

Colorado State University – Pueblo Academic Program Assessment Report for AY 2015-2016

Program: BS in Industrial Engineering

Date: 10 June 2016

Completed by: Jane M Fraser

Assessment contributors (other faculty involved in this program’s assessment): Professors Bedoya, DePalma, Jaksic, Wollega, and Yuan.

Please describe the 2015-2016 assessment activities for the program in Part I. Use Column H to describe improvements planned for 2016-2017 based on the assessment process. In Part II, please describe activities engaged in during 2015-2016 designed to close-the-loop (improve the program) based on assessment activities and the information gathered in 2014-2015. Thank you.

In the Department of Engineering, we use ABET language. “Assessment is one or more processes that identify, collect, and prepare data to evaluate the attainment of student outcomes and program educational objectives. ... “Evaluation is one or more processes for interpreting the data and evidence accumulated through assessment processes. Evaluation determines the extent to which student outcomes and program educational objectives are being attained. Evaluation results in decisions and actions regarding program improvement.” (<http://www.abet.org/network-of-experts/for-current-abet-experts/refresher-training/module-4-quality-improvement-of-student-learning/>)

All assessment data are kept in notebooks in Technology 274, with one notebook per outcome (outcomes a-k are specified by ABET). Each semester, faculty members complete a form reporting on the assessments done in the courses each taught that semester. The assessment data for each outcome are evaluated on a three year schedule. That evaluation and minutes from the department meeting with the discussion and conclusion are presented below the table.

I. Program student learning outcomes (SLOs) assessed in this cycle, processes, results, and recommendations.

A. Which of the program SLOs were assessed during this cycle? Please include the outcome(s) verbatim from the assessment plan.	B. When was this SLO last assessed? Please indicate the semester and year.	C. What method was used for assessing the SLO? Please include a copy of any rubrics used in the assessment process.	D. Who was assessed? Please fully describe the student group(s) and the number of students or artifacts involved.	E. What is the expected achievement level and how many or what proportion of students should be at it?	F. What were the results of the assessment?	G. What were the department’s conclusions about student performance?	H. What changes/improvements to the <u>program</u> are planned based on this assessment?
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<p>(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context</p>	<p>Every outcome is assessed every semester. Outcome (h) was last evaluated in Spring 2016.</p>	<p>(h) is supposed to be assessed in EN 343 Engineering Economics, but we have not had such assessments. It is assessed for the BSE students in their senior project class, EN 488.</p>	<p>All BSIE seniors in EN 488 in Spring 2013, 2014, 2015, and 2016.</p>	<p>At least 75% of students will discuss their project results with respect to global and societal issues (including sustainability aspects of their projects) as evidenced by inclusion of such sections in their final reports.</p>	<p>The goal was met in all semesters.</p>	<p>We concluded that our students are meeting this criterion.</p>	<p>We will make sure that assessments are done in EN 343 in the future. We currently ask students to write separately on the impact of solutions and on sustainability; we will integrate those required paragraphs into one.</p>
<p>(i) a recognition of the need for, and an ability to engage in life-long learning</p>	<p>Every outcome is assessed every semester. Outcome (i) was last evaluated in Spring 2016.</p>	<p>(i) is assessed in EN 101 and EN 215, and EN 488</p>	<p>All students in EN 101 in Fall 2014, Spring 2015, Fall 2015, and Spring 2016. Assessment involves a question on the midterm concerning lifelong learning. All BSIE students in EN 488 in Spring 2013, 2014, 2015, and 2016.</p>	<p>In EN 101, the goal varies somewhat depending on who is teaching the course but the following is typical: The goal for this assignment is for 70% of all students to score at least 8 of 10 available points. In EN 488, each team must include a paragraph describing how they learning new material in order to complete their project.</p>	<p>The goals were met in all classes.</p>	<p>We concluded that our students are meeting this criterion.</p>	<p>We plan to be more explicit with students on what we want in the paragraph describing their lifelong learning. We will continue to require a paragraph related to lifelong learning: describe what you already knew; describe what you needed to learn to complete the project; and describe how you learning that material. The instructions to students in EN 487/488 and the rubric will be revised to reflect this change.</p>

Comments: The chart below is a summary of the assessments for outcome (h). This summary was discussed by the faculty and the result of that discussion is show below. A similar chart and discussion are also attached below for outcome (i).

