PURDUE SCHOOL OF ENGINEERING AND TECHNOLOGY 2012-2013 ACADEMIC YEAR ASSESSMENT REPORT

Prepared by the School's Assessment Committee and Karen Alfrey, Chair

September 5, 2014

Introduction

The Purdue School of Engineering and Technology, IUPUI (E&T) continues its tradition of reporting its outcomes assessment activities by department or (where appropriate) by academic program. The assessment activities of most programs in the school are guided by the discipline-specific accreditation requirements of ABET, Inc. (http://abet.org/, formerly the Accreditation Board for Engineering and Technology), which accredits our engineering, technology, and computing programs; of the National Association of Schools of Music (NASM, http://nasm.arts-accredit.org/), through which the department of Music and Arts Technology is accredited; and of the Council for Interior Design Technology (CIDA, http://www.accredit-id.org/), the accrediting body for our Interior Design Technology program. The Organizational Leadership and Supervision (OLS) program, which is not accredited at the program level, uses the campus's Principles of Undergraduate Learning (PULs) as their framework for program assessment. Technical Communications (TCM) offers a certificate program and a recently-established Bachelor's degree in Technical Communication, as well as providing supporting coursework (and assessment data on student learning outcomes in those courses) for many of the programs in the school.

School Assessment Processes

The program outcomes defined by ABET, NASM, and CIDA to describe the knowledge, skills, and habits of mind expected of successful graduates of these programs cover the same broad areas as IUPUI's Principles of Undergraduate Learning, but with more specificity appropriate to the needs of each discipline. (ABET outcomes for engineering programs, for example, include several outcomes that could be considered specific examples of Quantitative Skills, one of the PULs.) Thus, by focusing on attainment of discipline-specific outcomes, programs are assured of meeting the more broadly-defined PULs.

Student Learning Outcomes for each undergraduate program are published in the Bulletin: http://www.iupui.edu/~bulletin/iupui/2012-2014/schools/purdue-engineer-tech/undergraduate/student_learning_outcomes/index.shtml. For engineering programs, ABET defines eleven core outcomes (commonly designated as "a through k" in keeping with ABET terminology):

> Upon completion of this program, students will be able to demonstrate:
> a. an ability to apply knowledge of mathematics, science, and engineering.
> b. an ability to design and conduct experiments, as well as to analyze and interpret data.
> c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
> d. an ability to function on multidisciplinary teams.
> e. an ability to identify, formulate, and solve engineering problems.
> f. an understanding of professional and ethical responsibility.
> g. an ability to communicate effectively.
> h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

i. a recognition of the need for, and an ability to engage in life-long learning.
j. a knowledge of contemporary issues.
k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Some programs may define additional program-specific outcomes appropriate to their discipline. For baccalaureate degree programs in engineering technology, the eleven core "a through k" ABET outcomes are:

Upon completion of this program, students will be able to demonstrate:
a. an ability to select and apply the knowledge, techniques, skills and modern tools of their disciplines to broadly-defined engineering technology activities;
b. an ability to select and apply a knowledge of mathematics, science, engineering and technology to engineering technology problems that require the application of principles and applied procedures or methodologies;
c. an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes;
d. an ability to design systems, components or processes for broadly-defined engineering technology problems appropriate to program educational objectives;
e. an ability to function effectively as a member or leader on a technical team;
f. an ability to identify, analyze and solve broadly-defined engineering technology problems;
g. an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature;
h. an understanding of the need for and an ability to engage in self-directed continuing professional development;
i. an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity;
j. a knowledge of the impact of engineering technology solutions in a societal and global context; and
k. a commitment to quality, timeliness, and continuous improvement.

