CRITERIA 2, 3, and 4 ONLY

Self-Study Report

(Intro excerpted from Criterion 1)

Self-Study Report
Engineering Program
Bachelor of Science
Upper State University

July 1, 2015

B. Program History

The Engineering program at Upper State University is a general engineering program that serves the regional economy of Northern Upper State, USA. The program has been in existence since 1978.

C. Options

Students may complete a program in Engineering with options in one of four areas: Civil Engineering, Chemical Engineering, Electrical Engineering, and Mechanical Engineering. The degree conferred is the B.S. in Engineering with an option in one of these four areas if the student has satisfied the relevant option requirements. The option is noted on the student transcript, but is not indicated on the degree conferred.

CRITERION 1. STUDENTS

A. Student Admissions

Since the last accreditation visit, overall student enrollment in the Engineering program has nearly doubled. Over the course of this doubling, the average SAT score of admitted students has also increased, as shown in the table below:

Table 1-1. History of Admissions Standards for Freshman Admissions

Academic Year	Composite SAT		Percentile Rank in High School		Number of New Students Enrolled
	Minimum	Average	Minimum	Average	
2005-2006	840	1055	51%	72%	45
2006-2007	835	1065	53%	62%	52
2007-2008	825	1075	48%	68%	59
2008-2009	850	1050	47%	65%	70
2009-2010	830	1062	52%	78%	100
2010-2011	850	1107	55%	75%	95
2011-2012	840	1084	50%	79%	113
2012-2013	870	1089	51%	70%	99
2013-2014	900	1137	55%	76%	107
2014-2015	910	1109	56%	74%	110

All Upper State University (USU) freshman engineering students are admitted and dually enrolled in the Undergraduate University Division (UUD) and the College of Natural Science and Engineering (CNSE). Since enrollment in the Engineering Program in CNSE is limited, the following requirements must be met for admission:

1. Cumulative high school grade point average of 2.5 or higher on a 4.0 point scale
2. Ranked in the top half of high school graduating class
3. SAT composite score of at least 950 or ACT composite of 20 or above.

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CRITERION 2. PROGRAM EDUCATIONAL OBJECTIVES

The Engineering Program at Upper State University has accepted and implemented the use of the term "objectives" as described in the current ABET Engineering Criteria. Hence, the objectives are broad statements that describe the career and professional accomplishments that the faculty of the Engineering program at USU are preparing graduates to attain.

The Program Educational Objectives of the USU Engineering program have existed in a formal document since 1990, although before the early 2000s they were referred to as program goals. The objectives have undergone three revisions, most notably in the latest version written to conform with ABET definitions and evaluation requirements. Our objectives support the mission of both the institution and our college.

A. Mission Statement

Institutional Mission

In its one hundred-year history, Upper State University has been a leader in educating the people of this state. In continuation of this rich tradition, Upper State University maintains its commitment to advancing knowledge and serving a worldwide society. USU is committed to providing access to quality education and expert knowledge, to promoting scholarship and problem solving to address the needs of a global society, to advancing diversity both on our campus and within the community, and to making people matter.

College of Natural Science and Engineering Mission Statement

The CNSE will produce science and engineering graduates who are able to integrate theoretical knowledge and practical application as productive citizens in an ever-changing technological world. The CNSE graduate will have the skills to be a productive member of the community, to work in an interdisciplinary and global framework, and will have an appreciation of the effect of their work on the global society.

B. Program Educational Objectives

The program educational objectives are published in our on-line undergraduate catalog (reproduced below) (**www.usu.edu/ugcatalog**), in college brochures, in recruiting literature, and are posted in our building in various display cases. The program educational objectives for the USU Engineering Program are as follows:

The USU Engineering Program will enable its graduates to:

1. Be effective in engineering design and the practical application of engineering theory
2. Exhibit teamwork and effective communication skills
3. Be characterized by effective leadership skills and high standards of ethics
4. Be successfully employed or accepted into graduate programs
5. Expand their knowledge and capabilities in continuing education or other lifelong learning experiences
6. Serve their communities, whether locally, nationally, or globally.