(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

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Course	Semester	Goal met?	Notes	IE, E, or both?	
EN 343	Fa 15			Both	
EN 487/488	Sp 13	Yes	Five of six reports included appropriate discussion of global and societal issues. All discussed sustainability	Both	Jaksic
EN 487/488	Sp 14	Yes	Four of five five teams discussed global and societal issues: factory in China, recycling. Only the Open-Source Robotic Arm did not discuss such issues. They did not generally include a separate section on such issues.	Both	Jaksic
EN 487/488	Sp 15	Yes	Seven of nine reports had strong discussions. Four projects were related to sustainability. Topics discussed included material choice, utilization of resources, energy use, and more.	Both	Fraser
		Yes	Both primarily IE teams had projects related to sustainability (evacuation and Pueblo county energy savings) and their discussions were strong.	IE	Fraser
		No	Five of the seven (71%)BSE reports had strong discussions.	EN	Jaksic
EN 487/488	Sp16	Yes	The two reports had adequate, but not really strong sections.	IE	Fraser
EN 487/488	Sp16				Jaksic

The evidence shows that our students are able to understand and discuss the impact of engineering solutions.

We stress sustainability as the topic for students to address since sustainability includes the global, economic, environmental and societal context.

Jane Fraser, 11 May 2016

9 May 2016 discussion:

We should continue to ask senior project teams to write a separate paragraph, even if the entire project has a focus on such impacts because we want them to recognize and focus on these ideas at some point during the project. We currently ask teams to provide two paragraphs:

*The report must include a section on the impact of your proposed solution in a **global and societal context**. Issues you may consider include: impact on workers, impact on the local community, environmental issues, and other relevant issues facing the community, state, nation, and world.*

*The report must include a section on **sustainability** aspects of the project. Topics may include optimization of resources, product life cycle, benefits to the current and future generations, etc.*

We will integrate these two paragraphs into one, since sustainability involves a global, economic, environmental and societal context.

We think that our PROPEL funded emphasis on integrating sustainability throughout the curriculum has changed the curriculum and has had an impact on our students. For example, in the senior seminar in fall 2015, Professor Bedoya asked the students to brainstorm sustainability issues in the design of a smart phone and they were successful, with industrial engineering students focusing on manufacturing and material choice and engineering students focusing on design and energy use. We are having an impact on our students. They have to get it: it's their earth.

This section is worth 5 points of the final grade and will be graded using the following rubric:

Points	
5	Impacts of science or technology that are mentioned are appropriate, and the explanation of those impacts is complete. Tradeoffs are considered, as well as how the choice of engineering design affects the impacts.

4	Impacts discussed are appropriate, but explanation is incomplete or unclear.
3	Explanation is clear, but impacts discussed are incomplete or only somewhat appropriate.
2	Impacts mentioned are incomplete or only somewhat appropriate, and explanation is incomplete or unclear.
1	Impacts mentioned are either very obvious or not important, and there is no explanation of them.
0	Section is omitted or has none of the features described above.

Also, the report must include a section on **sustainability** aspects of the project. Topics may include optimization of resources, product life cycle, benefits to the current and future generations, etc.

This section is worth 5 points of the final grade and will be graded using the following rubric:

Points	
5	Section consists of one or more paragraphs. Sustainability aspects are well documented and integrated within the project.
4	Section consists of a single paragraph with appropriate examples, but justifications are incomplete or vague.
3	Section consists of a single paragraph but is not integrated into the project.
2	Section includes a single sentence.
1	Sustainability is mentioned only as a part of another objective.

0	Section is omitted.
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(i) a recognition of the need for, and an ability to engage in life-long learning

We focus on a recognition of the need for life-long learning in EN 101 and assess it by asking on the midterm why engineers need to engage in life-long learning. We all reinforce life-long learning in all Engineering courses. In EN 487/488, the students discuss how you detect and remedy a gap in knowledge; we will make sure the discussion covers the points we discussed. We will assess lifelong learning in EN 487/488 by having the students include a section on it in their reports.

