PURDUE SCHOOL OF ENGINEERING AND TECHNOLOGY 2004 ASSESSMENT REPORT

Prepared by the School's Assessment Committee and Charles F. Yokomoto, Chair
July 1, 2004

Introduction

In its 2002 Assessment Annual Report, the seven department of the Purdue School of Engineering Technology submitted assessment reports for its programs to the Program Review and Assessment Committee (PRAC). Those reports included the following information:

- General outcomes for the program
- PULs associated with the general outcomes
- Measurable learning outcomes
- Where students will accomplish the learning
- How students will accomplish the learning
- Assessment methods used
- Assessment findings
- Improvements put in place and improvements planned based on assessment findings

In 2003, the campus asked that departments submit only the following information:

- Assessment methods used
- Changes made
- Impact of changes

In 2004, the campus request was for more of the kind of information that departments provided in 2004. As of July 1, 2004, four of seven departments have submitted their reports to the School's Assessment Committee, and these reports have been forwarded to the Program Review and Assessment Committee (PRAC). As other departments submit their reports to the school's committee, they will in turn be submitted to PRAC.

The E&T Assessment Committee

The school's assessment committee has been very active since its inception in the fall semester of 1996. Under the guidance of Dr. Charles Yokomoto, Professor of Electrical and Computer Engineering, the committee has met monthly. The members of the current committee are the following:

Hasan Akay, Mechanical Engineering
Tim Diemer, Organizational Leadership and Supervision
Eugenia Fernandez, Computer Technology
Patricia Fox, Organizational Leadership and Supervision and Dean's Office
Sally Frettinger-Devor, Mechanical Engineering Technology
Marjorie Rush Hovde, Technical Communications
Laura Lucas, Construction Technology
Brian King, Electrical and Computer Engineering
Peter Orono, Freshman Engineering
Nasser Paydar, Dean's Office
Armando Pellerano, Mechanical Engineering Technology
Ramana Pidaparti, Mechanical Engineering
Kenneth Reid, Electrical and Computer Engineering Technology

Erdogan Sener, Construction Technology
Wanda Worley, Technical Communications
Charles Yokomoto, Assessment Committee Chair, Electrical and Computer Engineering
H. Öner Yurtseven, Dean

Due to the monthly meetings that the assessment committee has held since its inception in the fall of 1996, members of the committee have a considerable amount of shared understanding of outcomes assessment and how it can be accomplished. The departments were encouraged to determine their own particular ways to implement outcomes assessment, particularly in their choices of their major source of assessment data. In this way, departments could tailor their process to match the organizational personality of its faculty and its curriculum.

Seven Departments—Seven Ways of Doing Assessment

Taken from our School's 2002 annual report and updated to current times, Table 1 characterizes the differences in ways that our seven departments have chosen to implement our common assessment plans. Column 2 of the table describes the whether a department's process is based on its professional accreditation or the IUPUI Principles of Undergraduate Learning (PUL). Two of the departments have developed their assessment programs around the engineering accreditation criteria of the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET/EAC), four by the by the technology accreditation criteria of the Technology Accreditation Commission of ABET (ABET/TAC), and one has chosen to be guided by the IUPUI Principles of Undergraduate Learning (PUL).

Table 1. Characterization of Departmental Assessment Processes.

Department	Basis	Primary Strategy	Supplemental Sources of Assessment Data
Computer Technology (CPT)	ABET/TAC	Assessment in selected courses that cover the department's outcomes	Student self reports of well they feel they have learned the course outcomes using surveys Retention rates, graduation rates, and number of degrees conferred Continuing students satisfaction using in-house survey Alumni satisfaction Employer satisfaction
Construction Technology (CNT)	ABET/TAC	Assess actual learning in all courses taught by full-time faculty and selected courses taught by associate faculty. Each course is assigned one or more of the department's outcomes for assessment.	Student self reports of well they feel they have learned the course outcomes using surveys Retention rates, graduation rates, and number of degrees conferred Continuing students satisfaction Alumni satisfaction Employer satisfaction
Electrical and Computer Engineering (ECE)	ABET/EAC	Assess selected courses with strong emphasis on the senior capstone design course and the senior ethics course.	Focus group discussion with seniors Retention rates, graduation rates, and number of degrees conferred Continuing students satisfaction using in-hours survey Alumni satisfaction Employer satisfaction
Electrical Engineering Technology (EET)	ABET/TAC	Assess how well students feel they have learned the course objectives/ outcomes using surveys	Continuing students satisfaction Senior capstone project Student works in selected courses Retention rates, graduation rates, and number of degrees conferred Alumni satisfaction

			Employer satisfaction
Mechanical Engineering (ME)	ABET/EAC	Assess student self reports of confidence in the course outcomes	Capstone design course Student works (artifacts) in selected courses Student self reports of well they feel they have learned the course outcomes using surveys Retention rates, graduation rates, and number of degrees conferred Continuing students satisfaction Alumni satisfaction Employer satisfaction Exit interview
Mechanical Engineering Technology (MET)	ABET/TAC	Assess actual learning through comprehensive exam or portfolio, depending on the degree program	Student works (artifacts) in selected courses Student self reports of well they feel they have learned the course outcomes using surveys Retention rates, graduation rates, and number of degrees conferred Continuing students satisfaction Alumni satisfaction Employer satisfaction
Organizational Leadership and Supervision (OLS)	PUL	Assess actual learning in selected courses, including the required senior research project course	Graduating senior survey Passing rate on certificate program Retention rates, graduation rates, and number of degrees conferred Continuing students satisfaction Alumni satisfaction Employer satisfaction

Due to a recent changeover to an outcomes assessment based accreditation process, engineering faculty and technology faculty must demonstrate student accomplishment of Program Outcomes that they write for their programs, and these much include eleven, directly or indirectly, eleven program outcomes written by ABET. The EAC and TAC outcomes are similar but not the same, and both sets map quite well into the PULs. Rather than developing a complex outcomes assessment process where both the ABET outcomes and PUL outcomes are assessed, the six ABET directed departments have chosen a strategy of assessing their ABET Program Outcomes and demonstrating through a relational matrix that they cover the PULs.

To show that the eleven ABET outcomes for EAC and for TAC map into the PULs, two tables were developed, Table 2 for engineering programs and Table 3 for technology programs. The engineering mapping differs slightly from the technology matrix in that it demonstrates the quality of the linkage, rating the linkage as strong, moderate, or mild. Both tables show that the eleven ABET outcomes adequately cover the PULs.

TABLE 2. PULS COVERED BY ABET/EAC CRITERION 3, ITEMS A-K

Created by David Bostwick, Oct. 15, 1999

Revised by Hasan Akay and Charlie Yokomoto, May 21, 2002

3 = strong linkage, 2 = moderate linkage, 1 = mild linkage

ABET/EAC CRITERIA #3, items a through k	PULs COVERED BY THE ABET/EAC a-k																			
	PUL 1					PUL 2					PUL 3			PUL 4			PUL 5			PUL 6	
	Core Communication and Quantitative Skills					Critical Thinking					Integration and Application of Knowledge			Intellectual Depth, Breadth, and Adaptiveness			Understand Society and Culture			Values and Ethics	
	a	b	c	d	e	a	b	c	d	e	a	b	c	a	b	c	a	b	c	a	b
(a) - An ability to apply knowledge of mathematics, science and engineering				3		2	2		2	2	2	3	2	3	2						
(b) - An ability to design and construct experiments as well as to analyze and interpret data						3	3	3	2			2		3	1	2					
(c) - An ability to design a system, component, or process to meet desired needs						2	2	3	3	1	3	2	3	3		3					
(d) - An ability to function on multi-disciplinary teams			2												1	3			2		
(e) - An ability to identify, formulate and solve engineering problems		2		3		3	3	3	3	3	3	3	3	3	1	2					
(f) - An understanding of professional and ethical responsibility						2	3					2	1		3	2	1	1	2	3	1
(g) - An ability to communicate effectively	3		3																		
(h) - The broad education necessary to understand the impact of engineering solutions in global societal context											1	2	2			2	2	2		2	
(i) - A recognition of the need for and an ability to engage in life-long learning		3			2		2														
(j) - A knowledge of contemporary issues		2								1					1			2			2
(k) - An ability to use the techniques, skill and modern engineering tools necessary for engineering practice					3							3	2	3							

PULS OVERED BY ABET/TAC CRITERION 1, ITEMS A-K

Created by David Bostwick, Oct. 15, 1999

Revised by Laura Lucas, Eugenia Fernandez, Ken Rennels, Rich Pfile, and Charlie Yokomoto, Dec. 2001

ABET OUTCOMES *TAC CRITERIA #1 items (a) to (k)*	**PRINCIPLES OF UNDERGRADUATE LEARNING ADDRESSED**																			
	# ONE					**# TWO**					**# THREE**			**# FOUR**			**# FIVE**			**# SIX**	
	Core Communication and Quantitative Skills					Critical Thinking					Integration and Application of Knowledge			Intellectual Depth, Breadth, and Adaptiveness			Understand Society and Culture			Values and Ethics	
	a	**b**	**c**	**d**	**e**	**A**	**b**	**c**	**d**	**e**	**a**	**b**	**c**	**a**	**b**	**c**	**a**	**b**	**c**	**a**	**b**
(a) - Demonstrate an appropriate mastery of the knowledge, techniques, skills and modern tools of their discipline				⑨	⑨							⑨		⑨							
(b) – Apply current knowledge and adapt to emerging applications in mathematics, science, engineering and technology						⑨	⑨		⑨	⑨			⑨	⑨		⑨					
(c) - Conduct, analyze and interpret experiments and apply experimental results to improve processes		⑨				⑨		⑨		⑨				⑨							
(d) – Apply creativity in the design of systems, components or processes appropriate to program objectives							⑨		⑨				⑨	⑨		⑨					⑨
(e) – Function effectively on teams			⑨																⑨		
(f) - Identify, analyze and solve technical problems		⑨		⑨		⑨	⑨	⑨	⑨					⑨		⑨					
(g) - Communicate effectively	⑨		⑨								⑨								⑨		
(i) - Understand professional, ethical and societal responsibilities						⑨						⑨						⑨		⑨	
(j) - Recognize contemporary professional, societal and global issues and be aware of and respect diversity										⑨		⑨	⑨		⑨		⑨	⑨	⑨	⑨	
(k) - Have a commitment to quality, timeliness and continuous improvement					⑨					⑨	⑨					⑨				⑨	

Web Sites that Describe Our Assessment Processes

Further information on our assessment processes can be found on the Web. Power Point slide shows that describe the outcomes assessment process of the Mechanical Engineering Department by Hasan Akay, the Organizational Leadership and Supervision Department by Cliff Goodwin, and the School of Engineering and Technology by Charlie Yokomoto can be viewed at

http://www.planning.iupui.edu

How Evidence of Student Learning Is Collected and Reported In E&T

The departments in the Purdue School of Engineering and Technology have well-developed assessment processes, and while each department has developed its own strategy for collecting evidence on individual students and reporting collectively on student performance, there is a considerable amount of commonality. This commonality is due to the close working relationships among the department. Since the fall semester of 1996 department representatives on the schools assessment committee have met regularly to talk about assessment methods, processes, and strategies. In this report each department will describe accomplish both tasks.

Computer Information Technology (CIT)

In the Department of Computer Information Technology, we collect direct evidence (course grades, exams, lab reports, and project reports) and indirect evidence (surveys). The majority of the evidence we collect is tied to our Measurable Learning Outcomes (MLO) which are derived from the accreditation requirements established by the Accreditation Board for Engineering and Technology (ABET). While CIT programs are not ABET accredited, the department has chosen to develop its outcomes assessment program using the Program Outcomes required by ABET. The ABET Outcomes are mapped onto IUPUI's Principles of Undergraduate Learning to demonstrate how our outcomes cover the PULs.

Collecting Evidence on Individual Students

We collect both direct and indirect forms of evidence on learning. Direct evidence is collected in most of our courses. The evidence is collected on each student in the class to provide data for a particular program outcome. This evidence may be computer labs and projects, final exams, homework assignments or project reports

Indirect evidence is collected from individuals using surveys administered by IUPUI's Office of Information Management and Institutional Research (IMIR). Some of the IMIR surveys are sent to all students, and some are sent out to a sampling of students.

Reporting Evidence Collectively

The data that we collect on individual students in our selected classes is summarized into spreadsheets to allow us to analyze the data. We record the number of students meetings the target for the MLO and calculate the percent of the population above target score for each MLO. From this, conclusions are drawn on whether or not students were successful in demonstrating learning for that particular MLO.

The preceding paragraph describes how we report collectively on individual evidence collected in particular classes, but this reflects learning only in particular classes. For each ABET Outcome, we collect data on multiple MLOs which are related to that outcome. We then pool the data over the MLOs to obtain a broader snapshot of learning for a particular ABET outcome. When we collect the same type of data in the same course over several semesters, we also pool that data to get an overall feel for learning outcomes. We can also display data from several semesters in separate columns to allow us to look for trends in the data.

Construction Technology (CNT)

In the Department of Construction Technology, we have an IUPUI Principle of Undergraduate Learning (PUL) linked to each course, and we expect each faculty to submit evidence of student learning for this PUL at the end of each semester. We collect mostly direct evidence in terms of the scoring data generated from all the students who did the work in the all the courses (exams, projects, and essays etc) and some indirect evidence (surveys and faculty feedback). Thus we have over the last several semesters, amassed samples of not only student work but also the teaching materials and rubrics used by the faculty to achieve the student learning and to score student works, respectively. The majority of the evidence we collect is tied to our professional Program Outcomes (PO), which are mapped into IUPUI's Principles of Undergraduate Learning. Our professional program outcomes were written to satisfy accreditation requirements that have been established by the Accreditation Board for Engineering and Technology (ABET).

Individual and Collective Evidence, Direct and Indirect

We have set a departmental goal of 60 % of the students in each course achieving above average scoring (as defined and scored by the instructor) on the work assignment, and then collect data (student scores) from all the students doing the work and compare it to the goal. For the courses that meet the goal, we try to use feedback to refine the work towards its success in teaching the PUL objective and for the courses that do not meet the goal we review the teaching materials and rubrics to try to improve the connection between the student learning and the objective. We also collect samples of student work to represent a range of student abilities on that work item.

We use indirect evidence through the use of the following surveys:

- In-house and campus continuing students satisfaction
- Campus alumni survey

We attempt to collect data from all courses (including the separate sections of the same course) but with more than half of our courses taught with part time instructors, and with no incentive for either full or part-timers to comply with assessment expectations, participation is consistently low.

Electrical and Computer Engineering (ECE)

The Department of Electrical and Computer Engineering collects a considerable amount of evidence of student learning, both direct and indirect, because of our professional accreditation efforts. We collect direct evidence (exams, lab reports, and project reports) and indirect evidence (surveys and focus group discussions). The majority of the evidence we collect is tied to our professional Program Outcomes (PO), which are mapped into IUPUI's Principles of Undergraduate Learning. Our professional program outcomes were written to satisfy accreditation requirements that were established by the Accreditation Board for Engineering and Technology (ABET) in the year 2000.

Collecting Evidence on Individual Students

Direct evidence is collected in core of selected classes, not in every class. This evidence is collected on each student in the class, and the evidence may be final exams, laboratory reports, or project reports. The classes in this core were selected to provide coverage of the department's Program Outcomes.

Indirect evidence is collected from individuals using surveys. Some surveys are administered in all courses, some are administered in the core of selected classes, and some surveys are administered by IUPUI's Office of Information Management and Institutional Research (IMIR). Some of the IMIR surveys are sent to all students, and some are sent out to a sampling of students.

Reporting Evidence Collectively

The data that we collect on individual students in our selected classes is inputted into spreadsheets to allow us to analyze the data. We analyze the data in two ways: First, we calculate the average across students for each outcome assessed. Then we calculate the percent of the population above target core for each outcome. We compare each result with the reference levels that we set for each outcome and for each method of calculation, and conclusions are drawn on whether or not students were successful in demonstrating learning.

The preceding paragraph describes how we report collectively on individual evidence collected in particular classes, but this reflects learning only in particular classes. A broader snapshot is obtained by combining data from several semesters in one of several ways. For some kinds of data, we pool the data by computing averages over several semesters. For other kinds of data, we display data in a table where data from several semesters are shown in separate columns to allow us to look for trends in the data.

Electrical and Computer Engineering Technology (ECET)

In the Department of Electrical and Computer Engineering Technology (ECET), a considerable amount of evidence of student learning is collected because of our professional accreditation efforts. We collect direct evidence (exams, lab reports, and project reports) and indirect evidence (surveys and semester evaluations). The majority of the evidence we collect is tied to our professional Program Outcomes, which are mapped into IUPUI's Principles of Undergraduate Learning. Our professional program outcomes were written to satisfy accreditation requirements that have been established by the Accreditation Board for Engineering and Technology (ABET).

Collecting Evidence on Individual Students

We collect two forms of evidence on learning, direct and indirect. Direct evidence is collected in core of selected classes, and evidence is collected on each student in the class, and the evidence may be final exams, laboratory reports, or project reports. The classes in this core were selected to provide evidence on particular program outcomes.

Indirect evidence is collected from individuals using surveys. Semester assessment surveys are collected from each course each semester.

Reporting Evidence Collectively

The data that we collect on individual students in our selected classes is entered into spreadsheets to allow us to analyze the data. We analyze this data a number of ways: averages across students for individual outcomes, averages of specific items in rubrics to identify strengths and/or weaknesses, and percentage of students reaching and exceeding target expectations.

Freshman Engineering

The Freshman Engineering Program administers three engineering courses in the freshman curriculum. One is a learning community course that orients students to the university, to strategies for student success, and to the engineering profession. The second course is primarily a computer tools class and the third is a computer programming course. There are multiple sections of each course each semester. Exams, quizzes, computer programming and simulation projects, CAD projects, and library research projects are evaluated to measure achievement of course contents. In the learning community course a questionnaire is administered to measure the effectiveness of teams in the final project.

Reporting Evidence Collectively

In all sections of all three courses, a survey is conducted in which students report how well they feel they have mastered each of the course outcomes. These self-reports are tabulated by outcome collectively for all students in each section and compared against pre-determined reference levels for student mastery. This semester the outcome survey results will be tabulated by outcome across sections for the first time.

Plans are being made to administer a common final exam in the freshman computer programming course during the coming academic year to assess learning outcomes for all students collectively in a standardized manner.

It should be noted that the collective assessment of learning goals at the freshman level, while useful for assessing and improving the freshman program, is difficult to correlate with the assessment of learning goals for all baccalaureate engineering graduates collectively. Over half of the students in the freshman engineering courses do not persist in engineering to graduation. On the other hand, many transfer students enter the engineering program at our institution with the freshman courses completed at another university. These diverse enrollment patterns add to the challenge of tracking student learning for a collective body of students.

Mechanical Engineering

A program assessment methodology has been in effect in Mechanical Engineering Department since Fall of 2000 in an effort to prepare for re-accreditation of our program by ABET (The Accreditation Board for Engineering and Technology). As a result, the department has developed a set of 18 program outcomes to meet the ABET requirements. In order to monitor how well the program outcomes are met, a set of course learning outcomes have been declared in each course to define what students are expected to learn in that course. These course outcomes are also mapped to program outcomes to assure the adequate coverage of the program outcomes. The program outcomes have also been linked to IUPUI PULs. This way, by monitoring how well the program outcomes are met we are also monitoring the coverage of PULs.

The department has established several tools for monitoring the degree of competency of students and continuous evaluation and improvement of the program. The tools that are on place fall into direct and indirect evidence categories. Among the indirect evidence tools category, we regularly conduct and analyze several surveys as follows:

1) Course learning outcomes surveys in all courses conducted at the end of each semester to determine self-assessment of students on how well the course outcomes are met. The results of these surveys are analyzed and posted on the web site for faculty to review and reflect upon.
2) Exit surveys on program outcomes conducted at the time of graduation to obtain assessment of graduates on how well the program outcomes are met.
3) Annual student satisfaction surveys to determine student satisfaction with the program.
4) Industrial Advisory Board that provides input on performance and expected qualifications of graduates.
5) Undergraduate Student Advisory Board that provides input on student satisfaction and needs.
6) Alumni surveys for measuring the impact of program outcomes in the performance of graduates.
7) Employer surveys for measuring effectiveness of the program outcomes in the work force.

The direct evidence tools consist of:

1. Feedback from faculty on the results of course outcomes submitted to the department at the end of each semester. These forms are used to document instructor's reflections on the results as well as the changes made and proposed. This information is shared with all ME faculty members.
2. Jury evaluations in some key courses that involve final project reports or presentations in front of an audience of faculty, industry guests, and fellow students. Juries consist of faculty and industry members – shared with all members of the ME faculty.
3. Instructor's assessment of student performance in course outcomes via evaluation of key exams, projects and homework against the course outcomes –shared with the department and the interested faculty.
4. Analysis of results of the Fundamentals of Engineering (FE) exam on students who take it in their senior year. This is a standardized exam, the results of which are used in measuring several of the program outcomes (mostly technical). Even though this is a voluntary exam, it is the first step in receiving professional engineering (P.E.) licensure. The students are encouraged and prepared to take it during the senior year. Currently, 50% of our graduating seniors take it and we have 100% passing record for the last three years. The results are hared with all faculty fro improvement.

The department has been collecting and analyzing most of these data since Fall 2000, which are summarized in the annual assessment reports submitted to the school and a self-assessment report prepared for the Fall 2004 visit of the ABET team.

Mechanical Engineering Technology (MET)

No report was received from the Department of Mechanical Engineering Technology.

Organizational Leadership and Supervision

Syllabi for classes offered by the Department of Organizational Leadership and Supervision at the School of Engineering and Technology include objectives for student learning that are directly connected to the IUPUI Principles of Undergraduate Learning (PUL). Over the length of a semester, each instructor designs one or more assignments that measure student performance with respect to the PUL - based learning objectives shown on the syllabus. Throughout the department a variety of assignments are used to measure PUL - based learning. The most common is a comprehensive assignment that requires students to make use of a broad range of the course content. Typical examples of the comprehensive assignments are reports, term papers and multi - media presentations. Comprehensive assignments of this type normally have due dates that fall within the final few weeks of the semester. In most cases a substantial part of the course grade is at stake.

A scoring guideline (rubric) is created for each of the PUL - based assignments. The rubric specifies minimum performance required to meet the PUL - based objective.

The department compiles information from each instructor at the end of fall and spring semesters. Each faculty member completes an assessment report to indicate the following:

- Which Principles of Undergraduate Learning were included in course objectives?
- What instruments were used to measure student performance in meeting minimum competency for each PUL?
- What scoring guide (rubric) was used to differentiate acceptable from unacceptable performance.
- What percentage of students achieved the specified minimum level of performance for each PUL?
- What changes and improvements in course content and delivery, if any, are implied by the results?

A summary report is prepared at the end of each academic year and submitted to the chair of the school's assessment committee.

Where Are the Departments in Their Assessment Processes?

The departments in the school differ in the degree to which they have been able to close the assessment loop and report on not only their assessment findings but the impact of changes put in place due to assessment findings. Departments that are closer to an accreditation visit are more likely to have closed the loop, and the Mechanical Engineering Department (ME) and the Electrical and Computer Engineering Department (ECE) should be the furthest along in closing the loop. In the fall of 2004, ECE will be undergoing its second accreditation visit under the new process. The ME Department will be visited for the first time under the new process. The Electrical and Computer Engineering Technology Department (ECET), the Construction Technology Department (CNT), and the Mechanical Engineering Technology Department (MET) will be visited under the new process for the first time in the fall of 2006. The Organizational Leadership and Supervision Department (OLS) and the Computer and Information Technology Department (CNT) are not accredited.

Historical Review of Our Department Annual Assessment Reports

Our department assessment reports that were submitted at the end of the 2001-2002 academic year gave a complete overview of each department's assessment process at that point in time, describing their general outcomes, measurable outcomes, courses where students accomplish learning, how the outcomes are assessed, assessment findings, and proposed or implemented changes to improve learning. For their 2002-2003 and 2003-2004 assessment reports, some departments continued to report in a similar manner with updated information on new findings, new changes, and the impact of prior changes, while other departments reported only new information. You may find past reports at http://www.planning.iupui.edu.

All or almost all of the seven departments have chosen to assess their program outcomes on a schedule that spreads the assessment work over several semesters, cycling through the courses that they assess. Thus a report for a particular year may not include assessment data on all of their outcomes, only on the outcomes assessed during that academic year. The ECE and ME reports for 2003-2004 include assessment of all outcomes because of their upcoming fall 2004 accreditation visit.

DEPARTMENTAL ANNUAL REPORTS

As of the date of printing, department assessment reports for the academic year 2003-2004 have been submitted by the following departments and are included in this report.

Computer and Information Technology (CIT)
Construction Technology (CNT)
Electrical and Computer Engineering (ECE)
Electrical and Computer Engineering Technology (ECET)
Freshman Engineering
Mechanical Engineering (ME)
Organizational Leadership and Supervision (OLS)

When a report is received from the Department of Mechanical Engineering Technology (MET), it will be distributed as a supplement to this report.

CIT 2003-2004 AY Assessment Report

Our Assessment Progress

The CIT Department has continued its assessment efforts by gathering and assessing artifacts for various Measurable Learning Outcomes (MLOs) that we have developed for each ABET TAC criterion. By addressing the set of ABET TAC Criteria, the CIT Department believes that the Principles of Undergraduate Learning are also assessed.

This year, artifacts were collected and assessed in eight courses. Results are given in the attached "Outcomes Assessed during AY 2003-2004" document. Our plan is to continue to collect artifacts from a different subset of courses each semester and thus, over a 3-5 year period, accumulate assessment information from all courses in our curriculum.

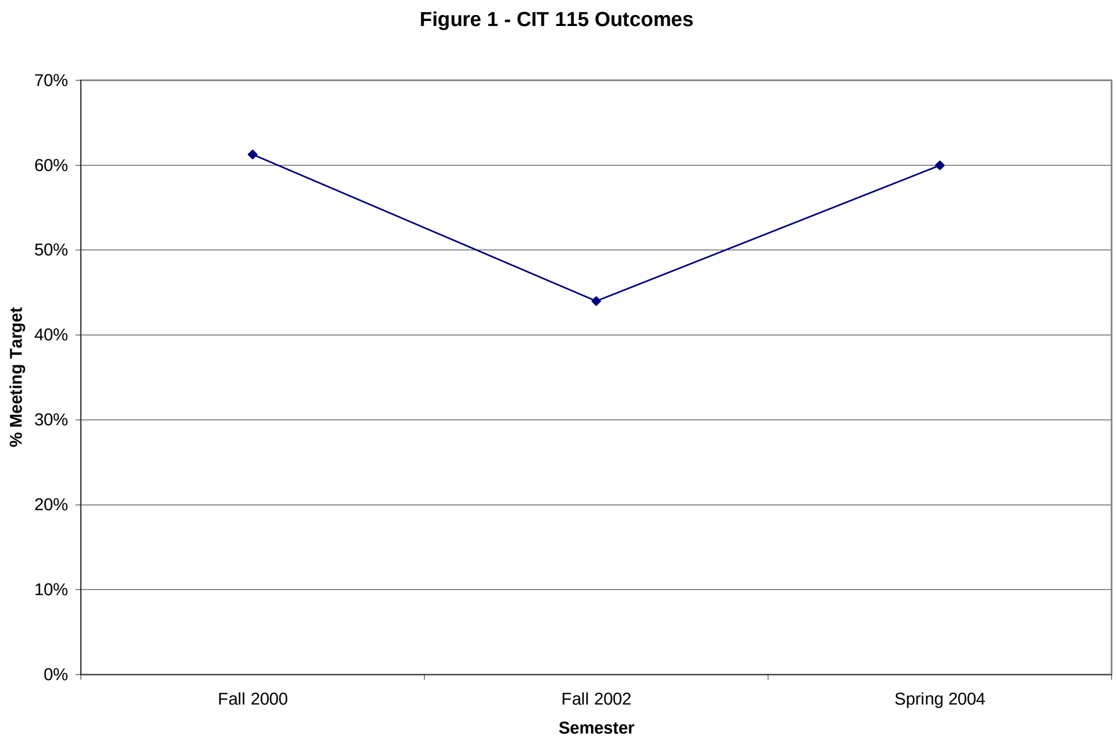
This year, we focused on ABET TAC Criterion a. "Demonstrate an appropriate mastery of the knowledge, techniques, skills and modern tools of their discipline". Collectively learning outcomes for this criterion were acceptable (71% met the target score). However we also looked more closely at outcomes in three courses: CIT 106, CIT 115 and CIT 307. All are survey courses which provide basic knowledge for our degrees. CIT 106 and CIT 115 act as gateway courses for the A.S. while CIT 307 is considered a gateway to the B.S. degree. Last year changes were made in CIT 106 and CIT 115 to improve student learning. Table 2 lists the changes made in these courses based on prior assessment findings.

Table 2: Changes Made in 106 & 115

Course	Changes Made
CIT 106	In collaboration with University College, a student tutoring program, led by previous CIT 106 students, was implemented. An online Skills Assessment Manager was used to test student proficiency in the software. This tool also provides practice tests for students. Web design concepts were eliminated from CIT 106 since they are taught in CIT 223. This provides students with more time to study the other applications. Coverage of vocabulary and basic computer concepts was added to the course.
CIT 115	The course was redesigned to use short lectures utilizing active learning techniques in conjunction with the completion of small projects.

This year, performance on MLO a2 - Demonstrate a proficient level of competency in word processing, spreadsheet, database, graphical presentation, Internet browser and Web publishing software remained satisfactory in CIT 106 with 70% of the students earning a C or higher on the integrated project.

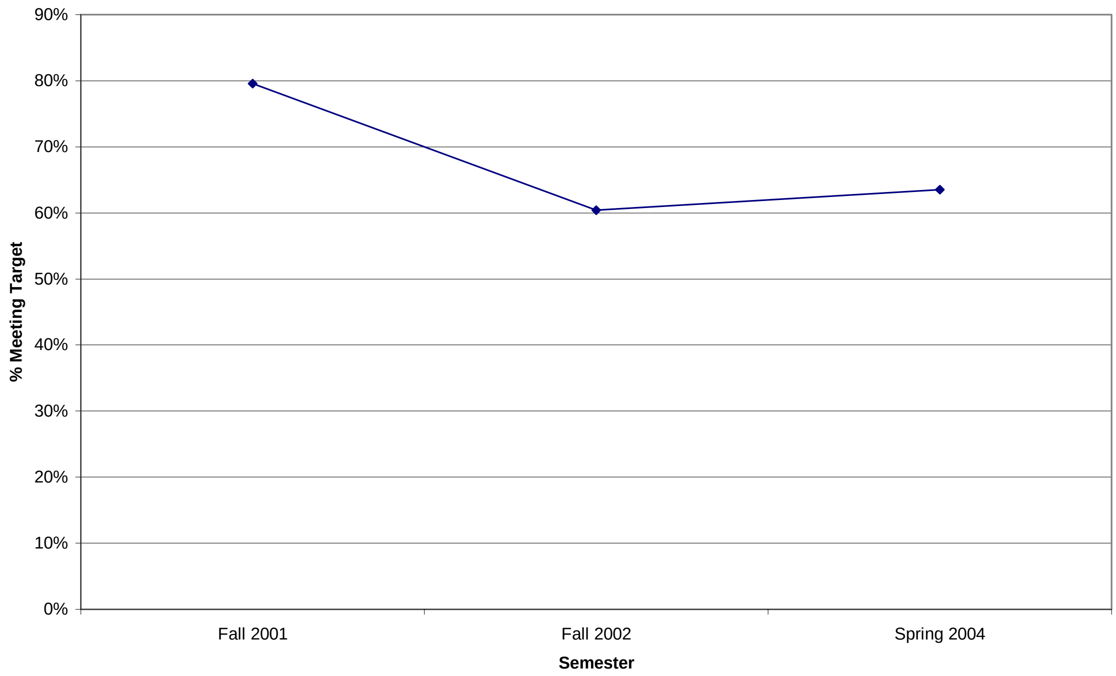
Performance in CIT 115 did not meet our target of 70% of the students at or above 80%. Only 60% of the students in CIT 115 met the target score. As you can see from Figure 1, outcomes in CIT 115 have been and continue to be problematic.



