Centralization of Assessment Efforts at the College-Level for Sustainability

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Outline

• ABET Requirements
• Describe specific methodologies
  – Criteria 2, 3, 4
  – Examples
• Lessons learned, overall & general comments.
• College-wide overview
Recent ABET Visit, ‘Went Well’

- 12 Programs evaluated for reaccreditation
  - Including 2 outside CENG
- 1 Program evaluated for first accreditation
- (Specific results confidential)
- FYI:
  - ~5300 undergrads, 9 depts
  - Simultaneous visit (CAC & EAC)
- Biomedical Engr going for 1st accr in ~3 years
My Role?

• Provide centralized services
  – On-Going: run surveys of seniors, alumni
  – Gather data from university-wide sources
  – Visit Prep: Additional data services (course offerings, teaching assn), transcripts, schedule

• Provide suggestions
  – Share best practices. Report from BAP, ASEE

• Specific specific guidance
  – Self Study template. Found recent S-S online

• Also an ABET Program Evaluator - *Invaluable*!
  – 5 team members are PEVs, including our Dean
Criterion 2: Objectives

• ‘Objectives’ define career accomplishments of graduates, ~3-5 years after graduation.
• Programs define their own Objectives.
• Examples: Graduates will…
  – Continue education (graduate school or other)
  – Work in an ethical manner
  – Become leaders on project team
  – Be good members of the community, do volunteer work
Criterion 2: Objectives

• Assessment, Typical Approaches
  – Use alumni surveys
  – Feedback from Industrial Advisors

• Evaluation, As specified by ABET
  – All alumni should attain one or more Objectives. ‘1-of-N’ requirement.
  – All Objectives should be attained by at least some alumni.
  – Are program improvements needed? (C4)
Survey Methods, Improved

- **Short, Short, SHORT!**
- (Likert scale questions directly on PEOs.)
- Asked specific questions (‘yes/no’), for more accurate data - fewer misinterpretations
  - On career accomplishments of alumni
  - Drop ‘Leader in field?’, rather ‘Award for work?’

- Web-based, via SurveyMonkey.com
  - Alumni: ‘PolyLink’, helps build on-line community
  - Seniors: Email addresses form Data Warehouse
  - SurveyMonkey provides simple statistics
  - Post summaries on BlackBoard (Each Program had own Bb course).

- Prize and gift offered
Survey Methods, *Improved*

- **Email Prompt / Message**
  - Modified subject line - less likely flagged as spam
  - An energetic email message
  - Sender appears to be Dept Chair

- **Return Rates**
  - Alumni: 20%-40% (2x - 3x improvement)
  - Seniors: 100%, if a strict course requirement.
    - 75% if requested & reprompted
  - PolyLink provides bounce-back stats
Criterion 3: Outcomes

• Outcomes define students’ abilities at graduation.
• Recommend: Use ABET’s standard 3A-3K
• Requirements: (Challenging!)
  – Programs define more specific measurable skills. (Action verb - Preferably high on Bloom’s scale)
  – Curricula must ensure that every student has an opportunity to learn these skills.
  – Employ both direct & indirect measures in a sustainable process. (Direct recommended).
Criterion 3: Outcomes ‘A-K’

(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.

Note:
Over half are non-technical, non-traditional for engineering programs!
Engage GE Community for a better curricular mapping (win-win)!
‘Measurable’ Skills - 3D

• 3D) Multidisciplinary Teams
• Students will be able to…
  – Recognize value of a MD team: broad skill set.
  – Communicate effectively with colleagues in other disciplines and listen well.
  – Employ flexible styles and behaviors and recognize the style of another.
  – Identify when problems occur due to poor team member interaction. Identify ways to improve team dynamics.
• Assess: Via reflection after (or mid) project.

