional growth

MSET Learning Outcome 3

Present results of research in a clear and concise manner, both verbal and written

I&ET Mission: Prepare students for professional technical employment.
CEPS Mission: Prepare students to enhance their professions.
University Mission: Encourage professional growth

MSET Learning Outcome 4

Understand how products are designed and developed in the commercial sector with knowledge of design, manufacturing processes, materials, and information transfer

I&ET Mission: Prepare students for professional technical employment.
CEPS Mission: Prepare students to enhance their professions.
University Mission: Encourage professional growth

MSET Learning Outcome 5

Develop analytical and practical techniques to analyze systems of related components such as manufacturing facilities, machinery, and fluid/thermal systems

I&ET Mission: Prepare students for professional technical employment.
CEPS Goal 2: Prepare students to participate in an increasingly diverse economy.
University Mission: Encourage professional growth

MSET Learning Outcome 6

Develop an interdisciplinary approach to problem solving by utilizing knowledge of electronics, mechanics, materials, manufacturing and economics

I&ET Mission: Prepare students for professional technical employment.
CEPS Mission: Prepare students to enhance their professions.
University Mission: Encourage professional growth.

2. How were they assessed? & 3. What was learned?

MSET Learning Outcome 1

Access information databases on details of recent technological innovations in areas such as materials, manufacturing, electronics, design, and instrumentation

Course #	Course Name	Term	Learning Outcome	Assessment Method	Standard of Mastery
IET501	Industrial and Academic Research Methods	Fall	Students will be able to identify and find sources of information for conducting reviews of literature.	Literature review portion of the research project prospectus paper (class term project).	Students will identify and obtain a sufficient amount of credible information sources to justify the need for their proposed study and justify their selected research method.
IET523	Emerging Technologies	Fall	Students will be able to locate, interpret, and synthesize information about emerging technologies in various disciplines.	Class term project.	Students will identify and obtain a sufficient number of information sources to foster ideas for the proposed innovations in their term projects and to support their plans for protecting the intellectual property that could result from their proposed innovations.

What Was Learned?

Students continued to demonstrate a high level of ability to locate needed information resources. Regarding the previous year's observation that students were not always obtaining resources that were produced with the proper level of rigor, there was improvement over prior results. Extra instruction was provided in both IET501 and IET523 about how to judge the credentials of an information resource and about the importance of matching the credentials of an information resource with the requirements of the work being done. Also, IET501 students spent one class section at the library, receiving additional training from the reference librarian. The quality of works cited in student reference lists

seemed to improve as compared with the prior academic year, meaning that students more frequently resorted to academic and technical journals. In order to obtain quantifiable results in the future, the instructor of IET501 and IET523 has identified a metric to quantify the quality of works cited. Future assessments will include data about the proportion of works cited that came from acceptable sources.

MSET Learning Outcome 2

Learn how to conduct research in an efficient manner

Course #	Course Name	Term	Learning Outcome	Assessment Method	Standard of Mastery
IET501	Industrial and Academic Research Methods	Fall	Students will be able to set up full- and fractional- 2^k industrial experiments using standard design of experiments procedures, conduct the experimental runs, and analyze the results.	Class design of experiments (DOE) project.	The experimental design will assess the effects of the project's control factors, using the minimum amount of trial runs while maintaining the desired alpha level.
IET501	Industrial and Academic Research Methods	Fall	Students will be able to write a research proposal and outline the body of a research report and a thesis paper according to university and APA style requirements.	Research project prospectus paper (class term project).	The student's proposed research method will be correctly matched to the problem statement and will not contain any extraneous elements.

What Was Learned?

The logic for applying DOE principles is very cut and dried. As long as the students can correctly assess the nature of the problem, identify and categorize input factors, and determine how to measure outcomes, then applying the DOE principles is a pretty straightforward task. Students in IET501 correctly configured the experimental designs for their assignments. Performance was at 100%, since they would not have been able to complete their analyses if the experimental designs were not properly configured.

In the prior year's assessment, student performance in selecting appropriate research methods was deemed to be less than desired, as a whole. During the AY2011-2012, students were scored on the acceptability of the research method in their prospectus papers, based on whether or not the method was appropriate for addressing their proposed research problems. Since this is the first group of students who were assessed in this

manner, the data will serve as a baseline for future comparisons. The aggregate student score for this item during AY2011-2012 was 82%, meaning that students earned a total of 115 points out of 140 possible points (14 students @ 10 points each).