Changes planned for next year will have students help generate rubrics for the assignments thereby increasing their connection to the work. In addition more small-group exercises and in-class debates will be added.

Performance in CIT 307 also continues to be a problem as shown in Figure 2. The course content is being re-vamped to integrate it better with our new Networking Track Plan of Study. More active-learning components will be added as well.

Figure 2 - CIT 307 Outcomes



DEPARTMENT OF COMPUTER & INFORMATION TECHNOLOGY 2004 ANNUAL REPORT
2003-2004 Outcomes Assessed during AY 2003-2004
Prepared by Eugenia Fernandez, June 25, 2004

General outcomes	Associated PULs	Measurable Outcomes	Methods used to assess the outcomes	Assessment findings (baseline from AY 2003-2003)	Improvements (changes) put into place based on assessment findings	Assessment findings (current)	Impact of changes that were put in place
ABET TAC Outcome (a) : Demonstrate an appropriate mastery of the knowledge, techniques, skills and modern tools of their discipline.	1(d), 1(e), 3(b), 4(a), 4(b)	a1. Explain the terminology and basic concepts of information technology.	Assessed in CIT 115 using comprehensive final & term paper Assessed in CIT 307 using comprehensive final.	Only 44% of students in CIT 115 scored 80% or more on the final. Only 60% of the students in CIT 307 scored 80% or more on the final.	CIT 115 was redesigned to use short lectures utilizing active learning techniques in conjunction with the completion of small projects. No improvements made in 307.	Only 60% of students in CIT 115 scored 80% or more on the term paper.	Performance increased, but still did not meet target. In future will have students help generate rubrics and will provide more small group exercises and in-class debates.
		a2. Demonstrate a proficient level of competency in word processing, spreadsheet, database, graphical presentation, Internet browser and Web publishing software.	Assessed in CIT 106 using a "Putting it All Together" project	74% of the students earned a C or better on this assignment.	No improvements were needed since our goal was met.	70% of the students earned a C or better on the project.	Performance on the project in CIT 106 continues to be satisfactory,.
ABET TAC Outcome (b): Apply current knowledge and adapt to emerging applications in technology.	2(d), 2(e), 3(a), 3(c), 4(a), 4(b), 4(c)	b4. Transfer current knowledge to new technologies such as new or different software applications	CIT 325 using Heuristic Analysis	81% of the students earned 80% or better on this assignment	No improvements were needed since our goal was met.	84% of the students earned 80% or better on this assignment	Performance continues to be satisfactory.

General outcomes	Associated PULs	Measurable Outcomes	Methods used to assess the outcomes	Assessment findings (baseline from AY 2003-2003)	Improvements (changes) put into place based on assessment findings	Assessment findings (current)	Impact of changes that were put in place
ABET TAC Outcome (d): Apply creativity in the design of systems, components or processes appropriate to program objectives.	4(b)	d2. Create analysis and design deliverables for information technology applications.	In CIT 254 students create Use Case Scenarios for an application.. In CIT 374 and CIT 384 students, write a single report compiled from work by the entire class.	81% of the students earned 80% or more on this assignment.	No improvements were needed since our goal was met.	52% of the students earned 80% or more on this assignment.	Require more in-class non-graded examples
		d3. Integrate industry standard components into the design of a comprehensive computer solution	In CIT 388 students wrote an object-oriented program which accessed a SQl Server database.	No baseline available.		Only 32% of the students earned 80% or higher on this assignment.	More coverage of database usage; require more UML pre-work
ABET TAC Outcome (f): Identify, analyze, and solve technical problems.	1(d), 2(a), 2(b), 2(c) 2(d), 3(a), 3(c), 4(c),	f2. Apply a problem solving protocol to the solution of technical problems.	Assessed by a lab report in CIT 499 Advanced Network Security	Only 71% of the students earned 80% or more on this lab.	Annotate why students are required to keep a journal. Section journal for notes and troubleshooting.	Only 67% of the students earned 80% or higher on this assignment.	Increase emphasis on problem-solving and communications.

DEPARTMENT OF CONSTRUCTION TECHNOLOGY 2004 ANNUAL REPORT

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Measurable outcomes (desired behaviors)	Associa-ted PULs	Methods used to assess the desire behaviors		Assessment findings (baseline from previous years data)	Improvements (changes) put into place based on baseline findings	Assessment findings (current)	Impact of changes that were put into place
		COURSE WHERE TAUGHT course numbers; ART=Arch; CET=Civil; CNT=Constr	**WORK ITEM TYPE:**	goal of 60% of class scoring above average on the selected work item	As part of the assessment checklist each faculty is asked to make comments on changes/improvements for next time time they teach the course. These comments are collected and collated across semesters.	Focus this year has been on getting faculty to review the improvements they previously listed and/or provide more comments as to improvements	faculty have been reviewing previous change comments for this class for review and feedback. This is still in progress for most faculty and most courses
a- mastery demonstrate an appropriate mastery of the knowledge, techniques, skills and modern tools of their discipline	1d, e, 3 b, 4a, b	ART 120, ART 222, ART 285, CET 231, CET 452, CNT 280, CNT 330, CNT 447, CNT 470, CNT 494	IPJ, FX,GPJ, TX,CA,I BJ,PSH,	A majority of the courses have been meeting the departmental goal of 60%, courses that don't meet the goal are reviewed with more emphasis on connecting course objectives to student learning especially in relationship to the work item.	see listing as appendix A to this report: comments over the last two semesters are listed per course and per teacher	A majority of the courses providing data continue to meet the departmental goal of 60%, but more data from more courses would improve analysis.	Faculty as a whole are more aware of student learning in their courses and more of them are willing to try improvements and report back on the perceived impact of those changes. Faculty participation is still low.
b- knowledge- apply current knowledge and adapt to emerging applications in SME & T	2d, e,	CET 452, CNT 494	FX, TX,CA,I BJ,PSH,	A majority of the courses have been meeting the departmental goal of 60%, courses that don't meet the goal are reviewed with more emphasis on connecting course objectives to student learning especially in relationship to the work item.	see listing as appendix A to this report: comments over the last two semesters are listed per course and per teacher	A majority of the courses providing data continue to meet the departmental goal of 60%, but more data from more courses would improve analysis.	Faculty are becoming more knowledgeable about incorporating measurable objectives in their courses and some adjustments are being made to have this outcome access in more courses. Faculty participation is still low.

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Measurable outcomes (desired behaviors)	**Associa-ted PULs**	**Methods used to assess the desire behaviors**		**Assessment findings (baseline from previous years data)**	**Improvements (changes) put into place based on baseline findings**	**Assessment findings (current)**	**Impact of changes that were put into place**
		COURSE WHERE TAUGHT course numbers; ART=Arch; CET=Civil; CNT=Constr	**WORK ITEM TYPE:**	goal of 60% of class scoring above average on the selected work item	As part of the assessment checklist each faculty is asked to make comments on changes/improvements for next time time they teach the course. These comments are collected and collated across semesters.	Focus this year has been on getting faculty to review the improvements they previously listed and/or provide more comments as to improvements	faculty have been reviewing previous change comments for this class for review and feedback. This is still in progress for most faculty and most courses
c- analysis - conduct, analyze and interpret experiments and apply experimental result to improve process	1b, 2a,b,c 4a,	ART 165, CET 104, CET 160, CET 231, CET 267, CET 312,	PSX,LR, FX,TX,IBJ, PSH,	A majority of the courses have been meeting the departmental goal of 60%, courses that don't meet the goal are reviewed with more emphasis on connecting course objectives to student learning especially in relationship to the work item.	see listing as appendix A to this report: comments over the last two semesters are listed per course and per teacher	A majority of the courses providing data continue to meet the departmental goal of 60%, but more data from more courses would improve analysis.	Faculty as a whole are more aware of student learning in their courses and more of them are willing to try improvements and report back on the perceived impact of those changes. Faculty participation is still low.
d- creativity- apply creativity in the design of system, components or processes appropriate to program objectives	4b	ART 155, ART 222, CET 267, CNT 494	IPJ, FX,GPJ, TX,	A majority of the courses have been meeting the departmental goal of 60%, courses that don't meet the goal are reviewed with more emphasis on connecting course objectives to student learning especially in relationship to the work item.	see listing as appendix A to this report: comments over the last two semesters are listed per course and per teacher	A majority of the courses providing data continue to meet the departmental goal of 60%, but more data from more courses would improve analysis.	Faculty as a whole are more aware of student learning in their courses and more of them are willing to try improvements and report back on the perceived impact of those changes. Faculty participation is still low.

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Measurable outcomes (desired behaviors)	**Associa-ted PULs**	**Methods used to assess the desire behaviors**		**Assessment findings (baseline from previous years data)**	**Improvements (changes) put into place based on baseline findings**	**Assessment findings (current)**	**Impact of changes that were put into place**
		COURSE WHERE TAUGHT course numbers; ART=Arch; CET=Civil; CNT=Constr	**WORK ITEM TYPE:**	goal of 60% of class scoring above average on the selected work item	As part of the assessment checklist each faculty is asked to make comments on changes/improvements for next time time they teach the course. These comments are collected and collated across semesters.	Focus this year has been on getting faculty to review the improvements they previously listed and/or provide more comments as to improvements	faculty have been reviewing previous change comments for this class for review and feedback. This is still in progress for most faculty and most courses
e- team function effectively on teams	1c, 3a,b,c 4c, 5c	ART 222, CNT 330, CNT 447, CNT 470,	GPJ,	A majority of the courses have been meeting the departmental goal of 60%, courses that don't meet the goal are reviewed with more emphasis on connecting course objectives to student learning especially in relationship to the work item.	see listing as appendix A to this report: comments over the last two semesters are listed per course and per teacher	A majority of the courses providing data continue to meet the departmental goal of 60%, but more data from more courses would improve analysis.	Faculty as encouraged to have group projects in all courses because of feedback from our advisory panel. More courses are expected to access this objective next semester
f- problems- Identify, analyze and solve technical problems	1d, 2a,b,c,d 3a,c 4c	ART 117, CET 104, CET 160, CET 260, CET 267, CET 312, CET 350, CET 452, CNT 110, CNT 280, CNT330, CNT 341, CNT 470, CNT 494	IPJ, FX,GPJ, TX,PSH, PSX, CA,IBJ,	A majority of the courses have been meeting the departmental goal of 60%, courses that don't meet the goal are reviewed with more emphasis on connecting course objectives to student learning especially in relationship to the work item.	see listing as appendix A to this report: comments over the last two semesters are listed per course and per teacher	A majority of the courses providing data continue to meet the departmental goal of 60%, but more data from more courses and from a more diverse set of work items would improve analysis.	Faculty as a whole are more aware of student learning in their courses and more of them are willing to try improvements and report back on the perceived impact of those changes. Faculty participation is still low.

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Measurable outcomes (desired behaviors)	**Associa-ted PULs**	**Methods used to assess the desire behaviors**		**Assessment findings (baseline from previous years data)**	**Improvements (changes) put into place based on baseline findings**	**Assessment findings (current)**	**Impact of changes that were put into place**
		COURSE WHERE TAUGHT course numbers; ART=Arch; CET=Civil; CNT=Constr	**WORK ITEM TYPE:**	goal of 60% of class scoring above average on the selected work item	As part of the assessment checklist each faculty is asked to make comments on changes/improvements for next time time they teach the course. These comments are collected and collated across semesters.	Focus this year has been on getting faculty to review the improvements they previously listed and/or provide more comments as to improvements	faculty have been reviewing previous change comments for this class for review and feedback. This is still in progress for most faculty and most courses
g- communicate effectively, written, oral and drawing	1a,c	ART 210, ART 284, CET 104, CET 231, CET 260, CET 267, CET 275, CET 312, CNT 110, CNT 330, CNT 347, CNT 470, CNT 494	IPJ, FX,GPJ, TX,OP,PSH, PSX,CA,	A majority of the courses have been meeting the departmental goal of 60%, courses that don't meet the goal are reviewed with more emphasis on connecting course objectives to student learning especially in relationship to the work item.	see listing as appendix A to this report: comments over the last two semesters are listed per course and per teacher	A majority of the courses providing data continue to meet the departmental goal of 60%, but more data from more courses and from a more diverse set of work items would improve analysis.	Faculty are being educated to the idea that the spectrum of communication must be taught practiced and accessed. And that choosing the most effective method of communicating is the most important aspect. Faculty participation is still low.
h- lifelong- recognize the need for and possess the ability to pursue lifelong learning	6b	CNT 105, CNT 447	CA	A majority of the courses have been meeting the departmental goal of 60%, courses that don't meet the goal are reviewed with more emphasis on connecting course objectives to student learning especially in relationship to the work item.	see listing as appendix A to this report: comments over the last two semesters are listed per course and per teacher	A majority of the courses providing data continue to meet the departmental goal of 60%, but more data from more courses would improve analysis. Two courses is not good coverage of this objective	Faculty as a whole are more aware of this kind of lifelong student learning in their courses and more of them are willing to try improvements and report back on the perceived impact of those changes but it is one of the hardest to tie into course content. Faculty participation

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Measurable outcomes (desired behaviors)	**Associa-ted PULs**	**Methods used to assess the desire behaviors**		**Assessment findings (baseline from previous years data)**	**Improvements (changes) put into place based on baseline findings**	**Assessment findings (current)**	**Impact of changes that were put into place**
		COURSE WHERE TAUGHT course numbers; ART=Arch; CET=Civil; CNT=Constr	**WORK ITEM TYPE:**	goal of 60% of class scoring above average on the selected work item	As part of the assessment checklist each faculty is asked to make comments on changes/improvements for next time time they teach the course. These comments are collected and collated across semesters.	Focus this year has been on getting faculty to review the improvements they previously listed and/or provide more comments as to improvements	faculty have been reviewing previous change comments for this class for review and feedback. This is still in progress for most faculty and most courses
i- society- understand professional, ethical and societal responsibly	3a,b, 5c, 6a	ART 210, CNT 447	GPJ,	A majority of the courses have been meeting the departmental goal of 60%, courses that don't meet the goal are reviewed with more emphasis on connecting course objectives to student learning especially in relationship to the work item.	see listing as appendix A to this report: comments over the last two semesters are listed per course and per teacher	A majority of the courses providing data continue to meet the departmental goal of 60%, but more data from more courses would improve analysis. Two courses is not good coverage of this objective	Faculty as a whole are more aware of this kind of lifelong student learning in their courses and more of them are willing to try improvements and report back on the perceived impact of those changes but it is one of the hardest to tie into course content. Faculty participation is still low.
j- issues- recognize contemporary professional, societal and global issues and be aware of and respect diversity	2e, 4c, 5a,b,c	CNT 105,	CA	A majority of the courses have been meeting the departmental goal of 60%, courses that don't meet the goal are reviewed with more emphasis on connecting course objectives to student learning especially in relationship to the work item.	see listing as appendix A to this report: comments over the last two semesters are listed per course and per teacher	although this course continues to meet the departmental goal of 60%, more data from more courses would improve analysis. One course, even this intro course is not good coverage of this objective	Faculty as a whole are more aware of student learning in their courses and more of them are willing to try improvements and report back on the perceived impact of those changes. Faculty participation is still low.

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		COURSE WHERE TAUGHT course numbers; ART=Arch; CET=Civil; CNT=Constr	**WORK ITEM TYPE:**	goal of 60% of class scoring above average on the selected work item	As part of the assessment checklist each faculty is asked to make comments on changes/improvements for next time time they teach the course. These comments are collected and collated across semesters.	Focus this year has been on getting faculty to review the improvements they previously listed and/or provide more comments as to improvements	faculty have been reviewing previous change comments for this class for review and feedback. This is still in progress for most faculty and most courses
k- improvement have a commitment to quality, timeliness and continuous improvement	1e, 2d,e, 4c, 6a,	ART 120, ART 155, CET 104, CET 260 CET 267, CET 350, CNT 330, CNT 341, CNT 342,	IPJ, FX, PSH, CA,	A majority of the courses have been meeting the departmental goal of 60%, courses that don't meet the goal are reviewed with more emphasis on connecting course objectives to student learning especially in relationship to the work item.	see listing as appendix A to this report: comments over the last two semesters are listed per course and per teacher	Many courses continue to contribute to meeting the departmental goal of 60%, a better distribution of the work items is the next step.	Faculty as a whole are more aware of student learning in their courses and more of them are willing to try improvements and report back on the perceived impact of those changes. Faculty participation is still low.

Appendix A- improvements per course

course taught	Fall 03	course taught	Spring 03
Class	Comments from #10 Improvements	Class	Comments from #10 Improvements
ART 117	Include descriptive geometry material	ART 117	
ART 117	Set firm deadlines for exercises and have more tests.	ART 117	Gaining a better knowledge of oncourse over summer will help; introduce architectural desktop earlier during the semester, it made explaining 3D & sections easier for students to understand; save creating CAD Finish Boards for last, to much computer stuff
ART 117	Additional visual aids - shapes; add colors	ART 155	Employ additional help in the class(i.e. T.A.'s) to help students during projects especially for the larger classes
ART 155	The use of a small scaled model would help the students understand the building systems.	ART 165	Some topics can be put "online" for future distance education. A prototype will be made summer 2003.
ART 210	Fine tune grading rubric, divide papers in to 2 parts, and edit out/reduce number of slides	CET 104	
CET 104	Fine tune lab exercises	CET 160	handouts w/ basic explanations in color
CET 260	Include semester project	CET 260	
CET 267	Issue a course workbook to students (Designed by BDK)	CET 267	
CET 304	This class was the most variable that I have had in terms of experience with the subject matter, In future classes I will make a concerted attempt early in the class to determine the range I am dealing with and make appropriate adjustments.	CET 308	
CET 402	None pending comments from student evaluations. There are a number of students in this class with quite a bit of background in the subject and I expect good input from those students on the approaches I used.	CET 430	more practical field problems and case studies
CET 430	To assign group (3 or 4) of students a practical field problem/project.	CNT 165	
CNT 280	more work on spreadsheets	CNT 222	
CNT 302	Do a midterm, require attendance.	CNT 280	

Appendix A- improvements per course

course taught	Fall 03	course taught	Spring 03
Class	**Comments from #10 Improvements**	**Class**	**Comments from #10 Improvements**
CNT 447	Use oncourse as part of curriculum	CNT 341	Enhance the term project to cover wider/more topics of the course.
CNT 452	Research or text that may expand specifics on construction craft quality. Devise a "team work-group project."	CNT 452	
CNT 494	Cover finding of effective interest rate for periods more than a year but not necessarily a whole year. Cover models for A/P, F/A etc several times and practice more on model. Introduce "Payback Period" topic together with B/C chapter and illustrate payba	CNT 470	
INTR 151	Some material in book & videos is outdated; more field trips-prefer a field trip with a loom to see actual weaving process; less lecture & more "hands-on".	INTR 103	Next semester I would like to utilize Oncourse to maintain my gradebook. Also, I would like to better utilize the text.
INTR 151	More hands-on and/or in-class discussion rather than traditional lecture; More check-ups on project to determine actual progress & need for help.	INTR 103	refine syllabus to more effectively use in-class work time
INTR 202	I will not be teaching next semester, classroom on 3rd floor is not conducive for showing materials examples to a group, perfer conference table "style" on first floor	INTR 124	
INTR 228	Less technical drawing and more programming work required.	INTR 124	Next time I would like to implement more "daily" space planning exercise to be completed in class.
INTR 252	Better tours and clearer visual illustrations of systems, esp. structural.	INTR 224	I would like to follow one residential project all the way through rather than selecting different projects to perform planning on
		INTR 228	Capstone class was too big - need to investigate smaller size; final presentations in front of jurors only.

ECE OUTCOMES ASSESSMENT NARRATIVE
2004

The Department of ECE has a fully developed and functional outcomes assessment program largely due to the head start it received because of the campus program assessment and review in conjunction with its 2002 campus accreditation by the North Central Association (NCA). This process began in August 1994 and began to accelerate in the fall of 1996 because of two factors: the preliminary publicity of the new ABET EC2000 and the appointment of Dr. H. Öner Yurtseven as Dean of the School of Engineering and Technology. One of our department faculty members, Dr. Charles Yokomoto, was one of the founding members of the campus Program Review and Assessment Committee (PRAC), which was formed to guide the campus in outcomes assessment. He has remained in that position and continues to represent the school, giving the school and department continuity in leadership.

The Department of ECE, as well as all departments in the School of Engineering and Technology, follows a comprehensive, well-developed continuous improvement plan with the necessary feedback loops. The flowchart for the process followed by the Department of ECE is shown in Appendix I-D.

Who Is Responsible for Continuous Improvement in the Department of ECE?

Several departmental committees play major roles in the ECE's continuous improvement process. They are the following:

- The ECE Undergraduate Affairs Committee (UAC) that functions as the department's planning committee and serves as the department's assessment committee.
- The ECE Undergraduate Curriculum Committee (UCC), which oversees the curriculum and works hand-in-hand with the UAC.
- The ECE ABET Accreditation & Assessment Committee (AAC) composed of Drs. Russell Eberhart, Maher Rizkalla, Charles Yokomoto and Gina Smith.
- The faculty of the department, who approve the changes proposed by the UCC and implement the continuous improvement processes developed by the UAC.
- In addition, several constituent groups play significant roles. They are the following:
- The department's Industry Advisory Committee (IAC), which provides both feedback and input to the continuous improvement process.
- The continuing students who provide feedback on their satisfaction with various elements of the curriculum.
- The alumni of the program who provide feedback on the curriculum and how well they were prepared professionally.
- The employers of our graduates who provide feedback on the preparedness of our graduates for work in their companies.
- The roles that these groups play in our process are described in Appendix I-D.

- The ECE Industry Advisory Committee has been very active. Its membership is made up of practicing engineers from major industries from the area. The composition of the Industry Advisory Committee is shown in Table 1.

Table 1. Composition of the Department's Industry Advisory Committee

Name	Industry	Position/Title
William Baldwin	Electronic Manufacturing Solutions	President
Casey Crawley	Thomson Consumer Electronics	Project leader
James Gucinski	NSWC Crane	Director, battery group
Michael Lowry	Delphi	Project manager
J. Jessie Martin	Eli Lilly	Project leader
Raja Rajashekara	Delphi	Project leader
Peter Thayer	MobileAria	Vice President

Starting the Process

The first departmental mission statement was developed in 1996. After a few minor revisions, it is as follows:

> *The Department of Electrical and Computer Engineering will provide the best educational environment for our students to succeed in their chosen field of interest. This includes a modern and evolving ABET approved curriculum, the highest quality teaching and research, modern laboratories, and an involved and motivated faculty to engage and mentor the students in a multifaceted learning experience. We identify three constituencies that will benefit from this active mode of education: the students, the faculty, and industry. We expect that our students will be identified as very competent professionals with the highest level of ethical behavior, loyalty to their employer and community, and a life-long habit of self-improvement.*

After the mission statement was developed, our Program Educational Objectives (PEOs) and the Program Outcomes (POs) were written; they have gone through several revisions. The current versions are shown in Tables 2 and 3.

Table 2: EE and CmpE Program Educational Objectives

Program Educational Objectives
1. Our students will be educated in the basic principles of their discipline and the state of the art.
2. The students will demonstrate competency in engineering problem solving and the ability to complete design tasks.
3. The students will develop and maintain modern technological skills, effective oral and written communication skills, and the ability to perform well in group engineering experiences.
4. The students will be able to integrate mathematics, science, humanities, and social studies into their primary work.
5. Students are expected to understand and appreciate ethics, diversity, and cultural implications in their work.
6. Students are expected to develop the habits of life-long learning.

The EE Program Outcomes parallel the EAC/ABET Criterion 3, fulfill the IUPUI Principles of Undergraduate Learning.

Table 3: EE and CmpE Program Outcomes

Program Outcomes	Related Program Educational Objectives
The EE Program Outcomes characterize student learning in the program as the following:	
a. The ability to apply mathematics, science, and engineering	1, 4
b. The ability to (b1) design and conduct experiments and (b2) to analyze and interpret data.	2, 3
c. The ability to design a system, component, or process to meet desired needs.	2
d. The ability to work on multi-disciplinary teams.	3
e. The ability to identify, formulate, and solve engineering problems.	2
f. The understanding of professional and ethical responsibilities.	5
g. The ability to communicate effectively (g1) orally and (g2) in writing.	3
h. The broad education necessary to understand the impact of engineering solutions in a global and societal context.	4, 5
i. The recognition of the need for, and an ability to engage in, lifelong learning.	6
k. The ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	1, 3
l. The ability to use the library and Internet to obtain information.	3
m. The ability to apply critical thinking when solving problems, doing design, and resolving ethical dilemmas.	2
n. The ability to apply creativity when needed, such as in the design process.	2
o. An appreciation of quality workmanship in producing a product.	3

How We Assure That the Faculty Will Be Able to Demonstrate That Students Have the Abilities Described in EC2000's Criterion 3

Courses on the Plan of Study (POS)

The EE program requires students to follow a curriculum in which a majority of the courses are required. Out of the 126 hours required for the degree, the student is allowed to take 15 hours of electives in the major, 3 hours of a science elective, 3 hours of a technical elective, and 15 hours in the humanities and social sciences. All of these electives must be selected from lists of approved courses. A sample of the Plan of Study is shown in Appendix I-E along with the lists of approved electives.

Currently, six of the hours in the humanities and social sciences must be in courses designated as upper level courses by the faculty who teach them. Furthermore, depth is promoted by requiring that at least six hours reside in one department.

Student Experiences That Address Program Outcomes in Required Courses

Course outcomes have been written for all of the engineering and computer science courses taken by our electrical engineering majors, and each outcome has been linked to our Program Outcomes. This insures that students are given learning experiences and assessed in each of our Program Outcomes. Table 4 presents a summary of the coverage of the Program Outcomes in required courses. Elective courses are not included.

Table 4. Coverage of Program Outcomes in All Required Electrical Engineering Courses

	Program Outcomes in All Required EE Courses																
	a	b1	b2	c	d	e	f	g1	g2	h	i	j	k	l	m	n	o
ENGR 195					X		X	X		X	X		X	X			X
ENGR 196	X	X			X	X			X				X				
ENGR 197						X							X				
ECE 201	X					X											
ECE 202	X					X	X						X				
ECE 207	X	X	X										X				
ECE 208		X	X	X									X				
ECE 255	X			X		X											
ECE 264	X			X		X							X				
ECE 266	X		X	X		X							X				
ECE 267		X	X	X		X		X	X				X				
ECE 301	X	X	X	X							X						
ECE 302	X		X	X		X											
ECE 311	X		X			X											
ECE 340	X	X						X					X				
ECE 362	X	X	X	X					X		X						
ECE 382	X		X	X		X							X				
ECE 400	X						X										
ECE 401					X		X			X		X			X		
ECE 440	X		X	X		X											
ECE 492	X	X	X	X	X			X	X					X	X	X	X
TCM 360								X	X								
Total # of occurrences	16	8	11	11	4	12	4	5	5	2	3	1	11	2	2	1	2

As shown in the table, program outcome a, the ability to apply knowledge of math, science, and engineering, is addressed in 16 courses, program outcome b1, the ability to design and conduct experiments, is addressed in eight courses and so on.

Students are given two major experiences in writing (Program Outcome g2). All engineering majors must take ENG W131, the basic composition course, and TCM 360, a two-credit course in technical communications (oral and written). In addition, students do a significant amount of writing in ECE 492 (Senior Design) and ECE 401 (Professionalism and Ethics). They are also given experiences in writing in their laboratory courses, all of which all require written laboratory reports. In ECE 492, students produce a comprehensively written project report and make oral presentations several times throughout the semester. They are likewise given two major experiences in oral presentations in COMM R110 and TCM 360. Their performances in TCM 360 are formally assessed for the continuous improvement process by faculty who are trained to assess written works and oral presentations, using scoring rubrics developed by Dr. Marjorie Hovde who is a member of the English Department in the School of Liberal Arts and the Technical Communications program in the School of Engineering and Technology. Written work and formal oral presentations are also assessed in ECE 492 (Senior Design) and ECE 401 (Professionalism and Ethics).

ECE 401 is a one-credit course in professionalism and ethics. It is an intensive, one-credit course that focuses on three aspects of ethics: theories of ethics, principles of applied ethics, and professional ethics, which includes workplace ethics. In this course, students learn models of right and wrong (theories of ethics), skill development for the resolution of dilemmas (applied ethics), and issues in the workplace such as whistle blowing, confidentiality, conflict of interest, risk assessment, and the global impact of engineering decisions on cultures and the environment.

ECE 492 is a three-credit, one-semester course where the students apply the knowledge and skills gained in the curriculum to a large-scale, team-oriented design project.

How We Assess Students with Regard to Our Program Outcomes

A comprehensive outcomes assessment process was developed that uses multiple measures to determine whether or not our students can demonstrate the Program Outcomes. They include the following:

- Surveys of Continuing Students--The departmental survey instrument and results are shown in a table in Appendix I-D.
- Alumni Survey conducted by Office of Information Management and Institutional Research (IMIR) using items developed by the ECE and Department of Mechanical Engineering (ME). The survey instrument is shown in Appendix I-D.
- Assessment of actual learning by using scoring rubrics to assess student work. In our program, we have targeted a set of required courses to assess. They are:
  - ECE 492 Senior Design, a capstone design course
  - ECE 401 Professionalism and Ethics
  - ECE 301 Signals and Systems
  - ECE 255 Introduction to Analog Electronics Analysis and Design
  - TCM 360 Technical Communications

Scoring rubrics were developed to assess student works from the courses listed above as sources of assessment material. Several of the rubrics are shown in Appendix I-D.

- Employer satisfaction with CmpE and EE graduates.
- Focus group discussion with senior students
- End-of-semester course evaluations

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
2004 ANNUAL ASSESSMENT REPORT

Prepared by Charles Yokomoto and Maher Rizkalla

June 18. 2004

The following tables present the following information:

Column 1: The Program Outcome being assessed in the table. The Program Outcomes are written expressly for our professional accreditation by the Accreditation Board for Engineering and Technology (ABET). Each of our Program Outcomes has been linked to the IUPUI Principles of Undergraduate Learning (PUL), and these linkages are demonstrated by Table 1 on page 4 of this report.

Column 2: The Measurable Outcomes that define the Program Outcome.

Column 3: Courses where the outcome is taught.

Column 4: How the outcomes are measured.

Column 5: Findings from the complete 2002 assessment of outcomes for our Fall 2002 accreditation visit.

Column 6: Improvements (changes) planned and implemented based on the 2002 findings.

Column 7: Findings from the complete 2004 assessment of outcomes for our Fall 2004 accreditation visit.

Column 8: Impact of the changes.

Column 9: Further changes planned and proposed.