Each undergraduate course taught in the school has identified one or more emphasized PULs, as well as any discipline-specific outcomes emphasized in the course. Based on these defined areas of emphasis, specific courses may be targeted for assessment of a given outcome. The campus-level PUL assessment process, which calls for assessing PULs in every undergraduate class on a 5-year cycle, provides supplemental data on learning outcomes and a check on the validity of our program-specific outcomes data. The bulk of program assessment is administered and performed at the department level, with the school assessment committee providing a mechanism for sharing resources and best practices, as well as disseminating information and guidance on new campus-level assessment processes. An example of the mapping between discipline-specific outcomes and PULs is shown in the table on the next page.

Prompted by the establishment of Principles of Graduate Learning at IUPUI, graduate programs in the School of Engineering and Technology have likewise established student learning outcomes, published in the Bulletin: http://www.iupui.edu/~bulletin/iupui/2012-2014/schools/purdue-enginer-tech/graduate/student_learning_outcomes/index.shtml Due to the highly specialized, integrative

nature of graduate programs, assessment of these outcomes focuses primarily on the thesis (or final project) rather than on individual courses.

ABET/EAC Criteria #3 2011-12 Evaluation Criteria **Engineering programs must demonstrate that their students attain:**	**INDIANA UNIVERSITY-PURDUE UNIVERSITY INDIANAPOLIS** **PRINCIPLES OF UNDERGRADUATE LEARNING**							
	PUL 1 **Core Communication and Quantitative Skills**			**PUL 2** **Critical Thinking**	**PUL 3** **Integration and Application of Knowledge**	**PUL 4** **Intellectual Depth, Breadth, and Adaptiveness**	**PUL 5** **Understanding Society and Culture**	**PUL 6** **Values and Ethics**
	A	**B**	**C**					
(a) an ability to apply knowledge of mathematics, science, and engineering		X		X	X	X		
(b) an ability to design and conduct experiments, and analyze and interpret data		X		X	X	X		
(c) an ability to design a system, component, or process to meet desired needs with realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability				X	X	X		
(d) an ability to function on multidisciplinary teams	X					X	X	
(e) an ability to identify, formulate, and solve engineering problems		X		X	X	X		
(f) and understanding of professional and ethical responsibility				X	X	X	X	X
(g) an ability to communicate effectively	X						X	
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context					X	X	X	X
(i) a recognition of the need for, and an ability to engage in life-long learning			X	X			X	X
(j) a knowledge of contemporary issues				X		X	X	X
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice			X		X	X		

School Assessment Milestones

The school's Engineering Technology programs underwent an accreditation visit by the ETAC (engineering technology commission) of ABET, Inc. in October 2013. The Biomedical Engineering Technology (BMET) program was seeking an initial accreditation; technology programs seeking re-accreditation included Electrical, Computer, and Mechanical Engineering Technology (EET, CET, MET); and Construction Engineering Management Technology (CEMT). In preparation for the upcoming visit, each program completed an extensive self-study detailing their assessment and continuous improvement processes and providing evidence that student learning outcomes are being attained. In addition to being submitted to ABET, copies of these self-studies are on file in the Dean's Office of the School of Engineering and Technology. These self-studies provide additional details and analysis of the assessment processes and outcomes summarized in this report. Results of the accreditation visit are discussed below in the Engineering Technology section.

The Interior Design Technology program also underwent an accreditation visit by the Council for Interior Design Accreditation (CIDA) in November 2013. As a result of this visit, the program has been awarded the full six-year re-accreditation. The findings of the visiting team are highlighted below in the Interior Design Technology section under Engineering Technology.

In January 2012, IUPUI and Ivy Tech were selected to participate in the AAC&U Quality Collaboratives project, an initiative to develop best practices for the seamless articulation and transfer of coursework across institutions using the AAC&U's Degree Qualifications Profile as a framework. Building on existing ties established through the E&T Assessment Committee, faculty from both institutions are working together to build a common assessment framework to ensure that students transitioning into the junior year of the Mechanical, Electrical, Computer, and Energy Engineering programs at IUPUI are equipped with the skills and knowledge they need to succeed, regardless of whether they completed their first two years at IUPUI or in the new pre-engineering sequence at Ivy Tech. The first Ivy Tech pre-engineering students successfully completed this two-year program in May 2014 and will be entering the IUPUI engineering programs in August.