MSET Learning Outcome 3

Present results of research in a clear and concise manner, both verbal and written

Course #	Course Name	Term	Learning Outcome	Assessment Method	Standard of Mastery
IET501	Industrial and Academic Research Methods	Fall	Students will be able to present results of research in a clear and concise manner, both verbal and written.	Conduct a design of experiments (DOE) project, write a report, and present the results.	The student's analysis will be presented in writing with tabulated summary results and supporting analytical graphs when necessary. The information flow will be logical, following standard procedures for DOE analysis. The presentation will be sufficiently clear so that every audience member understands the student's interpretation of the results.

What Was Learned?

AY2011-2012 was the first year for tracking this assessment item. IET501 students were given reporting requirements for their DOE assignments that were in accordance with the expectations as outlined in this level of mastery. Aggregate student scores for DOE assignments were 95% (15 students, 4 DOE assignments). The instructor observed that once students were given guidance about how experimental reports should be formatted and about performance expectations, they were generally able to produce well-organized reports, to apply logic to their analyses, and communicate their findings.

MSET Learning Outcome 4

Understand how products are designed and developed in the commercial sector with knowledge of design, manufacturing processes, materials, and information transfer

Course #	Course Name	Term	Learning Outcome	Assessment Method	Standard of Mastery
IET521	Product Design and Development	Fall	Design a product that applies the principles of Design for Manufacturability, Design for Assembly, and Design for Quality, and user ergonomics.	Final project evaluation	The student's product will be designed in such a way that it is safe and easy to use. The design will also be such that the product can be fabricated and assembled in a quality manner, within specified budget and production rate constraints.

What Was Learned?

Data about student performance on the product development project has not yet been provided by the course's instructor.

MSET Learning Outcome 5

Develop analytical and practical techniques to analyze systems of related components such as manufacturing facilities, machinery, and fluid/thermal systems

Course #	Course Name	Term	Learning Outcome	Assessment Method	Standard of Mastery
IET525	Systems Analysis and Simulation	Fall	Students will be able to model and simulate simple manufacturing, construction, and decision making problems using commercially available software.	Simulation project.	The student's simulation project will employ correct process modeling procedures, it will include all operations in the production of the department's Toys for Tots project, and it will function properly using Pro Model software.

What Was Learned?

Student performance on the project continued to be strong.

Academic Year	# Students	Project Score
2010-2011	27	97%
2011-2012	12	100%

MSET Learning Outcome 6

Develop an interdisciplinary approach to problem solving by utilizing knowledge of electronics, mechanics, materials, manufacturing and economics

Course #	Course Name	Term	Learning Outcome	Assessment Method	Standard of Mastery
IET521	Product Design and Development	Fall	Design a product that applies the principles of Design for Manufacturability, Design for Assembly, and Design for Quality, and user ergonomics.	Final project evaluation	The student's product design will employ materials that balance product quality and safety requirements with process constraints such as the capabilities of available mechanical and electronic manufacturing equipment.
IET526	Engineering Project Cost Analysis	Fall & Spring	Demonstrate an understanding of the theoretical and conceptual basis upon which the practice of financial project analysis is built.	Exams	Students will achieve at least 80% scores on course exams.
IET555	Engineering Project Management	Winter	Student will demonstrate the ability to establish budgets, assign resources, draft proposals, and implement plans.	Given a project scenario, along with requirements, constraints, and resource information, students will create a project baseline plan and budget.	The project's baseline plan will be able accomplish all required deliverables within the time and budget constraints.

What Was Learned?

Student performance in IET526 was measured using performance on exams. This was done because the performance on any one exam question does not measure comprehensive understanding of the subject. The course has three exams, including the final exam. Average performance measurements were as follows:

Academic Year	# Students	Exam 1	Exam 2	Exam 3
2010-2011	24	85%	95%	97.5%
2011-2012	9	91%	85%	94%

The subject matter in this course becomes significantly more difficult throughout the quarter, but moves from abstract concepts to contextual applications of those concepts as the quarter progresses. This seems to fit well with the types of students who enroll in the program, as shown by the improvement in scores from the first exam to the final. It is not known what caused the dip in performance for exam 2 in AY2011-2012. The instructor will pay close attention to performance on exam 2, and the events leading up to that exam, when the course is offered during AY2012-2013.