C. Consistency of the Program Educational Objectives with the Mission of the Institution

The program educational objectives for engineering at USU support the missions of the institution and of the college. As has been noted above, the University mission is one of providing access to quality education and expert knowledge, to promoting scholarship and problem solving to address the needs of a global society, to advancing diversity both on our campus and within the community, and to making people matter. In support of this institutional mission, the CNSE has adopted a mission that is focused on producing science and engineering graduates who are able to integrate theoretical knowledge and practical application as productive citizens in an ever-changing technological world. Graduates of the CNSE programs are expected have the skills to be a productive member of the community, to work in an interdisciplinary and global framework, and will have an appreciation of the effect of their work on the global society.

The program educational objectives listed above are focused on attributes of the graduates that enable them to fulfill the vision that is found in the mission of the University and the mission of the CNSE.

D. Program Constituencies

The principal constituencies of the Engineering program are:

- Engineering faculty,
- Current engineering students,
- Alumni,
- Major donors, and
- Employers.

E. Process for Establishing and Review of Program Educational Objectives

The overall process to determine and approve the current version of the Program Educational Objectives began in the summer of 2004. A first draft of the Program Educational Objectives was presented in early fall by the Curriculum Committee—a representative body of faculty, advisors, and students. All engineering faculty were invited to edit the proposed PEOs; about 50 percent of the faculty responded, which is a good response level for the survey approach used in this exercise. The second draft was presented to our Advisory Council (industrial and alumni advisory board) for comments. While on campus for the fall semester Career Fair (November, 2005), 10 representatives of major employers participated in a lunchtime focus group during which the PEOs were evaluated and discussed. Copies of the PEOs had been distributed to the employer representatives about two weeks in advance of the focus group meeting. Given the input from all of these sources, the final version of the Program Educational Objectives was approved by a unanimous vote of the engineering faculty in April, 2006.

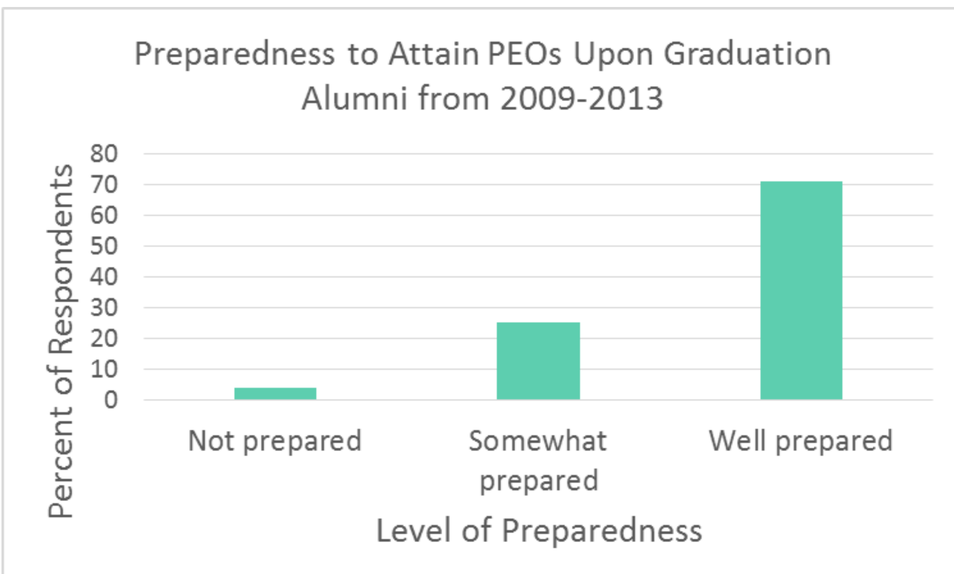
Whether the review of PEOs suggests a need for their revision or not, the following table summarizes the scheduling of constituent input to PEOs