In 2014-2015 the School of Engineering and Technology will be undergoing a program review of advising services. The results of this review will be highlighted in next year's report.

The E&T 2013-2014 Assessment Committee

This year the E&T Assessment Committee was chaired by Karen Alfrey, Director of the Undergraduate Program in Biomedical Engineering. The members of the 2013-2014 committee were the following:

Karen Alfrey, Biomedical Engineering
Mark Atkins, Ivy Tech
Dan Baldwin, Computer Graphics Technology
J. Bradon Barnes, Ivy Tech
Elaine Cooney, Engineering Technology
Eugenia Fernandez, Computer Information and Graphics Technology
Elizabeth Freije, Electrical and Computer Engineering Technology
Michael Hall, Ivy Tech
Stephen Hundley, Technology Leadership and Communication
Alan Jones, Mechanical Engineering
Betty Klein, Design and Communication Technology
Roberta Lindsey, Music and Arts Technology

Emily McLaughlin, Interior Design Technology
Danny King, New Student Academic Advising Center
Corinne Renguette, Technical Communications
David Russomanno, Dean
Seemein Shayesteh, Electrical and Computer Engineering
Jane Simpson, Electrical and Computer Engineering
Elizabeth Wager, Organizational Leadership and Supervision
Bill White, Construction Engineering Management Technology
Jennifer Williams, Career Services
Wanda Worley, Associate Dean for Undergraduate Programs
Paul Yearling, Mechanical Engineering Technology

Departmental and Program Annual Reports for 2013-2014

The 2013-2014 departmental and program assessment reports included in this school report represent the collected works of the following:

Engineering Technology: Includes Biomedical Engineering Technology (BMET), Construction Engineering Management Technology (CEMT), Electrical and Computer Engineering Technology (EET and CpET), Mechanical Engineering Technology (MET), Architectural Technology (ART), and Interior Design Technology (IDT).

Engineering and Computing: Includes Biomedical Engineering (BME), Electrical and Computer Engineering (EE and CE), Energy Engineering (EEN), Mechanical Engineering (ME), Motorsports Engineering (MSTE), Computer Graphics Technology (CGT) and Computer Information Technology (CIT)

The table below outlines reporting for the school over the last three years. Previous years' reports are available at http://www.planning.iupui.edu/43.html under "School Assessment Reports".

Programs		2009-10	2010-11	2011-12	2012-13	2013-14
BME		x	x	x	x	x
EE/CE				x		x
ME/EEN		x	x			x
MSTE				x		x
CIT		x				x
CGT		x	x			x
ART			x	x		x
IDT			x	x	x	x
TCM		x			x	
OLS				x	x	
ECET		x	x	x	x	x
MET				x	x	x
BMET		x			x	x
CEMT		x	x	x	x	x
MAT		x	x			
NSAAC		x				

Engineering Technology

ABET Accreditation Visit

The five IUPUI technology programs currently accredited under the Engineering Technology Accreditation Commission (ETAC) of ABET, Inc. – Biomedical Engineering Technology (BMET), Construction Engineering Management Technology (CEMT), Mechanical Engineering Technology (MET), Electrical Engineering Technology (EET) and Computer Engineering Technology (CpET) – underwent an accreditation visit in October 2013. This was an initial – and very successful – accreditation visit for the Biomedical Engineering Technology (BMET program): no shortcomings were noted, meaning that the Commission is satisfied that the program meets all the criteria for accreditation, including demonstrating that students completing the program meet the ABET learning outcomes (a-k) for technology. The final report from the program evaluator particularly praised the well-equipped on-campus laboratories that give students the opportunity for hands-on work with the very tools they would use in the field; as well as the excellent working relationship between the BMET program and local hospitals and medical equipment managers, providing opportunities for all students in the program to complete an internship experience. The commission voted to accredit the BMET program until the next general review, the 6-year maximum allowed by the ABET accreditation process.