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‘Measurable’ Skills - 3H

• 3H) Societal Impact
  • Students will be able to…
    – Identify societal impact associated with a project
    – Awareness of response of science and technology to needs driven by society, health & safety, or the environment.
    – Awareness of the potential for a negative impact of science and technology on society, perhaps resulting from an unintended consequence.
  • Assess: Short essay, or ‘Give an example’
‘Measurable’ Skills - 3J

- 3J) Contemporary Issues
- Students will be able to...
  - Demonstrate awareness of current or recent events in nation or world that could influence a student's career path or their field.
  - Identify sustainability issues associated with a project
  - Identify a disruptive technology.
  - Demonstrate awareness of the way technology impacts and is impacted by public policy making [local, state, federal].
- Assess: Short essay, or ‘Give an example’
‘Measurable’ Skills - 3I

- 3I) Life-Long-Learning
- Students will be able to…
  - Learn new techniques, tools, or devices outside the classroom environment.
  - Find appropriate technical resources, compare quality and availability of sources
  - Organize info, and evaluate applicability / usefulness.
- Assess: Via reflection after (or mid) project.
Effort to Identify Measurable Skills - Helpful

- Finding common ground on what is most important in your discipline
  - Provide focus & reinforcement
- Provide closer ties to curriculum.
  - Get better traction with faculty
- Skills seem trite?
  - Make more meaningful!
- Raise the bar, as Program improves
Assessment Instruments Vary, Methods Scalable

- Involving course projects / assignments / exams
  - Faculty Assessors examine sampling of student work, using rubrics. (Common approach). Requires rubric… All A-K?
  - Capstone projects, group presentations, peer evals (rubric)
  - Embedded questions on common finals

- Student Analysis of Own Senior Project
  - Project styles may vary, but analysis can be consistent. All A-K!
  - LLL: ‘Identify new tools, abilities learned outside classroom’.

- Writing Proficiency Exam
  - Graduation requirement, institutionalized. Rubric/norming.

- Fundamentals in Eng’g Exam
  - A-K coverage limited. Used by some programs.

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Assessment Instruments - Consider Worst-Case Measures

• Locally-developed exams
  – Inspired by ABET & IAB comments
  – Multiple-choice (scalable) or essay.
  – Required in course, contributes ~5% to grade
  – Summative, 4 years. All Outcomes covered.
  – Yields new information, beyond coursework.

• Results for Local Exams
  – Students: Fine or Bomb. No need to split hairs.
  – Engages faculty: Shocked/disgusted with student performance
Broad Spectrum
Of Outcomes Valuable

• Example: MD Team Skills (Help creative process)
  – A. Black, 1990 identified 32 traits of creative people.
    Divergent thinking, flexible, risk taker, sensitive, severely critical…
  – Less likely to have all 32 traits in a homogeneous team.
  – Hence MD teams are more likely to include qualities which are in opposition.
    • Csikszentmihalyi, M. 1999

• MD teams foster creativity, which plays a crucial role in concept generation and eng’g design.

• Would broad, non-traditional Outcomes be included, without ABET requirement?
Criterion 4: Improvement

• (C2,C3-ABET) There must be an assessment and evaluation process that periodically documents and demonstrates the degree to which the program outcomes are attained.

• (C4-ABET) Each program must show evidence of actions to improve the program. These actions should be based on available information, such as results from C2, C3 processes.

• Presently, requirement addresses justification (for initiating) an improvement, in 2009
  – Document program improvements.
  – Actions based on appropriate info.
  – Don’t put ‘cart before horse’ regarding changes

• ‘Continuous process’, but no specific requirements for follow-on measures, in 2009

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Criterion 4: Improvement

- From C4:
- (C4-ABET) Each program must show evidence of actions to improve the program. These actions should be based on available information, such as results from C2, C3 processes.

