ABET

Introduction of ABET to CE 203

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What is ABET?

- ABET is an organization that provides world leadership to ensure quality and stimulate innovation in applied science, computing, engineering and technology education.
- ABET is the primary organization responsible for monitoring, evaluating, and certifying the quality of education in these areas in the U.S.

ABET Evaluates Programs

- ABET accredits programs that lead to degrees, and not institutions.
- All paths of study leading to a degree must meet the ABET requirements for a program to be accredited.
- A program is typically described by a unique set of objectives and outcomes achieved by an unique course of study – curriculum and related co- and extra-curricular activities
- A student transcript is the primary evidence of degree completion

Terms Used by ABET

- Objectives
- Outcomes
- Performance Criteria
- Assessment
- Evaluation

Objectives

- Statements that describe the expected accomplishments of graduates during the first few years after graduation

Outcomes

- Statements that describe what students are expected to know and able to do by the time of graduation.

Performance Criteria

- Specific, measurable statements identifying the performance(s) required to meet the outcomes; confirmable through evidence (standards, rubrics, specification, metrics, etc.)

Assessment

- Processes that identify, collect, use and prepare data that can be used to evaluate achievement (knowledge, skills, attitude and values, behavior).
- Can be group or individual, formative or summative.

Evaluation

- Process of reviewing the results of data collection and analysis and making a determination of the value of findings and action to be taken.

Criterion 1 - Students

- The program must evaluate student performance
- Advise students regarding curricular and career matters
- Monitor student progress to foster their success in achieving outcomes
- The institution must have and enforce policies for transfer students and validation of courses taken for credit elsewhere
- The institution must have and enforce procedures to assure that all students meet program requirements

Criterion 2 – Program Educational Objectives

- Each program must have:
  - Detailed published education objectives consistent with the mission of the institution
  - Process based on needs of constituents in which objectives are determined and periodically evaluated
  - An educational program, including a curriculum that prepares students to attain program outcomes
  - A process of on-going evaluation of the extent and uses results to develop and improve the program outcomes

Criterion 3 – Program Outcomes and Assessment

- Programs must demonstrate their graduates have outcomes "a to k"
- Program must have an assessment process with documented results that indicate the degree to which outcomes are attained
- Evidence that the results of the assessment process are applied to the further development and improvement of the program

Assessment Tools and Measures

- The primary outcomes assessment should be based on direct measures of student learning
- Senior exit surveys, alumni surveys, and employer surveys as means of outcomes assessment are indirect measures.
- A system must be in place to ensure that all graduates have, to some extent, attained the prescribed outcomes and all elements of the Professional Component

ABET Criteria 2000

- (a) an ***ability*** to apply knowledge of mathematics, science and engineering
- (b) an ***ability*** to design, conduct experiments,as well as analyze and interpret data
- (c) an ***ability*** to design a system,component or process to meet desired needs
- (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 and social context
- (i) a recognition of the need for, and an ***ability*** to engage in lifelong learning
- (j) a knowledge of contemporary issues
- (k) an ***ability*** to use the techniques, skills, and modern engineering tools necessary for engineering practice

Accepted Direct Assessment

- Student portfolios
- Subject content examinations
- Performance observations
- Performance evaluations of internships and/or co-ops

Criterion 4 – Professional Component

- Faculty must ensure that the curriculum devotes adequate attention and time to each component, consistent with the outcomes and objectives of the program and institution
- Preparation for engineering practice
  - Major design experience
- Subject areas appropriate to engineering

Subject Areas

- One year of a combination of college-level mathematics and basic sciences appropriate to the discipline
- One and one-half years of engineering topics, consisting of engineering sciences and engineering design appropriate to the student's field of study
- A general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives

Criterion 5 - Faculty

- Sufficient in number and competencies to cover all curricular areas
- Sufficient in number to accommodate adequate levels of student-faculty interaction, advising and counseling, service, professional development, and interactions with industrial and professional practitioners and employers
- Ensure proper guidance of the program and its evaluation, development, and improvement.

Criterion 6 - Facilities

- Classrooms, laboratories, and associated equipment must be adequate to accomplish program objectives and provide an atmosphere conducive to learning
  - Opportunities to learn the use of modern engineering tools
  - Computing/information infrastructure to support scholarly activities of the students and faculty and the educational objectives of the institution

Criterion 7 - Institutional Support and Financial Resources

- Institutional support, financial resources, and constructive leadership must be adequate to assure quality and continuity of the program
  - Attract, retain, and provide for professional development of a well-qualified faculty
  - Resources to acquire, maintain, and operate equipment and facilities
  - Adequate support personnel
  - Support of quality-improvement efforts

Program Criteria

- Each program must satisfy applicable Program Criteria
  - Curricular topics
  - Faculty qualifications
- Current Program Criteria unique to Agricultural Engineering
- Must satisfy all Program Criteria Implied by title of program

Accreditation Definitions

- Deficiency
- Weakness
- Concern
- Observation

Deficiency

- Indicates that a criterion, policy, or procedure is not satisfied. Therefore, the program is not in compliance with the criteria.