The visiting Program Evaluators raised several concerns about the other programs that needed to be addressed after the visit. The most critical of these concerns were:

- In both EET and CpET, there was a slight mismatch in wording between ABET outcomes *c* and *k* and the CpET student outcomes; in particular, the CpET outcomes omitted the ability to "apply experimental results to improve processes" and the commitment to "continuous improvement". A concern was raised that these crucial elements of the ABET outcomes were therefore not being effectively assessed or considered as part of the continuous program improvement process. In response, CpET updated the wording of their own outcomes, collected data on the new outcomes during the fall 2013 semester, and incorporated those findings into their continuous improvement process.
- In CEMT, a serious concern was raised that although the program had a well-defined process to collect course-level outcomes (primarily via the campus PUL assessment process), there was no systematic process to consider overall student outcomes at the program level. Furthermore, to the extent that program improvements were reported, they were dictated by sources and policy decisions external to CEMT rather than by consideration of student outcomes and how to improve them. In response, CEMT has significantly revamped their program-level outcomes assessment and improvement process using a template that is being adopted school-wide for tracking student outcomes for ABET-accredited programs. This new process is described in detail in the Engineering and Computing section below.

In addition, although it did not rise to the level of a concern that required immediate action, the program evaluator for Mechanical Engineering Technology observed that students in the program had mentioned that it was common knowledge that students having trouble in mathematics could find an easier path to completing the mathematics requirements by taking those courses at the local community college (Ivy Tech). The evaluator recommended that IUPUI work closely with its feeder colleges to ensure that similar levels of quality are achieved across institutions for courses that are deemed to be equivalent. Through joint representation on the School of Engineering and Technology's Assessment Committee we already maintain a close relationship with the pre-engineering faculty at Ivy Tech (some of whom also support or have supported the Ivy Tech technology programs), and already have plans for assessment activities this fall that will help ensure that students taking foundational courses at Ivy Tech are sufficiently well-prepared for success in IUPUI engineering and technology programs.

Architectural Technology
The Architectural Technology program will be discontinued after May 2015, when the remaining 18 students in the program are expected to graduate. Therefore, rather than undergo a full reaccreditation process this fall, the program has requested that its existing accreditation be extended through May 30, 2015. No deficiencies or weaknesses were listed following the previous general accreditation review of this program in 2006, and all courses for this program are contained within other accredited programs (primarily the four-year interior design program, accredited by the Council for Interior Design Accreditation). The extension request was granted, and this program will terminate in May 2015.

Interior Design Technology
The Interior Design Technology program (IDT) also underwent a re-accreditation visit in fall 2014. In their final report, the Council for Interior Design Accreditation (CIDA) highlighted the following strengths of the program:

- Community engagement
- Annual student design show event held on campus
- Study abroad opportunities
- Dedicated Career Services office for job placement
- Global view of Design
- Multidisciplinary collaboration
- Strong assessment methods and data

The main concern raised by this visit was that some instructional facilities and work spaces were not adequate to the needs of the program or sufficiently available to students – a problem that may be addressed with more dedicated spaces or more hours of availability for existing facilities. In light of the overall strength of the evidence that this program is educating students who are well-prepared for the Interior Design industry, the Interior Design Technology program received the full six year re-accreditation.

Engineering and Computing

The next ABET visit for IUPUI programs accredited under the Engineering Accreditation Commission (EAC) and the Computing Accreditation Commission (CAC) will take place in Fall 2016. Programs involved in this visit include two new programs that will be seeking a first-time accreditation (Energy Engineering and Motorsports Engineering) as well as two programs that have undergone significant reorganization at the departmental level since their previous accreditations in 2009 (Computer Information Technology and Computer Graphics Technology). To help ensure these programs are well-prepared for this visit, all IUPUI engineering and computing programs will be undergoing a mock ABET visit in Spring 2015. In the coming year, programs will collect assessment data on the ABET a-k learning outcomes and draft scaled-down versions of the ABET self-study focusing on analyzing the outcomes data. We will be visited next spring by an external evaluator familiar with the ABET accreditation process who will provide feedback on areas to target for improvement, in particular areas in which we may not be providing sufficient evidence of compliance with ABET criteria, in advance of the 2016 accreditation visit.