- For additional perspective, compare Criteria versus:
  - See ABET’s ‘E62 PEV Worksheet 7-18-2008.doc’ (www.abet.org)

- From PEV Worksheet:

<table>
<thead>
<tr>
<th>4. CONTINUOUS IMPROVEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shows evidence of actions to improve program</td>
</tr>
<tr>
<td>Actions based on appropriate available information</td>
</tr>
</tbody>
</table>

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Criterion 4: Improvement

• (C4-ABET for 2010/11-Proposed)
  – The program must use assessment data for regular evaluations. The results of these evaluations must be systematically used to effect continuous improvement of the program. Other information may also be used in effecting continuous improvement.

• Note
  – ‘Assessment data’ more specific
  – ‘Systematically used’
  – ‘Continuous’
  – ‘Other info’ OK (Good!)

• Does not say, ‘Improvements must affect measures’…
  – Might it, in 6 years? (I wouldn’t be surprised!)
Criterion 4: Improvement

- Logic of Justification: Many-to-Many Mapping
  - Based on many sources of info (typical, across univ)
- Justification could include:
  - Measurements AND
  - Faculty observation, IAB observation, surveys / exit interviews (open ended)

- Don’t put ‘cart before horse’ regarding changes.
  - Look for a control group, and validating measurement
  - Deploy quiz/survey for validation purpose
- Contrast
  - Assessment measurement vs. validation measurement!

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Culture Change: Data-Driven Decision Making

• “Others are doing X. Let’s do that too!”
  – How to prioritize possible options for changes?

• “We know water is wet. Why measure?”
  – Consistent benchmarks over many years.
  – Avoid anecdotal decisions

• For ABET Evaluator: Prove water is wet.
  – Assessment evidence beneficial when preparing publication on innovative teaching methods for peer review.

• Goal: Data with ‘pedagogical significance’ rather than statistical significance.
(My) Rubric Describing Quality of Improvements

- **Very Strong**
  Many improvements with clear ties to assessment data and at least one follow-on measurement to close the loop using identical assessment instruments before and after the change

- **Strong**
  Many improvements with clear ties to assessment data and at least one follow-on measurement to close the loop

- **Good**
  Improvements with ties to assessment data and some loose efforts to close the loop

- **OK (Still ‘OK’, but thin ice)**
  Improvements with some ties to assessment data

(Computer Science not included above. Requirements differ in 2008).

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Examples of Improvements

• Added numerical methods based on FE Exam (direct, computers area) and other indications. Since have observed a (slight) improvement in these scores. A similar change was justified/validated in the area of ethics.

• Increased emphasis on design in curriculum based on senior survey input. Surveys have since indicated better abilities in this area.

• Stepped up undergrad advising by assigning individual faculty to students, based on survey input. Surveys have since shown an improvement.

• Adjusted support courses and prerequisites related to statistics area, based on exit interviews.

• Improved advising of students regarding benefits of a graduate degree, based on input from Senior Surveys.
Surveys Used For Many Purposes - Styles Vary

- To ensure ABET compliance
  - Ask seniors ABET Criteria verbatim (Varied interpretations!)
- For more useful data
  - Translate ABET, local / specific terms, e.g. describing skills
- To help program improvement process, *for quick loop closure!*
  - Ask directly about impact in classroom
  - Possibilities? Priorities? Benefits?
  - Students, Faculty, Industry Advisors all partake & appreciate giving input - Rank importance of changes.
  - Impact of some improvements diffuse, assess locally with a control group.
How Can This All Get Done?

• Centralize Processes, as Appropriate
  – Senior & Alumni surveys
  – Provide Self-Study draft

• Processes remaining decentralized
  – Direct Measures (Good, of more interest to faculty, require more faculty input)
  – Improvements
How Can This All Get Done?

• Appropriate use of technology
  – Document mgmt - (e.g. via BlackBoard)
  – “Where can I put all this info?”
  – One Bb course per Program
    • Create template with slots to fill, copy to each Program
  – Posted items document time line (e.g. surveys)
  – Bb system supported by university, with training for users
How Can This All Get Done?