1. Program Outcome	2. Measurable Outcomes	3. Courses That Cover This Outcome	4. How the Outcomes are Measured.	5. What are the 2002 assessment findings?	6. Improvements (changes), Planned and Implemented	7. What are the 2004 assessment findings?	8. Impact of changes	9. Further Changes Planned and Proposed
a1. The ability to use mathematics and engineering science. The ability to apply knowledge of science was split off as outcome a2 for assessment purposes. This part of ABET Criterion 3, Outcome a, is	a1(1) The ability to solve engineering science problems that require depth on knowledge in the major. a1(2) The ability to solve engineering science problems that require knowledge of	ECE201, 202, 255, 264, 266, 301, 302, 311, 362, 382, 365, 369, 440 In addition to the mathematics that they use in their engineering courses, EE majors are required to take MATH 163, 164, 261, and	ECE students' ability to use mathematics and engineering science is assessed in ECE 305, 382, and 444. In the future, ECE 305 will be replacing by ECE 311, and ECE 444 will be upgraded with a laboratory to become EE 440.	From ECE 492: 78% of the class scored 3.0 or better out of 4.0 (goal: 70%) From ECE 301: Marginally successful on final exam with six of 12 problems that require this ability solved successfully. From ECE 440:	ECE 492: none needed at this time. ECE 301 and ECE 440: first work on awareness of the value of being able to apply mathematics. Then work on the skills. Often it is the lack of awareness rather than the lack of potential to	ECE 301: Outcomes were generally met on scoring the final exam according to the degree of difficulty of problems. ECE 440: marginally successful based on students successfully	ECE 301: More time will be spent on stability. ECE 440: Continue to emphasize value of mathematics and mathematical approach to problem solving rather than a computational	ECE 301: More time will be spent on stability.

interpreted to mean the application of mathematics and engineering science. The applied aspects of engineering are assessed in outcomes b, c, and k.	mathematics.	262.		Solving problems that require mathematics and engineering science-- students averaged 46% (desired average = 58%) –(goal not met) Ability to solve problems in ECE 440 that require depth of knowledge—1 of three problems solved successfully (goal not met) Problems that require comprehension of text—1 of three problems solved successfully (goal not met	develop the ability that is the problem. ECE 440 is one of the most difficult of our senior courses. Thus it is not surprising that our goals were not met all three measures. The Curriculum Committee will be asked to discuss this and related problems.	solving three of six problems on the final exam. ECE 492 Sp ’03 and Sp ’04: this outcome scored 3.47/4.00—successful.	approach. ECE 492: Revisions that were put into place were successful, including a faculty committee to review all project proposals for technical content and appropriateness. Also, more faculty involvement of faculty in the evaluation of projects has been initiated.	

1. Program Outcome	2. Measurable Outcomes	3. Courses That Cover This Outcome	4. How the Outcomes are Measured.	5. What are the 2002 assessment findings?	6. Improvements (changes), Planned and Implemented	7. What are the 2004 assessment findings?	8. Impact of changes	9. Further Changes Planned and Proposed
a2. The ability to use science in engineering (EC2000 Outcome a). This part of ABET Criterion 3, Outcome a, is interpreted to mean the application of science principles taught in our engineering courses. The two most likely candidates are EE 305 (elective) and EE 311 (required).	Level 1: The ability to recall memorized information at a basic level. Level 2: The ability to recall routine knowledge of definitions, principles, or laws, possibly without true understanding Level 3: The ability to use basic definitions, principles, or laws, requiring an understanding rather than rote recall Level 4: The ability to apply reasoning that integrates knowledge of different kinds to come up with the correct response	For EE majors, we now use ECE 311 as our main course to assess this outcome, supplemented with data from ECE 202, ECE 201, and ECE 255 and course grades fro Physics 152 and 251 and from Chemistry C105. ECE 311 replaces ECE 305 from the 2002 visit. For CmpE majors, we obtain data from ECE 201, ECE 202, and ECE 255, as well as course grades from Phys 152, Phys 251, and Chem C105.	Student final exams in EE 305 were assessed. Two types were written. One type assessed students' general knowledge of the science principles through multiple-choice questions. The other type assessed problem solving.	From EE305: The final exam contained 12 multiple choice and short answer questions that tested student ability to apply knowledge of science (physics of semiconductor materials) to the design and analysis of semiconductor devices. The class average bettered the instructors target on eight of the 12 questions.	None planned at this time...	Physics 152 course grades Sp '04: engineering students' final grades averaged 2.95/4.00—satisfactory Phys 251 course grades Sp '04: engineering students' final grades averaged 2.87/4.00—satisfactory. Chemistry course grades Sp '04: engineering students' final grades averaged 2.61/4.00--satisfactory ECE 201 findings Sum '04: From first exam on science principles, students averaged 76% (n = 13)—satisfactory. ECE 202	No changes were required during the previous cycle.	For EE majors: ECE 311--provide more supplemental materials and practice. For CmpE majors: no changes needed.

						findings: satisfactory based on mid-term exam on magnetic coupling. ECE 255 findings: satisfactory based on 75% average on science unit. ECE 311 (for EE degree only): marginally satisfactory.		

1. Program Outcome	2. Measurable Outcomes	3. Courses That Cover This Outcome	4. How the Outcomes are Measured.	5. What are the 2002 assessment findings?	6. Improvements (changes), Planned and Implemented	7. What are the 2004 assessment findings?	8. Impact of changes	9. Further Changes Planned and Proposed
b1. The ability to design and conduct experiments (EC2000 Outcome b)	Students will be assessed on their ability to test a design to determine if it meets the design criteria. This will be done in ECE 492.	ECE207, 208, and 267 provide laboratory experiments for lecture classes ECE201, 255, and 266, respectively. ECE362 is a lecture/laboratory course, ECE492 is a capstone design course, and ECE301 is an engineering science course where students cover material on designing and conducting experiments.	Projects reports in ECE 492 For 2004, projects in ECE 255 were assessed.	From EE 492: Students were assessed on their ability to test a design to determine its functionality. The class average was 3.2 out of 4.0 (goal = 3.0), and 89% of the class scored at least 3.0 (goal = 70%)	None panned at this time.	ECE 492: Successful (3.27/4.00) from Sp '03 and Sp '04 data. ECE 255 project Sp '04: Successful (average score 89% on a desired average score of 65% for the class).	None were needed	None planned

1. Program Outcome	2. Measurable Outcomes	3. Courses That Cover This Outcome	4. How the Outcomes are Measured.	5. What are the 2002 assessment findings?	6. Improvements (changes), Planned and Implemented	7. What are the 2004 assessment findings?	8. Impact of changes	9. Further Changes Planned and Proposed
b2. The ability to analyze and interpret data (EC2000 Outcome b)	Students will be able to interpret output waveforms, output data tables from computer programs and simulators, and input-output data from systems.	ECE students are required to take ECE 207, 208, 266, 267, 301, 302, 311, 440, and 492.	This general outcome is assessed in ECE492, the senior capstone design course. This is assessed as part of the grading of the project through an evaluation of the final report and the oral presentation. This outcome is assessed in ECE492, the capstone design course.	ECE 492: This outcome was not satisfied. The average score (Fall 2000) was 2.2 out of 4.0 (goal 3.0) and only 30% of the class scored better than 3.0 (goal 60%).	The ECE Curriculum Committee has selected required, prerequisite courses where the analysis and interpretation of data can be emphasized. This includes ECE 207, 208, and 267, which are laboratory courses where students make measurements that result in data that can be analyzed and interpreted.	ECE 492: Successful based on score of 3.29/4.00, an improvement over the 2002 data.	Improvements were made, but not necessarily due to changes in pre-requisite courses.	No further changes needed.

1. Program Outcome	2. Measurable Outcomes	3. Courses That Cover This Outcome	4. How the Outcomes are Measured.	5. What are the 2002 assessment findings?	6. Improvements (changes), Planned and Implemented	7. What are the 2004 assessment findings?	8. Impact of changes	9. Further Changes Planned and Proposed
c. The ability to design a system, component, or process to meet desired needs (EC2000 Outcome c)	Students will be able to c(1 Execute the design according to the formal design process taught in the course. c(2) Complete the design project successfully.	ECE students are required to take ECE 208, 255, 266, 267, 301, 302, 311, 362, 382, 444, and 492.	This general outcome is assessed in ECE 492, the senior capstone design course. This is assessed as part of the grading of the project through an evaluation of the final report and the oral presentation.	From data from the Fall 2000 ECE 492 class, c(1) was clearly met (average score = 3.0, goal = 3.0; 75% of the class > 3.0, goal = 60%) c(2) was clear y met (average score = 3.0, goal = 3.0; 75% of the class > 3.0, goal = 60%)	None needed from 2002 findings.	ECE 492 from Sp ’03 and Sp ‘04 c(1) was clearly met (3.17/4.00), which is an improvement from the previous cycle. c(2) was clearly met (3.75/4.00) from faculty evaluations of oral presentations. ECE 255 Sp ’04: c(2) Students met this outcome successfully from their amplifier design project (89% class average)	None were needed from 2002 cycle.	None needed.

1. Program Outcome	2. Measurable Outcomes	3. Courses That Cover This Outcome	4. How the Outcomes are Measured.	5. What are the 2002 assessment findings?	6. Improvements (changes), Planned and Implemented	7. What are the 2004 assessment findings?	8. Impact of changes	9. Further Changes Planned and Proposed
d. The ability to work on interdisciplinary teams	Students will demonstrate: d(1) Attendance at group meetings d(2) Contributions to group discussions d(3) Carrying out assignments d(4) Spirit of teamwork d(5) was assessed holistically from instructor and advisor observations of teams in the laboratory and in team meetings with the instructor or advisor.	ECE students are required to take ENGR 195, and ECE 401, and ECE 492, all of which use interdisciplinary teams to some degree.	Outcome d1 was assessed in ECE401 using a fairly detailed rubric is used. Outcome d2 was assessed holistically through instructor and advisor observations. Outcome d3 was assessed through an essay written on an exam.	Outcomes d(1) through d(4) were assessed in ECE/ME401, where ECE and ME students worked in mixed teams. Using a holistic measure of teamwork that was based on the difference of the highest and lowest scores of self-rating, students were successful on this teamwork assessment. d(5): Instructor's evaluation of teamwork through holistic observations shows that t his outcome was clearly met (average	No improvements needed at this time.	ECE 401: Sp '04, all teams rated each member on "value to the team", and all teams averaged 3.00/4.00 or better—successful. ECE 492 Sp '03 and Sp '04 combined data: instructor rating of all teams averaged 3.29/4.00—satisfactory.	No improvements were needed after the previous cycle of assessment.	None needed.

				score over all teams > 3.0 out of 4.0 and more than 80% of the teams scored 3.0 or better.)				

1. Program Outcome	2. Measurable Outcomes	3. Courses That Cover This Outcome	4. How the Outcomes are Measured.	5. What are the 2002 assessment findings?	6. Improvements (changes), Planned and Implemented	7. What are the 2004 assessment findings?	8. Impact of changes	9. Further Changes Planned and Proposed
e. The ability to identify, formulate, and solve engineering problems (EC2000 Outcome e)	e(1) Students will be able to translate a need into a design task identifying the need and formulating it as a design task.	ECE students are required to take ENGR 197, and ECE201, 202, 207, 208, 255, 264, 266, 267, 302, 311, 382, 440, and 492.	This outcome is assessed in ECE 492 holistically in an assessment of the students' ability to identify and formulate the design task that is assigned to them. Although the assessment is holistic, it is based on the instructor's interaction with the design team throughout the semester-long project.	e(1): scores on the students' ability to identify and formulate the design problem for their capstone design problem was met, but not clearly met (60% of the class $\geq$ 3.0 out of 4.0, goal = 60%)	No changes are necessary.	ECE 255: Improvements in determining an appropriate strategy needed. ECE 301: ECE 311: Weakness in problems requiring reading comprehension. ECE 440 ECE 492:	No changes were required during the previous cycle (see column 6).	ECE 311: Provide more supplemental materials and practice. ECE 255: More help in the form of help sessions will be given, with more experiences in determining an appropriate strategy from among possible strategies.

1. Program Outcome	2. Measurable Outcomes	3. Courses That Cover This Outcome	4. How the Outcomes are Measured.	5. What are the 2002 assessment findings?	6. Improvements (changes), Planned and Implemented	7. What are the 2004 assessment findings?	8. Impact of changes	9. Further Changes Planned and Proposed
f. An understanding of professional and ethical responsibilities (EC2000 Outcome f)	f(1) Describe how codes of ethics help an engineer work ethically. f(2) Analyze a behavior using models of right and wrong (ethical bases) f(3) Analyze ethics codes using models of right and wrong (ethical bases) f(4) Describe how group discussions can help with critical thinking. f(5) Discuss ethical issues in the workplace. f(6) Described how knowledge of cultures is needed for ethical behavior	ECE students are required to take ECE 400 and 401.	The outcomes were assessed in ECE 401 using a variety of rubrics to score assignments and by using an essay final exam.	The scores on the final exam in ECE 401 on all outcomes were satisfactory except for f(4), critical thinking in ethical situations, and f(6), the understanding of different cultures.	More time, emphasis, and/or assignments that require critical thinking and understanding of cultures have been programmed into the course. Students will be given additional exercises in applying critical thinking to an ethical situation and on the effect of different cultures on engineering decision making.	ECE 401 Sp ’04: f(1) marginally successful f(2) improved to successful f(3) marginally successful f(4) Successful f(5) marginally successful f(6) marginally successful	The ability to use models of right and wrong outcome was met this cycle, as was the outcome on understanding cultural impact of engineering Some improvements in learning specifics for a multiple choice exam are needed. Performance on the essay part of the final exam was better than on the multiple-choice exam.	Emphasis will be placed on acquiring specific knowledge for multiple choice exams.

1. Program Outcome	2. Measurable Outcomes	3. Courses That Cover This Outcome	4. How the Outcomes are Measured.	5. What are the 2002 assessment findings?	6. Improvements (changes), Planned and Implemented	7. What are the 2004 assessment findings?	8. Impact of changes	9. Further Changes Planned and Proposed
g1. The ability to communicate effectively orally (EC2000 Outcome g)	We have defined oral presentations as taking place in the workplace. Students are assessed in TCM 360 on the following competencies: g1(1) Introduction g1(2) Content g1(3) Assumptions g1(4) Conclusions g1(5) Organization g1(6) Visuals g1(7) Style/Wording g1(8) Length g1(9) Grammar g1(10) Delivery g1(11) Pace/Volume g1(12) Body Lang. g1(13) Visual Equip g1(14) Q&A time g1(15) Appropriateness g1(16) Overall rating In ECE 492 starting Sp 04;: g1(17) Overall quality of the oral presentation and effectiveness of visual aids.	ENGR 195 ECE 401, 492 TCM 360	In TCM 360, oral presentations were assessed by a team of faculty members who were trained by Dr. Marjorie Hovde. They use a scoring rubric that was developed by Dr. Hovde. This assessment process was taken over by Dr. Wanda Worley Fall '03.	Student performance was satisfactory on all outcomes in the TCM 360 assessment except for Introduction and Conclusions.	In TCM 360, more emphasis is being placed on the Introduction and Conclusions sections, including examples of best practices and peer tutoring. Students must be made to realize that these two sections are as important as the main body of the presentation.	TCM 360 Sp '04: All outcomes were met successfully ECE 492: Average 4.23/5.00—successful.	Changes made after the previous cycle improved performance.	No changes needed.

1. Program Outcome	2. Measurable Outcomes	3. Courses That Cover This Outcome	4. How the Outcomes are Measured.	5. What are the 2002 assessment findings?	6. Improvements (changes), Planned and Implemented	7. What are the 2004 assessment findings?	8. Impact of changes	9. Further Changes Planned and Proposed
g2. The ability to communicate effective in writing (EC2000 Outcome g)	We have defined writing as workplace writing. Students are assessed on the following competencies: g2(1) Introduction g2(2) Content g2(3) Assumptions g2(4) Conclusions g2(5) Organization g2(6) Visuals g2(7) Style/Wording g2(8) Page Layout g2(9) Length g2(10) Grammar g2(11) Sources g2(12) Appropriateness g2(16) Overall rating	ENGR 195 EE401, 492 TCM360	Assessment of students' written papers was assessed in TCM 360 using a scoring rubric developed by Dr. Marjorie Hovde of the TCM program. The assessment of learning outcomes was taken over by Dr. Wanda Worley Fall '03.	TCM 360: Performance on all outcomes was satisfactory except for g2(2) Content, g2(4) Conclusions. g2(6) Visuals, and g2(11) Sources	Improvements put in place include more emphasis on the four areas of weakness.	TCM 360 Sp '04: Performance on all outcomes except g2(10) on grammar and punctuation was satisfactory.	Performance improved on g2(2) and g2(4).	Instructors will spend more time on grammar and punctuation and recommend that students make use of the TCM Writing Center for help with this outcome.

1. Program Outcome	2. Measurable Outcomes	3. Courses That Cover This Outcome	4. How the Outcomes are Measured.	5. What are the 2002 assessment findings?	6. Improvements (changes), Planned and Implemented	7. What are the 2004 assessment findings?	8. Impact of changes	9. Further Changes Planned and Proposed
h. A broad education necessary to understand the impact of engineering solutions in a global and societal context (EC2000 Outcome h)	h(1) 2002 visit: Ability to discuss how U.S. technological developments can have an impact on society locally and globally, the latter requiring an understanding of different cultures h(2) 2004 visit: Ability to relate humanities and social science electives to the global, cultural, and environmental impact of engineering decisions.	ECE 401	h(1). A question on this outcome was written for the ECE 401 final exam. h(2). Students were asked to write a paper that described how two of their general education electives helped them understand the global nature of engineering in particular and business in general.	h(1): This outcome was met successfully on the Fall 2000 essay exam question, with 70% of the class scored 8.0 out of 10.0 or better (goal 70%). On the Spring 2002 exam, performance was better, with a class average of 9.1 out of 10 (goal = 8.0) and 94% of the class scored 8.0 or better (goal = 70%). h(2): 11 A, 10 B, 4 C, 1 D, 1F for an overall average of B+, which we consider to be successful.	None needed at this time.	h(1) is no longer assessed. Focus is on h(2) instead. This outcome was judged to be successful from the distribution of grades on the student papers described in column 4, with 29 of 38 papers scoring B+ or better, and 18 of 38 scoring A- or better.	No changes were needed from the previous cycle.	No changes needed.

1. Program Outcome	2. Measurable Outcomes	3. Courses That Cover This Outcome	4. How the Outcomes are Measured.	5. What are the 2002 assessment findings?	6. Improvements (changes), Planned and Implemented	7. What are the 2004 assessment findings?	8. Impact of changes	9. Further Changes Planned and Proposed
i. A recognition of the need for and the ability to engage in lifelong learning. (EC2000 Outcome i)	i(1): Graduates of the program will report continued education by reporting that they have attained advanced degrees and certificates, have attended workshops. i(2): Students will demonstrate the ability to use the library and the Internet to search for information for their projects.	ECE 362, 401, 492	ECE 401: Students are assessed on a group homework project that requires them to find print and Internet articles that demonstrate an ethical issue. Also, the groups may use library and Internet searches to find articles that will improve their group presentation (term project.) ECE 492: Students are assessed on their use of the library and Internet to search for background information for their design projects.	ECE 401-- Collecting news articles and interpreting them: 5 groups A, one group C, one group B, which we consider successful demonstration of this aspect of lifelong learning. ECE 492: Students in this course (Fall 2000) clearly met the outcome (average score = 3.2, > the desired 3.0; 67% of the class above 3.0, > the desired 60%) An alumni survey was conducted by IMIR with the following findings, which we consider successful indications of lifelong learning: Advanced degrees: 8 of 30 (27%) received	No improvements are needed at this time.	ECE 401: Assignment on finding Internet and newsprint articles on ethical issues was successful. ECE 492: Average score on project reports on Library and Internet resources was 3/25/4.00—successful.	No improvements were needed from the previous cycle.	No improvements needed.

				advanced degrees in business, law, engineering, dentistry, or medicine. Certificates rcvd: 9 Workshops and short courses: 17 Journals subscribed: 11				

1. Program Outcome	2. Measurable Outcomes	3. Courses That Cover This Outcome	4. How the Outcomes are Measured.	5. What are the 2002 assessment findings?	6. Improvements (changes), Planned and Implemented	7. What are the 2004 assessment findings?	8. Impact of changes	9. Further Changes Planned and Proposed
j. A knowledge of contemporary issues (EC2000 Outcome j)	j(1) Students are able to identify and interpret current ethical issues in the print and Internet media. j(2) Students will be able to write an essay on the final exam on the importance of knowledge of current events to a professional engineer.	ECE 401	j(1) is assessed by grading the quality of the ethical issues submitted by students on the assignment that requires them to find articles that describe ethical issues. j(2) is assessed on the final essay exam.	ECE 401: j(1): Six groups recorded the following group grades—A+, A+, A+. A-, A-, B+, C, which we consider successful. j(2): From the Fall 2000 semester, the class average was 8.5 out of 10 (goal 8.0) and 80% of the class scored 8.0 or better (goal 70%). In the Spring 2002 semester, the class averaged 9.2 out of 10 (goal = 8.0) and 100% scored 8.0 or better (goal = 70%) Both performances are considered to be successful	None needed at this time.	ECE 401 from Sp '04: j(1) 100% of the groups met the judging criteria on their contemporary issues assignment (number of articles and analysis of articles). j(2) This outcome was clearly met on the final exam.	No changes were needed from the previous cycle.	No changes needed.

1. Program Outcome	2. Measurable Outcomes	3. Courses That Cover This Outcome	4. How the Outcomes are Measured.	5. What are the 2002 assessment findings?	6. Improvements (changes), Planned and Implemented	7. What are the 2004 assessment findings?	8. Impact of changes	9. Further Changes Planned and Proposed
k. The ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (EC2000 Outcome k)	k(1) Students will be able to use engineering tools successfully in the completion of their senior design project.	ENGR 195, 196, 197 ECE 202, 207, 264, 266, 267, 311, 321, 382	k(1) is assessed by the instructional team or the course supervisor that grades the senior design project reports. This ability is graded on a scale of 4: excellent 3.: competent 2: satisfactory 1: marginal 0: poor	ECE 402: k(1) On the senior design project, 78% of the student teams demonstrated that they were competent of better (> 3.0 on a scale from 0 to 4.0)	No improvements needed at this time.	ECE 492: This outcome in the combined Sp ’03 and Sp ’04 data showed marked improvement. The average score was 2.80/4.00, and the score increased to 3.40/4.00.	No improvements were required from the last cycle.	No changes are required.

1. Program Outcome	2. Measurable Outcomes	3. Courses That Cover This Outcome	4. How the Outcomes are Measured.	5. What are the 2002 assessment findings?	6. Improvements (changes), Planned and Implemented	7. What are the 2004 assessment findings?	8. Impact of changes	9. Further Changes Planned and Proposed
l. The ability to use the Internet and the Library for research	*l*(1) Students will be able to use the Internet and Library to find resource material for their senior design project (EE 492) *l*(2) Students will be able to use the Internet and library to search for articles on ethical dilemmas for EE 401	ECE 401, EE 492, EE 362	In ECE 492, this is scored with a holistic score in the project scoring rubric by the instructor from information provided in their final reports. In ECE 401, students are scored on the basis of the quality of the articles and the number of articles submitted.	ECE 492: Average score 3.4/4.0 (goal = 3.0) and 100% of the class scored 3.0 or better (goal = 70%), Spring 2002 ECE 401: The seven groups in the Spring 2002 received grades of A+, A+, A+, A-, A-, B+, C. We consider this to be a successful level of performance	None planned at this time.	This outcome was successfully met in both ECE 401 and ECE 492. In ECE 401, students did Internet and library research for articles on ethical issues. In ECE 492, students did research to find reference materials on their projects.	None were needed from the previous 2002 cycle.	None needed.

1. Program Outcome	2. Measurable Outcomes	3. Courses That Cover This Outcome	4. How the Outcomes are Measured.	5. What are the 2002 assessment findings?	6. Improvements (changes), Planned and Implemented	7. What are the 2004 assessment findings?	8. Impact of changes	9. Further Changes Planned and Proposed
m. The Ability to Think Critically	m(1) In ECE 492, the ability to think critically in the course of the design of their senior design project. m(2) In ECE 401, the ability to think critically to resolve ethical dilemmas. Critical thinking occurs in many of the problem solving and laboratory courses, but ECE 492 and ECE 401 and the courses where students apply critical thinking in broader ways than solving engineering problems.	ECE 401, 492, and all problem solving courses.	In ECE 492, this is scored with a holistic score in the project scoring rubric by the instructor from information provided in their final reports. In ECE 401, awareness of the importance of critical thinking is assessed with an essay question on the final exam. Also in ECE 401, critical thinking is assessed in a team presentation of their defense of both sides of an ethical dilemma and on the resolution of dilemmas.	ECE 492: Average score 3.5/4.0 (goal = 3.0) and 75 %of the class scored 3.0 or better (goal = 70%), Spring 2002—outcome met successfully. ECE 401 final exam question: class average was 9.1/10.0 (goal = 8.0), and 100% of the class scored above 8.0 (goal = 70%) Spring 2002. Outcome met successfully. The seven groups in the Spring 2002 received grades of A, A-, A-, A-, A-, A-, B. We consider this to be a successful level of performance	None planned at this time.	ECE 401 Sp '04: 100% of the 10 groups scored B+ or better on the related assignment. ECE 492 Sp '03 and Sp '04: Successful on 3.03/4.00 score, but decreased slightly.	None were needed from 2002 cycle.	None needed.

1. Program Outcome	2. Measurable Outcomes	3. Courses That Cover This Outcome	4. How the Outcomes are Measured.	5. What are the 2002 assessment findings?	6. Improvements (changes), Planned and Implemented	7. What are the 2004 assessment findings?	8. Impact of changes	9. Further Changes Planned and Proposed
n. The Ability to Use Creativity in Design (When Needed)	The ability to think outside the box when necessary in the course of a design project.	ECE 492	In ECE 492, this is scored with a holistic score in the project scoring rubric by the instructor from information provided in their final reports and from consultations that the students have with the instructor.	ECE 492: Average score 3.00/4.0 (goal = 3.0), but only 50 %of the class scored 3.0 or better (goal = 70%), Spring 2002—outcome is considered to be met successfully if one of the two criteria are met.	None planned at this time since creativity is not strongly weighted in our Program Outcomes.	ECE 492 Sp ’03 and Sp ‘04: Successful based on score of 3.35/4.00.	No changes were needed from the 2002 cycle.	None needed.

1. Program Outcome	2. Measurable Outcomes	3. Courses That Cover This Outcome	4. How the Outcomes are Measured.	5. What are the 2002 assessment findings?	6. Improvements (changes), Planned and Implemented	7. What are the 2004 assessment findings?	8. Impact of changes	9. Further Changes Planned and Proposed
o. An appreciation of quality workmanship in producing a product.	A recognition that workmanship is important in the delivered product in a senior design experience	ECE 492	In ECE 492, this is scored with a holistic score in the project scoring rubric by the instructor from observations of the final deliverable.	ECE 492: Average score 2.6/4.0 (goal = 3.0) and 56%of the class scored 3.0 or better (goal = 70%), Spring 2002—outcome was not successfully met.	Since this outcome has been given a lower priority, it will be addressed after the higher priority outcomes are addressed. A recommendation from the instructor is that this course needs to be a two-semester course in order for workmanship to improve.	ECE 492 Sp '03 and Sp '04: Successful based on score of 3.78/4.00. This improved from the 2002 cycle.	No changes were needed from the 2002 cycle.	None needed.

ECET ASSESSMENT SUMMARY OF THE A.S. DEGREE PROGRAM – SPRING 2004

Prepared by Kenneth Reid and the ECET Faculty

1. General outcomes:	**2. What the student will know or be able to do? (measurable outcomes)**	**3. How will you help students learn it (in class or out of class)**	**4. Where will your students learn it?**	**5. How each of the measurable outcomes is measured**	**6. 2003 assessment findings**	**7. Changes planned/put into place**	**8. 2004 assessment findings**	**9. Impact / further change needed**
ABET Criterion 1, item a; Demonstrate an appropriate mastery of the knowledge, techniques, skills and modern tools of their discipline.	There are sets of generally accepted skills that are used in the discipline such as circuit analysis and design, analog and digital design, and programming.	Laboratories are a strong component of this learning objective. In addition normal classroom activities such as lectures, homework, and group learning activities.	Mastery of a skill set is a primary objective of the departments teaching mission and all courses in this curriculum have this as a primary focus.	Student self-assessment of their comprehension of course objectives was measured for courses taught during the spring semester. There were 128 course objectives identified with this criterion.	The department is strong in this outcome with many relevant course objectives and 84.6 percent of students indicating they strongly agree or agree that they can perform tasks indicated by the course objectives	Courses are assessed at the end of each semester for continuous improvement.	The department is still strong in this outcome with 84.1% percent of students indicating that they strongly agree or agree that they can perform tasks indicated by the course objectives.	The department will continue to survey students on the course objectives, and identify a set of standard questions from final exams from three required courses in each AS program & track student scores on these problems.

ECET Assessment Summary of the A.S. Degree Program – Spring 2004

1. General outcomes:	**2. What the student will know or be able to do? (measurable outcomes)**	**3. How will you help students learn it (in class or out of class)**	**4. Where will your students learn it?**	**5. How each of the measurable outcomes is measured**	**6. 2003 assessment findings**	**7. Changes planned/put into place**	**8. 2004 assessment findings**	**9. Impact / further change needed**
ABET Criterion 1, item b; Apply current knowledge and adapt to emerging applications in mathematics, science, engineering and technology.	This is determined by a student's ability to synthesize information and arrive at reasoned conclusions. Given that the laboratory level is state-of-the-art & emerging technology (as our industrial advisory board has indicated), students demonstrate this in laboratory assignments.	Laboratories are a strong component of the learning. In addition normal classroom activities such as lectures, homework, and group learning activities.	ECET155, ECET207, ECET231, ECET234 and ECET 284 have course objectives relevant to this criterion.	Student self-assessment of their comprehension of course objectives was measured for courses taught during the spring semester. Twenty nine course objectives from courses taught in the Spring 2004 semester related to this course objective.	The department remained strong in this area with 87.5 percent of students indicating they strongly agree or agree they can perform tasks in this area.	Courses are assessed at the end of each semester for continuous improvement. Specific assessment of items in this topic showed the department to be strong in this area, and no specific changes were implemented due to assessment data.	The department remained strong in this area with 83.2 percent of students indicating they strongly agree or agree they can perform tasks in this area.	The department will investigate a formal way to have the IAB evaluate our laboratory projects to assess their level in addition to the student self-assessment. We are also looking at revising the design rubric to see if some areas in that rubric apply more to this area.

ECET Assessment Summary of the A.S. Degree Program – Spring 2004

1. General outcomes:	**2. What the student will know or be able to do? (measurable outcomes)**	**3. How will you help students learn it (in class or out of class)**	**4. Where will your students learn it?**	**5. How each of the measurable outcomes is measured**	**6. 2003 assessment findings**	**7. Changes planned/put into place**	**8. 2004 assessment findings**	**9. Impact / further change needed**
ABET Criterion 1, item c; Conduct, analyze and interpret experiments and apply experimental results to improve processes.	Students ability to conduct experiments and properly measure outputs and form proper conclusions based on the outputs.	Laboratories are a strong component of this learning objective. All EET courses include a laboratory component.	Students will learn this objective in all AS courses, since they are all include a laboratory component.	Student self-assessment of their comprehension of course objectives was measured for courses taught during the spring semester. There were 26 course objectives identified with this criterion. Laboratory practicals are given in many courses that require a student to design a circuit or system, construct it, and analyze the results to determine if improvements are needed.	The department is strong in this area with 84.9 percent of students indicating they strongly agree or agree they can perform tasks related to this objective. 80 percent of students scored 70% or higher on the EET205 laboratory practical	Courses are assessed at the end of each semester for continuous improvement. Specific assessment of items in this topic showed the department to be strong in this area, and no specific changes were implemented due to assessment data.	The department remains strong in this area with 79.3 percent of students indicating they strongly agree or agree they can perform tasks related to this objective**.** 85.7 percent of students scored 70% or higher on the EET209 laboratory practical.	The department will investigate using other laboratory practical exams in addition to the student self-assessment. We are also looking at revising laboratory grades to assess the lab separate from the conclusion (the conclusion would be applicable in this area).

ECET Assessment Summary of the A.S. Degree Program – Spring 2004

1. General outcomes:	2. What the student will know or be able to do? (measurable outcomes)	3. How will you help students learn it (in class or out of class)	4. Where will your students learn it?	5. How each of the measurable outcomes is measured	6. 2003 assessment findings	7. Changes planned/put into place	8. 2004 assessment findings	9. Impact / further change needed
ABET Criterion 1, item d; Apply creativity in the design of systems, components or processes appropriate to program objectives.	Students should be able to design a system by creatively applying fundamental skills learned in the curriculum.	Some laboratory assignments and projects require a creative approach such as the course projects in ECET109 ECET157, ECET159 and ECET234.	ECET109, ECET157, ECET159, ECET164, ECET207, ECET209, ECET234, and ECET257 have course objectives that have a creative component.	Student self-assessment of their comprehension of course objectives was measured for courses taught during the spring semester. There were 29 course objectives identified with this criterion	The department is strong is this outcome with many relevant course objectives and 89 percent of students indicating they strongly agree or agree that they can perform tasks indicated by the course objectives.	ECET 257 was offered as a problem-based learning course for the first time – all problems presented required significant creativity. Other classes are implementing PBL assignments.	The student self evaluations showed that 84.2 percent strongly agreed or agreed that they could perform tasks related to this objective. The results of the design rubric in ECET257 showed an average of 4.43/5.0.	Investigate methods to further quantify creativity, including within problem-based learning courses or modules.

ECET Assessment Summary of the A.S. Degree Program – Spring 2004

1. General outcomes:	2. What the student will know or be able to do? (measurable outcomes)	3. How will you help students learn it (in class or out of class)	4. Where will your students learn it?	5. How each of the measurable outcomes is measured	6. 2003 assessment findings	7. Changes planned/put into place	8. 2004 assessment findings	9. Impact / further change needed
ABET Criterion 1, item e; Function effectively on teams.	Students should successfully work within a team environment: this includes understanding different roles within a team and working with others in modular designs and projects.	Laboratories are a strong component of this learning objective. In addition normal classroom activities such as lectures, homework, and group learning activities. ECET 234 had some additional instruction on effective teaming, and results were significantly higher.	Students work in small groups in most of our laboratories and learn practical group skills. In addition, courses taught in spring 2002 have 5 course objectives related to group activities. Courses ECET109, ECET155, ECET209 and ECET234 have group projects.	A team-assessment rubric was completed by students and the instructor teaching EET 234. This course was used to evaluate group activity since it is one of the last courses taken for the A.S. degree. Course objectives were evaluated by students.	The percentage of students who strongly agree or agree that they can perform tasks indicated by the course objectives was 83.2 percent. Results from team rubrics in ECET 159 and ECET 209 showed 84.2% of students ranked their team as 3,4, or 5 on a 5-point scale: the average team ranking was 3.79 out of 5	We plan to have students write down the qualifications for a good lab partner in ECET157 and then use this data as a teaching tool. Lab partners will be evaluated based on this criteria. Additional student training at the team level is required: team training has been introduced in EET 155. Assessment rubrics for self- and peer-evaluation will continue to be used.	The percentage of students who strongly agree or agree that they can perform tasks indicated by the course objectives was 83 percent. Results from team rubrics in ECET 234 showed 94.6% of students ranked their team as 3,4, or 5 on a 5-point scale: the average team ranking was 4.48 out of 5	We need to investigate ways to introduce “team training” into the curriculum at the proper level.

ECET Assessment Summary of the A.S. Degree Program – Spring 2004

1. General outcomes:	**2. What the student will know or be able to do? (measurable outcomes)**	**3. How will you help students learn it (in class or out of class)**	**4. Where will your students learn it?**	**5. How each of the measurable outcomes is measured**	**6. 2003 assessment findings**	**7. Changes planned/put into place**	**8. 2004 assessment findings**	**9. Impact / further change needed**
ABET Criterion 1, item f; Identify, analyze and solve technical problems.	There are sets of generally accepted problem types used in the discipline.	A large portion of normal classroom activities such as lecture and homework are devoted to teaching this objective. Laboratories also play a strong role in teaching related to this learning objective.	Mastery of discipline related problem solving is primary objective of the departments teaching mission and all courses in this curriculum have this as a primary focus.	Student self-assessment of their comprehension of course objectives was measured for courses taught during the spring semester. There were 66 course objectives identified with this criterion. Answers to a selected problem from a terminal analog course, EET284, were analyzed to determine problem solving skills.	The department is strong is this outcome with many relevant course objectives and 81.7 percent of students indicating they strongly agree or agree that they can perform tasks indicated by the course objectives. The results from the selected EET 204 problem indicate a 4 out of a possible 5 for problem solving. Results from EET154 indicate that 23 out of 26 students were successful, an 88% success rate.	We are looking at better defining our goals and assessment strategy in this area to better delineate (a) from (f) based on Bloom's level. We plan to look at this over summer 2004.	The department has many course outcomes in this area: 83.9% of students strongly agree or agree that they can accomplish tasks in this area. Results from a survey of three questions in ECET284 measuring analysis skills showed that 65.33% of students scored 70% or higher: there is some question on which analysis problems should be used.	The department will review a set of standard questions from final exams from three required courses in each AS program & track student scores on these problems in addition to the student self-assessment. We are also looking at better delineating (a) from (f) to introduce an assessment of troubleshooting in the laboratory.

ECET Assessment Summary of the A.S. Degree Program – Spring 2004

1. General outcomes:	**2. What the student will know or be able to do? (measurable outcomes)**	**3. How will you help students learn it (in class or out of class)**	**4. Where will your students learn it?**	**5. How each of the measurable outcomes is measured**	**6. 2003 assessment findings**	**7. Changes planned/put into place**	**8. 2004 assessment findings**	**9. Impact / further change needed**
ABET Criterion 1, item g; Communicate effectively.	We evaluated based on communications skills that are expected by industry of recent AS graduates.	Students are required to write papers that are returned for corrections. Oral presentations are critiqued. ENGW131 and COMM R110 are required courses in the curriculum.	Students take the required English composition and speech courses. In addition, papers are required in ECET157 and ECET234. Seventeen course objectives from courses taught in spring were related to communications. Nearly all laboratories require written reports.	Oral presentations and writing skills were evaluated in ECET234.	87.8 percent of students surveyed strongly agreed or agreed they could do tasks in these areas. ECET 155 peer evaluations had an average evaluation of 93%, and written reports (final formal reports) evaluation of 95.6%. Evaluations in ECET204 indicate that 90% of students made written & oral presentations that the instructor felt would be acceptable for a recent A.S. graduate.	Additional instructions on written and oral presentations were introduced in lecture and on the Internet for students in ECET 234.	84.9 percent of students surveyed strongly agreed or agreed they could do tasks in these areas. ECET 234 peer evaluations of oral presentations had an average evaluation of 3.95 out of 5. Instructor evaluations for ECET234 were: oral presentations: 3.86/5 (77%) written: 4.0/5 (80%)	The department will also identify specific written & oral requirements & use a standard assessment rubric to better measure improvement.

ECET Assessment Summary of the A.S. Degree Program – Spring 2004

1. General outcomes:	**2. What the student will know or be able to do? (measurable outcomes)**	**3. How will you help students learn it (in class or out of class)**	**4. Where will your students learn it?**	**5. How each of the measurable outcomes is measured**	**6. 2003 assessment findings**	**7. Changes planned/put into place**	**8. 2004 assessment findings**	**9. Impact / further change needed**
ABET Criterion 1, item h; Recognize the need for and possess the ability to pursue lifelong learning.	Evaluate student's ability to investigate an unfamiliar topic outside of class using global research tools.	Provide guidance to direct students to appropriate research tools.	ECET106 and ECET234.	Student self-assessment of their comprehension of course objectives was measured for courses taught during the spring semester. There were two course objectives identified with this criterion.	The department is strong is this outcome with many relevant course objectives and 90.9 percent of students indicating they strongly agree or agree that they can perform tasks indicated by the course objectives.	Courses such as EET 234 have added assignments requiring students to conduct a research project using outside recourses.	85 percent of students indicated they strongly agree or agree that they can perform tasks indicated by course objectives.	A rubric will be developed for peer assessment of the validity of sources (including Internet URL's). We are also looking at a modification of the writing rubric to separate out "relevant courses used"

ECET Assessment Summary of the A.S. Degree Program – Spring 2004

1. General outcomes:	**2. What the student will know or be able to do? (measurable outcomes)**	**3. How will you help students learn it (in class or out of class)**	**4. Where will your students learn it?**	**5. How each of the measurable outcomes is measured**	**6. 2003 assessment findings**	**7. Changes planned/put into place**	**8. 2004 assessment findings**	**9. Impact / further change needed**
ABET Criterion 1, item i; Understand professional, ethical and societal responsibilities.	Evaluation of course objectives and review case studies / safety requirements. Performance ratios from student designs.	Ethical case studies related to safety are presented in the classroom. Teach design tradeoffs based on costs.	ECET157 and ECET231.	Student self-assessment of their comprehension of this course objective was measured for ECET231 during the spring semester.	80 percent of students indicating they strongly agree or agree that they understand ethical issues related to safety.	ECET 106 and ECET 231 students will be introduced to the importance of these issues in the workplace. Many courses including ECET 106 and ECET 109 course information refers students to the “Code of Conduct” pages on the Internet.	95.2% of students surveyed indicated that they strongly agree or agree that tasks associated with these objectives can be accomplished.	The department is developing a “faculty survey of student behavior” using the Code of Conduct and Civility Statement. We’re also reviewing the teaming rubric to separate out “professional conduct” bullets for assessment.

1. General outcomes:	**2. What the student will know or be able to do? (measurable outcomes)**	**3. How will you help students learn it (in class or out of class)**	**4. Where will your students learn it?**	**5. How each of the measurable outcomes is measured**	**6. 2003 assessment findings**	**7. Changes planned/put into place**	**8. 2004 assessment findings**	**9. Impact / further change needed**
ABET Criterion 1, item j; Recognize contemporary professional, societal and global issues and be aware of and respect diversity.	Respect diversity: Increased awareness of personality types and individual differences.	Students are taught to identify their own personality types based on standard scales such as Meyers-Briggs.	ECET106	Classroom lecture accompanied by on-line assessments.	91.5 percent of students surveyed indicated that they strongly agree or agree that tasks in course objectives in this are can be completed.	EET 103 and EET 105 course information refers students to the "Code of Conduct" pages on the Internet; The department is developing a "faculty survey of student behavior" using the Code of Conduct and Civility Statement.	71.9 percent of students surveyed indicated that they strongly agree or agree that tasks in course objectives in this are can be completed (note: a large number of responses were marked "undecided")	The department is developing a "faculty survey of student behavior" using the Code of Conduct and Civility Statement.

ECET Assessment Summary of the A.S. Degree Program – Spring 2004

1. General outcomes:	**2. What the student will know or be able to do? (measurable outcomes)**	**3. How will you help students learn it (in class or out of class)**	**4. Where will your students learn it?**	**5. How each of the measurable outcomes is measured**	**6. 2003 assessment findings**	**7. Changes planned/put into place**	**8. 2004 assessment findings**	**9. Impact / further change needed**
ABET Criterion 1, item k; Have a commitment to quality, timeliness and continuous improvement.	Timeliness outcomes measured and a rubric for quality will be generated.	Enforcing strict project deadlines and explain the quality rubric.	ECET 109, ECET 157 & ECET 284	We have identified courses for which we track the number of assignments of varying complexity that are submitted by the due date..	91.5 percent of students surveyed indicated that they strongly agree or agree that tasks in course objectives in this are can be completed. In an initial assessment, 83% of the assignments tracked in ECET 207 were submitted on time.	We will increase the amount of data collected to accurately track timeliness.	87% of assignments of different level of complexity and importance in ECET 109 and ECET 234 were submitted on time.	The department plan includes identifying more assignments in different courses for which timeliness will be recorded. Students will *not* be notified which assignments are used to collect this data

ECET ASSESSMENT SUMMARY OF THE B.S. DEGREE PROGRAM – SPRING 2004

1. General outcomes:	**2. What the student will know or be able to do? (measurable outcomes)**	**3. How will you help students learn it (in class or out of class)**	**4. Where will your students learn it?**	**5. How each of the measurable outcomes is measured**	**6. 2003 assessment findings**	**7. Changes planned/put into place**	**8. 2004 assessment findings**	**9. Impact / further change needed**
ABET Criterion 1, item a; Demonstrate an appropriate mastery of the knowledge, techniques, skills and modern tools of their discipline.	There are sets of generally accepted skills that are used in the discipline such as circuit analysis and design, analog and digital design, and programming.	Laboratories are a strong component of this learning objective. In addition normal classroom activities such as lectures, homework, and group learning activities.	Mastery of a skill set is a primary objective of the departments teaching mission and all courses in this curriculum have this as a primary focus.	Student self-assessment of their comprehension of course objectives was measured for courses taught during the spring semester. There were 35 course objectives from courses taught in Spring 2004 identified with this criterion, including ECET491 senior design, the department's terminal course. The design itself and the design process were evaluated in ECET 491. Selected exam questions were used in ECET303. We also surveyed graduates 6 months after graduation to determine how well the ECET department prepared them for the job market.	The department continued to be strong is this outcome with many relevant course objectives and 81.9 percent of students indicating they strongly agree or agree that they can perform tasks indicated by the course objectives. 100% of graduates surveyed replied that the department did a good or excellent job of preparing them for their current assignment.	Courses are assessed at the end of each semester for continuous improvement. In the future the student self-assessment will be augmented with an instructor assessment of students' ability to comprehend the course objectives.	The department continues to be strong is this outcome with 35 relevant course objectives in each course offered; 80.4 percent of students indicating they strongly agree or agree that they can perform tasks indicated by the course objectives	Four courses within ECET will be targeted for assessment of this item in addition to Senior Design

ECET Assessment Summary of the B.S. Degree Program – Spring 2004

1. General outcomes:	**2. What the student will know or be able to do? (measurable outcomes)**	**3. How will you help students learn it (in class or out of class)**	**4. Where will your students learn it?**	**5. How each of the measurable outcomes is measured**	**6. 2003 assessment findings**	**7. Changes planned/put into place**	**8. 2004 assessment findings**	**9. Impact / further change needed**
ABET Criterion 1, item b; Apply current knowledge and adapt to emerging applications in mathematics, science, engineering and technology.	This is determined by a student's ability to synthesize information and arrive at reasoned conclusions.	Laboratories are a strong component of the learning. In addition normal classroom activities such as lectures, homework, and group learning activities.	ECET417, ECET453, ECET490, and ECET491 have course objectives relevant to this criterion. For example, ECET 417 uses VHDL (not typically found in Technology programs).	Student self-assessment of their comprehension of course objectives was measured for courses taught during the spring semester. Altogether 24 course objectives from courses taught in the Spring 2004 semester related to this course objective.	90.0 percent of students indicating they strongly agree or agree that they can perform tasks indicated by the course objectives.	Courses are assessed at the end of each semester for continuous improvement.	80.4 percent of students indicated they strongly agree or agree that they can perform tasks indicated by the course objectives. Out Industrial Advisory Board (IAB) has informally said that our labs deal with emerging technologies.	Additional courses within ECET will be targeted for assessment of this item in addition to Senior Design. A rubric to assess design skills has been developed and will be implemented in these courses. We are looking for a method to quantify our IAB opinion of our laboratories.

ECET Assessment Summary of the B.S. Degree Program – Spring 2004

1. General outcomes:	**2. What the student will know or be able to do? (measurable outcomes)**	**3. How will you help students learn it (in class or out of class)**	**4. Where will your students learn it?**	**5. How each of the measurable outcomes is measured**	**6. 2003 assessment findings**	**7. Changes planned/put into place**	**8. 2004 assessment findings**	**9. Impact / further change needed**
ABET Criterion 1, item c; Conduct, analyze and interpret experiments and apply experimental results to improve processes.	Students ability to conduct experiments and properly measure outputs and form proper conclusions based on the outputs.	Laboratories are a strong component of this learning objective. All ECET courses include a laboratory component.	Students will learn this objective in all AS courses, since they are all include a laboratory component.	Student self-assessment of their comprehension of course objectives was measured for courses taught during the spring semester. There were 5 course objectives identified with this criterion. Laboratory practicals are given in many courses that require a student to design a circuit or system, construct it, and analyze the results to determine if improvements are needed.	77.2 percent of students indicated they strongly agree or agree that they can perform tasks indicated by the course objectives.	Courses are assessed at the end of each semester for continuous improvement.	87 percent of students indicated they strongly agree or agree that they can perform tasks indicated by the course objectives.	Four courses within ECET will be targeted for assessment of this item in addition to Senior Design A rubric to assess design skills has been developed and will be implemented in these courses. We will review the writing & design rubrics to see if any items specifically fall intot his area.

ECET Assessment Summary of the B.S. Degree Program – Spring 2004

1. General outcomes:	**2. What the student will know or be able to do? (measurable outcomes)**	**3. How will you help students learn it (in class or out of class)**	**4. Where will your students learn it?**	**5. How each of the measurable outcomes is measured**	**6. 2003 assessment findings**	**7. Changes planned/put into place**	**8. 2004 assessment findings**	**9. Impact / further change needed**
ABET Criterion 1, item d; Apply creativity in the design of systems, components or processes appropriate to program objectives.	Students should be able to design a system by creatively applying fundamental skills learned in the curriculum.	Some laboratory assignments require a creative approach such as a lab project in ECET307 where students perform two designs and compare and contrast them. Results are presented in persuade investors to invest in the project. In ECET360 students design a production line and make the case for it to potential investors.	ECET303, ECET309, ECET360, ECET417, ECET490, and ECET491 have course objectives that have a creative component.	Student self-assessment of their comprehension of course objectives was measured for courses taught during the spring semester. There were 18 course objectives identified with this criterion. This outcome was also evaluated in ECET491 senior design, the department’s terminal course. The design itself and the design process were evaluated in ECET 491.	74.7 percent of students indicated they strongly agree or agree that they can perform tasks indicated by the course objectives. The results from ECET 491: 4.2/5.0 from a variety of faculty and industry evaluators.	Courses are assessed at the end of each semester for continuous improvement.	80.9 percent of students indicated they strongly agree or agree that they can perform tasks indicated by the course objectives. The results from ECET 491 were very close to the results obtained in the 2003 evaluation, with a 4.14/5.00 rating.	Investigate methods to further quantify creativity, including but not limited to the design rubric, especially within problem-based learning courses or modules., in addition to Senior Design

ECET Assessment Summary of the B.S. Degree Program – Spring 2004

1. General outcomes:	**2. What the student will know or be able to do? (measurable outcomes)**	**3. How will you help students learn it (in class or out of class)**	**4. Where will your students learn it?**	**5. How each of the measurable outcomes is measured**	**6. 2003 assessment findings**	**7. Changes planned/put into place**	**8. 2004 assessment findings**	**9. Impact / further change needed**
ABET Criterion 1, item e; Function effectively on teams.	Team performance was evaluated in ECET 417.	Laboratories are a strong component of this learning objective. In addition normal classroom activities such as lectures, homework, and group learning activities.	Students work in small groups in most of our laboratories and learn practical group skills. Courses ECET309, ECET 360 and ECET 417 have group projects.	A self-assessment was completed by students and the instructor teaching ECET 417. Course objectives were evaluated by students. There was one course with specific objectives relating to this criteria for courses taught in Spring 2004.	78.3 percent of students indicated they strongly agree or agree that they can perform tasks indicated by the course objectives A peer review of teammates in EET 360 rated team member contributions as a 4.4 out of 5.	Courses are assessed at the end of each semester for continuous improvement. Additional teaming instruction needs to be implemented throughout the curriculum.	81.5 percent of students indicated they strongly agree or agree that they can perform tasks indicated by the course objectives ECET 417 had two group projects: the first had an average team score of 3.7/5.0. After teaming instruction, the results were 4.53/5.0. There as a perception that more courses had problems with individual students within teams.	A self-assessment rubric will be used in EET 305 and/or 360: a peer assessment will be conducted in ECET 307 / 371 and/or 417. These rubrics are to be validated by OLS. The improvement in results in 417 show that more teaming instruction should be offered. We need to look at addressing teaming training earlier and throughout the curriculum.

ECET Assessment Summary of the B.S. Degree Program – Spring 2004

1. General outcomes:	**2. What the student will know or be able to do? (measurable outcomes)**	**3. How will you help students learn it (in class or out of class)**	**4. Where will your students learn it?**	**5. How each of the measurable outcomes is measured**	**6. 2003 assessment findings**	**7. Changes planned/put into place**	**8. 2004 assessment findings**	**9. Impact / further change needed**
ABET Criterion 1, item f; Identify, analyze and solve technical problems.	There are sets of generally accepted problem types used in the discipline.	A large portion of normal classroom activities such as lecture and homework are devoted to teaching this objective. Laboratories also play a strong role in teaching related to this learning objective.	Mastery of discipline related problem solving is primary objective of the departments teaching mission and all courses in this curriculum have this as a primary focus.	Student self-assessment of their comprehension of course objectives was measured for courses taught during the spring semester. There were 39 course objectives identified with this criterion. This outcome was also evaluated in ECET491 senior design, the department's terminal course. The design itself and the design process were evaluated in ECET 491.	The department is strong is this outcome with many relevant course objectives and 80.8 percent of students indicating they strongly agree or agree that they can perform tasks indicated by the course objectives. The results from ECET491 were a 4.4 out of a possible 5.	Courses are assessed at the end of each semester for continuous improvement.	83.1 percent of students indicated they strongly agree or agree that they can perform tasks indicated by the course objectives. Results of using the design rubric in ECET417 showed an average of 3.10 out of 5, with 77% of teams scoring a 3, 4, or 5.	Identify appropriate courses for assessment of this item in addition to Senior Design. A rubric to assess design skills has been developed and will continue to be implemented in these courses.

ECET Assessment Summary of the B.S. Degree Program – Spring 2004

1. General outcomes:	**2. What the student will know or be able to do? (measurable outcomes)**	**3. How will you help students learn it (in class or out of class)**	**4. Where will your students learn it?**	**5. How each of the measurable outcomes is measured**	**6. 2003 assessment findings**	**7. Changes planned/put into place**	**8. 2004 assessment findings**	**9. Impact / further change needed**
ABET Criterion 1, item g; Communicate effectively.	We evaluated based on communications skills that are expected by industry of recent AS graduates.	Students are required to write papers that are returned for corrections. Oral presentations are critiqued.	Students take the required English composition and speech courses. In addition, papers are required in ECET490 and ECET491.	Oral and written presentations were evaluated in ECET 491 senior the department's capstone course. Seven course objectives from courses taught in spring were related to communications.	78 percent of students indicated they strongly agree or agree that they can perform tasks indicated by the course objectives. Oral presentations in EET 360 were judged by an outside panel of experts: student presentations were rated at 4.2 out of 5. In ECET 491, the presentations were ranked as 4.2/5.0	The assessment rubrics used in Senior Design were slightly modified to reduce confusion: based on last semester, they will again be slightly modified	95.2 percent of students indicated they strongly agree or agree that they can perform tasks indicated by the course objectives. Written reports in ECET 417 were rated at 4.0/5.0 In ECET 491, the presentations were essentially the same as the previous presentations, ranked as 4.14/5.0	Written reports will be assessed in ECET 304, 417 and senior design; oral reports will be assessed in 360, 371 and senior design. There were more instances of plagiarism this semester: this must be addressed further.

ECET Assessment Summary of the B.S. Degree Program – Spring 2004

1. General outcomes:	**2. What the student will know or be able to do? (measurable outcomes)**	**3. How will you help students learn it (in class or out of class)**	**4. Where will your students learn it?**	**5. How each of the measurable outcomes is measured**	**6. 2003 assessment findings**	**7. Changes planned/put into place**	**8. 2004 assessment findings**	**9. Impact / further change needed**
ABET Criterion 1, item h; Recognize the need for and possess the ability to pursue lifelong learning.	Evaluate student's ability to investigate an unfamiliar topic outside of class using global research tools.	We require research projects using technical literature. ECET 490-91 requires demonstration of technical competence in state-of-the art project management and project design.	In ECET303, ECET307, ECET360, ECET403, ECET472, ECET490 and ECET491.	Student self-assessment of their comprehension of course objectives was measured for courses taught during the spring semester. There were six course objectives identified with this criterion.	The department is strong is this outcome with many relevant course objectives and 79.5 percent of students indicating they strongly agree or agree that they can perform tasks indicated by the course objectives.	Courses which require outside research as part of papers or projects are to stress the importance of assessing the validity of their sources.	87.5 percent of students indicated they strongly agree or agree that they can perform tasks indicated by the course objectives. One finding related to this objective was a sharp increase in plagiarism; the department has developed a plan to address this problem.	Investigate other assessment methods, especially in PBL courses/projects (PBL projects require self-directed learning, essential in life long learning). We are also looking at a modification of the writing rubric to separate out "relevant courses used" We are developing a plan to detect and educate students on plagiarism.

ECET Assessment Summary of the B.S. Degree Program – Spring 2004

1. General outcomes:	**2. What the student will know or be able to do? (measurable outcomes)**	**3. How will you help students learn it (in class or out of class)**	**4. Where will your students learn it?**	**5. How each of the measurable outcomes is measured**	**6. 2003 assessment findings**	**7. Changes planned/put into place**	**8. 2004 assessment findings**	**9. Impact / further change needed**
ABET Criterion 1, item i; Understand professional, ethical and societal responsibilities.	Students can successfully communicate the many alternative choices.	Ethical case studies are presented in the classroom.	ECET491.	There were 4 course objectives from B.S. courses taught in the Spring 2004 semester covering this criteria.	92.9 percent of students indicated they strongly agree or agree that they understand material related to course objectives covering this topic.	This will be better assessed in ECET491in the future.	84 percent of students indicated they strongly agree or agree that they understand material related to course objectives covering this topic. Plagiarism was found to be a significant problem in some courses this year: trhe department has a plan to address this issue.	A faculty survey and student self-assessment tool is planned. A variety of plagiarism detection is planned (google & turnitin.com), as well as education/training on the ethics associated with this practice. Finally, we are looking at using the item “professional conduct” in the team rubric to better assess this area.

ECET Assessment Summary of the B.S. Degree Program – Spring 2004

1. General outcomes:	2. What the student will know or be able to do? (measurable outcomes)	3. How will you help students learn it (in class or out of class)	4. Where will your students learn it?	5. How each of the measurable outcomes is measured	6. 2003 assessment findings	7. Changes planned/put into place	8. 2004 assessment findings	9. Impact / further change needed
ABET Criterion 1, item j; Recognize contemporary professional, societal and global issues and be aware of and respect diversity.	Respect diversity: Increased awareness of individual differences.	Case studies are presented in the classroom.	ECET491	There were five course objectives from B.S. courses taught in the Spring 2004 semester covering this criteria.	92.9 percent of students indicated they strongly agree or agree that they understand material related to course objectives covering this topic.	This will be better assessed in ECET491in the future.	85.5 percent of students indicated they strongly agree or agree that they understand material related to course objectives covering this topic.	A faculty survey and student self-assessment tool is planned.

ECET Assessment Summary of the B.S. Degree Program – Spring 2004

1. General outcomes:	**2. What the student will know or be able to do? (measurable outcomes)**	**3. How will you help students learn it (in class or out of class)**	**4. Where will your students learn it?**	**5. How each of the measurable outcomes is measured**	**6. 2003 assessment findings**	**7. Changes planned/put into place**	**8. 2004 assessment findings**	**9. Impact / further change needed**
ABET Criterion 1, item k; Have a commitment to quality, timeliness and continuous improvement.	Timeliness outcomes measured and a rubric for quality will be generated.	Teach project management making use of Gantt charts and other organizational tools.	ECET490/491	Student self assessment of their comprehension of course objectives was measured for courses taught during the spring semester. There were two course objectives identified with this criterion.	100 percent of students indicated they strongly agree or agree that they understand concepts behind the course objective.	Student self-evaluation and milestone (Gantt) charts (expected and delivered) will be evaluated in Senior Design	87.5 percent of students indicated they strongly agree or agree that they understand material related to course objectives covering this topic.	A rubric to assess milestone charts will be implemented in senior design (ECET 490/491).

FRESHMAN ENGINEERING PROGRAM 2004 ASSESSMENT ANNUAL REPORT							
		Based on ABET outcomes					
Prepared by Freshman Engineering Staff							
June-2004							
1	2	3	4	5	6	7	8
Program outcomes	**Measurable outcomes: What will the student know or be able to do?**	**Courses Reflecting the Outcomes**	**Methods of Teaching/Learning**	**How do you measure each of the desired behaviors listed in column 2?**	**What are findings in assessing general outcomes (column 1)?**	**Proposed improvements (and changes) based on available assessment findings?**	**Impact of changes?**
(a) Ability to apply knowledge of mathematics, science, and engineering	Students will be able to use Matlab to perform computations involving scalars, vectors and matrices. Students will be able reverse-engineer a real world electro-mechanical device. Students will be able to write programs in C language to solve engineering problems.	ENGR 196, ENGR 197	Lectures, computer assignments, labs, group discussions, homework assignments, reverse-engineering projects. .	Tests, homework, computer programs, course outcome surveys, student satisfaction surveys, evaluation of project reports.	Quantitative assessment across sections is not available. Outcome surveys for ENGR 196 and 197 have ratings above 3.75 for most outcomes involving math and science application. Preliminary survey indicates benefit of a reverse-engineering project in meeting learning objectives.	Use standardized exams for the different sections of courses to help better assess the program outcomes. (A standardized final exam for ENGR 197 is planned for 2004-2005.) Extend hands-on team projects to all sections of Engr 196. Develop better-structured projects using feedback gained from pilot project survey in spring 2004.	

Program outcomes	Measurable outcomes: What will the student know or be able to do?	Courses Reflecting the Outcomes	Methods of Teaching/Learning	How do you measure each of the desired behaviors listed in column 2?	What are findings in assessing general outcomes (column 1)?	Proposed improvements (and changes) based on available assessment findings?	Impact of changes?
(b) Ability to design and conduct experiments, as well as to analyze and interpret data	Students will be able to conduct experiments by following instructions for set up of simple experiments. Students will be able to obtain experimental numerical or graphical data and to compare results with theoretical models.	ENGR 196	Tutorials in class, lectures, computer assignments, lab work, group discussions, homework assignments, and Web resources.	Lab reports and outcome surveys.	Outcome survey results suggest that students have better mastery of simulation than of circuit construction and experimentation.	Make available to all sections the additional circuit building exercises that have been developed for extra credit.	

Program outcomes	Measurable outcomes: What will the student know or be able to do?	Courses Reflecting the Outcomes	Methods of Teaching/Learning	How do you measure each of the desired behaviors listed in column 2?	What are findings in assessing general outcomes (column 1)?	Proposed improvements (and changes) based on available assessment findings?	Impact of changes?
(d) Ability to function on multi-disciplinary teams	Students will be able to work together in small groups to carry out experiments and to complete projects. Students will be able to collaborate with others to report on project findings, orally and in writing. Students will be able to operate as a member of a team with an understanding of the roles and relationships of members.	ENGR 195, ENGR 196	Lectures and team building exercises, practice in teamwork doing laboratory experiments, reverse engineering projects, library research projects, and team oral and written reports.	Lab reports, project presentation grades, and peer evaluations	Current group work appears to provide sufficient interaction between students of different disciplines, but not all teams are functioning well.	Encourage student participation in student organizations and activities (ASME, NSBE, robots, moon buggy) at freshman level. Include more specific teamwork instruction in ENGR 196 and extend reverse engineering team projects to all sections. Add team instruction at Butler and also a more comprehensive team project.	Project survey and peer evaluations in IUPUI engineering classes indicate most groups are performing and that ENGR 195 instruction in teamwork has been helpful in teamwork in ENGR 196 pilot reverse engineering project.

Program outcomes	Measurable outcomes: What will the student know or be able to do?	Courses Reflecting the Outcomes	Methods of Teaching/Learning	How do you measure each of the desired behaviors listed in column 2?	What are findings in assessing general outcomes (column 1)?	Proposed improvements (and changes) based on available assessment findings?	Impact of changes?
(e) Ability to identify, formulate, and solve engineering problems	Starting with a given problem, students will be able to develop and solve algorithms with Matlab or C programs. Students will be able to solve for electrical circuit voltages and currents using Pspice.	ENGR 196, ENGR 197	Lectures, assigned computer programs, and class exercises.	Tests, quizzes, homework, computer programs, outcome surveys.	Complaints were received from some students in ENGR 197 regarding learning both Matlab and C programming in one semester. Too much is covered in a short time. In outcome surveys, students have criticized the textbook. In outcome surveys, writing of C programs to solve engineering problems continues to receive ratings lower than 3.75.	Review freshman courses to look at a possible rearrangement of content, offering Matlab and C programming as separate modules. Change the C textbook (being changed in fall, 2004). Administer a standardized C programming final exam in 2004-2005 to assist with assessment.	

Program outcomes	Measurable outcomes: What will the student know or be able to do?	Courses Reflecting the Outcomes	Methods of Teaching/Learning	How do you measure each of the desired behaviors listed in column 2?	What are findings in assessing general outcomes (column 1)?	Proposed improvements (and changes) based on available assessment findings?	Impact of changes?
(f) Understand professional and ethical responsibilities.	Students should be able to demonstrate a knowledge of the engineering professional societies Students should be able to articulate an understanding of the responsibility of engineers regarding safety.	ENGR 195	Lectures and case studies.	Homework, reports and outcome surveys.	Outcome surveys indicate student mastery (ratings above 4.1).	Try to insure that professional society representatives meet with all sections early in the semester.	

Program outcomes	Measurable outcomes: What will the student know or be able to do?	Courses Reflecting the Outcomes	Methods of Teaching/Learning	How do you measure each of the desired behaviors listed in column 2?	What are findings in assessing general outcomes (column 1)?	Proposed improvements (and changes) based on available assessment findings?	Impact of changes?
(g) Ability to communicate effectively	Students will be able to write reports and make project presentations to peers.	ENGR 195 ENGR 196	Lectures, project reports, and oral presentations including PowerPoint.	Written report and oral presentation evaluations using rubrics.	Students are developing an appreciation for communication skills in engineering. Better guidelines are needed for reports in reverse engineering project.	Improve guidelines for reverse engineering project reports.	

Program outcomes	Measurable outcomes: What will the student know or be able to do?	Courses Reflecting the Outcomes	Methods of Teaching/Learning	How do you measure each of the desired behaviors listed in column 2?	What are findings in assessing general outcomes (column 1)?	Proposed improvements (and changes) based on available assessment findings?	Impact of changes?
(h) The broad education necessary to understand the impact of engineering solutions in a global and societal context	Students will demonstrate awareness of global impact of engineering on society and environment.	ENGR 195	Lectures, literature surveys and case studies.	Homework, project reports, project presentations, and outcome surveys.	Students indicate a preliminary understanding in outcome surveys and in project presentations.	Build on foundation from ENGR 195 in reverse engineering projects in ENGR 196. .	

Program outcomes	Measurable outcomes: What will the student know or be able to do?	Courses Reflecting the Outcomes	Methods of Teaching/Learning	How do you measure each of the desired behaviors listed in column 2?	What are findings in assessing general outcomes (column 1)?	Proposed improvements (and changes) based on available assessment findings?	Impact of changes?
(k) Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Students will be able to use engineering tools like ProE, Matlab, Excel, and PSpice to complete engineering assignments. Students will be able to use Front Page to develop web pages. Students will be able to perform library and web searches. Students will be able to use PowerPoint in presentations.	ENGR 195, ENGR 196, ENGR 197	Lectures, classroom assignments, tutorials, homework, and laboratory work.	Graded assignments, lab reports, tests, project presentations, and outcome surveys.	Products produced indicate at least minimal proficiency in use of tools such as Front Page, PowerPoint, Excel, PSpice, library databases, and ProENGINEER. Survey of pilot reverse engineering project participants indicated that the project enhanced ProE proficiency. Outcome surveys indicate students are confident of MATLAB mastery (ratings above 3.75).	Extend reverse engineering projects to all sections of ENGR 196 to enhance ProE applications and give more experience with PowerPoint.	

Freshman Engineering Assessment Report for 2003-2004
Part 2

Analysis of Student Satisfaction Survey Data

Student satisfaction data for the Freshman Engineering Program summarized below show an improvement in student satisfaction for ALL categories in the Spring 2004 semester when compared with those considered in Spring 2003. A comparison between Fall 2003 and Spring 2004 is not as dramatic, indicating a slight drop in about half the categories with a rise in the rest.

-In both spring and fall semesters satisfaction was relatively high in the areas of academic advising and classroom environment.

-Students were least satisfied with quality of help sessions in aiding performance in spring 2004. This is an important category especially as it relates directly to retention. We have been monitoring help session attendance and are continually adjusting hours to try to meet student needs. Recently one of the faculty members has been in attendance at two of the regularly scheduled help sessions per week to monitor the support given to students. In the future tutor training will be required. We are proposing having a room designated for Freshman engineering ("Learning Center") where students would be able to congregate during the school hours to get whatever assistance is needed. The room would be manned by student assistants and also equipped with computers and any other equipment to make the environment conducive.

-Quality of the computer labs has been variable for some time but peaked in spring 2004, when some labs were upgraded with new computers. A computer lab in the engineering building is also to be upgraded for the fall 2004 semester. It has been designated for engineering class use.

-Opportunities for networking with fellow students and faculty through professional societies such ASME, IEEE, etc has shown a steady rise from Spring 2003 when it had the lowest rating to Spring 2004 when it is about average. In the freshman learning community class, we are trying to place increased emphasis on participation in student organizations because of the benefits gained. We have established a freshman student listserv and hope to use it more in the future to promote student organization activities.

-Hopefully the inclusion of more hands-on project work in the freshman curriculum will also help to familiarize students with engineering disciplines.

-Assistance with career planning and department selection is an area we hope to incorporate in academic advising since many students at this stage are not sure what kind of engineering they are interested in.

Summary of Student Satisfaction Survey Results
Freshman Engineering Program
2003-2004

	Questions	Spring 2003	Fall 2003	Spring 2004
1.	Quality of Academic Advising	3.88 (95)	3.97 (139)	3.95 (129)
2.	Quality of student support in adjusting to college	3.56 (81)	3.77 (124)	3.72 (129)
3.	Scheduling of ENGR 195, 196, 197	3.76 (104)	3.80 (141)	3.78 (129)
4.	Classroom environment conducive to learning	3.82 (103)	3.86 (145)	3.91 (129)
5.	Quality of Engineering and Technology computer labs	3.85 (105)	3.60 (141)	3.99 (129)
6.	Quality of ENGR 196/197 help sessions in aiding classroom performance	3.48 (61)	3.61 (88)	3.54 (129)
7.	Opportunities for networking with fellow students and faculty through professional societies such as ASME, IEEE, AIAA, SWE, NSBE, SAE, etc.	3.25 (63)	3.60 (103)	3.73 (129)
8.	Career planning assistance, department selection (ME/ECE/others) and study skills development	3.43 (71)	3.38 (117)	3.57 (129)
9.	Overall freshman experience on the IUPUI campus	3.57 (97)	3.75 (138)	3.79 (129)
10.	Overall quality of Freshman Engineering education	3.65 (100)	3.80 (142)	3.78 (129)
11.	Quality of Instruction (new question for Spring 2004)	N/A	N/A	3.89 (129)

Retention

The following tables show four-year engineering retention data for students matriculating in Freshman Engineering during the 1999–2000 academic year and the 2000-2001 academic year. Data indicate that retention needs to be improved, particularly for beginning students admitted directly from high school. The higher retention rates for IUPUI transfers may be due to the fact that students who drop out during the first year of enrollment in other IUPUI academic units (and in University College in particular) are not reflected in the data. (Such students entering Freshman Engineering have already succeeded in the first year of enrollment.) Similarly, the data show that once students have completed the freshman engineering curriculum and have been admitted to the engineering departments, retention in engineering is very high.

The Office of Freshman Engineering has initiated the following efforts to improve retention:

- We have further developed the learning community course (ENGR 195), first piloted in the fall semester of 1999, to include increased emphasis on teamwork and group experiences. The course now includes greater emphasis on information technology resources and skills as well. By increasing the number of sections from four in 1999-2000 to seven in 2003-2004, we have exposed more students to the study of engineering and strategies for success. Course evaluations from students are very high.

- More hands-on work is being developed in the Introduction to Engineering course. In the fall semester, new circuits projects, including sequential timer and oscillator circuits, were introduced. In the spring semester of 2004 a reverse engineering project, using a tool with both electrical and mechanical components (a gasoline powered weed-eater) was piloted. Studies show that introduction of hands-on projects in the freshman year improves retention of engineering students. Such projects, when done in small groups, foster community and also show students the relevance of other courses in the curriculum.

- Tutoring for both ENGR 196 and ENGR 197 has been increased. Tutoring sessions in the computer lab are scheduled throughout the week. The Freshman Program envisions a learning center where freshman students can meet and work on homework for freshman courses, with tutoring help available during extended hours throughout the week.

- Plans have been made to improve advising at Butler by reviewing early warning grades of freshman students and initiating intervention with those having difficulty and also by asking each student to make an advising appointment with an engineering advisor each semester. Learning community topics will be incorporated into the freshman curriculum at Butler.

Retention Statistics for
Students Entering Freshman Engineering during 1999-2000 Academic Year
As of July, 2003

Academic Standing	Beginners	Transfers Other Schools	IUPUI Transfers	EDDP
Graduated or at Senior Status in Engineering	14	26	15	12
Still in Engineering at Freshman – Junior Level	5	10	5	1
Known to have Transferred to Another University	5	2	2	1
Graduated or at Senior Status at IUPUI in Major other than Engineering	8 (Includes 2 AS degrees in Tech).	3	2	11 (at Butler)
At IUPUI in another Major at Freshman – Junior Level	3	5	4	
Dropped Out	19	24	8	10
Total	**54**	**70**	**36**	**35**
Percentage Retained in Engr	**35.19**	**51.43**	**55.56**	**37.14**

Retention Statistics for
Students Entering Freshman Engineering During 1999-2000 Academic Year
And Later Moved to ECE or ME Department
As of July, 2003

Academic Standing	Beginners	Transfers Other Schools	IUPUI Transfers	EDDP
Graduated or at Senior Status in Engineering	14	23	14	12
Still in Engineering at Freshman – Junior Level	3	5	3	
Graduated or at Senior Status at IUPUI in Major other than Engineering		1		
At IUPUI in another Major at Freshman – Junior Level		1	2	
Dropped Out		4		
Total	**17**	**34**	**19**	**12**
Percentage Retained in Engr	**100**	**82.35**	**89.47**	**100**

Retention Statistics for
Students Entering Freshman Engineering during 2000-2001 Academic Year
As of June, 2004

Academic Standing	Beginners	Transfers Other Schools	IUPUI Transfers	EDDP
Graduated or at Senior Status in Engineering	16	30	12	12
Still in Engineering at Freshman – Junior Level	3	13	4	
Known to have Transferred to Another University	4	6	2	1
Graduated or at Senior Status at IUPUI in Major other than Engineering	3	4		9 (at Butler)
At IUPUI in another Major at Freshman – Junior Level	2	2	1	2
Dropped Out	14	46	4	6
Total	**42**	**101**	**23**	**30**
Percentage Retained in Engr	**45.24%**	**42.57%**	**69.57%**	**40.0%**

Retention Statistics for
Students Entering Freshman Engineering During 2000-2001 Academic Year
And Later Moved to ECE or ME Department
As of June, 2004

Academic Standing	Beginners	Transfers Other Schools	IUPUI Transfers	EDDP
Graduated or at Senior Status in Engineering	16	30	12	12
Still in Engineering at Freshman – Junior Level	2	4	3	
Graduated or at Senior Status at IUPUI in Major other than Engineering	1			
At IUPUI in another Major at Freshman – Junior Level	1			
Dropped Out				1
Total	**20**	**34**	**15**	**13**
Percentage Retained in Engr	**90%**	**100%**	**100%**	**92.31%**

Retention Summary
Percentages of Students Retained in Engineering

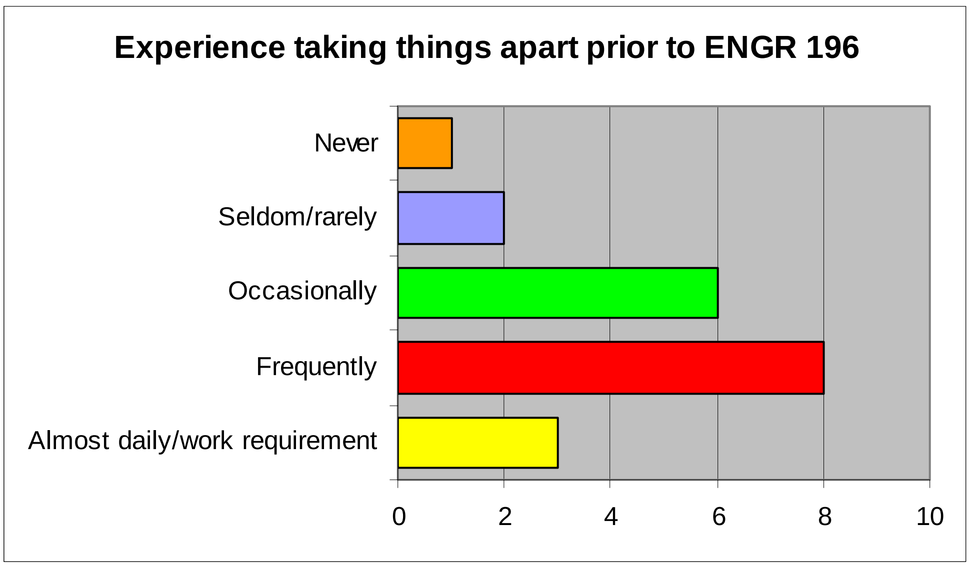
Admission Category	**Students Entering 1999-2000 Percentage Retained**	**Students Entering 2000-2001 Percentage Retained**
Beginners	35.19 %	45.24 %
Transfers from Other Schools	51.43 %	42.57 %
IUPUI Transfers	55.56 %	69.57 %
EDDP	37.14 %	40.0 %
Overall Retention (All Students)	**45.12 % (n = 195)**	**40.82 % (n = 196)**

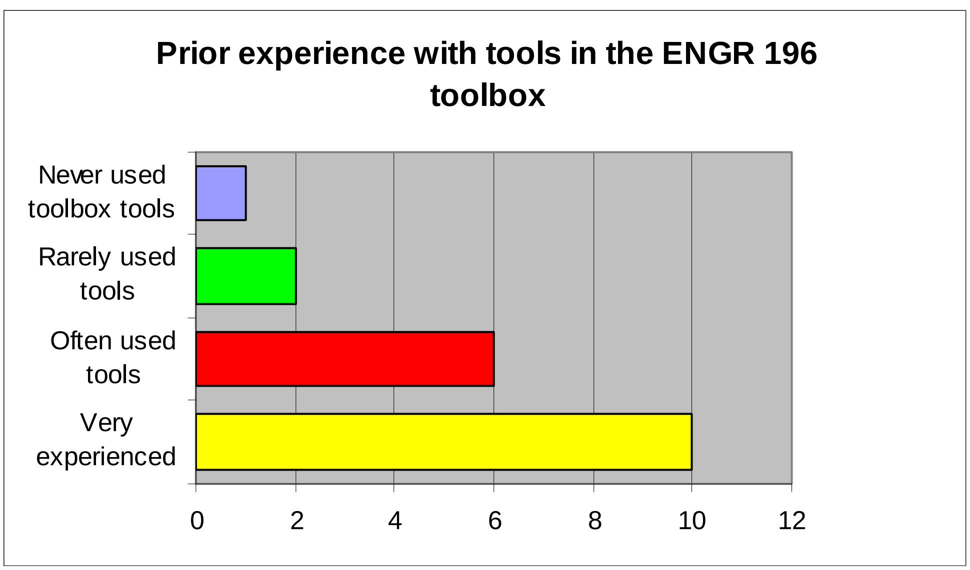
Analysis of the ENGR 196 Project Survey

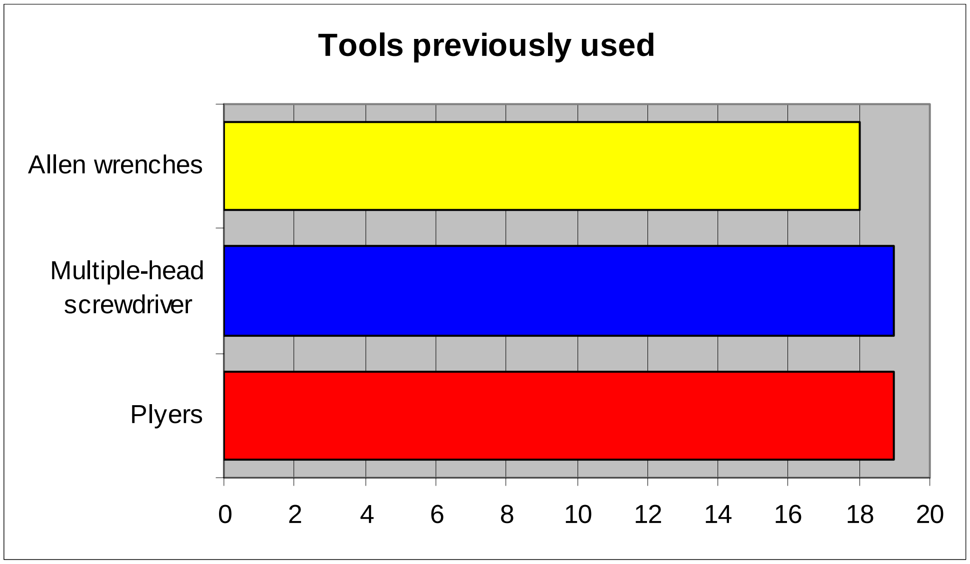
One of the Spring 2004 sections of ENGR 196 piloted the weedeater project in which students reversed engineered an actual weedeater, drew the weedeater parts in ProEngineer and then reassembled the weedeater. The project was designed to give students a multidisciplinary, hands experience with both engineering design and some of the software taught in ENGR 196. Students were divided in teams and made group presentations at the end of the semester. They then were surveyed about how the project affected their understanding of the coursework and of engineering.

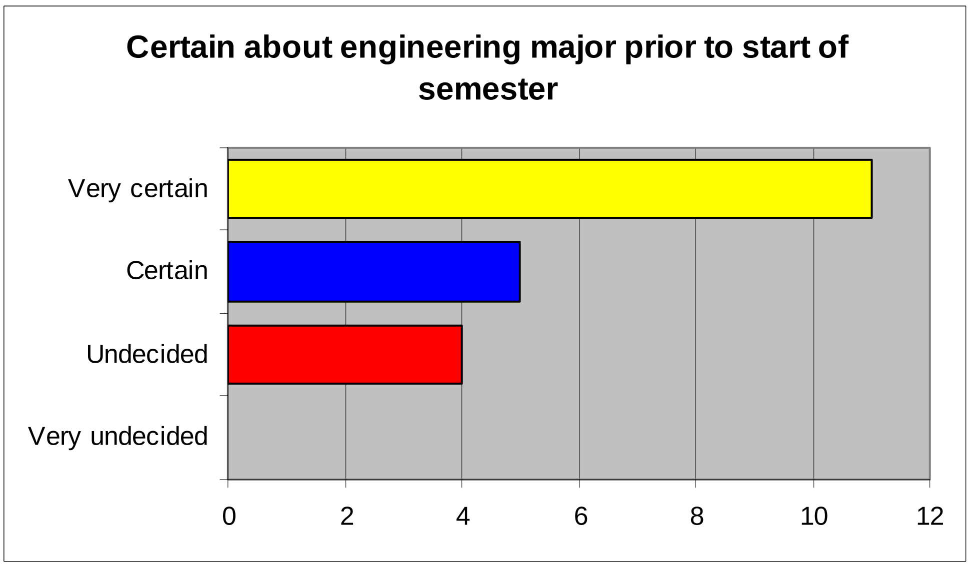
Additionally, 13 of the 20 students taking the class either were currently or previously enrolled in ENGR 195, Introduction to the Engineering Profession. These students responded to additional questions regarding some of the topics covered in ENGR 195 such as use of library research methods and teamwork.

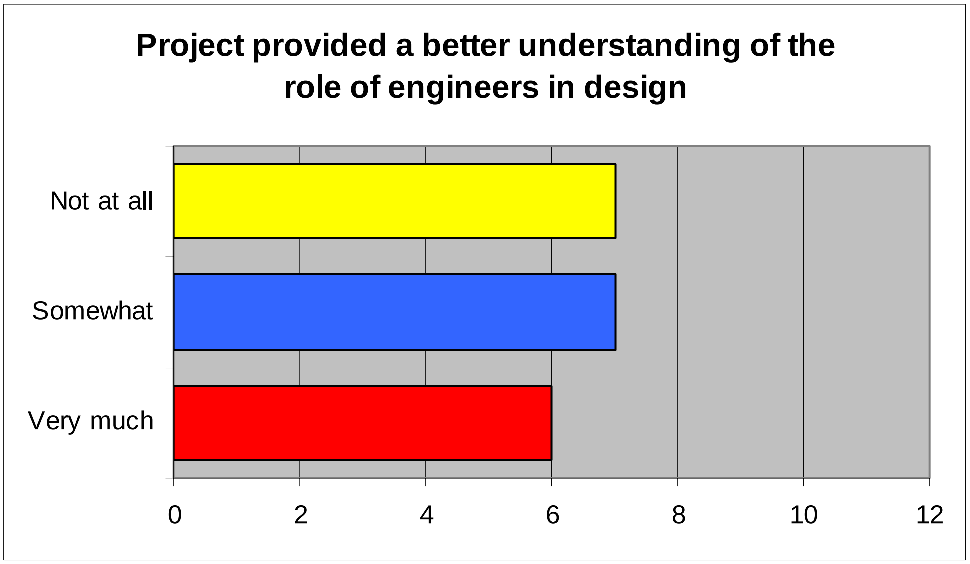
The following charts illustrate the student responses:

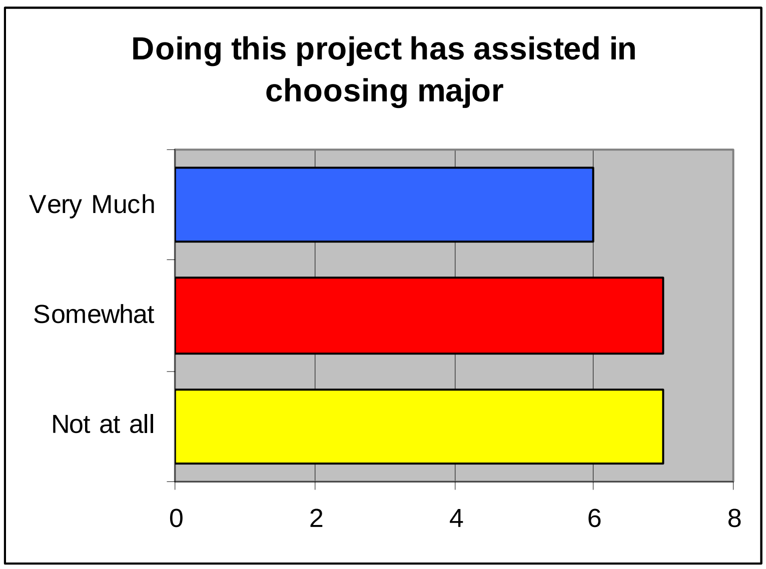


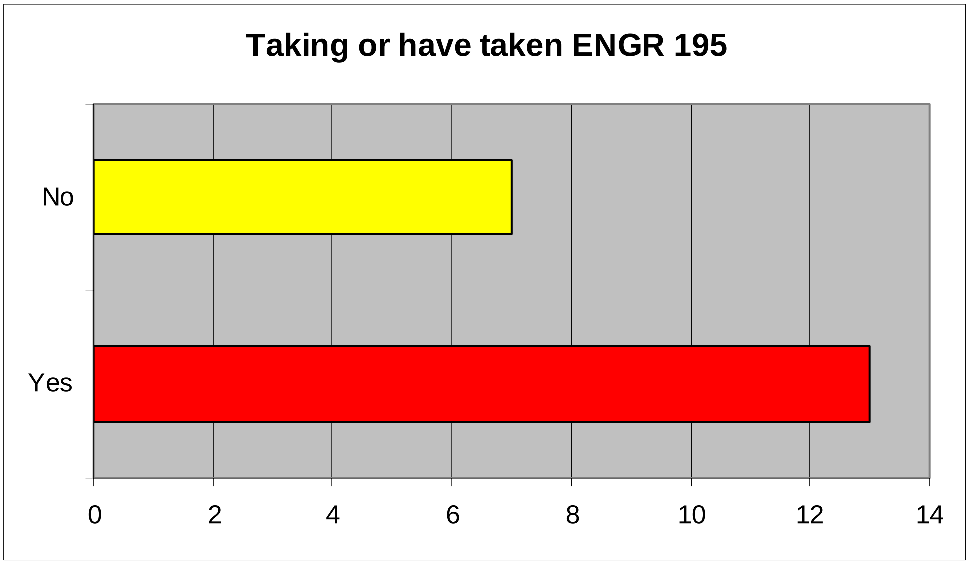



Tools previously used
Allen wrenches
Multiple-head screwdriver
Plyers
0
2
4
6
8
10
12
14
16
18
20

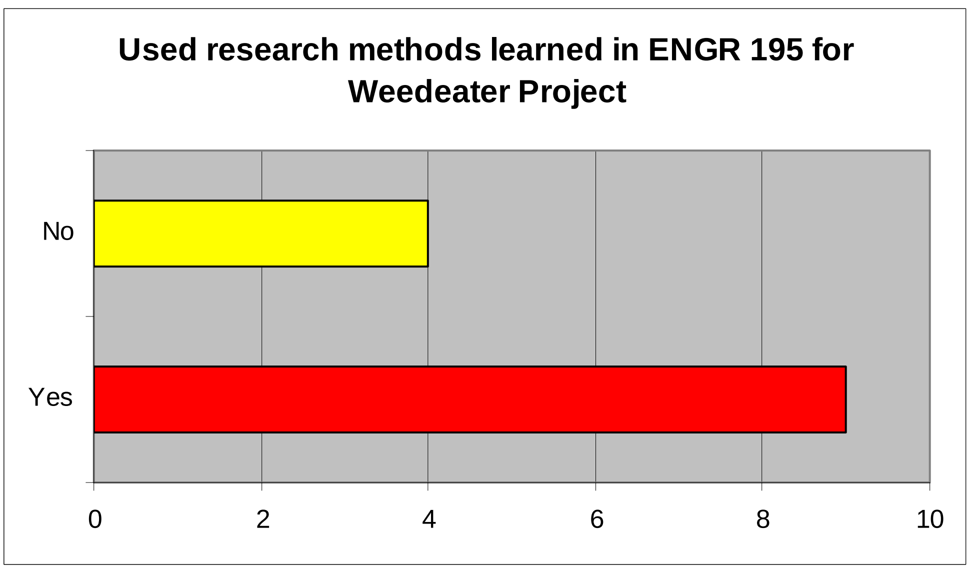

Certain about engineering major prior to start of semester
Very certain
Certain
Undecided
Very undecided
0
2
4
6
8
10
12

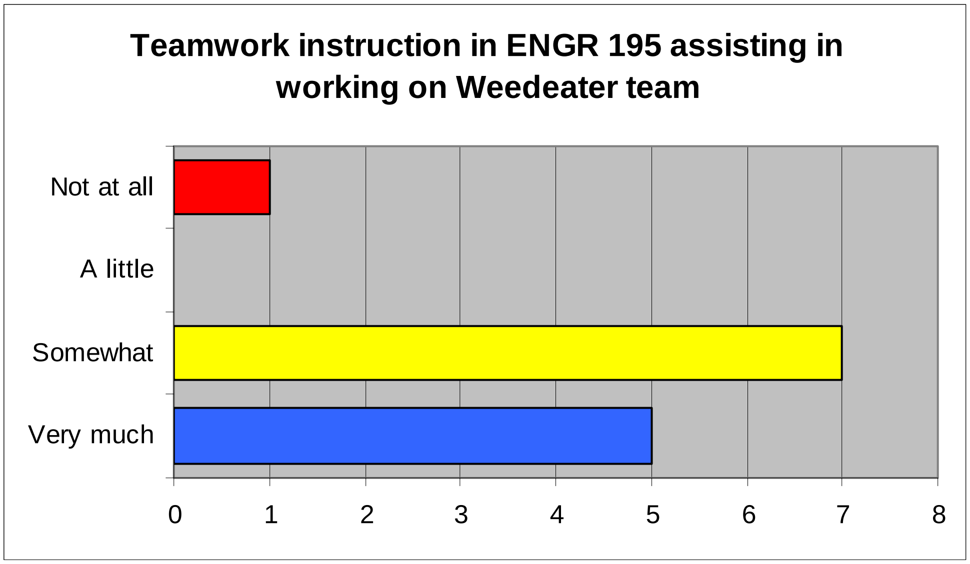

Project provided a better understanding of the role of engineers in design
Not at all
Somewhat
Very much
0
2
4
6
8
10
12

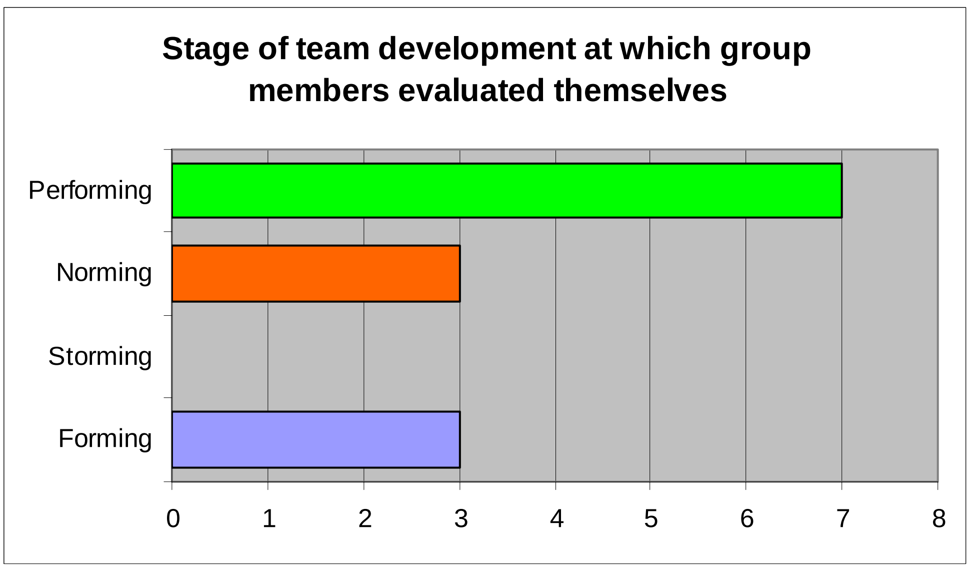

Doing this project has assisted in choosing major
Very Much
Somewhat
Not at all
0
2
4
6
8



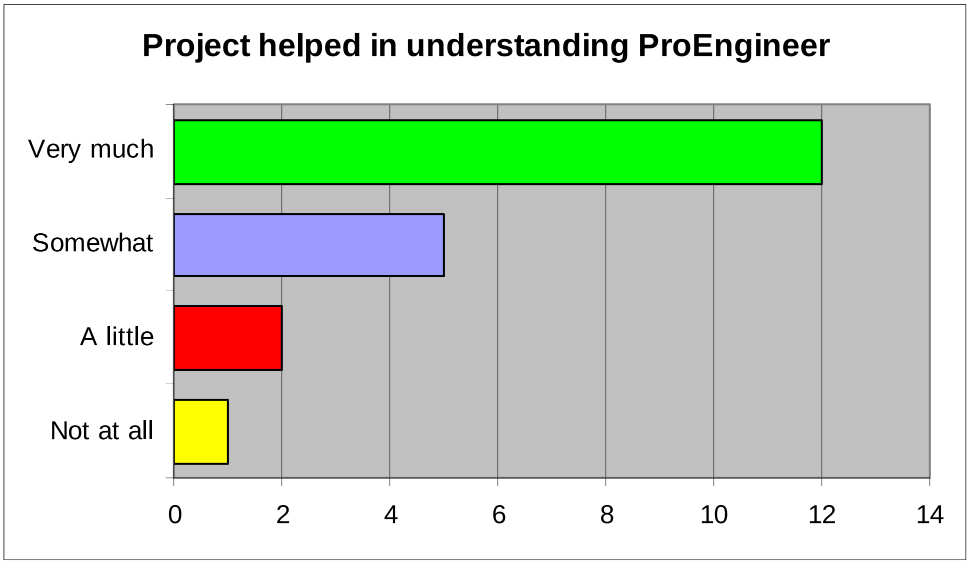
The following three questions were answered only by those students who have taken or were currently taking ENGR 195.

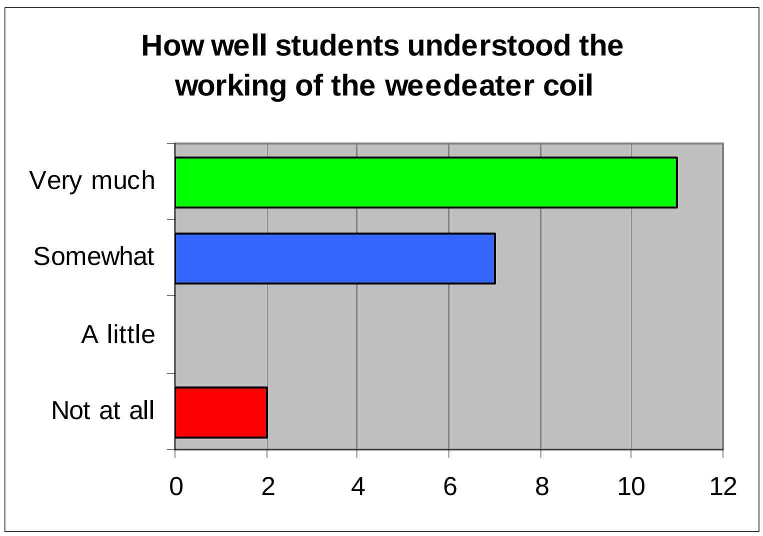






The remaining responses were asked of all students.


Project helped in understanding ProEngineer
Very much
Somewhat
A little
Not at all
0
2
4
6
8
10
12
14


How well students understood the working of the weedeater coil
Very much
Somewhat
A little
Not at all
0
2
4
6
8
10
12

Department of Mechanical Engineering, IUPUI
Annual Assessment Report for 2003/2004 Academic Year

Prepared by: H.U. Akay in collaboration with ME Faculty

July 6, 2004

1. Preamble

A program assessment process has been in place in the Department of Mechanical Engineering since Fall 2000 for continuous evaluation and improvement of its undergraduate program. This process has been influenced by the requirements of the Accreditation Board for Engineering and Technology (ABET) together with the assessment processes of IUPUI and the School of Engineering and Technology. Consistent with the criteria set by ABET, a set of *Program Educational Objectives* has been prepared that describe the expected accomplishments of graduates during the first few years after graduation as well a set of *Program Outcomes* that describe what students are expected to perform by the time of graduation. Our Bachelor's of Science in Mechanical Engineering degree is scheduled to be reviewed by ABET for re-accreditation in Fall 2004, for which a comprehensive self-study report has been prepared. In this report, we will summarize the program assessment process that has been in place in the department and the findings and changes made as a result of this process. More details are in the full self-study report which is accessible from url: http://www.engr.iupui./edu/me/fabetreport.shtml).

2. Program Educational Objectives of the Department of Mechanical Engineering

The Program Educational Objectives have been set by the Department's Assessment and Undergraduate Education Committees in consultation with the faculty, and feedback from industry and alumni. These objectives have been made to be consistent with the mission of the department. Accordingly, the Program Educational Objectives of the Department of Mechanical Engineering are to educate undergraduate students who – during the first few years following the graduation – will:

1. Demonstrate excellent technical capabilities in mechanical engineering and related fields
2. Be responsible citizens
3. Continue their professional advancement through life-long learning
4. Apply sound design methodology in multidisciplinary fields of mechanical engineering
5. Competently use mathematical methods, engineering analysis and computations, and measurement and instrumentation techniques
6. Practice effective oral and written communication skills
7. Understand the environmental, ethical, diversity, cultural, and contemporary aspects of their work
8. Work collaboratively and effectively in engineering or manufacturing industries

3. Program Outcomes of the Department of Mechanical Engineering

The Program Outcomes of the department have been prepared by the faculty with early feedback received from alumni and employers consistent with the criteria set by the Accreditation Board for Engineering and Technology (ABET). Accordingly, the Program Outcomes of the Department of Mechanical Engineering are to educate graduates who – by the time of graduation – will be able to:

a. Demonstrate and apply knowledge of mathematics, science, and engineering with:

- a1. Knowledge in chemistry and calculus-based physics in depth [1, 5]
- a2. Mathematics through multivariate calculus, differential equations, and linear algebra [1, 5]
- a3. Probability and statistics [1, 5]
- a4. Mechanical engineering sciences: solid mechanics, fluid-thermal sciences, materials science [1, 4, 5]

b. Conduct experiments methodically, analyze data, and interpret results [1, 5]
c. Design a system, component, or process to meet desired needs with applications to:
- c1. Mechanical systems [4]
- c2. Thermal systems [4]

d. Function in teams to carry out multidisciplinary projects [4, 8]
e. Identify, formulate, and solve engineering problems [5]
f. Understand professional and ethical responsibilities [2, 7]
g. Communicate effectively in writing and orally [6]
h. Understand the impact of engineering solutions in a global and societal context through broad education [7]
i. Recognize the need to engage in lifelong learning [3]
j. Demonstrate knowledge of contemporary issues [2]
k. Use the techniques, skills, and modern tools of engineering effectively and correctly in engineering practice with:
- k1. Mechanical engineering analysis tools (e.g., ANSYS, ProMechanica, etc.) [4, 5, 8]
- k2. Engineering design and manufacturing tools (e.g., AutoCAD, ProE, etc.) [4, 5, 8]
- k3. Internet and library information resources [3, 8]
- k4. Mathematical computing and analysis tools (e.g., Matlab, Excel, LabView, Minitab, etc.) [4, 5, 8]

The relationship of the above program outcomes from a thru' k to program objectives 1 thru' 8 listed in Section 2 are indicated in brackets. This relationship is further depicted in Table 1, where it is seen that each outcome meets at least one objective, conversely at least one objective is covered by at least one of the program outcomes. Since the program outcomes are adequately linked to meet the program educational objectives, we believe that the program educational objectives will be adequately met by strongly meeting the program outcomes.

4. IUPUI Principles of Undergraduate Learning

Our program outcomes have been made to be also consistent with the IUPUI Principles of Undergraduate Learning (PULs), a set of campus-wide adopted principles which describe the fundamental intellectual competence and cultural and ethical awareness that every graduate of an IUPUI baccalaureate degree program should attain as follows:

1. Core Communication and Quantitative Skills
2. Critical Thinking
3. Integration and Application of Knowledge
4. Intellectual Depth, Breadth, and Adaptiveness
5. Understanding Society and Culture
6. Values and Ethics

More information on the PULs is accessible from the IUPUI teaching portfolio web site http://www.iport.iupui.edu/teach/teach_pul.htm.

Our department has decided early in the process to focus primarily on the program outcomes, while making sure that the PULs are met automatically by meeting the program outcomes. A matrix showing the linkage between our program outcomes and the IUPUI PULs prepared for this purpose showed that there is a sufficient linkage between the program outcomes and PULs as can be seen in Table 2. This way, the assessment efforts on program outcomes lead to assessment of PULs.

5. Tools and Methodology for Continuous Evaluation and Improvement of the Program

The department has developed several tools for continuous evaluation and improvement of the program which are described in this section.

Tools Developed

The tools that we have in place to assess effectiveness of our program and making changes when needed fall into direct and indirect evidence categories. Among the indirect evidence category, we regularly conduct and analyze several surveys as follows:

1. Course learning outcomes surveys in all courses conducted at the end of each semester to determine self-assessment of students on how well the course outcomes are met
2. Exit surveys on program outcomes conducted at the time of graduation to obtain self-assessment of the graduates on how well the program outcomes are met
3. Annual student satisfaction survey conducted annually to determine student satisfaction with the program
4. Undergraduate Student Advisory Board that provides input on student satisfaction and needs
5. Alumni survey for measuring the impact of program outcomes in the performance of graduates

Table 1 Linkage between program outcomes and program objectives (X indicates the linkage).

Program Outcomes	Program Objectives							
	1	2	3	4	5	6	7	8
a1	X				X			
a2	X				X			
a3	X				X			
a4	X			X	X			
b	X				X			
c1				X				
c2				X				
d				X				X
e					X			
f		X					X	
g						X		
h							X	
i			X					
j		X						
k1				X	X			X
k2				X	X			X
k3			X					X
k4				X	X			X

Table 2 Linkage of ME Program Outcomes (ABET) to PUL Outcomes (prepared by C. Yokomoto and H. Akay).

3 = strong linkage, 2 = moderate linkage, 1 = mild linkage

ABET OUTCOMES EAC CRITERIA #3, items a through k	INDIANA UNIVERSITY-PURDUE UNIVERSITY INDIANAPOLIS PRINCIPLES OF UNDERGRADUATE LEARNING																				
	PUL 1					PUL 2					PUL 3			PUL 4			PUL 5			PUL 6	
	Core Communication and Quantitative Skills					Critical Thinking					Integration and Application of Knowledge			Intellectual Depth, Breadth, and Adaptiveness			Understand Society and Culture			Values and Ethics	
	a	b	c	d	e	a	b	c	d	e	a	b	c	a	b	c	a	b	c	a	b
(a) - An ability to apply knowledge of mathematics, science and engineering				3		2	2		2	2	2			3	2						
(b) - An ability to design and construct experiments as well as to analyze and interpret data				1		3	3	3	3					3	1						
(c) - An ability to design a system, component, or process to meet desired needs									3		3	2	3	3		3					
(d) - An ability to function on multi-disciplinary teams			2												1	3			2		
(e) - An ability to identify, formulate and solve engineering problems		2		3		3	3	3	3	3	3		3	3	1	2					
(f) - An understanding of professional and ethical responsibility		1				3	3			2		1	1		3			1	2	3	
(g) - An ability to communicate effectively	3		3																		
(h) - The broad education necessary to understand the impact of engineering solutions in global societal context													2		2		2	2		2	2
(i) - A recognition of the need for and an ability to engage in life-long learning		1																			
(j) - A knowledge of contemporary issues		1								1					1	1	2	2	1	2	2
(k) - An ability to use the techniques, skill and modern engineering tools necessary for engineering practice					3							3	1	3							

The direct evidence tools consist of:

1. Industrial Advisory Board that provides input on performance and expected qualifications of graduates
2. Employer survey for measuring effectiveness of the program outcomes in the work force
3. Fundamentals of Engineering (FE) exam results on students who take it in their senior year
4. Feedback forms for course outcomes survey results completed and submitted at the end of each semester by the faculty teaching the courses
5. Jury evaluations in key courses that involve final project reports or presentations in front of an audience of faculty, industry guests, and fellow students
6. Instructor's assessment of student performance in course outcomes via evaluation of key exams, projects and homework against the course outcomes

It is to be noted that the course outcomes surveys are independent of the course and instructor evaluations. While the course outcome survey results are shared with all faculty, course and instructor evaluation survey results are confidential and shared only with the individual faculty as a means of feedback to improve his or her teaching.

Groups/Committees Monitoring Assessment

Results of the above assessment tools have been continuously monitored by the following groups and committees in the department:

1. Assessment and Accreditation Committee (AAC)
2. Undergraduate Education Committee (UEC)
3. Industrial Advisory Board (IAB)
4. Undergraduate Student Advisory Board (USAB)
5. Department Faculty

As a result of more than two years of study, the shortcomings of the 1998 curriculum have been identified which led to a new curriculum in Fall 2003 that better addresses the ABET Engineering Criteria 2000.

6. Assessment Process in Mechanical Engineering

The assessment process that has been established in and the use of the developed assessment tools are summarized with the flow chart shown in Figure 1. Among the tools used for assessing the program, the course learning outcomes and the program outcomes (or exit) surveys have been conducted each semester since Fall 2000 and Spring 2001, respectively. The student satisfaction survey has been conducted each year since Spring 2001. The alumni survey on new program outcomes were conducted in 2001 and 2003, and the employer survey was conducted in 2003. In this section, we will describe these surveys and the obtained results and how these led to a new curriculum in Fall 2003.

Course Learning Outcomes

In the assessment process adopted, course outcomes have been written for all of the freshman engineering and mechanical engineering courses (both undergraduate and graduate, including the electives). Each course outcome has been linked to program outcomes. The outcomes lists and their linkage to program outcomes are included in the syllabus of each course and announced to students at the beginning of each semester as a part of the course syllabi by the faculty. These outcomes are also posted on the department web site as a part of the course syllabi they are also included in the course syllabi of instructors. Similarly, a set of learning outcomes has been declared in each course that has an experimental laboratory. The outcomes lists prepared by faculty teaching the courses and reviewed/approved by the Assessment and Accreditation

Committee (AAC) typically contain 8 and 12 outcomes for uniformity. When appropriate, the outcomes are further revised based on feedback received from faculty and students and approval of the AAC. The department has also requested all service departments who offer courses in ME program to declare similar course learning outcomes to be included as a part of the course syllabi.

Course Learning Outcomes Surveys

The course learning outcomes are used by the faculty to monitor student performance in exams, quizzes, HW, and projects. They are further monitored by receiving self-assessment from students at the end of each semester in the form of Course Outcomes Surveys.

A typical Course Outcomes Survey, where students are asked to rate their perceived competency in each outcome from 1 to 5 (5 being the highest, 1 being the lowest competency) is given in Table 3. For those courses with an experimental lab component, separate surveys are conducted to assess the lab outcomes as well. A threshold of 3.75 has been set as the minimum goal by the AAC and approved by the faculty to reach in each course outcome. This threshold was decided to be a reasonably high goal to reach based on the results received in Fall 2000 surveys (first time administering of such surveys in the department). It proved to be a reasonable yet challenging goal to reach with all other surveys and evaluations we have performed.

Shown in Figure 2 are the overall averages of all course outcomes survey results in each semester since Fall 2001, indicating that at least 70% of the outcomes are above the 3.75 threshold in each semester, with the exception of Spring 2003, which is considered an anomaly. We note that, with the exception of Spring 2003, the average rating of all course outcomes are above the 3.75 threshold, while the Spring 2003 average is only slightly below 3.75. These survey results, along with all other surveys used for assessment are made available to the faculty with statistical analysis and also posted on the department's assessment database http://www.engr.iupui.edu/me assessment/fsurveys.shtml accessible by faculty. This analysis only shows the overall trend in meeting the outcomes. A separate analysis survey results on each program outcomes has also been made as reflected in our 2004 ABET Report (http://www.engr/iupui.edu/me/fabetreport.shtml). A sample analysis will be given later.

Faculty Feedback Form on Course Outcomes

In order to systematically analyze the survey results, the faculty are asked to provide feedback on the survey results explaining the reasons for the lowest two or three outcomes, reflect upon the adequacy of the outcomes, indicate any changes made in the course or any suggestions for changes. The suggestions are implemented if approved by the AAC. The benefits of these forms are:

- To give faculty opportunity to analyze the results and provide feedback
- To document any changes or suggestions made
- To guide those who might be teaching the same course in subsequent semesters

These completed feedback forms are included in the course portfolios prepared by the faculty for each course and kept as a department record on the department database (http://www.engr.iupui.edu/me/fassessment.shtml).

Table 3. A sample course outcomes surveys for laboratory section of a course.

ME 372 Mechanical Design II (3 cr.)
Laboratory Outcomes Survey
Fall 2003

After having completed this course, on a scale from (1) to (5), please rate how well this course has helped you to perform the following course outcomes.
(1 = Very dissatisfied, 5 = Very satisfied).

1.	Operate and explain the function of typical mechanical systems, such as cam-follower systems and planetary gear trains [a4, b].	**1**	**2**	**3**	**4**	**5**
2.	Measure and explain the effect of design parameters on system dynamics and performance, including the effect of cam profile on the dynamics of a cam-follower system and the effect of unbalance on the performance of a rotor [a4, k4].	**1**	**2**	**3**	**4**	**5**
3.	Calculate and experimentally measure the speed reduction and the efficiency of planetary gear systems, and to observe the effect of design configuration on the efficiency [a4, b].	**1**	**2**	**3**	**4**	**5**
4.	Explain failure due to fatigue and measure the effect of design parameters (i.e. material strength) and operating conditions (i.e. magnitude of cyclic load) on the lifetime of machine elements [a4, b].	**1**	**2**	**3**	**4**	**5**
5.	Explain the creep phenomenon and predict failure due to creep by generating the extension-time curve and extracting creep constants from experimental data [a4, b].	**1**	**2**	**3**	**4**	**5**
6.	Explain failure due to resonance (or excessive vibration) through the observation of the phenomenon of whirling and the measurement/extraction of modal parameters at resonance [a4, b].	**1**	**2**	**3**	**4**	**5**
7.	Work in teams to conduct experiments effectively and efficiently [b].	**1**	**2**	**3**	**4**	**5**
8.	Collect, process, and analyze data, and write lab reports to document experimental work [g, b].	**1**	**2**	**3**	**4**	**5**

Letters in brackets refer to ME Program outcomes.
Comment on your achievement of course outcomes (use other side of paper).

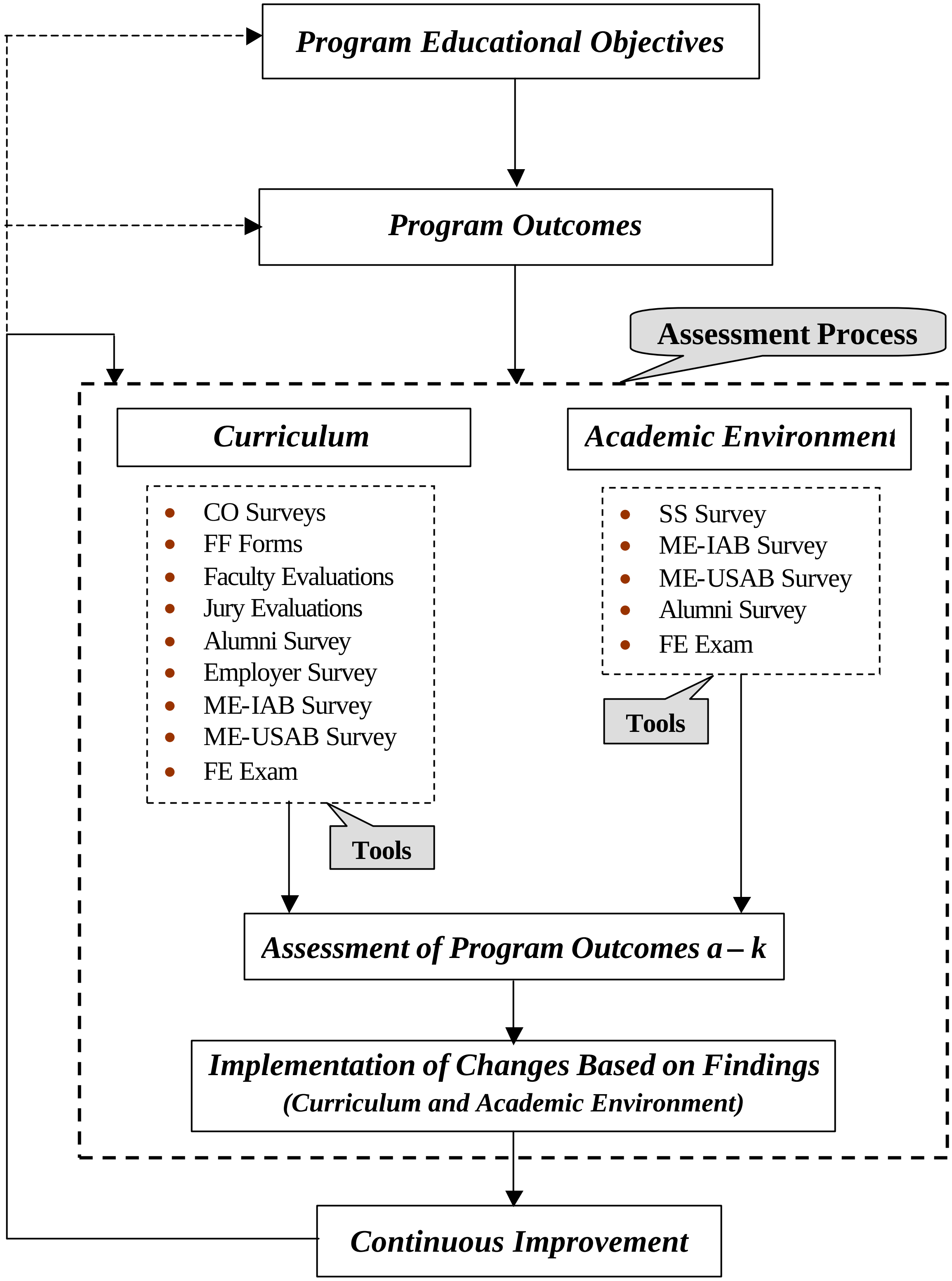


Figure 1 Assessment process chart for continuous improvement of program educational objectives and outcomes.

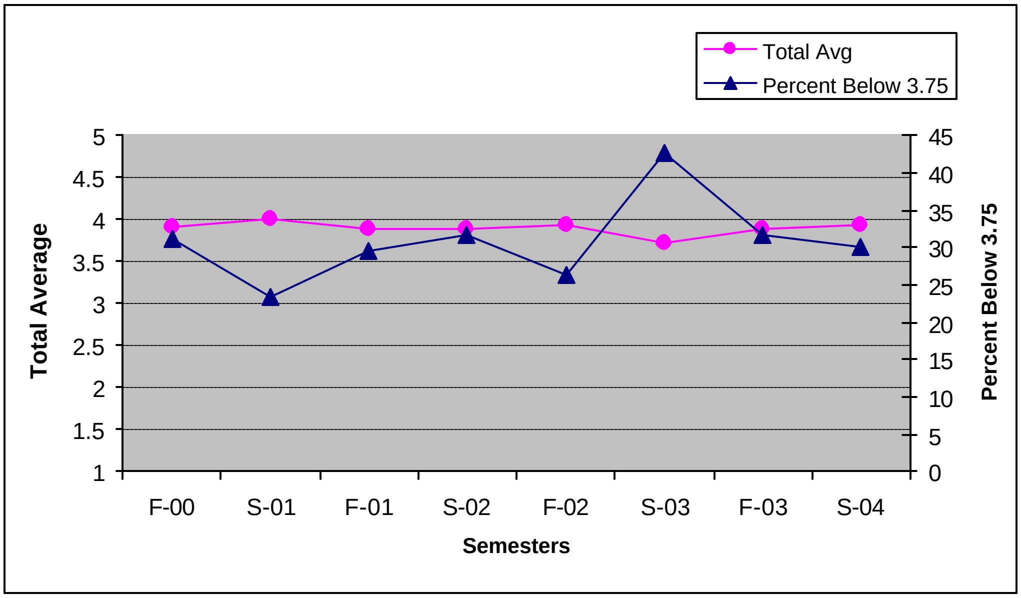


Figure 2. Summary of Course Outcomes Surveys of all ME courses since Fall 2000, including the electives.

Mapping of Course Learning Outcomes to Program Outcomes Matrix

In order assure that all program outcomes are covered adequately through the courses in the curriculum, a mapping method has been utilized where the course outcomes are mapped into program outcomes in the form of a matrix. This is shown for the curriculum of Spring 2001 in Table 4. The degree of coverage of program outcomes in each course is categorized as *P* for primary, *S* for secondary, *T* for tertiary coverage.

A total index chosen as an overall indicator of the coverage is computed by using the expression

$$T_{index} = 5 * P + 3 * S + T$$

where, depending on the degree of coverage in a course, the learning outcomes in each course are rated as P = Primary Outcome (50% or more coverage); S = Secondary Outcome (30-49% coverage); and T = Tertiary Outcome (10-29% coverage).

At least one primary coverage and one secondary coverage of each of the program outcomes is chosen as a goal (i.e., $T_{index} \geq 8$). This map showed the shortcomings of the program, in areas such as statistical analysis and design of thermal-fluid systems as well as some of the general education related outcomes, more specifically, outcomes a3, c2, and i.

Program Outcomes (Exit) Survey

Similar to course outcomes surveys, an exit survey is conducted for graduating seniors before they receive their diploma. The survey questions directly reflect the program outcomes of the department. Shown in Table 5 are the results of the Program Outcomes Surveys conducted every semester since Spring 2001. As in course outcomes surveys, the responses are rated from 1 thru' 5 (5 being the highest, 1 being the lowest competency). The surveys in Spring 2001 and Fall 2001 basically reflect the evaluation of the curricula before Spring 2001. The remaining surveys reflect the evaluation of the Spring 2001 curriculum. The effects of the Fall 2003 curriculum are expected to be measured after two to three years. The findings of this survey are in agreement with the results of the Program Outcomes Matrix in Table 4.

Student Satisfaction Survey

In order to receive feedback from all mechanical engineering students on services, resources and educational environment in the department, satisfaction surveys are administered once a year. Shown in Table 6 is the summary of this survey. This survey gives the department valuable input in improving the academic environment and the resources. Our goal is to reach the 3.75 threshold in all categories in the survey, which is consistently achieved in the overall quality of ME education category and nearly met in the overall professional experience category. However, we are below the threshold in many of the resource dependent categories. In spite of low ratings in a number of categories the ratings received in the Overall Quality of ME Education category is an indication that the students still appreciate the high quality education they receive. The measures taken in advising and scheduling seem to have a minor effect in changing student satisfaction in these areas. This is an area we plan to take additional measures.

Alumni Survey

Shown in Table 7 are the questions and results of two alumni surveys conducted in 2001 and 2003, for the graduates of last six or seven years in each case. The questions posed were designed to measure the degree of importance as well as the preparation to carry out engineering skills consistent with the program objectives and outcomes. They are also consistent with the Principles of Undergraduate Learning established by IUPUI, which define a basic core of competency level for all IUPUI students. The numbers in brackets after each survey question in Table 7 indicate the corresponding Program Objectives of our department; the letters indicate the Program Outcomes to be listed in Section 3. These results are further analyzed in Section 3 in conjunction with the program outcomes. Here we summarize them in relation to the program educational objectives.

The results indicate a major improvement in the preparation category for all questions, with preparation being above the 3.75 threshold score (close to good standing) set by the department while the preparation in 2001 survey for objective 7 were deemed to be below the threshold, so were the objectives 1, 2 and 5. Most of the responses in importance category were higher than the preparation category in both surveys, while they were closer in the more recent survey. This indicated the need for us to focus on several of the program objectives and the corresponding outcomes. However, it is encouraging to note that the scores in preparation category show significant improvement in the recent survey as compared to the earlier one.

Previously, the alumni survey was conducted by the IUPUI Office of Information Management and Institutional Research through traditional means. Starting from 2003, they will be administered online by the School. So far, we were able to receive surveys from roughly 21% of the eligible alumni (average N = 46). This participation is expected to increase with the online system leading to more reliable data in the future. Nevertheless, the current survey reinforces the results of all other studies we have conducted in assessing our program outcomes.

The survey has also showed a major competency increase in many of the outcomes from 2001 to 2003. The school has setup a database, where alumni surveys will be conducted online starting from 2001. This will allow us to receive more regular feedback from our alumni.

Employer Survey

The School of Engineering and Technology has also setup an online survey system for survey of employers, which is usually more difficult to obtain, because of the confidentiality concerns in employers that hire our alumni. The results of the only survey that is based on our program objectives and outcomes conducted recently (2003/2004) are summarized in Table 8. The numbers in brackets after each survey question in the table indicate the corresponding Program Objectives of our department; the letters indicate the Program Outcomes to be listed in Section 3. The results show that in the performance category we meet the department's minimum threshold score of 3.75 (close to good standing) in most categories, with the exception of: 1) knowledge and abilities in the state of the art tools in his or her discipline, 2) Ability to integrate knowledge from humanities and the social sciences into his or her own work, 3) Awareness of the impact of his or her work in a global context. The scores by employers are generally close but mostly less than those of alumni in the 2003 survey. With the new changes incorporated into the program as will be described in Sections 3 and 4 to follow, we believe that our graduates will be better prepared in these skills. It is interesting to note that the industry needs in softer or social skills such as cultures and societal matters seem to be rather low, which is rather surprising, but consistent with the alumni survey results. The score of 4.08 in response to the overall quality question (last question in Table 8) is encouraging.

The participation rate in this survey was quite low (less than 10 % of the B.S.M.E. graduates of the last seven years). Nevertheless, even with this small sample, the results support our findings in other surveys. However, this number is expected to grow in the future with prior and persistent notices to be sent to the employers. We plan to use our and school's advisory boards for this purpose too.

Industrial Advisory Board Survey

In Spring 2002, the Industrial Advisory Board was asked to rate the importance of the program outcomes a-k in adopted by the program. This survey given in Table 9 indicated that the industry considered the importance of outcomes a2, a3, i, h, j, and k3 considerably lower than all others. We attribute this to the industry's perspective that gaining technical and communication skills are more important than the general education related outcomes. Competency in design, technical, analytical, problem solving, and communication skills were deemed of highest importance. This is somewhat consistent with the employer survey results of Fall 2003 (Table 8).

Overall Summary of Assessment Results

Mapping of all course learning outcomes to program outcomes matrix in Spring 2001 as well as conducting: 1) course outcomes surveys, 2) program outcomes (exit) surveys, and 3) student satisfaction surveys from Spring 2001 till Fall 2003, have revealed certain shortcomings in the program. The shortcomings identified were:

1. Not enough exposure to and experience in:
    a. statistics and probability (outcome a3) indicated by both mapping and program outcomes surveys
    b. use of mechanical engineering analysis tools (outcome k1) indicated by program outcomes surveys
    c. design of thermal and fluid systems (outcome c2) indicated by both program mapping and program outcomes surveys
    d. use of engineering design and manufacturing tools indicated by program outcomes survey
2. Not enough in-depth study, understanding, and appreciation of:
    a. contemporary issues (outcome j)
    b. impact of engineering solutions in a global and societal context through broad education (outcome h)

These also confirmed the findings of the outcomes matrix of the Spring 2001 curriculum depicted in Table 4.

The shortcomings identified via student satisfaction surveys from Table 6 were:

1. Career planning assistance, job placement, and professional skills development
2. Quality of experimental labs
3. Quality of advising and help with the plan-of-study

The alumni surveys indicated a similar trend as the employer and exit surveys.

Based on the early findings, various additional changes have been made in the program structure and contents since Spring 2001 as described in the next section.

Table 4. Spring 2001 mapping of course learning outcomes to program outcomes in all required courses in the curriculum.

Courses	Program Outcomes																	
	a1	**a2**	**a3**	**a4**	**b**	**c1**	**c2**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k1**	**k2**	**k3**	**k4**
ENGR 195					T			S			T	T				S	S	
ENGR 196					T			T			T					S	S	S
ENGR 197		T							P									T
CHEM C105	P			S														
COM R110											P							
ENG W131											P							
ECON E201												T		S				
MATH 163	S																	
MATH 164	S																	
MATH 261		P					T											
MATH 262		P				P												
PHYS 152	P																	
PHYS 251	P																	
TCM 360										S	P							
Gen Eds (5)												3S		3S				
ECE 201	S				S	S			P									T
ECE 207 Lab	S				P	T												P
ME 200	T			P			T	T	S								T	
ME 262			T			S			T		T					S		T
ME 270	P			P					T									
ME 272				P	S				T									
ME 272 Lab	T			S	P													P
ME 274	P			P					P									
ME 310		S		P	T		T		T									
ME 310 Lab				T	P						T							
ME 314	T	S		P	T		T		T						T			
ME 314 Lab		S	T	P				T	T		T							
ME 330		S		T					P									S
ME 340	T	T	S	P	S				T		T							P
ME 340 Lab				S	P			P			T							P
ME 344				P		T							T					
ME 372				T	T	P		T	T		T	T		T	S	T	T	
ME 372 Lab				P	P				S		T						P	
ME 401										P		T		S				
ME 462				T	T	P		S	T	T	S		S	S			T	
ME 482		P		T		T					T							T
ME Elec (4)				4P														
Total P	**4**	**3**	**0**	**15**	**4**	**3**	**0**	**1**	**4**	**1**	**3**	**0**	**0**	**0**	**1**	**1**	**1**	**4**
Total S	**5**	**4**	**1**	**3**	**3**	**1**	**0**	**2**	**10**	**1**	**1**	**4**	**1**	**6**	**1**	**4**	**2**	**2**
Total T	**4**	**1**	**1**	**4**	**6**	**3**	**3**	**4**	**4**	**1**	**10**	**3**	**1**	**1**	**0**	**0**	**3**	**4**
Total Index	**39**	**28**	**4**	**94**	**41**	**21**	**3**	**15**	**54**	**9**	**28**	**15**	**4**	**19**	**8**	**17**	**14**	**30**

*Depending on the degree of coverage in a course, the learning outcomes in each course are rated as P = Primary Outcome (50% or more); S= Secondary Outcome (30-49%); and T = Tertiary Outcome (10-29%). Total Index is used as a final indicator calculated from 5*P + 3*S + T.*

Table 5. Program Outcomes (Exit) survey results of last three years (Spring '01 - Fall '03).

Program Outcomes	**S '01 (11)**	**F '01 (6)**	**S '02 (11)**	**F '02 (11)**	**S '03 (13)**	**F '03 (13)**	**Average** (weighted)
a. *Demonstrate and apply knowledge of mathematics, science, and engineering with:*							
a1. Calculus-based physics in depth	4.27	4.83	4.00	4.67	3.93	3.85	4.20
a2. Mathematics through multivariate calculus, differential equations, and linear algebra	3.91	4.83	4.31	4.22	4.20	4.00	4.19
a3. Probability and statistics	**2.73***	3.50	3.31	3.11	3.00	3.15	**3.11***
a4. Mechanical engineering sciences: solid mechanics, fluid-thermal science, material science	4.09	4.33	4.31	4.44	4.00	4.31	4.23
b. Conduct experiments methodically, analyze data, and interpret results	**3.64****	4.67	4.38	4.67	4.20	4.08	4.23
c. *Design a system, component, or process to meet desired needs with applications to:*							
c1. Mechanical systems	3.73	4.83	4.54	4.56	4.07	4.00	4.23
c2. Thermal systems	**3.55**+	4.17	3.85	4.22	3.87	3.15	**3.75**+
d. Function in teams to carry out multidisciplinary projects	3.80	4.17	4.23	4.33	4.13	3.92	4.09
e. Identify, formulate, and solve engineering problems	4.00	4.33	4.46	4.67	4.33	4.15	4.32
f. Understand professional and ethical responsibilities	4.20	4.50	4.38	4.67	4.07	3.62	4.20
g. Communicate effectively in writing and orally	4.50	4.50	4.54	4.56	4.13	4.00	4.34
h. Understand the impact of engineering solutions in a global and societal context through broad education	**3.90**++	4.33	4.15	3.86	3.93	3.77	**3.96**
i. Recognize the need to engage in lifelong learning	3.90	4.50	4.38	4.56	4.33	3.92	4.24
j. Demonstrate knowledge of contemporary issues	**3.80**++	4.17	4.08	3.89	3.93	3.77	**3.92**++
k. *Use the techniques, skills, and modern tools of engineering effectively and correctly in engineering practice with:*							
k1. Mechanical engineering analysis tools (e.g., ANSYS, ProMechanica, etc.)	3.90	4.00	3.62	3.67	3.62	3.77	**3.74**~
k2. Engineering design and manufacturing tools (e.g., AutoCAD, ProE, etc.)	4.00	4.17	3.38	4.22	3.80	4.08	3.92
k3. Internet and library information resources	4.00	4.00	4.00	4.44	4.00	4.00	4.07
k4. Mathematical computing and analysis tools (e.g., Matlab, Excel, etc.)	4.20	4.17	4.46	4.22	4.46	4.08	4.27
Overall Average	3.89	4.33	4.13	4.28	4.13	3.87	4.08

Notes on Results of Table 5:

* Low score in outcome a3 led to more emphasis in statistical and probability applications in ME 340 and ME 314 lab, and to a new required course in the current Fall 2003 curriculum.

** Low score in outcome b led to a renewed emphasis in experimental lab courses, including standard format for lab reports and continuous upgrading of lab experiments.

+ Low score in outcome c2 led to a new elective in Fall 2002 which became a required course in the current Fall 2003 curriculum.

++ Low scores in outcomes j and h led to a reorganization of the general education electives in the current Fall 2003 curriculum.

~ Low scores in outcome k1 is understandable because mechanical engineering analysis tools are handled with elective courses. However, the stronger emphasis we place upon ANSYS in the elective course ME 450 and ProMechanica in ME 372 is expected to improve this.

Relatively low scores in some of the outcomes, such as a2, c1, and i, and in the first survey conducted in the Spring 2001 survey, put a renewed emphasis on these outcomes and revisions in the current courses which led to improvements in subsequent years.

Table 6. Student satisfaction survey results (*Sophomores, Juniors and Seniors combined; 1 = least satisfactory, 5 = most satisfactory).*

Survey Question	Spring 2001 (60 Students)	Spring 2002 (69 Students)	Spring 2003 (83 Students)	Spring 2004 (69 Students)	Four-year Average (weighted)
1. Quality of Instruction	3.61	3.58	3.71	3.54	3.61
2. Quality of ME experimental labs (ME 272, 310, 314, 340, 372)	3.13	3.35	3.15	3.08	3.18
3. Quality of ME design courses (ME 262, 372, 462)	3.45	3.55	3.44	3.17	3.40
4. Quality of computing facilities for design and computational labs	3.16	3.38	3.62	3.55	3.45
5. Quality of advising and help with the POS	3.27	3.27	3.20	3.30	3.26
6. Scheduling of courses/classes	3.28	3.56	3.19	3.47	3.37
7. Classroom environments conducive to learning	3.68	3.75	3.96	3.77	3.80
8. Career planning assistance, job placement, and professional skills development	2.96	2.89	2.80	3.00	2.91
9. Opportunities for networking with fellow students and faculty through professional societies	3.81	3.95	3.33	3.54	3.64
10. Overall professional experience	3.65	3.58	3.65	3.58	3.62
11. Overall quality of ME education	**3.75**	**3.82**	**3.82**	**3.64**	**3.76**

Table 7. Alumni survey results – average assessment of essential skills and knowledge
(numbers in brackets indicate Program Educational Objectives; letters indicate Program Outcomes).

Indicate how important the following skills or knowledge are to your performance and how well ME Department Prepared you.	**1993 - 2001 Graduates (N = 44)**		**1996 - 2003 Graduates (N = 48)**	
	Importance[a]	**Preparation[b]**	**Importance[a]**	**Preparation[b]**
Ability to apply the basic principles of your discipline [1], [a4]	4.11	3.84	4.32	4.03
Knowledge and abilities in the state of the art in your discipline [1], [k1, k2, k4]	3.44	3.33	3.81	3.81
Ability to solve engineering problems using methods, tools and skills of modern tools of your discipline [1], [k1, k1, k2, k4]	4.11	3.82	4.24	4.19
Ability to consider several points of view and arrive at a reasoned conclusion [1], [e]	4.45	3.50	4.38	4.24
Ability to plan, organize, and complete a design task [4], [c1, c2]	4.56	3.62	4.46	4.22
Ability to design and conduct an experiment [4], [b]	3.40	3.51	4.08	4.00
Ability to continuously learn new skills and knowledge [3], [i]	4.51	3.95	4.59	4.38
Ability to communicate effectively orally [6], [g]	4.67	3.53	4.73	4.32
Ability to communicate effectively in writing [6], [g]	4.40	3.76	4.68	4.32
Ability to work successfully as a member of a team [8], [d]	4.58	3.80	4.68	4.70
Ability to take initiative [2, 5]	4.51	3.44	4.78	4.46
Ability to integrate mathematics and science into your work [5], [a1, a2]	3.71	3.91	4.24	4.16
Ability to integrate knowledge from humanities and the social sciences into your own work [7], [j]	2.91	2.95	3.84	4.08
Ability to evaluate the quality and validity of data, information and evidence [1, 5], [b]	4.27	3.58	4.59	4.05
Ability to use information resources such as databases, libraries and the Internet [3], [k3]	3.71	3.36	4.57	4.38
Understanding and appreciation of ethics and professionalism as related to your work [2, 7], [f]	4.04	3.98	4.46	4.41
Awareness of value of considering diversity and differences in cultures in your work [7], [h]	3.62	3.22	4.19	4.41
Awareness of the impact of your work in a global context [7], [h]	3.27	2.93	4.30	4.03
Awareness of the importance of safety issues to your work [7], [h]	3.96	2.91	4.41	3.83

[a] Responses provided on a 5-point scale, where 1 = No importance, 2 = Little, 3 = Somewhat, 4 = Important, and 5 = Very important.

[b] Responses provided on a 5-point scale, where 1 = Poor, 2 = Marginal, 3 = Adequate, 4 = Good, and 5 = Very good.

Table 8. Employer survey results – average assessment of essential skills and knowledge
(numbers in brackets indicate Program Educational Objectives; letters indicate Program Outcomes).

Indicate how important the following skills or knowledge are for performance of your employees and how well our recent graduates perform (six years)	**1995 - 2003 Graduates (N = 14)**	
	Importance[a]	**Preparation[b]**
Ability to apply the basic principles of his or her discipline [1], [a4]	4.73	4.10
Knowledge and abilities in the state of the art in his or her discipline [1], [k1, k2, k4]	4.00	3.55
Ability to solve engineering problems using methods, tools and skills of modern tools of his or her discipline [1], [k1, k2, k4]	4.82	4.18
Ability to consider several points of view and arrive at a reasoned conclusion [1], [e]	4.64	4.36
Ability to plan, organize, and complete a design task [4], [c1, c2]	4.45	4.18
Ability to design and conduct an experiment [4], [b]	3.64	3.82
Ability to continuously learn new skills and knowledge [3], [i]	4.50	3.91
Ability to communicate effectively orally [6], [g]	4.50	4.00
Ability to communicate effectively in writing [6], [g]	4.42	3.91
Ability to work successfully as a member of a team [8], [d]	4.67	3.92
Ability to take initiative [2, 5]	4.58	4.42
Ability to integrate mathematics and science into his or her work [5], [a1, a2]	4.00	4.10
Ability to integrate knowledge from humanities and the social sciences into his or her own work [7], [j]	2.82	3.55
Ability to evaluate the quality and validity of data, information and evidence [1, 5], [b]	4.45	4.00
Ability to use information resources such as databases, libraries and the Internet [3], [k3]	4.25	4.42
Understanding and appreciation of ethics and professionalism as related to his or her work [2, 7], [f]	4.25	4.25
Awareness of value of considering diversity and differences in cultures in his or her work [7], [h]	3.67	3.92
Awareness of the impact of his or her work in a global context [7], [h]	3.33	3.75
Awareness of the importance of safety issues in his or her work [7], [h]	4.25	4.00
Based on your professional experience and opportunities to observe ME graduates from IUPUI and other institutions, what is your impression about the overall quality of the IUPUI graduates?	NA	**4.08**

[a] Responses provided on a 5-point scale, where 1 = No importance, 2 = Little, 3 = Somewhat, 4 = Important, and 5 = Very important.

[b] Responses provided on a 5-point scale, where 1 = Poor, 2 = Marginal, 3 = Adequate, 4 = Good, and 5 = Very good.

Table 9. Industrial Advisory Board's rating of the importance of program outcomes.

(Posed Question: On a scale from (1) to (5), please rate the importance of the following program outcomes adopted by our department (1 = least important, 5 = The most important)

Program Outcomes	**S '02 (N = 11)**
a. *Demonstrate and apply knowledge of mathematics, science, and engineering with:*	
a1. Knowledge in chemistry and calculus-based physics in depth	4.27
a2. Mathematics through multivariate calculus, differential equations, and linear algebra	3.91
a3. Probability and statistics	**2.73***
a4. Mechanical engineering sciences: solid mechanics, fluid-thermal science, materials science	4.09
b. Conduct experiments methodically, analyze data, and interpret results	**3.64****
c. *Design a system, component, or process to meet desired needs with applications to:*	
c1. Mechanical systems	3.73
c2. Thermal systems	**3.55**+
d. Function in teams to carry out multidisciplinary projects	3.80
e. Identify, formulate, and solve engineering problems	4.00
f. Understand professional and ethical responsibilities	4.20
g. Communicate effectively in writing and orally	4.50
h. Understand the impact of engineering solutions in a global and societal context through broad education	**3.90**++
i. Recognize the need to engage in lifelong learning	3.90
j. Demonstrate knowledge of contemporary issues	**3.80**++
k. *Use the techniques, skills, and modern engineering tools effectively and correctly in engineering practice with:*	
k1. Mechanical engineering analysis tools (e.g., ANSYS, ProMechanica, etc.)	3.90
k2. Engineering design and manufacturing tools (e.g., AutoCAD, ProE, etc.)	4.00
k3. Internet and library information resources	4.00
k4. Mathematical computing and analysis tools (e.g., Matlab, Excel, etc.)	4.20
Overall Average	3.89

7. Interim Changes Made from 1998 till Fall 2003

Since the last ABET visit in 1998, while the established assessment process has been continuing, a number of changes have been gradually introduced into the program, in response to findings in the coverage of outcomes in the courses and the feedback from faculty, alumni, students, and industry. These changes are summarized below.

Freshman Engineering Curriculum

A unified Freshman Engineering curriculum was launched in 2000 in an effort to provide a uniform education to all engineering programs in our school. The changes that were reflected in our Spring 2001 curriculum are as follows:

1. Adding a one-credit campus community-learning course, *ENGR 195 Introduction to Engineering Profession,* that introduces students to the engineering profession and to campus resources. The course is designed to help students develop essential communication and thinking skills along with the study and time-management and library research skills needed for success in studying engineering. Collaborative techniques used in engineering are practiced.
2. Changing *ME 196 Introduction to Computer Applications in Engineering* course to *ENGR 196 Introduction to Engineering* where students develop skills using computer-aided design and simulation software for engineering systems applicable to both mechanical and electrical engineering.
3. Changing *ME 197 Introduction to Computer Programming* to *ENGR 197 Introduction to Programming Concepts* where both Matlab and C programming languages are taught.
4. Changing *CHEM 111 Chemical Science I*, a four-credit hour course, to *CHEM 105 Principles of Chemistry I*, a three-credit hour course. This was made possible by changes in course structuring in chemistry department without loss of content. This reduction of one credit hour in the freshman curriculum was compensated by addition of *ENGR 195*.
5. Changing the second chemistry course in the curriculum, *CHEM C112 Chemical Science II,* to a science elective, allowing students to choose from a pool of science courses including math, chemistry, physics, and biology. This gives students an opportunity to choose topics from their specific area of interest, allowing them to explore science areas such as biology, physics, and chemistry.

These changes were designed to better prepare students to changing trends in engineering and sciences and give them the opportunity to transfer among engineering majors in the school without loosing any credits. It is also designed to better familiarize the freshman engineering students with the engineering profession.

The main differences between the Spring 2001 curriculum and the previous curriculum have been in the distribution and content of courses in the Freshman Engineering program and addition of a community-learning course, *ENGR 195,* that is designed to better familiarize students with engineering profession and retain them in the program. The three *ENGR* courses in the freshman curriculum (*ENGR 195, ENGR 196,* and *ENGR 197*) are offered by the Freshman Engineering Program, that was established in 1998. The remaining courses in the freshman curriculum (*CHEM C105, MATH 163, MATH 164, PHYS 152, COMM R110, ENG W131,* and a *science elective*) are taught by the respective Science and Liberal Arts departments outside the School.

Revision of Mechanical Design Courses

The first mechanical design course, *ME 262,* has been revised to introduce the design process and computer-aided design (CAD) tools in the early stage, leaving for more room for actual design implementations and mechanism and machine design in the second mechanical design course, *ME 372*. CAD/CAM software ProE is introduced in *ENGR 196* and then used extensively in *ME 262* and *372*. Analysis tool ProMechanica is introduced in *ME 372*. Moreover, two computer-aided analysis courses: 1) *ME 450 Computer-Aided Analysis* and 2) *ME 446 CAD/CAM Theory and Applications* are offered regularly as technical electives. A finite-element software, ANSYS, is used in *ME 450* for solving stress and heat transfer problems in solids, preparing the students for using such tools for design and analysis of mechanical systems. A CAD/CAM software, ProEngineer, and a mechanical analysis software, ProMechanica, are used in the elective course *ME 446* more in depth.

A stronger lab component is added to *ME 372* with more experiments and a extended lab manual. Thus, the students are better equipped with the principles of design to carry out more elaborate design projects in the capstone design course *ME 462*. A concerted effort has been made to encourage students to build a physical or a computer model of their projects in *ME 462*. Moreover, a seminar component was added to the course where students get exposed to speakers from industry and academia on issues regarding team work, project management, six-sigma, and environment. A jury consisting of faculty and industry representatives evaluates the final projects presented at the end of the semester. A monetary reward of $1,500 established by Rolls-Royce Corporation is awarded to the best design team each semester.

Joint Offering of Selected Courses with Electrical and Computer Engineering

In order to provide a multidisciplinary culture to mechanical, electrical, and computer engineering students, as well as take advantage of the faculty diversity, both departments decided to offer controls/dynamics/measurement related courses jointly, by cross-listing and teaching them by ME or ECE faculty alternately. Such cross-listed courses that are required in the curriculum are:

1. ME 340/ECE 340 Dynamics Systems and Measurements
2. ME 482/ECE 382 Controls System Analysis and Design
3. ME 401/ECE 401 Engineering Ethics and Professionalism

Moreover, various other electives such as robotics, mechatronics, optimization are cross-listed and taught either by ME or ECE faculty in a given semester, providing additional multidisciplinary experience and interaction to students.

Career Planning Assistance, Job Placement, and Professional Skills Development

Such services are currently school-wide and campus-wide. Thus, at this time the department cannot be very effective in this area. However, the recent administrative changes in the school on internship and job placement are expected to improve such services. The department is also assisting the school in bringing a more visible status to internships and coop programs which are expected to improve the job placement of our students. The students have access to IUPUI as well as Purdue University Career Opportunities Office in West Lafayette. These services were not widely utilized by our students, as they were not adequately advertised to the students. This however is changing with department's and school's efforts in advertising these via web sites and list serves. Moreover, the school has hired a student services specialist who coordinates all internship and job placement activities within the school, which is expected to improve these services.

Advising

Even though students have been very satisfied with the advising system in freshman engineering, the ME student satisfaction surveys indicated that they are less satisfied with the advising and help with the plan of study. One of the reasons for this is that the campus online registration system does not require advisor's consent before registering. Hence, many students tend to take courses without receiving the benefit of talking with their advisors. To alleviate this the department has emphasized the advising system for each student to see his/her advisor at least once a semester to receive advice on registering, course requirements, future goals, etc. This process is also emphasized on the department web site on advising: http://www.engr.iupui.edu/me/advising.shtml. The faculty members who serve as advisors are also trained to deal with student records.

Upgrading of Laboratories

Even though the students seem to enjoy working in experimental labs, they have been less satisfied with the conditions of experimental facilities and lab manuals. To alleviate this more emphasis has been placed on preparing more common lab manuals in all labs, lab report writing standards, safety, etc. Common guidelines for preparation of laboratory manuals have been prepared by the faculty to be used in experimental labs. The department has instituted a 10% differential fee ME courses to invest more on purchasing new lab equipment and hire more TAs to assist faculty members. The impacts of these are expected to be seen in the coming years.

8. New ME Curriculum – Effective Fall 2003

In addition to all the changes described above, a new curriculum has been developed to be in effect since Fall 2003 that further addresses curriculum related shortcomings as follows:

1. The new curriculum has the same number of credit hours (130) as the old curriculum, but the contents of the curriculum are modified to remedy the shortcomings and meet ABET's current Engineering Criteria more effectively.
2. The following are the electives (total of 33 credit hours) in the new ME curriculum, effective Fall 2003:
   a. Science Elective 3 cr.
   b. Statistics Elective 3 cr.
   c. General Education Electives 15 cr.
   d. Free Elective 3 cr.
   e. ME electives 9 cr.
3. The Science Elective may be selected from biology, chemistry, physics, math, and computer science.
4. One Statistics Elective is introduced in the new curriculum to give students the opportunity to learn statistics and probability in depth with applications. This elective can be selected from *STAT 350 Introduction to Statistics*, *STAT 511 Statistical Methods I*, and *ECE 302 Probabilistic Methods*.
5. A total of 15 credit hours of course work is required in the general education category. These courses are in addition to the 9 credit hours required in written communications (*ENG W131*), public speaking (*COMM R110*), technical communications (*TCM 360*), and engineering ethics and professionalism (*ME 401*).
6. General Education Electives list includes courses that address ABET's general education outcomes on contemporary, societal, cultural, environmental, and ethical issues in more depth. Two sets of lists are developed via a survey conducted among all departments outside the department to identify courses emphasizing cultures, and contemporary issues. At least two courses (six credits) are required to be taken from a restricted list consisting of such courses. This list has been prepared by conducting a campus-wide survey jointly with the ECE Department among several departments on the contents of potential courses. In the new curriculum, six of the hours in the humanities and social sciences must be in courses designated as upper level courses by the faculty who teach them. Furthermore, depth is promoted by requiring that at least six hours reside in one

department. More details on a new policy developed for selection of general education electives are provided in Section 4 and Appendix I-H.

7. *ECE 201 Linear Circuit Analysis I* and *ECE 207 Electronic Measurement Techniques* (an experimental lab course) are combined into a new modern course with emphasis on digital electronics. This new course, *ECE 204 – Introduction to Electrical and Electronic Circuits* (4 cr.), is a required course for all students in ME curriculum which also has an experimental lab component. *ECE 204* is a prerequisite for *ME 330 Modeling and Analysis of Dynamic Systems*. This way, mechanical engineering students are exposed to more modern circuit applications and will be able to perform better in courses involving electromechanical systems.
8. A new design course titled *ME 414 – Thermal-Fluid Systems Design* is added as a new required course to the curriculum for all ME students. *ME 372 Mechanical Design I* is a prerequisite and *ME 314 Heat and Mass Transfer* is a corequisite of this course. This way, students will receive a more extensive experience in design of thermal and fluid systems. This course has replaced one of the ME electives of the old program.
9. Changes were made to internship and coop programs to elevate the prestige of internships and coops and giving one ME credit for each session, up to a maximum of 3 credits (more details to follow).

Prior to the new curriculum a number of changes that have been implemented in the curriculum from 1998 till Fall 2003 as outlined in the previous section are transitioned to the new curriculum.

The program map of the courses in the new curriculum is shown in Figure 3 (also posted at http://www.engr.iupui.edu/me/bulletin/programmapfall2003.htm), where the courses are grouped into nine professional components as 1) freshman engineering, 2) communication and ethics, 3) engineering design, 4) mechanical sciences, 5) mathematics and physical sciences, 6) thermal-fluid sciences, 7) systems, measurements and control, 8) ME electives, and 9) other electives (general education, science, and free) as shown on the map.

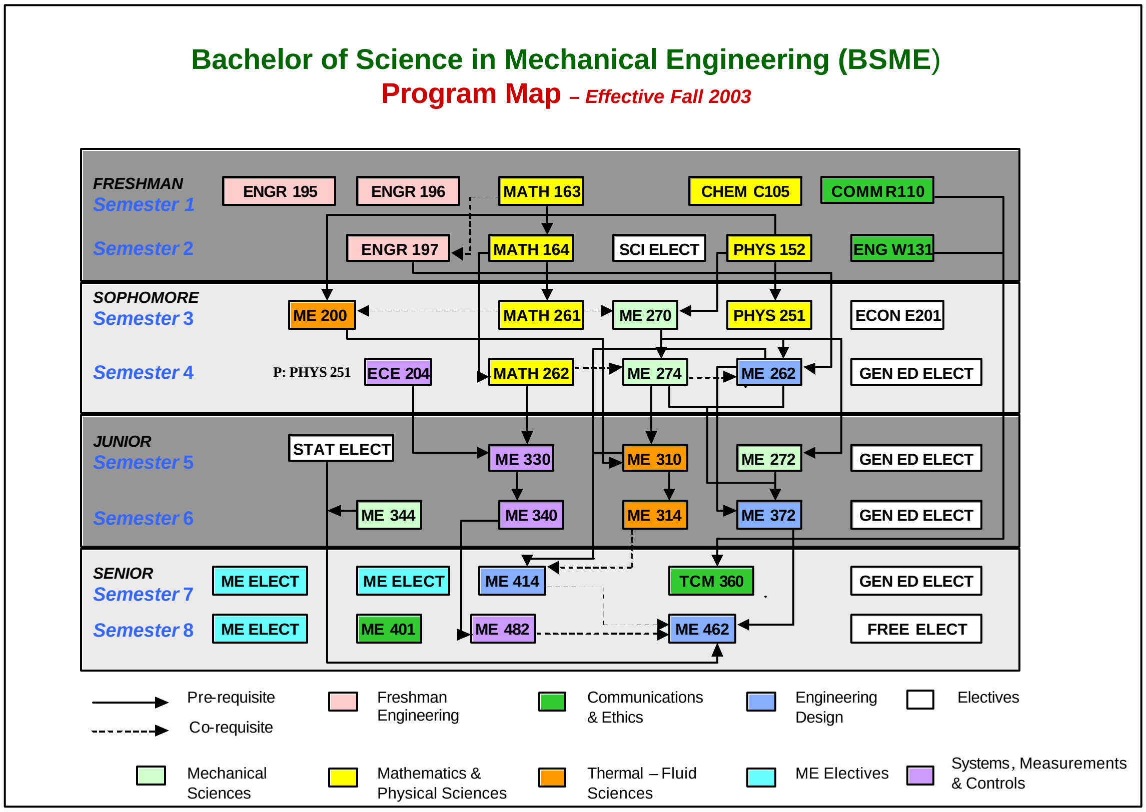


Figure 3. Program map of the latest curriculum effective since Fall 2003.

Revision of Internship and Coop Courses

In order to attract more students to internship and coop programs, we have recently revised the internship and coop requirements so that there will be more faculty-student interaction during student's sessions in industry. While the coop program has more formal requirements, internship program is more flexible. Students in coop program are required to work for three alternating sessions (semesters) in the same company. On the other hand, each internship session may be in different companies approved by the department. Students sign up for one-credit *ME I184 Career Enrichment Internship* or *ME C184 Cooperative Education Practice* for internship and coop, respectively, for the fist session, and then *ME I284* or *ME C284* for the second session, etc. The web page at http://www.engr.iupui.edu/me/advising.shtml provides more information on the program.

The recent changes made to provide more exposure and prestige to the programs were:

1. Counting each successful internship or coop session (one semester) as one credit hour of *ME* elective.
2. Requiring faculty advisor approval for acceptance to the program, and pass and fail system depending on the completion of session with a comprehensive report.
3. Requiring faculty advisor supervision during each session in order to increase student interaction with advisors and department interaction with industry.
4. Requiring students to give a presentation to fellow students and faculty after the completion of internship or coop session. These presentations are also used as a recruiting tool to attract more students to the programs for them to gain valuable professional experience before they graduate.

5. Evaluation of student's presentation by a jury of faculty members at internship presentation seminars organized by the department.

Mapping of Course Outcomes to Program Outcomes in New Curriculum – Program Matrix

The matrix in Table 10 presents a summary of the coverage of the Program Outcomes in required courses of the latest curriculum, where the numbers in each cell indicate the number of times a certain program outcome appear in a particular course's outcomes list. Courses taught outside the department are also linked to the program outcomes as shown in Table 10, giving a better picture of the entire program. As may be seen, compared to the Spring 2001 curriculum, the outcomes associated with a3, c1, i, and h are covered in more depth than previously. The same indexing scheme used for Spring 2001 curriculum has been used here too for determining the total index

$$T_{index} = 5 * P + 3 * S + T$$

9. Additional Feedback from Constituencies Before Implementing the New Curriculum

The department conducted two other surveys before the implementation of the new curriculum. These were:

1. Survey of Industrial Advisory Board on the department's methods, ABET preparations and the new curriculum
2. Survey of Undergraduate Student Advisory Board on the department's assessment methods, ABET preparations and the new curriculum

The results of these surveys are summarized in Table 11, which indicate a strong endorsement of our work, with lowest rating given for the general educations policy. The relatively low rating on this policy is attributed to our inability to articulate the importance of the knowledge for engineers regarding different cultures and society related issues. This policy is accessible from the url: http://www.engr.iupui.edu/me/genedrequirements_5-28-03.shtml.

Table 10. Mapping of course learning outcomes to program outcomes in required courses in the new curriculum (effective Fall 2003).

Courses	Program Outcomes																	
	a1	a2	a3	a4	b	c1	c2	d	e	f	g	h	i	j	k1	k2	k3	k4
ENGR 195					T			S			T	T					S	
ENGR 196					T			T	T		T					S	T	T
ENGR 197									P									T
CHEM C105	P			S														
COM R110											P							
ENG W131											P							
ECON E201												T		S				
MATH 163	S																	
MATH 164	S																	
MATH 261		P																
MATH 262		P																
PHYS 152	P																	
PHYS 251	P																	
STAT 305			P															
TCM 360										S	P							
Gen Eds (2)										2T		2T		2S				
Gen Eds (2)										2T		2P		2P				
ECE 204	S				S	S			P									T
ECE 204 Lab	S				P	T												P
ME 200	T			P			T	T	S								T	
ME 262				T		P			S		T					P		T
ME 270	P			P					S									
ME 272				P	S				S		T							
ME 272 Lab	T			S	P													P
ME 274	S			P					S									
ME 310	T	S		P					S									
ME 310 Lab				T	P						T							
ME 314	T	S		P					P									
ME 314 Lab		S	T	P				S	T		T							
ME 330		S		T					P									S
ME 340		T	S	P	P			S	S									P
ME 340 Lab				S	P			P			T							P
ME 344				P		T												
ME 372				S	T	P			T		T	T	T	T	P	S	T	
ME 372 Lab				P	P				S		T						P	
ME 401								S		P		T		S				
ME 414			S	P			P		S		S		S	T	S		S	
ME 462				T	T	P	S	S	T	T	S	T	T	S			T	
ME 482		P		T		T		P	S		S		T					T
ME Elec (3)				3P									T					
Total P	**4**	**3**	**1**	**14**	**6**	**3**	**1**	**2**	**4**	**1**	**3**	**2**	**1**	**2**	**1**	**1**	**1**	**4**
Total S	**5**	**4**	**2**	**4**	**2**	**1**	**1**	**5**	**10**	**1**	**3**	**2**	**0**	**5**	**1**	**2**	**2**	**1**
Total T	**4**	**1**	**1**	**5**	**4**	**3**	**1**	**2**	**4**	**5**	**9**	**5**	**4**	**2**	**0**	**0**	**4**	**4**
Tot Index	**39**	**28**	**12**	**87**	**40**	**21**	**9**	**27**	**54**	**13**	**33**	**21**	**9**	**20**	**8**	**11**	**15**	**27**

*Depending on the degree of coverage in a course, the learning outcomes in each course are rated as P = Primary Outcome (50% or more); S= Secondary Outcome (30-49%); and T = Tertiary Outcome (10-29%). Total Index is used as a final indicator calculated from 5*P + 3*S + T.*

Table 11. Results of survey of Industrial and Undergraduate Student Advisory Boards on the ME program assessment methods and curriculum changes.
(on a scale of 1 – 5; 1 – very unsatisfied, 5 – very satisfied)

Item	Industrial Advisory Board Assessment	Student Advisory Board Assessment
Vision statement	4.25	4.44
Mission statement	4.38	4.67
Program objectives	4.75	4.44
Program outcomes	4.75	4.44
New statistics and probability course	4.63	3.89
New fluid-thermal systems design course, ME 414	4.38	4.56
Changes made in the capstone design course, ME 462	4.25	4.63
Policy adopted for general education electives	4.00	4.11
Department's Assessment web site (http://www.engr.iupui.edu/me/fassessment.shtml)	4.50	4.33
Overall program assessment methods	4.63	4.67
Overall planned curriculum changes	4.38	4.56
Overall	4.45	4.43

10. Analysis of Evidence on Coverage of Program Outcomes

Partial evidence on the coverage of program outcomes and how well they are met is obtained from systematic usage of the assessment tools adopted by the department. These tools are: 1) course learning outcomes surveys, 2) program outcomes (exit) survey, 3) alumni survey, and 4) employer survey. While the employer survey provides direct evidence on the competency of our graduates, the remaining three surveys provide indirect evidence. It is also noted that the results of student surveys (course and program outcomes) reflect the outcomes of Spring 2001 curriculum, while the employer and alumni survey results reflect mostly the outcomes of the previous curriculum. The impact of the new curriculum will become more apparent within the next three years. Faculty feedback to course outcomes survey results via a standard form is an additional tool used in monitoring the changes in the curriculum and explaining the reasons for low scores in certain outcomes, if any, in a given course. This feedback form filled out by the faculty is accessible from the url: http://www.engr.iupui.edu/me/assessment/facfeedbackoutcomes.dot.

The results of these surveys are analyzed for each of the 18 program outcomes and presented here with the help of graphs. As referred earlier, the rating in all of these surveys are from 1 through 5, with 1 = the lowest rating and 5 = the highest. A threshold of 3.75 has been selected by the Assessment and Accreditation Committee and the faculty as a minimum goal to reach in all the outcomes.

With the results presented in the ABET report (http://www.engr.iupui.edu/me/fabetreport.shtml), we have observed that useful information can be obtained for making corrections/enhancements to the curriculum. Even though these tools mostly provide indirect evidence on the adequate coverage of outcomes, their systematic usage has shown to provide consistent results from semester to semester. Moreover, in most cases, the results of different surveys are in agreement, reinforcing the areas that we need to concentrate on.

More direct evidences obtained on the coverage of program outcomes are discussed in the next sub-section

A sample statistical analysis given in the ABET report for one of the outcomes is shown in Table 12, where averages of all course outcomes surveys (COS) results related to that outcome together with that of program outcome (exit) surveys (POS), alumni survey (AS), and employer survey (ES) results are graphed and compared against the goal. We note here that the results of the course outcomes surveys backed our earlier findings in program matrix map in Table 4 and led to creation of a new course to be offered in the new curriculum. This, process allows us to monitor the adequate coverage of program outcomes hence identify the shortcomings to overcome in early stages.

11. Additional Evidence on Coverage of Program Outcomes

The student performance in all courses is evaluated with quizzes, tests and homework. In addition to instructors' evaluation of student work and the evidence collected with various surveys (course outcomes, program outcomes, alumni, and employer), we have also been collecting data in several key courses via jury evaluations of major projects and other means to reinforce the findings of instructors' evaluations and surveys. For jury evaluations, the jury members are briefed in advance with the rubrics to be used. The students are also made aware of the survey questions for preparations in advance. All items are scored by the jury using a scale from 1 through 5, with 1 = Poor, 2 = Fair, 3 = Good, 4 = Very Good, 5 = Excellent. A goal of 3.75/5 (or 75%) was chosen as the minimum score to meet as in all surveys administered by the department. We plan to use this system more in the future to collect additional data for program improvements, as it mostly reinforces the findings of the surveys.

Other form of evidences collected by faculty to assure that the course outcomes, hence the program outcomes, are met adequately are in the form of evaluating key exams and projects and comparing student performance against the desired scores in these exams and projects. Here we summarize and the results of these as well as jury evaluations in some key courses, which collectively cover the core program outcomes. More information is included in our ABET report (http://www.engr.iupui.edu/me/fabetreport.shtml)

The hard evidences that are provided in our ABET report are:

1. *ME 314 Heat and Mass Transfer*. Covers the thermal-fluid systems, including laboratory experiments. Evidence includes two instructors' evaluation of student performance in exams with comparisons against the program outcomes.
2. ME 401 Engineering Ethics and Professionalism. Covers communications and ethics, including multidisciplinary team work, effective communication, lifelong learning, contemporary and societal issues. Evidence includes course instructor's evaluation of student performance in exams and team work with comparisons against the program outcomes.
3. ME 462 Capstone Design. Covers design, including selection of alternatives, meeting customer requirements, analysis for reliability, team work, project management, computer or physical model building, lifelong learning. Evidence includes evaluation of final capstone design project presentations by a jury of faculty and industry representatives. Also included are the evaluation of final capstone design project reports of each group by a jury of faculty consisting of at least three faculty members for: 1) technical merit (design specifications, concept generation and evaluation, product generation and evaluation, safety, environmental and ethical issues, and recommendations for improving the design) and 2) writing quality (professional report layout, organization, completeness, clarity, and quality of the

documentation). The students are given a final report format as a guide to follow the above items.

4. *ME 414 Thermal-Fluid Systems Design*. Covers thermal design, including usage of analysis and design tools, optimization, and design for six-sigma. Evidence includes evaluation of final design project presentations of teams by a jury of faculty and industry guests.
5. *ME 482 Control Systems Analysis and Design*. Covers controls and design, including multidisciplinary team work. Evidence includes evaluation of design project presentations of teams by a jury of faculty.
6. *TCM 360 Communication in Engineering Practice*. Covers oral and written communication, including professionalism. Evidence includes evaluation of final presentations of students by a jury of faculty.
7. *ME 450 Computer-Aided Engineering Analysis*. Covers usage of modern design and analysis tools, including stress and heat transfer analysis of solids. Evidence includes evaluation of final project presentations of teams by a jury of faculty.
8. Presentations of Interns and Coops. Covers professionalism, communication, and continuing education. Evidence includes evaluation of presentations of interns and coops on their internship or coop experiences by a jury of faculty.
9. *FE Exam* results, including comparison against the national averages. Covers technical and scientific skills. Evidence includes analysis of FE exam results of our students and comparisons against the national averages, which indicated that while the passing rate of our students is high, improvements are needed in some of the engineering science topics.

As a sample for jury evaluations, results of *ME 462* evaluations are given in Table 13.

We plan to continue monitoring these during the coming years. With the jury evaluations in selected key courses, we were able to measure the level of competency achieved in almost all of the program outcomes. These courses collectively contribute to outcomes a3, a4, c, d, e, f, g, h, i, j, k1, k3 and k4 of the program. The averages of the scores obtained via these jury evaluations indicate that the scores are all above the minimum threshold of 3.75 used as a goal to reach. We plan to continue administering such jury evaluations, as they provide additional information on student performance with input from several faculty and industry members. Even though all scores are above the desired goal, the general education and creativity and originality related areas are consistently lower than the others. These results will be used to further reinforce the importance of these outcomes within the program.

12. Impact of Changes Made

While the impact of the new curriculum is expected to be noticed in the next three years, the impact of the interim changes outlined in Section 7 have been observed in the improved quality of capstone design projects, which are richer in creativity, analysis and presentation. Shown in Table 13 are the comparison of evaluations of capstone project presentations by a jury of faculty and industry representatives since Spring 2002, indicating gradual increase almost in all categories which cover nine of the 18 program outcomes. Another impact of interim changes is observed with the increase of alumni survey scores from 2001 to 2003 in almost all categories, as observed in Table 7.

Table 12. A sample analysis for coverage of program outcomes.

Program Outcome c2

"Design a system, component, or process to meet desired needs with applications to thermal systems"

Measurable Outcomes. Ability to design thermal-fluid systems that meet desired needs, work in teams, communicate the design process and results in the form of written reports, posters, and/or oral presentations. Generate creative and multiple design ideas based on functional specifications and evaluate them based on customer requirements.

Courses Addressing This Outcome. Students learn about thermal-fluid systems in *ME 200, ME 310*, and *ME 314*. They are also introduced to design considerations, however, the core of design work is conducted in the newly instituted thermal-fluid systems design course *ME 414*. In *ME 414*, the students learn about design of piping systems and heat exchanges and apply which they have learned in a final design project which includes both components. Similar to in the capstone design course, they also present their projects to a group of faculty, customers, industry representatives and fellow students. Their work is also assessed by a jury of faculty and industry representatives. This outcome is also partially covered in multi-disciplinary projects of the capstone design course, *ME 462*, where some projects involve solid-fluid and thermal systems. *ME 462*, where they design, analyze and build a product to meet customer/user requirements. The projects often include multiple disciplines, such as fluid, thermal, solids, and electronic controls

Conclusions. The results of course outcomes surveys conducted in ME courses are summarized in figure below. These are also compared with available program outcomes (exit), alumni, and employer surveys as well as the minimum goal of 3.75 set by the department. The increase in course outcomes the last semester is a direct result of *ME 414*, which was offered as a technical elective in Fall 2003. Even though the employer and alumni survey results are higher than the exit survey results, the particular survey question does not distinguish thermal-fluid system design from mechanical design, hence alumni and employer survey results are not quite indicative of this outcome. Students of the new course, *ME 414,* complete final projects in teams that include piping and heat-exchanger systems. They present their projects to a jury at the end of the semester. The web site http://www.engr.iupui.edu/me/courses/fme414.shtml contains more information on this course, including the final project presentations of the students. The detailed results of the jury assessment of *ME 414*, which was offered as a technical elective in Fall 2002 for the first time showed that the addition of *ME 414* to the curriculum will enrich this outcome.

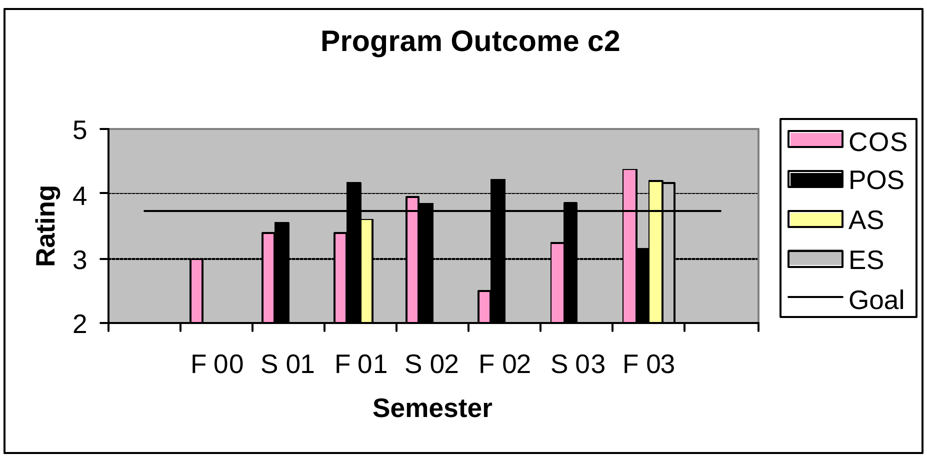


Table 13. Jury evaluation results of *ME 462 Capstone Design* course.

Items	Spring '02 N = 15	Fall '02 N = 44	Spring '03 N = 19	Fall '03 N = 34	Spring '04 N = 64
1. Project Objectives **[g]**	4.07	4.32	4.05	4.41	4.42
2. Creativity and Originality **[e]**	3.60	4.25	4.22	4.00	4.05
3. Use of Engineering Principles **[c, a4]**	3.60	4.05	3.95	4.22	4.00
4. Impact of the Design on Safety, Environment, and Society **[h, j]**	3.62	4.01	3.67	4.06	3.78
5. Professionalism and Team Work of the Design Group **[d, f]**	3.80	4.24	4.21	4.18	4.14
6. Effectiveness of the Presentation **[g]**	4.07	4.07	4.16	4.10	3.98
7. Life Long Learning and Ethical Aspects **[i]**	3.60	4.02	3.63	3.83	3.70
8. Overall Quality **[c]**	3.60	4.20	4.21	4.35	4.14
9. Overall Average (computed)	3.74	4.14	4.01	4.14	4.03

Note: All items are scored by the jury using a scale from 1 through 5, with 1 = Poor, 2 = Fair, 3 = Good, 4 = Very Good, 5 = Excellent. The bold letters in brackets indicate program outcomes.

SUMMARY OF STUDENT PERFORMANCE IN MEETING THE IUPUI "PRINCIPLES OF UNDERGRADUATE LEARNING" (PUL)

Department of Organizational Leadership and Supervision (OLS)

Prepared by Tim Diemer and the OLS Faculty

June 10, 2004

OLS 476, PUL 1

Objective	Method	Scoring Criteria	Results	Recommendation
To make efficient use of information resources to effectively orally communicate to a group.	Oral Presentations	Students are evaluated on: Presentation of relevant and accurate information (40%); Adherence to time limit (40%); Organization of material and technique (20%). Minimum required performance is score of “C” with goal of 90% achieving competence. Students are counseled frequently during the semester on these requirements.	84% completed the assignment and all who completed were competent. Grade of “C’” equates to competence. Grade of D=2 (they did not complete assignment); C=2; B=5; C=4.	Those who completed the assignment met the objectives. This was the best prepared and motivated group I’ve worked with. Two students felt that at 10% of the overall course grade, they did not need to participate to achieve a grade that was acceptable.

OLS 479, PUL 1

Objective	Method	Scoring Criteria	Results	Recommendation
	Group presentations	Delivery of presentation Knowledge of topic researched Preparedness Related Information in presentation/group project to material covered in class & text Goal for Students meeting minimum competence: 90% for this particular assignment	100% of Students successfully completed the assignment and demonstrated competence with the specified PUL.	

OLS 331, PUL 3 a, b

Objective	Method	Scoring Criteria	Results	Recommendation
To create a learning environment wherein at least 70% of the students acquire the necessary knowledge and skill s to successfully complete the course with a grade of C or better. Each class is designed to keep the students attention by using a multimedia approach including PowerPoint presentations, short instructional videos, and a variety of props. All students are encouraged to complete the course requirements and opportunities to makeup missed assignments are offered throughout the semester.	Retention Surveys	A+ 412 to 420 points A 399 to 411 points A- 391 to 398 points B+ 386 to 390 points B 374 to 385 points B- 357 to 373 points C+ 353 to 356 points C 336 to 352 points C- 315 to 335 points D+ 311 to 314 points D 294 to 310 points D- 273 to 293 points	100% of the students completed the required assignments. The objective was for 70% of the students to score a C or better. 85% of the students in D-359 and 90% in D-360 met the scoring objective. Student awarded a C or better demonstrated competency with PUL objective no. 3.	All students were offered an option for extra credit work and one-on-one counseling. (Three students who received a D were repeatedly offered a chance to raise their grades by completing additional work for extra credit. However, these students were not interested in taking advantage of this opportunity.) Many of the students did not print out the instructor notes pages provided in a word document until the day of class or not at all. The document contained 150 pages and greatly assisted the students in meeting course objectives. Future plans include publishing the instructor notes pages in a text as a requirement for the course.

OLS 274 , PUL 3 b

Objective	Method	Scoring Criteria	Results	Recommendation
Through answering of multiple choice and short essay questions, demonstrate an understanding of Strategic Compensation Analysis, Traditional Bases for Pay, Incentive Pay, Pay for Knowledge, and Skill Based Pay.	Exam	The test was two parts. The 1st part was 25 multiple choice questions worth 2 points each for a total of 50 points. The 2nd part was 10 short essay questions worth 10 points apiece for a total of 50 points. The two parts combined equal 100 points. I did not have a defined goal in terms outcomes although 60 was the minimum passing score.	The minimum passing score was 60 out of the 100. The final grade distribution was ten A's, nine B's, 7 C's, and 4 D's.	Generally the objective was met given the grade distribution. Perhaps some ungraded group and/or individual assignments used to augment class discussion/presentation would facilitate better overall understanding.

OLS 274, PUL 3 a, b, c

Objective	Method	Scoring Criteria	Results	Recommendation
Students are able to identify key leadership success factors (LSF's) for managers and supervisors. The objective is that this becomes a tool that they can use in the future to measure their effectiveness as leaders in their organization.	Group projects	1. Compliance with all aspects of assignment ((a) identification and description of eight success factors with integrity being at the center core, (b) preparation of a pie chart visual aid to present success factors, (c) description of performance / behavior for each category that depicts an area for needs development, (d) description that indicates that leaders is over-using skill, and (e) explanation of how the LSF's could be helpful in an organization (i.e. performance appraisal, recruiting, etc.). 2. Quality of Presentation 3. Incorporation of textbook and lecture material 4. Initiative to support LSF's by outside expertise 5. Group member involvement in presentation	There were two groups due to the size of the class. Each group successfully completed the assignment. One group scored 95 and the other group scored a 91.	

IUPUI Principles of Undergraduate Learning:
http://www.imir.iupui.edu/IUPUIfolio/teach/teach_pul.htm

1. Core Communication and Quantitative Skills
The ability of students to write, read, speak, and listen, perform quantitative analysis, and use information resources and technology and the foundation skills necessary for all IUPUI students to succeed. This set of skills is demonstrated, respectively, by the ability to:

a. express ideas and facts to others effectively in a variety of written formats;
b. comprehend, interpret, and analyze texts;
c. communicate orally in one-on-one and group settings;
d. solve problems that are quantitative in nature, and
e. make efficient use of information resources and technology for personal and professional needs.

2. Critical Thinking
The ability of students to analyze information and ideas carefully and logically from multiple perspectives. This skill is demonstrated by the ability of students to:

a. analyze complex issues and make informed decisions;
b. synthesize information in order to arrive at reasoned conclusions;
c. evaluate the logic, validity, and relevance of data;
d. solve challenging problems, and;
e. use knowledge and understanding in order to generate and explore new questions.

3. Integration and Application of Knowledge
The ability of students to use information and concepts from studies in multiple disciplines in their intellectual, professional, and community lives. This skill is demonstrated by the ability of students to apply knowledge to:

a. enhance their personal lives;
b. meet professional standards and competencies, and;
c. further the goals of society.

4. Intellectual Depth, Breadth, and Adaptiveness
The ability of students to examine and organize disciplinary ways of knowing and to apply them to specific issues and problems.

a. Intellectual depth describes the demonstration of substantial knowledge and understanding of at least one field of study.
b. Intellectual breadth is demonstrated by the ability to compare and contrast approaches to knowledge in different disciplines.
c. Adaptiveness is demonstrated by the ability to modify one's approach to an issue or problem based on the contexts and requirements of particular situations.

5. Understanding Society and Culture
The ability of students to recognize their own cultural traditions and to understand and appreciate the diversity of the human experience, both within the United States and internationally. This skill is demonstrated by the ability to:

a. compare and contrast the range of diversity and universality in human history, societies, and ways of life;
b. analyze and understand the interconnectedness of global and local concerns, and;
c. operate with civility in a complex social world.

6. Values and Ethics
The ability of students to make judgments with respect to individual conduct, citizenship, and aesthetics. A sense of values and ethics is demonstrated by the ability of students to:

a. make informed and principled choices regarding conflicting situations in their personal and public lives and to foresee the consequences of these choices, and;
b. recognize the importance of aesthetics in their personal lives and to society.

OLS NARRATIVE ON THE ASSESSMENT OF TWO COURSES

OLS 100 Assessment Project

Prepared by Cliff Goodwin

PUL Assessed:

#1 Core Communication and Quantitative Skills

a). express ideas and facts in a variety of written formats

Assessment questions:

1. What percentage of students enrolled in two sections (D336 & D337) of OLS 100 will follow the advice of their instructor and visit the writing center (at least once) as they write an assigned paper.

2. What effect will going to the IUPUI writing center (at least once) have on the quality of a five-page paper written by students enrolled in two sections of OLS 100.

Population:

Forty students enrolled in two sections of OLS 100 during spring semester 2004.

Dependent variable: Grades earned by students on a five-page leadership paper.

Independent variable: Student voluntarily visiting (at least once) the IUPUI writing center while writing a paper.

Methodology:

All students enrolled in two sections of OLS 100 were **highly encouraged** to visit the IUPUI writing center sometime during the writing process of their leadership paper.

Within the first six weeks of the semester the instructor gave oral encouragement during three different class periods when there was 100% attendance. The instructor did not mention the writing center again after the three times.

The writing center sent a note to the professor telling him who visited the center during the spring semester 2004. The instructor collected the notes without reading them. He therefore did not identify, by name, those students who went to the center until after he graded the papers. Not knowing who went to the center provided the characteristic of a blind study.

The instructor graded 40 leadership papers using an established rubric.

Grades earned on the paper by those students who went to the writing center were compared with those who did not.

Data:

1. Five students out of 40 students (12.5%) acted on the advice of the instructor and visited the writing center at least once as they wrote their paper.

2. Grades earned by the five students who went to the center (at least once) earned on average 4 points higher (10% improvement) on their papers than those who did not go.

3. Range of scores = 2 to 6 points.

Conclusions:

1. A large majority of students (87.5%) did not take the advice of their instructor to visit the IUPUI writing center.

2. Feedback from the writing center will improve student performance on writing projects.

Further research:

As a follow on to this project, during fall semester 2004, I plan to:

1. Sort for number of times a student goes to writing center to determine the relationship between how many times one goes and the quality of one's paper.

2. Set up a control group and an experimental group and **require** students in the experimental group to visit the center (at least once) as part of their course grade. Using the established rubric, grade the papers from both groups.

3. Interview students to determine why they go or do not go to the writing center.

<u>Student Work Assessed</u>:

Writing assignment**:** *Philosophy of Leadership paper*

Leadership paper Instructions:

Value: 40 points

Goal: Write a paper describing your personal philosophy of leadership. Your paper should be approximately five pages and should describe your beliefs, opinions, ideas about how you will lead your employees and company. Your personal philosophy may be the result of personal experiences, articles, books or journals you have read.

Criteria**:** The paper must contain at minimum of **three** references from other theorists who support and/or have influenced your philosophy.

All references should conform to the MLA style, or APA style for referencing other work. Your references may be taken from: books, periodicals, journals or the inter-net.

It must be typed, double-spaced, with 1’’ margins, 12-point type, and contain correct grammar, punctuation and spelling.

It must also contain the signature of a proofreader.

Issues Identified from Learning Outcomes in OLS Capstone Requirements

Prepared by Charles Feldhaus

Background on Capstone Requirements in Organizational Leadership and Supervision

In an academic context, capstones are often thought of as summative experiences that synthesize "all of the content within a particular major" and that connect this content "back to the institution's basic theme of general education" (Gardner and Van der Veer, 1998, p. 15). These experiences provide students with an opportunity to "demonstrate comprehensive learning in their major through some type of product or performance" (Palomba and Banta, 1999, p. 124), such as a thesis, an internship, or a research project. In other words, capstone experiences in OLS require students to pull together what they have learned in all of their previous classes – in OLS and elsewhere across the University – and to use these integrating experiences to demonstrate that they possess the knowledge, skills, and abilities required of a baccalaureate-level, college-educated student of leadership.

For OLS majors, capstone experiences are organized through two 400-level courses: OLS 410, *Survival Skills in Organizational Careers*; and OLS 490, *Senior Research Project*. These courses are required for all OLS majors, and should be taken in order toward the end of the program of study.

OLS 410 serves as the *professional development capstone*, in which students:

- Reflect upon the IUPUI *Principles of Undergraduate Learning* and their relationship to leadership;
- Read and present information on past and current issues, ideas, and trends related to leadership;
- Conduct an audit of their academic experiences;
- Participate in a Leadership Assessment Center to identify their strengths and areas of further development;
- Complete three comprehensive essays related to core OLS theories, models, and perspectives; and
- Develop their proposal for the *Senior Research Project*, which includes:
    - An identification of a research topic
    - A description of the significance of the topic
    - A literature review summarizing what is known about the topic
    - A design for carrying out research on the topic

OLS 490 serves as the *research requirement capstone*, in which students:

- Conduct applied research related to leadership (based on their proposal developed in OLS 410);
- Analyze, present, and interpret data from the research;
- Draw conclusions and make recommendations based on their research findings;
- Provide supporting evidence related to the research (e.g. references and appendices);
- Write a 25-30 page paper summarizing the research process and findings; and
- Make a 10-15 minute professional, multimedia presentation on their research findings

Because OLS 410 serves, in part, as a preparation for OLS 490, students are required to take OLS 410 *prior* to enrolling in OLS 490. In rare instances, students may concurrently enroll in both OLS 410 and OLS 490, although this practice is very strongly discouraged.

Learning Objectives for OLS 410

Upon completion of OLS 410, Survival Skills in Organizational Careers, the student should be able to:

1. Demonstrate mastery of concepts and ideas from OLS courses.
2. Provide specific, relevant, and accurate examples of leadership theories, models, approaches, etc. to the solving of organizational problems.
3. Summarize academic experiences and identify strengths and areas for future development.
4. Identify and describe the IUPUI Principles of Undergraduate Learning as they relate to the study of leadership and leadership-in-practice.
5. Examine, explain, compare, evaluate, and present current, relevant, and in-depth leadership issues or trends.
6. Demonstrate behaviors and reflect on experiences necessary for leadership and organizational survivability.
7. Identify an applied leadership-oriented topic, describe its significance, relate it to the existing literature, plan a research design, and write a research proposal.
8. Assume personal responsibility for learning and behavior.
9. Follow directions accurately.
10. Adhere to deadlines as directed.
11. Work in an interdependent manner with class colleagues.
12. Make class presentations/facilitations in a professional manner.
13. Submit work that is thorough, accurate, and professionally presented.
14. Manage time wisely.
15. Operate with civility and respect when disagreements arise.
16. Inform the Instructor and class colleagues when absences are necessary.
17. Come to class prepared, having completed the necessary readings/assignments.
18. Adhere to any other expectations that are jointly determined by the Instructor and class colleagues.

Learning Objectives for OLS 490

Upon completion of OLS 490, Senior Research Project, the student should be able to:

1. Identify and define a research problem that occurs in an applied organizational setting.

2. Develop research questions and/or hypotheses related to the research problem.

3. Define relevant terms and their importance to the research problem.

4. Describe the significance of a research problem to organizational leaders and other relevant stakeholders.

5. Locate relevant literature sources (traditional and electronic) that provide background information and understanding of a research problem.

6. Synthesize and summarize information from a variety of literature sources (traditional and electronic) into a well developed narrative.

7. Design appropriate research and data collection methods to solve a research problem.

8. Identify relevant data sources used in research, including their strengths and limitations and the issues associated with validity and reliability.

9. Collect data in a timely, ethical, and professional manner.

10. Analyze and interpret data in ways that are appropriate to the research problem.

11. Present data findings as they relate to the research questions and/or hypotheses of the research problem.

12. Develop specific conclusions based on the analysis, interpretation, and presentation of data.

13. Develop specific recommendations for policy, practice, and or future research based on the specific conclusions of the research.

14. Cite references in accordance with approved stylistic guidelines.

15. Create and utilize appendices to expand upon concepts and reference additional information.

16. Write a 25-30 page research report summarizing the research process and its findings that is free of spelling, grammar, and organization errors.

17. Use appropriate resources to complete the research project.

18. Manage the research project from initiation to completion.

19. Present research findings in the form of a well organized, professionally delivered 10-15 minute multimedia presentation.

20. Produce an executive summary highlighting important research project processes and findings.

Issues Identified in Assessment of Student Learning Outcomes in OLS 410 and OLS 490

Students in OLS 410 begin the semester by completing a series of individually developed essays related to comprehensive learning in prior OLS core courses – OLS 252, 263, 274, 327, and 390 (see attachment: Comprehensive Essays and Grading Criteria and Expectations for Comprehensive Essays).

In order to successfully complete OLS 410, students must "meet expectations" in developing the Comprehensive Essays. While all students ultimately met expectations, this assignment proved challenging for many students. Indeed, many students indicated that this assignment represented a major demonstration of their writing, critical thinking, and synthesis abilities. The strictness of deadline (due 3 weeks into the semester) served as a powerful reinforcement for students to produce timely and quality work.

Students in OLS 490 are provided with an extensive framework that describes grading criteria and expectations, and this framework is used to guide and evaluate student work (see attachment: Grading Criteria and Expectations for OLS 490, Senior Research Project).

In order to receive a passing grade in OLS 490 (and thus satisfactorily complete degree requirements for the baccalaureate degree in OLS), students must "meet expectations" in each of the ten equally-weighted areas of the Senior Research Project. While every OLS 490 student has, ultimately, met expectations, there is considerable variability in the length of time it takes for individual students to complete the research, writing, and presentation requirements for OLS 490. Indeed, one measure of student productivity in OLS 490 is to examine the percent of students completing the Senior Research Project in the semester in which they enrolled for OLS 490, as summarized in the table below:

Semester	*# Enrolled Students*	*% Completing*	*% Deferring*
Summer 2003	11	36	64
Fall 2003	4	0	100
Spring 2004	21	80	20

When one considers that the proposal for OLS 490 (at least ten written pages) is developed in OLS 410, there are a considerably high percentage of students who, for one reason or another, are incapable of completing the OLS 490 project within one semester. Feedback from students suggests that the overwhelming demands of other classes and additional outside responsibilities (e.g. work and family) are central reasons for lack of timely completion. While this trend improved significantly in spring 2004, there is still work to be done to improve efficient completion of OLS 490 within one semester.

As a result of reviewing student learning outcomes during AY 2003-04 in both OLS 410 and OLS 490, the following issues have been identified:

1. Critical thinking, reasoning, and writing needs improvement

Many students were not able to appropriately synthesize themes, trends, and interconnectedness of concepts from a variety of leadership-related readings. Too often, students based information in opinion, and did not establish factual interpretations and conclusions. While opinions are valuable in contextualizing information, they must be grounded in the theories, concepts, models, etc. of the discipline.

Too often, many students were unable or unwilling to locate information from appropriate sources (e.g. textbooks, journals, professional trade publications) to substantiate a thought. This "complacency of learning" was exhibited numerous times by students, either individually or in groups, and often served to weaken otherwise well-intentioned efforts to present information.

Written assignments, in general, were completed in a last-minute fashion, often resulting in poorly organized, ill-conceived narratives. Many students view major writing assignments (10 pages or more) as a challenge, and are, in many instances, ill-equipped to conceive and develop quality work in a timely manner. Additionally, despite encouragement from the Instructor to do so, many students made ineffective use of resources such as the Writing Center and peer review of written work.

Another area of concern centers on the appropriateness of writing styles. For example, several students write in a stream-of-consciousness manner, and fail to craft their message in either academic or professional language. Students also need tremendous assistance and guidance in citing work in manners that are consistent and appropriate for academic purposes.

2. Organizing, facilitating, and presenting information orally needs improvement

While OLS seniors tend to be very opinionated and conversant on issues related to their direct experiences in leadership and organizational settings, a large percentage of students lack the ability to conceptualize, organize, and deliver a presentation in an effective, professional manner. Too often, students exhibited an over-reliance on notes, PowerPoint slides, and textbooks, which indicated their lack of understanding and familiarity with the topic(s) being presented. In addition to formal presentations, students need improvement in facilitating informal discussions in large- and small-group settings.

3. Time management and seriousness of purpose needs improvement

While it is to be expected that students have multiple demands on their time, too many OLS seniors lack the ability to demonstrate their time management skills and seriousness of purpose as it relates to their activities as a senior-level, college-educated student of leadership. Frequently, it is apparent that OLS coursework remains a low priority – in spite of repeated reminders by the Instructor of the importance of investing in developing quality work. Many students also have casualness in their approach to writing, presenting, and discussing leadership issues. The level of depth, rigor, and adequate preparation is in need of improvement.

Proposed Changes in OLS Courses as a Result of Findings

OLS professors are meeting this summer to revisit academic and other requirements in the core OLS courses (252, 263, 274, 327, 390, 410, and 490). Anticipated changes include the following:

- Greater alignment of student learning outcomes in OLS core courses
- Increased emphasis on individual accountability for student learning
- Increased use of major writing assignments earlier in the curriculum
- Increased opportunity for students to engage in individual and group presentations earlier in the curriculum
- Greater emphasis on the interconnectedness of leadership concepts in OLS core courses
- Identification of concepts that are duplicative or omitted in OLS core courses

It anticipated that issues will be identified in summer 2004, and changes will be made and implemented in courses during AY 2004-05.

References

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