In preparation for these visits, and mindful of the concerns raised during the Technology ABET visit about explicitly addressing program-level outcomes assessment, the School has adopted a new assessment planning template. For each ABET outcome (a-k), Programs must report:

- Performance Indicators: What specific kind of evidence will be used to demonstrate that students are meeting the given outcome?
- Method(s) of Assessment: What specific piece(s) of student work will elicit these performance indicators?
- Where data are collected (specific course, experience, or survey)
- Year/Semester of Data Collection
- Target for Performance: What is the minimum expectation of performance if the program is successfully meeting that outcome?

Each of the programs undergoing the mock ABET visit has compiled and submitted such an assessment plan during the spring and summer of 2014. The completed documents are too extensive to be included in this brief report; however, the tables below provide an example of what the filled templates look like for Outcome A and Outcome B in one engineering program:

Outcome A: Students will demonstrate an ability to apply knowledge of mathematics, science, and engineering.

Performance Indicators	Method(s) of Assessment	Where data are collected	Year(s)/Semester of Data Collection	Target for Performance
Students will apply knowledge of mathematics, physics, and mechanics to solving a biomechanics problem.	Exam problems	BME 241	Every three years (next: fall 2014)	70% of students will score at least 80% on assessed problems.
Students will analyze a scientific paper from the literature by identifying the hypothesis, proposing the next experiment needed to test the hypothesis, and discussing how the results might be applied in developing a new product or therapy	Quiz	BME 381	Every three years (next: fall 2014)	70% of students will score at least 80% on the assessed quiz
Students will apply mathematical analysis to problems related to implantable materials and biological response	Exam problems	BME 381	Every three years (next: fall 2014)	70% of students will score at least 80% on the assessed quiz
Students will apply knowledge of mathematics, science, and engineering to solving problems related to diffusion and transport	Homework and exam problems	BME 461	Every three years (next: spring 2015)	70% of students will score at least 70% on assessed problems
COMMENTS:				

Outcome B: Students will demonstrate an ability to design and conduct experiments, as well as to analyze and interpret data.

Performance Indicators	Method(s) of Assessment	Where data are collected	Year(s)/Semester of Data Collection	Target for Performance
Students will successfully complete a laboratory assignment with a pre-lab component, data collection component, and analysis component	Pre-lab assignment Data pages from lab notebook Lab reports	BME 241	Every three years (next: fall 2014)	70% of students will earn a grade of 70% or higher on the lab assignment
Students will use statistical methods to analyze and interpret data	Exam problem	BME 322	Every three years (next: spring 2015)	70% of students will score at least 70% on the assessed problem
Students will determine the minimum number of samples needed to ensure the power of a statistical test	Exam problem	BME 322	Every three years (next: spring 2015)	70% of students will score at least 70% on the assessed problem
Design teams will develop, implement, and evaluate the success of a Verification and Validation plan	Final design reports	BME 491/492	Every three years (next: spring 2015)	80% of teams will score at least 60% of the points on the Verification/Validation section of the design report
COMMENTS:				

The "Comments" sections of the template will be used to comment on the results of these assessments and on whether or not the data collected in accordance with this plan meets the targets for performance set for each performance indicator. All the engineering and computing programs (Biomedical, Electrical, Computer, Energy, Mechanical, and Motorsports Engineering; and Computer Information Technology and Computer Graphics Technology) will be collecting and reporting on the data outlined in these plans during the 2014-15 academic year. Next year's PRAC report will summarize the major findings and areas for improvement.