Weakness

- Indicates that a program lacks the strength of compliance with a criterion, policy, or procedure to ensure that the quality of the program will not be compromised Therefore, remedial action is required to strengthen compliance with the criterion, policy, or procedure prior to the next evaluation.

Concern

- Indicates that a program currently satisfies a criterion, policy, or procedure; however, the potential exists for the situation to change such that the criterion, policy, or procedure may not be satisfied.

Observation

- Is a comment or suggestion which does not relate directly to the accreditation action but is offered to assist the institution in its continuing efforts to improve its programs.

ABET Outcomes – ISU Competency Matrix

Engineering 2000 Criterion 3 Program Outcomes and Assessment		ISU Competency													
		Engineering Knowledge	General Knowledge	Continuous Learning	Quality Orientation	Initiative	Innovation	Cultural Adaptability	Analysis and Judgment	Planning	Communication	Teamwork	Integrity	Professional Impact	Customer Focus
(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	✖		✖	✖	✖	✖	✖	✖	✖	✖	✖			✖
(d)	an ability to function on interdisciplinary 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 is a global and societal context	✖	✖	✖				✖	✖						
(i)	a recognition of the need for, and the 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	✖		✖	✖	✖		✖	✖						

Structure of Assessment Process

- Faculty
  - Course outcomes review
  - Committees - (on-going, but a 2 year cycle)
    - Curriculum
    - Integrated Program
    - Assessment and Planning
- Students
  - Focus groups in senior assessment
- Alumni/ Employer
  - Surveys and Advisory Council

2000 – 2006 Program Development Focus

Integrated Program

Emphasis on outcomes for :

- communication
- **business and project management including estimating and scheduling**

Strategies to improve outcome

Curriculum

Integrated sequence to emphasize professional and business courses in junior year plus capstone course expansion

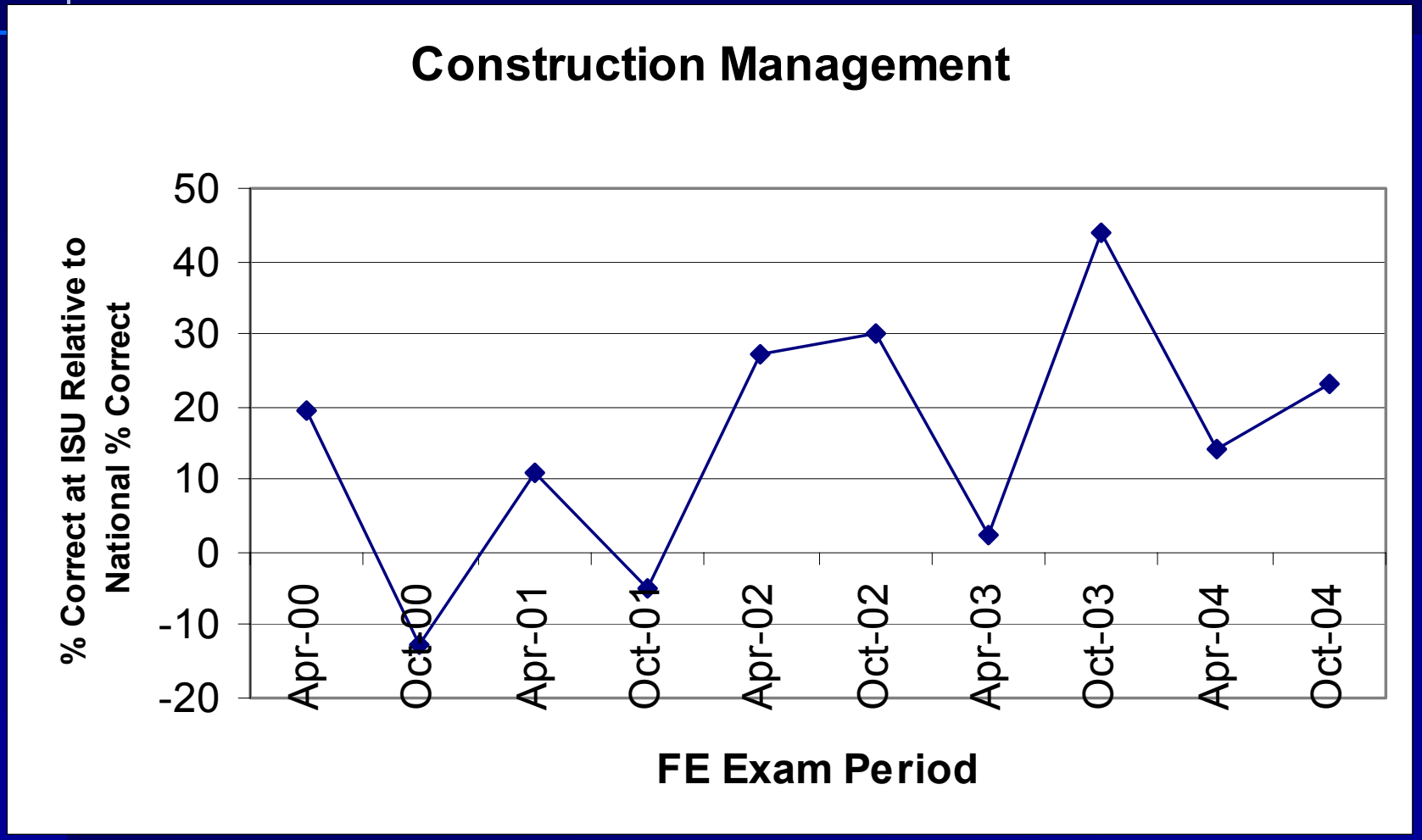
Faculty

New faculty from professional practice in civil engineering plus construction engineering program professionals

Assessment elements

- Annual Course review by instructors
- Senior focal group assessment teams
- Alumni / Employer surveys (a second round is currently in progress)
- Fundamentals of Engineering –

  See slide - have increased from below national average to 20% +/- above national average


Construction Management
% Correct at ISU Relative to National % Correct
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FE Exam Period

CE objectives (2005)

The objective of the Civil Engineering program is to prepare graduates who:

1. have a comprehensive education in the fundamentals of civil engineering
2. are prepared to undertake civil engineering design tasks
3. demonstrate effective communication skills and teamwork in multi-disciplinary projects
4. play a constructive role to address the needs of society and the environment
5. are motivated to continue their professional development

CE outcomes

The civil engineering graduates will (have)

(a)an *ability* to apply knowledge of mathematics, science and engineering

(b)an *ability* to design, conduct experiments, as well as analyze and interpret data

(c) an *ability* to design a system, component or process to meet desired needs

CE outcomes - continued

(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

CE outcomes - continued

(h) the broad education necessary to understand the impact of engineering solutions in a global and social context

(i) a recognition of the need for, and an *ability* to engage in lifelong learning

(j) a knowledge of contemporary issues

CE outcomes - continued

- **(k) an *ability* to use the techniques, skills, and modern engineering tools necessary for engineering practice**
- **(l) an understanding of cost estimating, planning and scheduling**
- **(m) knowledge of business and management**

ASCE program criteria

1) proficiency in mathematics through differential equations, probability and statistics,
2) calculus-based physics, and general chemistry;
3) proficiency in a minimum of four (4) recognized major civil engineering areas;

ASCE program criteria – cont'd

4) the ability to conduct laboratory experiments and to critically analyze and interpret data in more than one of the recognized major civil engineering areas;
5) the ability to perform civil engineering design by means of design experiences integrated throughout the professional component of the curriculum
6. an understanding of professional practice issues such as: procurement of work,

ASCE program criteria – cont'd

7. how the design professionals and the construction professions interact to construct a project,

8. the importance of professional licensure and continuing education, and/or other professional practice issues.

Course contributions to outcomes

Examples:

The following slide gives a portion of the table which identifies courses contributing to the program outcomes

a thru m

P = Primary emphasis

S = Secondary emphasis

M = Minor emphasis

	Outcomes (abbreviated)	CE 303	CE 304	CE 326 Environmental	CE 332 Structural anal.	Geol 201 Engr. Geology	CE 333 Str. Steel Dsgn	CE 334 Str. Conc. Dsgn	CE 355 Transportation[a]
a.	apply mathematics, science, and engineering		.	P	S	P	M	M	M
b.	design and conduct experiments			S					
c.	design system/process						P	P	
d.	multidisciplinary teams								
e.	formulate and solve engineering problems			P	P		P	P	P
f.	professional and ethical	S				M		M	

Course contributions to ASCE criteria - example

the ability to conduct laboratory experiments and to critically analyze and interpret data in more than one of the recognized major civil engineering areas	CE 111 Surveying (3 hours, weekly) CE 326 Environmental (2 hours, weekly) CE 360 Soils (3 hours, weekly) CE 382 CE Materials (3 hours, weekly)

Highlights for the ABET review

- Integration of communication
- Strengthening of construction management / business
- Increased emphasis for design / professional practice (two course sequence)
- Laboratories (Environmental, Geotechnical – in progress, other?)
- Increase use of developing technology - (GIS based software, media in

On-going faculty contributions

Where are we with faculty input - what can you be doing?

- Many course summaries received
- Many resumes received
- Need documentation of student work related to the ABET outcomes
- Class assessment/evaluation activity: Portions have been reported (Integration committee)