Points we will stress in EN 487/488 discussion:

You detect a gap in knowledge when someone point it out to you, when you feel a lack of certainty, or when you have questions you can't answer. You fill a gap in knowledge by reading books, industry publications, and articles. You can find and ask an expert. In some cases you can learn by trial and error: you can try, make errors, and fix what you did. If you forget something from a previous course, you need to learn it again. Part of life-long learning is reviewing what you knew once so you can apply it again. As you progress in your career, you will accumulate knowledge, but you will also gain professional wisdom. Remembering concepts is more important than details. You need to know where you can find answers. You need to know who you can ask to find answers.

Assessment in EN 487/488: The Senior Design final report must include a section "in which you (briefly) describe knowledge that you did not learn in any engineering course, but that you had to learn in order to complete your project. This section is meant to demonstrate your ability to engage in life-long learning. How did you determine what you needed to learn? How did you select the material and the learning method you used?"

That section is worth 5 points of the final grade and will be graded using the following rubric:

Points	
5	Describes clearly knowledge that was needed and why it was needed; how learning material was located and evaluated; how a learning method was selected; material used to learn the new knowledge; and how the knowledge was applied in the project.
4	All required topics are covered but some are not clearly described.

3	Description is clear but some required topics are omitted.
2	Some required topics are omitted and others are not clearly described.
1	The required section is present, but only minimally completed.
0	Section is omitted or has none of the features described above. Project did not involve learning and using knowledge not learned in an engineering course.

From 10 May 2016 department meeting minutes:

Leonardo reported on a discussion at the IISE national meeting. People recommended against using multiple choice questions to assess this outcome (we already do not do this) and recommended getting students into student organizations to promote lifelong learning. Programs assess the outcome by looking at the percent of students in student organizations. Our department pays the first year of student membership in any one professional organization: IISE, IEEE, ASME, SWE, NSBE, MAES, SHPE; we will put a permanent announcement on the Engineering Majors blackboard so students are aware of this policy.

Jude described how Space Grant projects require lifelong learning. In the required reports, he asks students to answer questions such as: what did you learn, how did you know you needed to learn this material, and how did you choose to learn the material. He doesn't require students to answer all questions. He plans to add examples of good answers to future instructions for the report.

We agreed with Jane's conclusion that we have a good strategy for promoting lifelong learning throughout the program and we have a good method of assessment. The evidence is that our students are meeting this criterion.

We discussed our assessment of lifelong learning in the senior project classes, EN 487 and EN 488. We agreed that most of the attention in that class is appropriately on the project. We will continue to require a paragraph related to lifelong learning: describe what you already knew; describe what you needed to learn to complete the project; and describe how you learning that material. The instructions to students in EN 487/488 and the rubric will be revised to reflect this change.

II. Follow-up (closing the loop) on results and activities from previous assessment cycles. In this section, please describe actions taken during this cycle that were based on, or implemented to address, the results of assessment from previous cycles.

A. What SLO(s) did you address? Please include the outcome(s) verbatim from the assessment plan.	B. When was this SLO last assessed? Please indicate the semester and year.	C. What were the recommendations for change from the previous assessment?	D. Were the recommendations for change acted upon? If not, why?	E. What were the results of the changes? If the changes were not effective, what are the next steps or the new recommendations?
(d) an ability to function on multi-disciplinary teams,	Every outcome is assessed every semester. Outcome (d) was last evaluated in Fall 2014.	“We plan to determine if we are teaching the correct content by asking our advisory boards what they want graduates to know; we plan to review how and what we are teaching about teamwork; and we plan to review how we are assessing teamwork.”	We had an indepth discussion during our BSE advisory board meeting of what the companies look for in teamwork. We worked with Barb Hadley and Fred Stulz to develop a new course on teamwork.	In Spring 2016, the new course was offered as EN 491. We will offer it again in Fall 2016. We are working on plans to make this a permanent course.

Comments: