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Cooperative Education as the Catalyst for Effective and Efficient Assessment of ABET Student Learning Outcomes for an Engineering Program

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Abstract

A comprehensive approach to industry partnerships can provide multiple types of measures and feedback mechanisms to assess student learning outcomes in an engineering program. At Grand Valley State University, a cooperative education program is the catalyst for developing and maintaing industry partnerships that provide consistent and regular external constituent input on students' knowldege, skills and abilities related to ABET student learning outcomes[1]. Constituent input regarding students' knowledge and preparation is provided in multiple and varied ways through direct feedback mechanisms in the workplace.

Input is obtained at various levels, ranging from student-specific to program-level feedback. Individual employers are engaged in student and curricular assessment at various levels and multiple times throughout the curriculum. The framework for assessment and assessment plans are detailed, and examples are provided that demonstrate how this information is evaluated and used for curricular improvement.

The cooperative education program provides assessment of student learning outcomes on a continuous (every semester), annual basis. Online tools allow for easy collection and summarization of input related to student outcomes. In addition to employer input on student abilities, students are required to complete online, distance-learning modules during each cooperative education semester which allow for additional direct measurement of student learning outcomes.

The relationships developed through the cooperative education program lead to different forms of involvement by the employer constituents, including course projects, senior capstone experiences/projects, and advisory boards. These directly address ABET's criteria that students are prepared for engineering practice through a curriculum incorporating appropriate engineering standards and multiple realistic constraints[2].

Introduction

Demonstration that graduates of an engineering program have met the student learning outcomes a-k is required to be compliant with ABET expectations for accreditation. There are many ways that the learning outcomes can be demonstrated, and most commonly is accomplished through assessment of some course-related activity including homework assignments, exams, laboratories, and projects. Some of the learning outcomes are not easy to assess in a typical classroom setting[3], and therefore alternative venues can be helpful in demonstration of the learning outcomes. Also, faculty are often the sole assessors of the student learning outcomes in classroom settings, and including other qualified constituents as assessors in the assessment can result in a more robust and quality process. Internship and co-op programs provide a unique opportunity to have students engage in learning of student outcomes in a different environment from the classroom, and work with, and be assessed by, practicing engineers. These types of programs provide an external constituent perspective and input to the assessment process.

Grand Valley State University (GVSU) has developed a comprehensive assessment and evaluation program that includes a mandatory co-op program as a significant component of the program, that has been recognized as an exemplar in engineering education[4]. This paper will describe the academic and assessment programs at GVSU, and provide examples of how the co-op program enhances them with expanded benefits of constituent involvement in other areas of the curriculum and assessment programs.

Curriculum Overview

The School of Engineering at GVSU offers a bachelor of science in engineering degree with majors in computer, electrical, interdisciplinary, product design and manufacturing, and mechanical engineering. The majors share a mostly common set of foundation courses including: calculus courses, physics and chemistry courses, a writing course, a computer-aided design/computer-aided manufacturing course, a programming course, a digital systems course, a circuits course, a measurements and statistics course, and a co-op preparation course. Each undergraduate major is a secondary admission program. Criteria for secondary admission include completion of all foundation courses with a grade of ‘C’ or better and maintaining an overall grade point average of 2.70 or higher (on a 4.00 scale).

All programs are accredited as co-op programs through ABET. During the co-op program, the student alternates semesters of academic, on-campus coursework with semesters of practice-oriented work hosted by a workplace with engineering-related functions. The academic semesters include the upper-division coursework for each major. Included in each major’s upper-division coursework is a senior capstone design course. The capstone project is interdisciplinary – students from each engineering major work together on selected industry-sponsored projects. The projects are selected by the faculty and typically proposed by the student in conjunction with his/her co-op workplace colleagues.

Co-op Program Overview

All admitted undergraduate students participate in a mandatory co-op program, for a total of twelve months of work experience, during the junior and senior year of the academic program. The cooperative education program is an alternating semester program that the student participates in during the last two years of the academic curriculum after secondary admission. Students work with the same company/organization for each of three four-month-long semesters. A typical sequence for a student is shown in Table 1.

Table 1. Academic/Co-op Sequence

	Fall	***Winter***	***Spring/Summer***
	(Sept.-Dec.)	(Jan.-April)	(May-Aug.)
Year 1			
Year 2			Co-op I
Year 3		Co-op II	
Year 4	Co-op III		
	= Engineering Fundamentals Coursework		
	= Engineering Upper Division Coursework		

Students receive three credits for each semester of co-op, for a total of nine co-op credits applied towards graduation. The student receives a letter grade for each co-op semester which is determined by taking into account the evaluations provided by the work supervisor, and the accuracy and quality of written work. A faculty member monitors and assesses the work of the student in collaboration with the co-op supervisor, including review of weekly student journals and visiting the work site each semester. At the end of every co-op semester, each student is assessed by the company supervisor using an online data collection tool. The assessment tool includes questions that are directly mapped to each of the program student learning outcomes. In addition, a faculty member is assigned as an advisor to each student during the co-op semesters. The faculty member corresponds on a regular basis throughout the semester with the student, and visits the worksite to meet with the student and supervisor to review the student’s work. This process provides two points for assessing the program student learning outcomes for each student.

Additional educational material is covered using modules via distance-learning. These modules target the coverage of professional skills and knowledge that engineering students need but do not easily get from on-campus, traditional technical courses. The content of the modules include material on engineering ethics and professionalism, engineering economy, project management, entrepreneurism, and professional communication. The complete set of on-line modules constitutes a thread of three full courses that are divided over the three required co-op courses. Having exposure to these practice-related issues while being in the workplace presents a unique opportunity for the students to apply what is learned. The online module curriculum for the first co-op semester is show in Table 2 as an example of content covered each co-op semester.

Table 2: Online Academic Content Covered During Co-op Semester I

Engineering Ethics and Professionalism
• personal vs. professional ethics
• engineering as a profession
• understanding codes of ethics
• connection of ethical problem solving to engineering design
• professional responsibility and legal liability
• legal responsibility of engineering
Engineering Economics
• cost vs. price
• time value of money – cash flow diagrams
• simple and compound interest
• time value of money – uniform series factors, gradient series factors
Project Management
• project life cycle
• types of projects
• project stakeholders
• project planning process – project charter, work breakdown structure

Modules are designed to be relatively brief, focused packets of information that could be reviewed within a 30-60 minute timeframe. The modules are delivered via Blackboard, the university-wide, web-based course management software, and consisted of various media including written materials, papers, videos, websites, podcasts, etc. Each module has an associated, short test or quiz that is automatically graded in Blackboard. Students have six to eight modules to complete in a given co-op semester, which is almost equivalent of one lecture-course credit. Modules are 'open' at scheduled times throughout the semester and students are required to complete them during that timeframe. A primary instructor is available for discussion and to answer questions at both regularly scheduled times for phone or video chat, as well as via email, chat or discussion board.

A screenshot showing the online environment for the modules is provided in Figure 1, and a screenshot of part of one of the online modules used during the first co-op semester is provided in Figure 2. Figure 3 is a screenshot of the online quiz environment students access to assess learning of the content provided in each module.

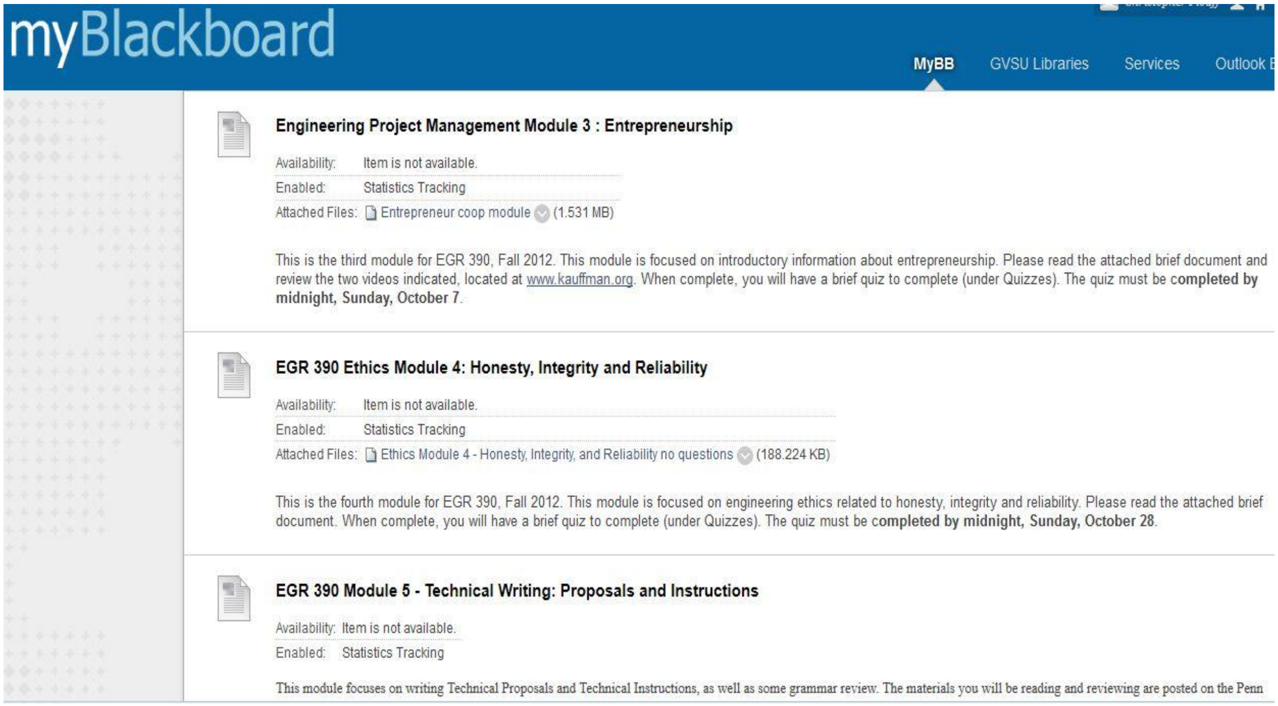
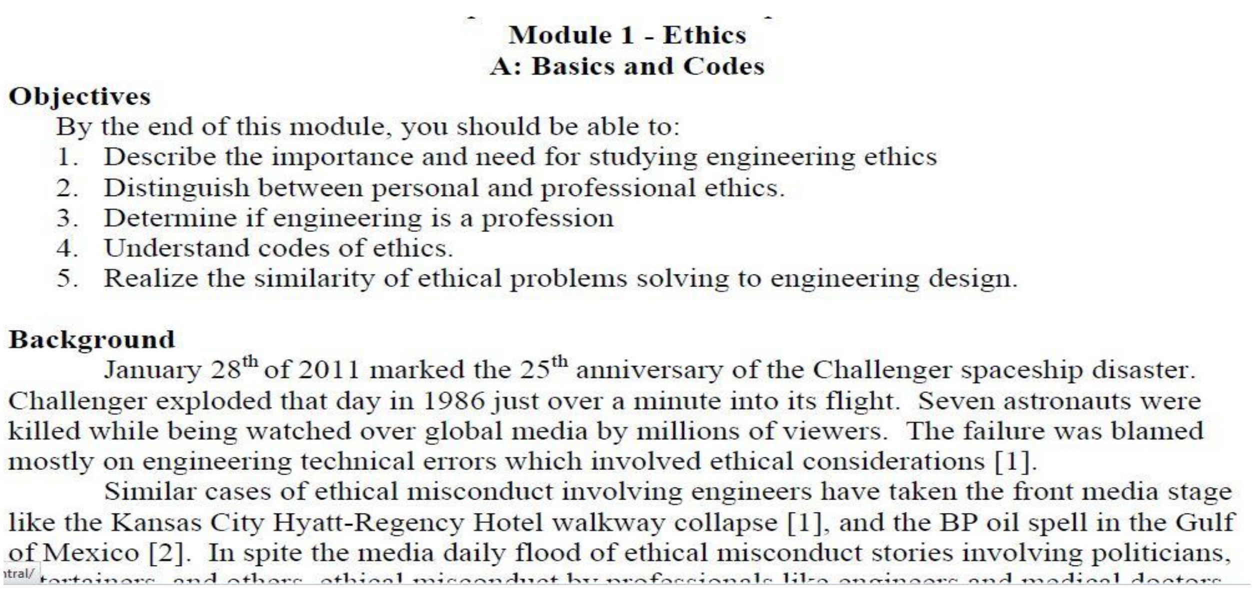


Figure 1: Screenshot of online environment for academic modules used during co-op semesters



Module 1 - Ethics
A: Basics and Codes

Objectives

By the end of this module, you should be able to:

1. Describe the importance and need for studying engineering ethics
2. Distinguish between personal and professional ethics.
3. Determine if engineering is a profession
4. Understand codes of ethics.
5. Realize the similarity of ethical problems solving to engineering design.

Background

January 28th of 2011 marked the 25th anniversary of the Challenger spaceship disaster. Challenger exploded that day in 1986 just over a minute into its flight. Seven astronauts were killed while being watched over global media by millions of viewers. The failure was blamed mostly on engineering technical errors which involved ethical considerations [1].

Similar cases of ethical misconduct involving engineers have taken the front media stage like the Kansas City Hyatt-Regency Hotel walkway collapse [1], and the BP oil spell in the Gulf of Mexico [2]. In spite the media daily flood of ethical misconduct stories involving politicians,

Figure 2: Screenshot of one of the online modules used in the first co-op semester

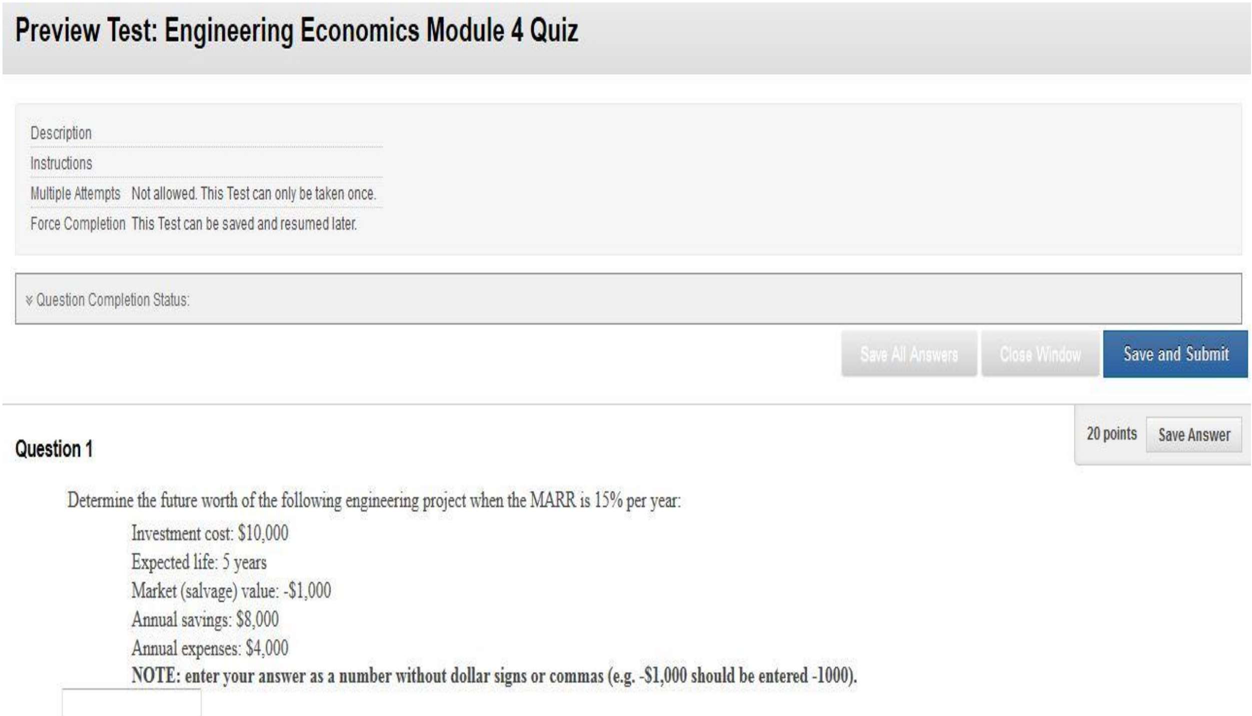


Figure 3: Screenshot of a quiz used to assess learning associated with an online module

Programmatic Assessment and Co-op Assessment

Each major in the School of Engineering has a comprehensive assessment and evaluation plan for reviewing appropriate and effective mastery of student learning outcomes. The plan is a multi-tiered approach that includes input from all major constituents to the program including faculty, students, employers, alumni, and community members. An example of the assessment and evaluation plan is provided in Table 3. Specific assessment and evaluation processes that are connected to the co-op program and industry-sponsored projects generated from the co-op program connections include:

- Employer assessment of student work during mandatory co-op work semesters (three assessments for each student – one for each co-op semester). A group of students is on co-op every semester, and therefore employer feedback is received every semester. Co-op assessments of students contain performance criteria related to achievement of every student learning outcome.
- Visits to student co-op work sites each semester by faculty members, consisting of (minimally) a discussion with the work site supervisor and review of student work. Assessment of the co-op assignment and work product written and submitted for each work site visit for each student.
- Formal and informal feedback on industry-sponsored course projects, including senior capstone design project.

- Industry advisory board meeting feedback conducted at the School-level and program-level once per academic year.
- Review and evaluation of industry feedback in the form of co-op assessments, site visit feedback, course project assessments, and advisory board feedback by program curriculum committee members at least once per academic year. Course and curriculum changes made and documented in program curriculum committee minutes.
- Systematically reviewing and evaluating industry feedback in the form of co-op assessments, site visit feedback, course project assessments, and advisory board feedback by program curriculum committee members. Course and curriculum changes made and documented in program curriculum committee minutes.
- Systematically reviewing and evaluating common items affecting the School (common courses, senior capstone design projects, etc.), arising from program curriculum committee review of industry feedback, by all School faculty. Course and curriculum changes made and documented in School meeting minutes.

As indicated on the plan, assessment information for student learning outcomes is obtained every semester in the form of evaluations of students conducted by the co-op workplace supervisor. The assessment of the student occurs three times – once for each semester of co-op – during the last two years of the degree program. All of the student learning outcomes for each major (ABET outcomes a-k) are covered and assessed. A review of the assessment information obtained during co-op semesters is conducted annually by the faculty of each major from two standpoints: 1) feedback on individual students at three points throughout the year of work completed; and 2) aggregate feedback from all students in a given major for a given semester.

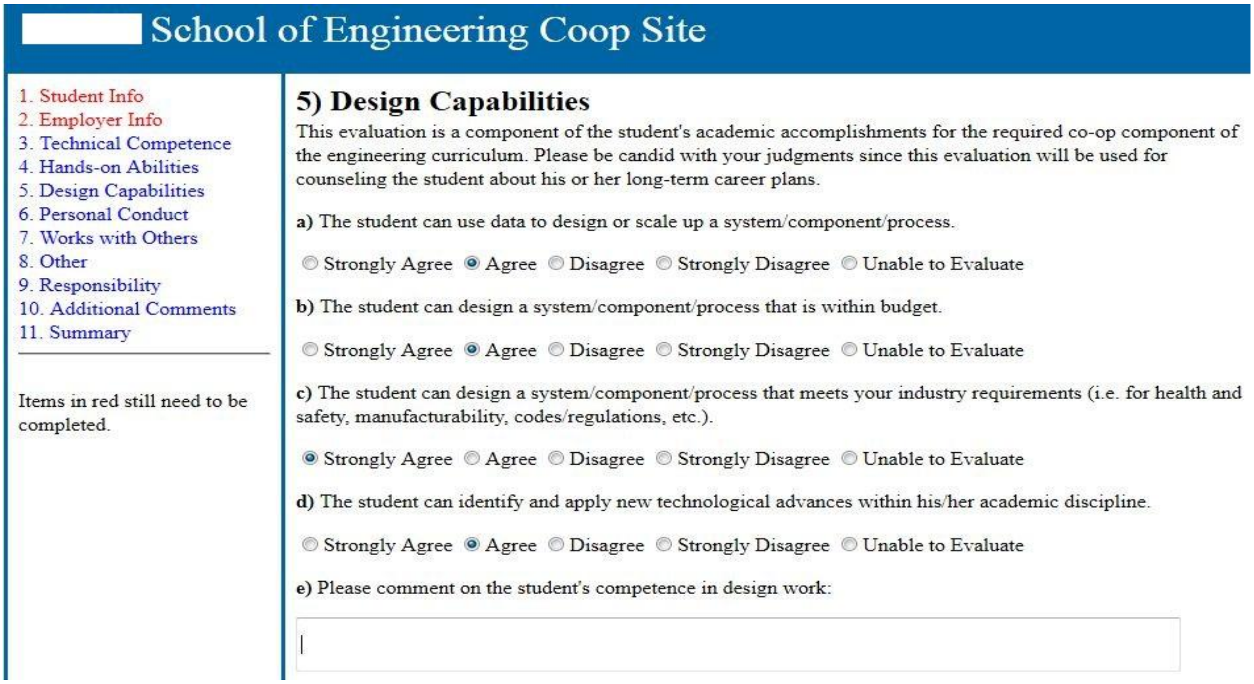
Table 3: Assessment and Evaluation Plan for Student Learning Outcomes

	Summer 2012	Fall 2012	Winter 2013	Summer 2013	Fall 2013	Winter 2014	Summer 2014	Fall 2014	Winter 2015	Summer 2015*	Fall 2015**
Student Learning Outcomes Assessment in Courses/Co-op											
Co-op Prep.		X						X			
Co-op I	X						X				
Co-op II			X						X		
Co-op III		X						X			
Senior Project I			X			X			X		
Senior Project II	X			X			X			X	
Reviewed/Evaluated		X			X			X			X
End of Semester Course Assessments											
Performed	X	X	X	X	X	X	X	X	X	X	X
Reviewed/Evaluated		X			X			X			X
Employer Evaluations of Co-op Students											
Performed	X	X	X	X	X	X	X	X	X	X	X
Reviewed/Evaluated		X			X			X			X
Senior Student Exit Surveys											
Performed	X			X			X			X	
Reviewed/Evaluated		X			X			X			X
Industry Surveys											
Performed	X						X				
Reviewed/Evaluated		X						X			
Alumni Surveys											
Performed	X						X				
Reviewed/Evaluated		X						X			
Industry Advisory Board Meeting											
Meet		X			X			X			
Reviewed/Evaluated			X			X			X		

* ABET Self-study Report Due

** ABET visit

Figure 4 provides a screenshot of the online employer assessment form used to assess co-op students. Figure 5 shows the automatically tabulated summary responses to the employer assessment questions, which are mapped to the student learning outcomes, summarized by major. This particular example shows the summary of two questions that map to the student learning outcome ‘g’: graduates have the ability to communicate effectively.


School of Engineering Coop Site

1. Student Info
2. Employer Info
3. Technical Competence
4. Hands-on Abilities
5. Design Capabilities
6. Personal Conduct
7. Works with Others
8. Other
9. Responsibility
10. Additional Comments
11. Summary

Items in red still need to be completed.

5) Design Capabilities

This evaluation is a component of the student's academic accomplishments for the required co-op component of the engineering curriculum. Please be candid with your judgments since this evaluation will be used for counseling the student about his or her long-term career plans.

a) The student can use data to design or scale up a system/component/process.

Strongly Agree / Agree / Disagree / Strongly Disagree / Unable to Evaluate

b) The student can design a system/component/process that is within budget.

Strongly Agree / Agree / Disagree / Strongly Disagree / Unable to Evaluate

c) The student can design a system/component/process that meets your industry requirements (i.e. for health and safety, manufacturability, codes/regulations, etc.).

Strongly Agree / Agree / Disagree / Strongly Disagree / Unable to Evaluate

d) The student can identify and apply new technological advances within his/her academic discipline.

Strongly Agree / Agree / Disagree / Strongly Disagree / Unable to Evaluate

e) Please comment on the student's competence in design work:

Figure 4: Screenshot of the online tool used by employers to assess co-op students each semester

The student produces written communication that is appropriate for the intended audience.

Major	Strongly Disagree	Disagree	Agree	Strongly Agree	Unable to Evaluate	Average
CE	0	0	8	2	1	3.200
EE	0	0	12	7	0	3.368
IE	0	0	0	0	0	
ME	0	0	32	9	3	3.220
PDM	0	0	10	4	0	3.286
All Majors	**0**	**0**	**58**	**19**	**4**	**3.247**

The student is effective in verbally presenting technical information to others.

Major	Strongly Disagree	Disagree	Agree	Strongly Agree	Unable to Evaluate	Average
CE	0	0	8	3	0	3.273
EE	0	0	12	7	0	3.368
IE	0	0	0	0	0	
ME	0	2	29	11	2	3.214
PDM	0	0	9	4	1	3.308
All Majors	**0**	**2**	**54**	**23**	**2**	**3.266**

Figure 5: Example summary of employer responses to co-op assessment questions for student co-op semesters

In addition, assessment of student learning outcomes occurs on a planned basis in required courses across the curriculum for each major. Most courses are on a two year cycle, with identified student learning outcomes assessed in the given course every two years. Table 3 identifies the co-op preparation course and the co-op semesters (I through III) as courses that are assessed and evaluated (referred to as academic assessment), in addition to the review of employer assessment materials of each student each co-op semester. During the academic assessment of co-op semesters, the online module content is reviewed and evaluated, just as the content and attainment of student learning outcomes of any other academic course would be evaluated.

The student learning outcomes are assessed in required courses according to an assessment matrix developed for each major. All required courses, including the co-op courses, are assigned a numerical value from zero to three. A zero rating indicates that the learning outcome is not addressed in the course, a one indicates the learning outcome is introduced in the course but it is not emphasized or assessed, a two indicates that the learning outcome is emphasized but not assessed in the course, and a three indicates the learning outcome is emphasized and assessed in the course. Figure 6 is the matrix of student learning outcomes assessed in required courses for the Mechanical Engineering program.

Figure 6 includes the co-op courses (I through III) and indicates that the following student learning outcomes (SLO) are assessed as part of the academic assessment plan for the Mechanical Engineering major:

SLO (d) an ability to function on multidisciplinary teams
SLO (f) an understanding of professional and ethical responsibility
SLO (g) an ability to communicate effectively
SLO (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
SLO (j) a knowledge of contemporary issues
SLO (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

As indicated earlier, all student learning outcomes (ABET outcomes a-k) are assessed during the assessments conducted by the workplace supervisors when assessing the co-op student. The academic assessment of the co-op courses focuses on the student learning outcomes identified above (SLO d, f, g, h, j, k) because these outcomes are covered specifically in the online modules during co-op or are common experiences that all students will receive during a given co-op semester. Appendix A provides an example of the assessment report compiled for ‘SLO g’ for the second co-op semester (co-op II) conducted winter 2012.

Program Outcome \ Course	Fundamentals of Engineering (required courses)									Upper Division (required courses)							Co-op			Senior Project	
	EGR 101	EGR 220	EGR 209	EGR 214	EGR 226	EGR 250	EGR 261	EGR 289	EGR 309	EGR312	EGR329	EGR345	EGR360	EGR365	EGR409	EGR468	EGR 290	EGR 390	EGR 490	EGR 485	EGR 486
Rubric: 0 = not covered or minimally covered; 1 = specifically covered, but not emphasized / assessed; 2 = emphasized; 3 = emphasized and assessed																					
a. Apply math, science, and engineering	1	2	2	**3**	**3**	2	2	0	2	**3**	2	2	**3**	2	2	2	1	1	1	2	2
b. Experiments, analyze/interpret data	0	**3**	1	2	2	1	0	0	**3**	0	1	**3**	0	**3**	1	2	1	1	1	1	1
c. Design within realistic constraints	**3**	0	1	2	1	0	**3**	0	1	0	1	**3**	1	2	**3**	2	1	1	1	**3**	**3**
d. Multi-disciplinary teams	**3**	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	**3**	**3**	**3**	**3**	**3**
e. Identify/formulate/solve egr. problems	0	0	2	2	**3**	1	1	0	**3**	1	**3**	2	**3**	2	2	2	1	1	1	2	2
f. Professional and ethical responsibility	1	0	0	0	0	0	0	**3**	1	0	0	1	0	0	1	2	**3**	**3**	**3**	2	2
g. Communicate effectively	2	**3**	1	**3**	0	2	0	2	2	1	1	2	1	**3**	**3**	1	**3**	**3**	**3**	2	2
h. Understand impact of engineering	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	**3**	**3**	**3**	**3**	1	1
i. Life-long learning	0	**3**	0	0	1	**3**	0	**3**	1	0	0	1	1	1	1	**3**	1	1	1	**3**	**3**
j. Contemporary issues	0	0	0	0	0	0	0	**3**	0	0	0	0	1	0	0	**3**	**3**	**3**	**3**	**3**	**3**
k. Modern engineering tools	**3**	2	1	2	2	2	**3**	0	2	**3**	**3**	2	0	1	2	1	**3**	**3**	**3**	2	2

Figure 6: Matrix of Student Learning Outcomes Assessment in Courses for the Mechanical Engineering Major

Co-op as Platform for Course Projects and Other Assessment Sources

Many of the courses in the upper division of each major include project-work as part of the means for assessing student learning. As an example, the Introduction to Product Design, Manufacturing Processes, and Manufacturing Controls Systems courses typically taken in the fall semester following the first co-op system in the Product Design and Manufacturing engineering major share a common project for assessing student learning outcomes. The projects used for these courses are often industry-sponsored projects that are generated from faculty contact with co-op employers during the assessment of co-op students. Sometimes the projects are proposed by the co-op student in conjunction with the sponsoring co-op company representatives. These projects are key in assessing the student learning outcomes associated with those courses.

The senior capstone design project is an industry-sponsored project in 90+% of the cases. The projects are proposed through solicitations of companies via students engaged in the third co-op semester during the final year of the degree program. Projects are selected for appropriateness by the faculty, and interdisciplinary teams of students from across the engineering majors in the School are assigned to complete the projects. Specific student learning outcomes that are assessed as part of the senior capstone design courses include the graduate having:

SLO (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
SLO (d) an ability to function on multidisciplinary teams
SLO (i) a recognition of the need for, and an ability to engage in life-long learning
SLO (j) a knowledge of contemporary issues

The industry surveys that are conducted on a biennial basis as indicated in Table 3 include, but are not limited to, the employers who have hired and supervised co-op students from GVSU over the past several years. The industry survey includes the same questions that are given for the supervisor assessment of a co-op student. The benefit in doing this is that the same questions are mapped to the student learning outcomes and can be compared when receiving assessment input related to an individual student (co-op assessment) and more general input related to graduates of a given major in total. The outcomes of both assessment tools are important and must be carefully reviewed for consistencies, and inconsistencies. What has been found is that an employer will sometimes provide higher ratings when completing a co-op assessment connected to an individual student, but then have somewhat lower ratings when asked to provide input on the same learning outcome as it relates to the graduates of the program (all student and graduates the employer has worked with) in aggregate.

Conclusion

A co-op or internship program provides a unique opportunity to obtain valuable assessment information to evaluate the student learning outcomes of an engineering program. ABET criteria for accreditation states that "students must be prepared for engineering practice through a curriculum culminating in a major design experience…incorporating engineering standards and multiple realistic constraints"[3]. Assessment derived from a co-op program can be used to demonstrate attainment of student learning outcomes while the student is participating in engineering practice. In addition, the co-op program provides for connections to engineering employers that can result in course projects used in various courses, including the senior capstone design course. These types of projects allow students to demonstrate knowledge and skills acquired through course work and the projects will incorporate engineering standards and realistic constraints. Moreover, the type of assessment information that can be obtained through the co-op program, along with follow-on course project assessments and associated surveys, provides for a robust, multi-tiered, and multi-dimensional set of feedback mechanisms generated from multi-constituent sources. These assessment sources provide the type of consistent, on-going input to the engineering program resulting in continuous, contemporary programmatic improvement.

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[2] *Criteria for accrediting engineering programs, 2013-2014*, accessed on 1/7/2013 from http://www.abet.org/DisplayTemplates/DocsHandbook.aspx?id=3149

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Appendix A: Example Student Learning Outcome Assessment Report from the Co-op Program

ABET Outcome Assessment
School of Engineering

Course/Survey/ Event:	EGR 390 Co-op II
Semester:	Winter 2012
Instructor:	XXXXX
Section Enrollment:	67 (total all majors)
Course Enrollment:	67 (total all majors)
Outcome Assessed:	(g) an ability to communicate effectively
Assignment/Problem/ Tool (Survey):	employer semester evaluation of co-op students
Number of Samples Assessed:	CE = 13; EE = 16; IE = 0; ME = 32; PDM = 10
Mean Score/ Result:	CE = 3.40; EE = 3.31; IE = N/A; ME = 3.13; PDM = 3.12 (out of 4.00)
Standard Deviation/ Range of Results:	CE = 0.52; EE = 0.48; IE = N/A; ME = 0.49; PDM = 0.48
Target:	3.20
Observations:	Employers rated the students relatively equally in written communication and verbal communication and above the target level for CE and EE (in other words, employers on average rated students above the 'agree' level for their ability to communicate effectively verbally and in writing). The mean for this outcome was up from a mean score of 3.26 the first semester of co-op (EGR 290). The area that increased this semester over the first co-op semester was effective verbal communication. The level of assessment of students for this outcome was good for CE and EE. The overall rating by employers on communication skills for ME and PDM was below the target level. More specifically, the written communication are met the target level, but the verbal communication areas was below target level. For both ME and PDM, verbal communication was rated as 'Agree' for the

	statement of ‘the student is effective in verbally presenting technical information to other,’ however, this equates to only average. The target is set to indicate that there should be above average performance across all students in this area.
Proposed Actions:	No need for any actions identified through this assessment for CE and EE. For ME and PDM, it is recommended that verbal communication be reviewed further in other assessments and determine if there is a need to provide additional verbal communication training for students.
Date Submitted:	5/11/12

Student Learning Outcome g: an ability to communicate effectively

Employer Evaluation of Student after EGR 390 - Co-op II

Computer Engineering

Performance Criterion	Strongly Disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)	Unable to Evaluate	Mean
a. student produces written communication that is appropriate for the intended audience	0	0	4	2	6	3.33
b. student is effective in verbally presenting technical information to others	0	0	5	4	3	3.44
Summary:	0	0	9	6	9	3.40

Electrical Engineering

Performance Criterion	Strongly Disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)	Unable to Evaluate	Mean
a. student produces written communication that is appropriate for the intended audience	0	0	9	4	1	3.31
b. student is effective in verbally presenting technical information to others	0	0	9	4	1	3.31
Summary:	0	0	18	8	2	3.31

Mechanical Engineering

Performance Criterion	Strongly Disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)	Unable to Evaluate	Mean
a. student produces written communication that is appropriate for the intended audience	0	0	17	6	2	3.26
b. student is effective in verbally presenting technical information to others	0	3	17	3	2	3.00
Summary:	0	3	34	9	4	3.13

Product Design &Manufacturing Engineering

Performance Criterion	Strongly Disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)	Unable to Evaluate	Mean
a. student produces written communication that is appropriate for the intended audience	0	0	6	2	1	3.25
b. student is effective in verbally presenting technical information to others	0	1	7	1	0	3.00
Summary:	0	1	13	3	1	3.12

ABET Outcome Assessment
School of Engineering

Course/Survey/ Event:	EGR 390 – Co-op II
Semester:	Winter 2012
Instructor:	XXXXX
Section Enrollment:	65 (total all majors)
Course Enrollment:	65 (total all majors)
Outcome Assessed:	(g) an ability to communicate effectively
Assignment/Problem/ Tool (Survey):	quizzes on two modules related to technical writing taken during the co-op semester
Number of Samples Assessed:	CE = 12; EE = 16; IE = 0; ME = 31; PDM = 10
Mean Score/ Result:	CE = 72.9; EE = 70.7; IE = N/A; ME = 70.8; PDM = 76.4 (out of 100.0)
Standard Deviation/ Range of Results:	CE = 17.7; EE = 14.7; IE = N/A; ME = 16.8; PDM = 14.2
Target:	75.0%
Observations:	For the second semester of co-op, the ratings of students on quizzes taken related to targeted material on technical writing was below the target level for CE, EE and ME students, and was acceptable (above the target) for PDM students. In general, the scores on the quiz for Technical Writing Module 1: Design and Progress Reports were below target level of 75.0%, and scores for Technical Writing Module 2: Proposals and Instructions were at or above the target level for all majors.
Proposed Actions:	No need for any actions identified through this assessment for PDM. The CE, EE and ME programs' scores were below target levels and should be addressed and should be monitored during the next offering of these co-op modules. The quiz for Technical Writing Module 1 should be reviewed to determine why the mean scores were below target levels for all majors.
Date Submitted:	5/21/12

Student Learning Outcome g: an ability to communicate effectively

Online Module Quiz Scores during EGR 390 - Co-op II

Computer Engineering

Module	<50%	50-59%	60-69%	70-79%	80-89%	90-100%	Mean
Technical Writing Module 1: Design and Progress Reports	2	1	2	3	4	0	69.5
Technical Writing Module 2: Proposals and Instructions	0	1	2	5	1	3	76.3
Summary:	2	2	4	8	5	3	72.9

Electrical Engineering

Module	<50%	50-59%	60-69%	70-79%	80-89%	90-100%	Mean
Technical Writing Module 1: Design and Progress Reports	1	2	2	8	3	0	69.4
Technical Writing Module 2: Proposals and Instructions	0	3	3	5	4	1	72.1
Summary:	1	5	5	13	7	1	70.7

Mechanical Engineering

Module	<50%	50-59%	60-69%	70-79%	80-89%	90-100%	Mean
Technical Writing Module 1: Design and Progress Reports	3	6	7	8	7	0	66.7
Technical Writing Module 2: Proposals and Instructions	1	2	10	3	10	5	74.8
Summary:	4	8	17	11	17	5	70.8

Product Design &Manufacturing Engineering

Module	<50%	50-59%	60-69%	70-79%	80-89%	90-100%	Mean
Technical Writing Module 1: Design and Progress Reports	0	1	1	3	5	0	74.4
Technical Writing Module 2: Proposals and Instructions	0	0	3	2	4	1	78.4
Summary:	0	1	4	5	9	1	76.4