Students in the IET555 class were also adept at establishing project baseline plans and project budgets. Their term project involves designing a public park and then creating the plan to build the park. Students were required to design a park using a given set of design requirements and design constraints, and then break down the work necessary for building their park design into deliverables and tasks, performing bottom-up budget calculations, and create a project baseline plan. Finally they were required to create a sales proposal and deliver a presentation based on their design, project plan, and proposed budget.

Academic Year	# Students	Aggregate Project Score
2010-2011	26	98%
2011-2012	16	96%

Data about student performance on the product development project for IET521 has not yet been provided by the course's instructor.

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

MSET Learning Outcome 1

Access information databases on details of recent technological innovations in areas such as materials, manufacturing, electronics, design, and instrumentation

In order to obtain quantifiable results in the future, the instructor of IET501 and IET523 has identified a metric to quantify the quality of works cited. Future assessments will include data about the proportion of works cited that came from acceptable sources.

MSET Learning Outcome 2

Learn how to conduct research in an efficient manner

During the AY2011-2012, students were scored on the acceptability of the research method in their prospectus papers, based on whether or not the method was appropriate for addressing their proposed research problems. Since this is the first group of students who were assessed in this manner, the data will serve as a baseline for future comparisons. The aggregate student score for this item during AY2011-2012 was 82%, meaning that students earned a total of 115 points out of 140 possible points (14 students @ 10 points each). Future assessments will present longitudinal reporting of this metric.

MSET Learning Outcome 3

Students will be able to present results of research in a clear and concise manner, both verbal and written.

This was the first year that aggregate student scores were collected and reported for their performance on writing DOE analysis reports. Future assessments will present longitudinal reporting of this metric. In future years, student performance will also be assessed for their performance on delivering oral presentations of their DOE analyses.

MSET Learning Outcome 4

Understand how products are designed and developed in the commercial sector with knowledge of design, manufacturing processes, materials, and information transfer

Data about student performance on the product development project has not yet been provided by the instructor of IET521. A different instructor taught the class during AY2012-2013, and this instructor has already begun the processes of devising some new metrics and analyzing performance. The new and old instructors will work together to devise the new metrics and to take another look the projects from AY2011-2012. The next assessment report will contain analyses of performance from both years.

MSET Learning Outcome 5

Develop analytical and practical techniques to analyze systems of related components such as manufacturing facilities, machinery, and fluid/thermal systems

The program coordinator and the course's instructor will continue to monitor student performance on the simulation project, and will hold discussions to examine the possibility of creating more detailed rubrics for analyzing and reporting performance.

MSET Learning Outcome 6

Develop an interdisciplinary approach to problem solving by utilizing knowledge of electronics, mechanics, materials, manufacturing and economics

The instructors for IET526 and IET555 will continue to monitor student performance.

Data about student performance on the product development project has not yet been provided by the instructor of IET521. A different instructor taught the class during AY2012-2013, and this instructor has already begun the processes of devising some new metrics and analyzing performance. The new and old instructors will work together to devise the new metrics and to take another look the projects from AY2011-2012. The next assessment report will contain analyses of performance from both years.

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

- Provided additional instruction in IET501 and IET523 about how to judge the credentials of an information resource, and about the importance of matching the credentials of an information resource with the requirements of the work being done.
- IET501 students spent one class section at the library, receiving additional training from the reference librarian.
- Added peer editing activities to IET501 for students at milestone stages of their prospectus paper projects (the original plan was to have students critique the research methods of the authors as presented in published articles). Students critiqued the problem statements (specificity, scope, etc.) and proposed research methods of fellow students.
- The IET525 instructor has designed and implemented a process simulation project that requires students to gather data from a real production process, use the data to build a simulation of the process, validate the model, and then run what-if analyses.
- Added a scenario with execution-phase disruptions to planned project activities in the IET555 park design/build project. The scenario required students to devise solutions to the problems that would allow the construction work to continue while minimizing the negative impacts on the project's budget and timeline.
- Note: The intended improvement to IET526, conducting economic analyses for project scenarios, is yet to be implemented.

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

Reduce the frequency of reporting.