Table 2.1 Summary of Constituent Input to PEOs

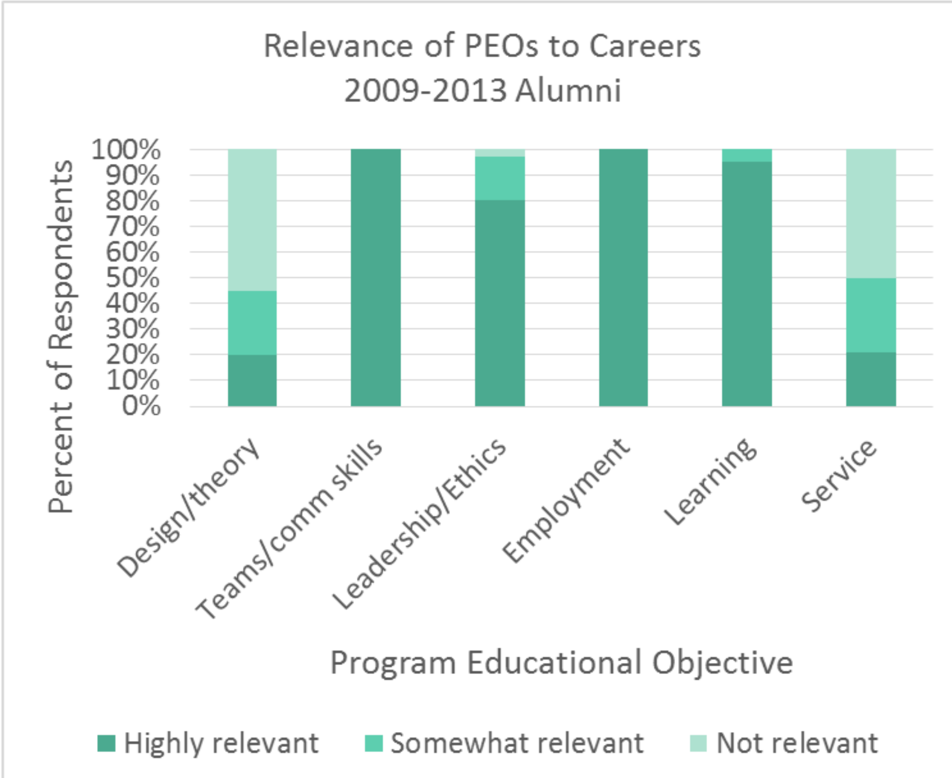
Input Method	Schedule	Constituent
Alumni survey	Every three years	Alumni 2-5 years out
Employer focus group	Every two years during Career Fair	Employers (and recruiters); some are alumni
Advisory Council discussions	As needed—available annually	Industrial representatives, employers, alumni
Curriculum Committee meetings	Available as frequently as needed	Faculty and students

A similar process is used every three years for the review of Program Educational Objectives. Alumni are contacted via a LinkedIn group of Engineering Alumni that is hosted by our career services unit. A link to the survey is provided to the alumni. The survey asks alumni from two to five years post-graduation about both their preparedness as graduate of our program in attaining the PEOs, and about the relevance of the PEOs to their careers. LinkedIn allows alumni to be sorted by graduation date.

Results of the most recent survey in Spring, 2014 indicate that 96% of graduates feel either somewhat prepared or well prepared to attain the Program Educational Objectives in their careers.



Next, when asked whether they felt that the PEOs were relevant to their careers, alumni responded that they felt that all PEOs were highly relevant to their careers with the exception of Design/Theory (#1) and the Service PEOs (#6).



These results were presented to the advisory council, which recommended that the design/theory and service PEOs be kept intact and that they were important in the careers of engineers. They suggested that the responses were due to the particular transitory nature of employment over the period of hiring of these alumni. The faculty accepted the recommendations of the Advisory Council, and the six PEOs were kept intact. The minutes of this meeting are included in the appendix.

CRITERION 3. STUDENT OUTCOMES

A. Processes for Establishing and Revising Student Outcomes

The student outcomes have been formulated to support the achievement of our program educational objectives when the skills, knowledge, and attitudes learned by students in our academic program are put into practice in the workplace or in post-graduate study. These outcomes were confirmed by the faculty as a whole in 1998 when the ABET outcomes were accepted as the program's outcomes. They have been revisited in conjunction with each of the three revisions of our program educational objectives. The process is one in which the faculty first engages in a thoughtful consideration of the program educational objectives based on input from our constituencies then revisits the student outcomes to ensure that they adequately support the program educational objectives. The Engineering student outcomes are intentionally aligned closely with ABET-designated outcomes, and our revisions of student outcomes always take the Engineering Criteria into consideration.

B. Student Outcomes

The student outcomes for the Engineering program at Upper State University are listed below. They have been reorganized slightly into a logical grouping of the knowledge and skills that are subsets of each outcome. In addition, we have added an outcome related to leadership. We have also adopted the Engineering Criteria definition of outcomes as narrower statements that describe what students are expected to know or be able to do by the time of graduation from our program.

1. an ability to identify, formulate, and solve engineering problems
   a) an ability to apply knowledge of mathematics, science, and engineering
   b) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
2. an ability to design and conduct experiments, as well as to analyze and interpret data
3. an ability to design a system, component, or process to meet desired needs
4. an ability to function on multi-disciplinary teams
5. an understanding of professional and ethical responsibility
6. an ability to communicate effectively, both orally and in writing
7. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context a recognition of the need for, and an ability to engage in life-long learning
8. a knowledge of contemporary issues
9. a willingness to assume leadership roles and responsibilities

C. Relationship of Student Outcomes to Program Educational Objectives

The manner in which the student outcomes support the program educational objectives is shown in Table 3.1. In this table, each outcome is associated with those program educational objectives it supports.

Table 3.1 Program Educational Objectives and Supporting Student Outcomes

Student Outcomes	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
1.						
1a	×			×		
1b	×			×		
2	×			×		
3	×			×		
4		×	×	×		
5			×			×
6		×				
7	×			×		×
8				×	×	
9					×	×
10			×	×		

D. Relationship of Courses in the Curriculum to the Student Outcomes

All of the outcomes mentioned above have been operationalized through a process in which each engineering faculty member analyzed the courses that s/he has taught over the last three years and assigned a weighting on the degree to which each outcome was supported by course content and materials. This was facilitated by providing the faculty member a definition of each outcome to help identify its potential coverage in any given course.

Table 3.2 shows working definitions of each outcome for the Engineering program, and Table 3.3a and Table 3.3b (for option courses) demonstrate where these outcomes are operationalized in our curriculum. Since engineering faculty only have a direct influence on the courses taught within our program, the coverage of all student outcomes is guaranteed in the EGR courses alone. Student study in math and basic sciences enhances achievement of outcomes, but engineering faculty members have no consistent ability to influence change in courses taught outside of our program.

Table 3.2 Definitions of Student Outcomes

Student Outcome	Working Definition
Engineering problem-solving	Use of sound reasoning, engineering analysis, creativity, and judgment to identify problems and formulate solutions both for well-defined and ill-defined problems
>Application of math & science	Understanding and properly applying principles from math and science to engineering problems
>Use of engineering tools	Using appropriate engineering tools and techniques, including computational hardware and software, to simplify or automate problem solving (e.g., iterative calculations)
Design & conduct experiments/analyze data	Designing and conducting experiments to test hypotheses, to understand component function, or to investigate phenomena/ using appropriate interpretive methods (graphical, statistical, etc.) to understand data, analyze trends, and draw conclusions
Design component, system, process	The often iterative process of devising a system, component or process, in which basic sciences, math, and engineering sciences are applied to convert resources optimally and within constraints to meet stated needs
Team work (multidisciplinary)	Two or more individuals from different disciplines (options) working together toward successful completion of a mutual objective or two or more individuals in the same discipline assuming different team roles; the skills needed to work in such an environment
Professionalism and ethics	Recognizing the need for an ethical response to a problem or issue and then acting in a manner consistent with integrity, moral standards, and codes of ethics
Communication skills	Efficient and effective writing, speaking, and presenting of concepts and results of a project in an understandable manner to an audience of one or more people
Global, societal, economic, environmental context of engineering	Understanding the effect of engineering solutions on the local, national, and global community
Lifelong learning skills	Pursuing and maintaining currency of knowledge and professional needs; continually improving
Knowledge of contemporary issues	Exhibiting knowledge of current issues that apply to the discipline and being able to intelligently discuss world happenings
Leadership	Responsibly providing or accepting delegation, implicitly or explicitly leading, and/or managing people or technical projects in a way that will achieve excellent results

Table 3.3a Outcomes Mapping for EGR Courses

Eng Outcome	1010	1015	1011	2001	2010	2015	2020	2040	2060	3001	3010	3013	3030	3050	4001	4090	4092
1. Eng. Problem-solving																	
a) Math, science, eng knowledge																	
b) Eng. Tools																	
2. Design																	
3. Expt's & data																	
4. Comm. Skills	**Oral**		**Oral & written**	**Oral & written**						**Oral & written**				**Oral & written**		**Written**	**Oral & written**
5. Ethics and Prof.																	
6. Teams (x-disc.)																	
7. Global, societal, economic, envirnmnt'l context																	
8. Lifelong learning																	
9. Contemp. Issues																	

Table 3.3b Outcomes Mapping for Option Courses

	Chemical					*Civil*				
Eng Outcome	***2021***	***3022***	***3024***	***4060***	***4081***	***2033***	***2034***	***3033***	***4032***	***4034***
1. Eng. Problem-solving										
a) Math, science, eng knowledge										
b) Eng. Tools										
2. Design										
3. Expt's & data										
4. Comm. Skills										
5. Ethics and Prof.										
6. Teams (x-disc.)										
7. Global, societal, economic, envirnmnt'l context										
8. Lifelong learning										
9. Contemp. Issues										

Table 3.3b Outcomes for Option Courses (continued)

	Mechanical					Electrical				
Eng Outcome	*3042*	*3044*	*4008*	*4042*	*4044*	2052	3056	4045	4056	4058
1. Eng. Problem-solving	■		■	■	■	■	■	■	■	■
a) Math, science, eng knowledge	■		■	■	■	■	■	■		■
b) Eng. Tools	■		■	■	■	■	■	■		■
2. Design	■		■		■	■	■	■	■	
3. Expt's & data		■								
4. Comm. Skills		■			■		■			■
5. Ethics and Prof.		■		■	■				■	
6. Teams (x-disc.)		■			■		■			■
7. Global, societal, economic, envirnmnt'l context			■							■
8. Lifelong learning					■			■		
9. Contemp. Issues	■				■	■				■

E. Documentation

At the time of the visit, course displays will be made available. These displays will contain syllabi and examples of student work that demonstrate attainment of outcomes as indicated in Table 3.2, Table 3.3a, and Table 3.3b. Material will be organized by course and each course will be subdivided by relevant outcomes.

F. Achievement of Student Outcomes

Faculty accountability in teaching toward the achievement of their course outcomes according to the outcomes shown on Tables 3.3a and 3.3b is supported by their submission of semesterly Faculty Course Reports (FCRs) in which they give a written account of student learning and provide the student survey outcomes assessment results. The reporting forms are available for faculty as automated forms on the web.

The curriculum is the chief means by which strategies are implemented for student learning to support outcomes and, ultimately, objectives. Co-curricular activities do not involve all students equally, and assessment of outcomes is difficult in such diverse conditions. Therefore, our program has focused its attention on the engineering courses for the learning needed for students to be able to demonstrate the required outcomes AND for outcomes assessment. This learning is distributed across the undergraduate curriculum, as was shown in Table 3.3. While all outcomes may not be covered in each course, when integrated across the curriculum (including the options), students are exposed to learning strategies for all ABET- and CNSE-designated outcomes.

In reference to Figure 2.1, the program's assessment plan uses multiple measures of student outcomes at both the program and institutional level. The outcomes assessment tools used include the following and are described in more detail on Table 3.4:

- Course survey on FCR (program level)
- Year-End survey (program level)
- Senior Exit Interview (program level)
- Co-operative Education Surveys (college level)
- Alumni Survey (institutional with questions added by program)
- CNSE Student Survey

Because of the small student-to-faculty ratio (roughly 16:1), the program faculty members believe that they have a good knowledge of individual student accomplishments and are able to make accurate judgments on the results of the assessment. Where possible, administration of these assessment instruments is staggered throughout the year to avoid respondent "burnout." Even though all outcomes are not assessed each semester, when integrated over the regular process cycle, all outcomes are assessed at some point in the curriculum, as shown in Table 3.4a. Not all outcomes are assessed at the same frequency. Table 3.6 (at the end of this section) shows a timeline of implementation of the main assessment tools and faculty responsibilities in this process. As a means of accountability, all faculty annual reviews include discussion of their participation in the assessment process.

Some of the assessment tools listed in Table 3.4b have been in place for the past 10 years. These assessment instruments include those designed specifically for the Engineering program and those administered by the institution. Table 3.5 shows that assessment of all outcomes is covered by the implementation of the six tools listed above and in these tables. All assessment tool results are based on or converted to a 5-point scale with 5 being high.

Table 3.4a Assessment Cycle (shading indicates assessment)

Eng Outcome	*2008-09 2011-12*			*2009-10 2012-13*			*2010-11 2013-14*		
1. Eng. Problem-solving									
a) Math, science, eng knowledge									
b) Eng. Tools									
2. Design									
3. Expt's & data									
4. Comm. Skills									
5. Ethics and Prof.									
6. Teams (x-disc.)									
7. Global, & societal, economic, envirnmnt'l context.									
8. Lifelong learning									
9. Contemp. Issues									

Table 3.4b Assessment Tools

Tool	Description	Frequency	Last administered
Course survey reported on FCR	Developed by and required by the university, this survey asks students to rate their courses; additional questions added by the Engineering Department query students on their performance in each of the course outcomes	Each semester for all courses	As of the time of this writing, at the end of the Fall, 2014 semester
Year-End survey	Also developed by the Engineering Department, this survey is web-based and is given to students in the four seminar courses. Questions deal with their self-evaluation of performance in the 12 engineering outcomes as integrated over the courses they have taken thus far.	Each year in the seminar courses (in the Engineering Graphics and Design course for 1st-year students)	Fall, 2013
Senior Exit Interview	This interview is conducted by one of the advisors; faculty members are not present. Although the main purpose of this interview is not to assess outcomes, qualitative data on student attitudes toward the program are obtained.	Each year, April in the 2nd-last week of classes	April, 2014
Co-operative Education Surveys	The Cooperative Education Program administers surveys to the co-op and internship students. The surveys are geared towards the student outcomes, and the results are easily and directly incorporated into our review process.	Three times a year after each semester (including summer).	April, 2014
Alumni Survey	While the main purpose of this survey is to gather information on the continued relevance of objectives, this survey also asks for a retrospective view of a graduates performance in each of the twelve outcomes relative to the importance of each outcome in the workplace	Biannually to a targeted audience of alumni 2-4 years post-graduation	March, 2013
CNSE Student Survey	This survey was developed nationally and consists of a variety of questions designed to assess student attitudes in multiple domains, as well as their perceptions of their skills and educational experience. Only seniors participate. This instrument has not provided meaningful data, and is being dropped from the assessment toolkit.	Annually, January	January, 2014

Table 3.5 Coverage of Outcomes by Assessment Tools

Outcome/Tool	Course Surveys	Year-End Student Survey	Senior Exit Interview	Co-op Survey	Alumni Survey	CNSE Student Survey
Eng. Problems	✖	✖	✖	✖	✖	
Math, science, & eng	✖	✖	✖	✖	✖	
Eng. tools	✖	✖	✖	✖	✖	
Design & conduct expts	✖	✖	✖	✖	✖	
Design system	✖	✖	✖	✖	✖	
Multi-discipl. team	✖	✖	✖	✖	✖	✖
Ethics/Prof	✖	✖	✖	✖	✖	✖
Comm. skills	✖	✖	✖	✖	✖	✖
Global, societal, economic, environmental context	✖	✖	✖		✖	✖
Life-long learning	✖	✖	✖		✖	✖
Contemp. issues	✖	✖	✖		✖	✖
Leadership	✖	✖	✖	✖	✖	

Table 3.6 Timetable of Faculty Responsibilities in Outcomes Assessment	
Process Time	**Activity**
Late summer/late fall	1. Review course outcomes and previous FCRs 2. Incorporate any changes for improvement
Fall/Spring	Conduct and record student assessment for designated outcomes Spring: Annual Faculty Reviews
End of semester	1. Conduct USU surveys 2. Complete FCRs • Include SIRS data and direct assessment results 3. Curr. Comm. CEF(s) for all courses
Late Spring semester	1. Web-based survey 2. Senior exit interview 3. Co-op surveys
Early Summer	Collation of assessment results (ABET Coordinator)
Early to Mid-Summer	Meeting of Curriculum Committee to discuss analysis results; make recommendations
Mid- to Late Summer	Recommendations to faculty Suggest changes for curriculum and program improvement

Table 2.2 shows the results of the evaluation process for the most recent set of surveys (2013-14). Some data are still being collected. However, the evaluation of achievement of objectives has been very positive, and changes are not indicated by the results.

Results of Assessment of Outcomes

The assessment instruments listed on Table 3.5 have yielded valuable quantitative and qualitative information about the extent to which student outcomes are achieved by our students at the time of graduation. An underlying assumption is that if achievement of outcomes is demonstrated at a point *before* graduation, then students will not "lose" that proficiency in their remaining undergraduate years. However, since the assessment tools also provide longitudinal data on the development of student performance through the curriculum, these data help identify opportunities for reinforcement of the outcome learning areas.

Integrated results of outcomes assessment are presented in Table 3.7 for the most recent year for which complete data are available. Given the nature of our student body and their areas of employment, our threshold for student performance is that, by the time of graduation, **67 percent of the students perform at level of 3.5/5.0 scale or better** for each outcome. The areas highlighted and underlined on Table 3.7 show areas of potential weakness in outcomes performance by students.

Table 3.7 Integrated Assessment Results 2013-2014 Academic Year

(highlighted/underlined values fall below threshold and are points that have been considered)

Outcome/ Assessment Tool	Year-End Student Survey (by year)	Senior Exit Interview	Co-op Survey (all students)	Alumni Survey	Course Surveys (averages for each AY)
	Percent of Respondents Indicating at or Above 3.5 Performance Level				
Eng. Problems	F=50% S=70% Jr=75% Sr=60%	83%	75%	85%	F=80% S=75% Jr=85% Sr=80%
Math, science, & eng	F=30% S=42% Jr=75% Sr=72%	75%	80%	55%	F=65% S=78% Jr=82% Sr=75%
Eng. tools	F=25% S=54% Jr=80% Sr=90%	93%	90%	85%	F=65% S=72% Jr=85% Sr=90%
Design & conduct expts	F=5% S=26% Jr=53% Sr=89%	95%	50%	75%	F=35% S=58% Jr=67% Sr=85%
Design system	F=7% S=16% Jr=54% Sr=89%	100%	75%	85%	F=25% S=55% Jr=75% Sr=95%
Multi-discipl. team	F=68% S=75% Jr=87% Sr=98%	75%	75%	90%	F=25% S=35% Jr=65% Sr=80%
Ethics/Prof	F=57% S=40% Jr=68% Sr=86%	85%	45%	35%	F=85% S=75% Jr=75% Sr=95%
Comm. skills					
Oral	Fr=78% Sr=80% Jr=54% Sr=90%	85%	75%	85%	F=55% S=75% Jr=85% Sr=95%
Written	F=89% S=57% Jr=67% Sr=90%	90%	60%	55%	F=60% S=25% Jr=45% Sr=55%
Global, societal, economic, environmental context	F=20% S=35% Jr=33% Sr=65%	65%		60%	F=25% S=43% Jr=67% Sr=87%
Life-long learning	F=27% S=55% Jr=78% Sr=89%	75%		85%	F=20% S=55% Jr=84% Sr=95%
Contemp. issues	F=10% S=24% Jr=56% Sr=56%	75%		55%	F=34% S=55% Jr=78% Sr=96%
Leadership	F=25% S=15% Jr=56% Sr=80%	75%	70%	85%	F=25% S=55% Jr=75% Sr=90%

CRITERION 4. CONTINUOUS IMPROVEMENT

A. Information Used for Program Improvement

As has been mentioned, our threshold for student performance is that, by the time of graduation, 67 percent of the students should indicate performance at a level of 3.5 out of 5.0 or better for each outcome. The data presented in Table 3.7 provided information to identify areas of potential improvement (see the areas highlighted in Table 3.7); this information has been used for program improvement.

B. Actions to Improve the Program

Tables similar to Table 3.7 for each assessment cycle are presented in the appendix. These tables show that assessed student performance in writing and in the application of mathematics and science to engineering problem-solving have been weak in the past (2009-10, 2010-11, and 2012-13). This section discusses actions taken to remedy these weaknesses and the results of those actions. Other weaknesses are highlighted in the appendix tables, but in some cases, only one of the several assessment instruments indicates a weakness. In other cases (ethics and professionalism, contemporary issues, global, societal, economic, environmental context), the weaknesses have appeared for the first time. In addition, for the sub-threshold performance in the global and societal context outcome, the results are very near the threshold and have been placed on "hold." Decisions on whether course or program changes are necessary are guided by the Curriculum Committee, faculty judgment, and the validation of results from several assessment sources. Indication of poor performance from one assessment tool may not justify the need for changes. *Recurrence* of weaknesses, even if in the results from one instrument, is given closer scrutiny.

<u>Applications of mathematics & science to engineering problems</u>
To improve student performance in these areas, a linear algebra course was removed from the program in the fall of 2011, and replaced by MTH 3030, Applied Math. The change allowed the students to apply mathematics in the context of engineering soon after they had completed their core of math courses. The linear algebra course taught by the Department of Mathematics and Statistics contained no explicit engineering content.

Table 4.1shows an improvement in math skills as the measures exceed the threshold in all but the alumni category. Given that most of the alumni surveyed would have taken the linear algebra course rather than the applied math course, the alumni response is consistent with the weaknesses of the earlier course sequence. The results in the tables for 2010-11 and 2012-13 are also consistent with the fact that students already in the program were allowed to continue in the original curriculum into which they matriculated into the university, i.e., many took the linear algebra course rather than the applied mathematics course.

Results of the year-end surveys show improvement in the students' ability to apply math from the freshman year on to the senior year with a peak in the junior year. This is the year in which students took the applied math course.

Ability to communicate effectively in writing

We assess oral and written communication skills separately. While results for oral communication skills were good, a weakness was observed in student writing skills and corroborated by faculty knowledge of student performance in courses.

To remedy this weakness, in Fall, 2012, the seminar courses in the sophomore year and beyond, EGR 2001, 3001, and 4001, added significant writing components to their syllabi. In EGR 2001, the course instructor added writing assignments covering ethics and global technology issues. EGR 3001 now includes writing of resumes, cover letters, and a mock lab report in which student papers are returned for editing until satisfactory performance is attained. EGR 4001 includes building of student portfolios in which students evaluate and reflect upon their performance in each of their academic years. Electronic portfolios were used for the first time in 2010-11. EGR 4001 also includes reflective BLOGS in which the instructor poses significant questions requiring student commentary. Examples of the types of issues discussed include evaluation and discussion of the relationship between the engineering curriculum and the required work experience, debate of such issues as global warming, outsourcing, and bio-renewables, and the importance of professional societies. Student writing is graded, even on the BLOGS.

These changes were made in Fall, 2012. Instructors of lab courses have noticed improved grades in preliminary lab reports. It appears that this multi-tiered approach to improving writing skills in our engineering students has already reaped benefits. Formal assessment will be conducted at the end of the Fall, 2015 semester (after the ABET accreditation visit).