• Synergy with campus efforts
  – Career Services: Employer surveys
  – Institutional Planning & Assessment
  – Writing Proficiency Exam, graduation requirement

• Use standardized tests (as much as is viable)
  – Fund in Eng’g, NSSE (via WASC)

• GE Community
  – Firm-up curricular mapping
  – Win-win, liberal arts instructors emphasize need to engineering students

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How Can This All Get Done?

• Synergy with campus efforts - WASC
  – Regional accreditation for the university
  – WASC defining measurable skills, associated with University Learning Objectives (similar to A-K)
  – WASC Teams examining curriculum map (incl. gen. ed.), skills, and defining rubrics for:
    • Written communication
    • Life-Long Learning (incl. information competency)
    • Others in subsequent years
  – Share results with ABET Program Coordinators!

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How Can This All Get Done?

- Synergy with campus efforts - Internal Review
  - Yet another on-campus review!
  - Current theme: Integrated educational experience including Gen Ed and the Major.
  - Targeting: Math & Oral Comm
  - Goal: Identify important ‘transferable’ skills
    - ‘Transferable’, a new concept in Gen Ed
    - Recognize broad value of Gen Ed, beyond discipline
    - Explicit skills more clear (‘on syllabi’)
    - Implicit skills: Quantitative reasoning (‘whose syllabus’?)
    - Hoping for productive discussions!

- Share results with ABET Program Coordinators!
How Can This All Get Done?

• Centralize Common Improvements?
  – One would be nice!
  – Students ‘Multidisciplinary Certified’
    • Pools co-curricular experiences to handle throughput and establish solid mapping
  – Tech Writing, Psychology
    • Strengthened curricular mapping
How Can This All Get Done?

- Become an ABET Evaluator
  - Attend Evaluator training (in Hawaii!)
  - Keep an eye on ABET.org (requirements evolve)
- Attend ABET Meetings:
    - Consistency checks, Pre-, Post-Visit
  - Commission Summit
- ‘Best Assessment Processes’ Symposia
- Programs work together, central coordination. Share best practices.

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How to Engage Faculty?

• **Shock of summative direct measures!**
  – Faculty provided questions that students failed to answer, in a summative setting.
  – Results unexpected, hence faculty engaged.

• **Student learning can be compartmentalized.**
  – Often faculty view is in terms of courses. Need verification of summative abilities.
  – Industrial Advisors raised this concern (disciplinary skills, quiz given during interviews).
Goal: Data-Driven Curriculum Revision
Adopted by Faculty

- Imagine a faculty member saying…

  - *Past*
    - ‘I changed my course. I know its better.’

  - *Now*
    - ‘I changed my course. I need to collect data for ABET.’

  - *Future*
    - ‘I think I need to improve my course. I need data to…
      - … assess severity of perceived problems.’
      - … assess impact of possible changes.
      - … assess benefits of improvements.’
What is the Value of ABET To Faculty & Students?

• *Encourages Scholarly Teaching Practices*

• ABET Evaluators are trained to ask,
  “How do you know good (communication) skills when you see them?”

• Good Answers, for ABET
  – “We defined skills and use a (test/quiz…)”
  – “We have a rubric to evaluate student work”

• Bad Answer, for ABET
  – “I know it when I see it!”

• *Beneficial, provides consistent evaluation.*
Conclusion: My Goals

• Develop sustainable processes
• Trying To:
  – Create a culture of data-driven decision making.
  – Establish value with faculty - Impact in classroom.
• Future: Track student longitudinally
  – Include assessment measures, track benefit of program improvements
  – Also provide data for educational research, documenting impact of innovative teaching methods.
  – ITS ‘Academic Analytics’ / CENG ‘Home Brew’
Finally - Perspective

• “We can still learn from an imperfect assessment process.”
  – Bok, ‘Our Underachieving Colleges’
  – A ‘Learn-by-Doing’ process!

• “It sure is nice to have all this data to review when considering curricular changes!”
  – CalPoly faculty member (recent)